Gender Education Gap and Economic Development

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Quantifying the causes of narrowing gender education gap

- Dramatic progress in gender equality with economic development
  - Educational attainment - metrics where gender equality has made quick progress
  - Wolfers, 2021: 25 to 34 year old women more likely to have tertiary degree in OECD
  - Low-income countries far behind (roughly 50% of men)
- Education has big implications for gender equality, mostly through bargaining (Lise and Seitz, 2011; Doepke and Tertilt, 2018)

Quantifying the causes of narrowing gender education gap

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- Consensus on work in the literature:

  – Aggregate patterns of female labor force participation rate is U-shape with development (Ngai, Olivetti, and Petrongolo, 2021; Goldin, 1995)

  – The rising service sector increases females' labor market hours (Ngai and Petrongolo, 2017; Rendall, 2018a and 2018b)

Our Theory of the Shrinking Gender Education Gap

- A simple marriage market
- Three-sector model with agriculture, manufacturing, and services
- Four types of labor by gender and skill are imperfect substitutes
- Cross-country productivity differences present exogenously skill-biased structural transformation (Buera et al. 2021)
- Robustness: cross-country differences in gender-biased technical change and home productivity (TBD)

Preliminary Results

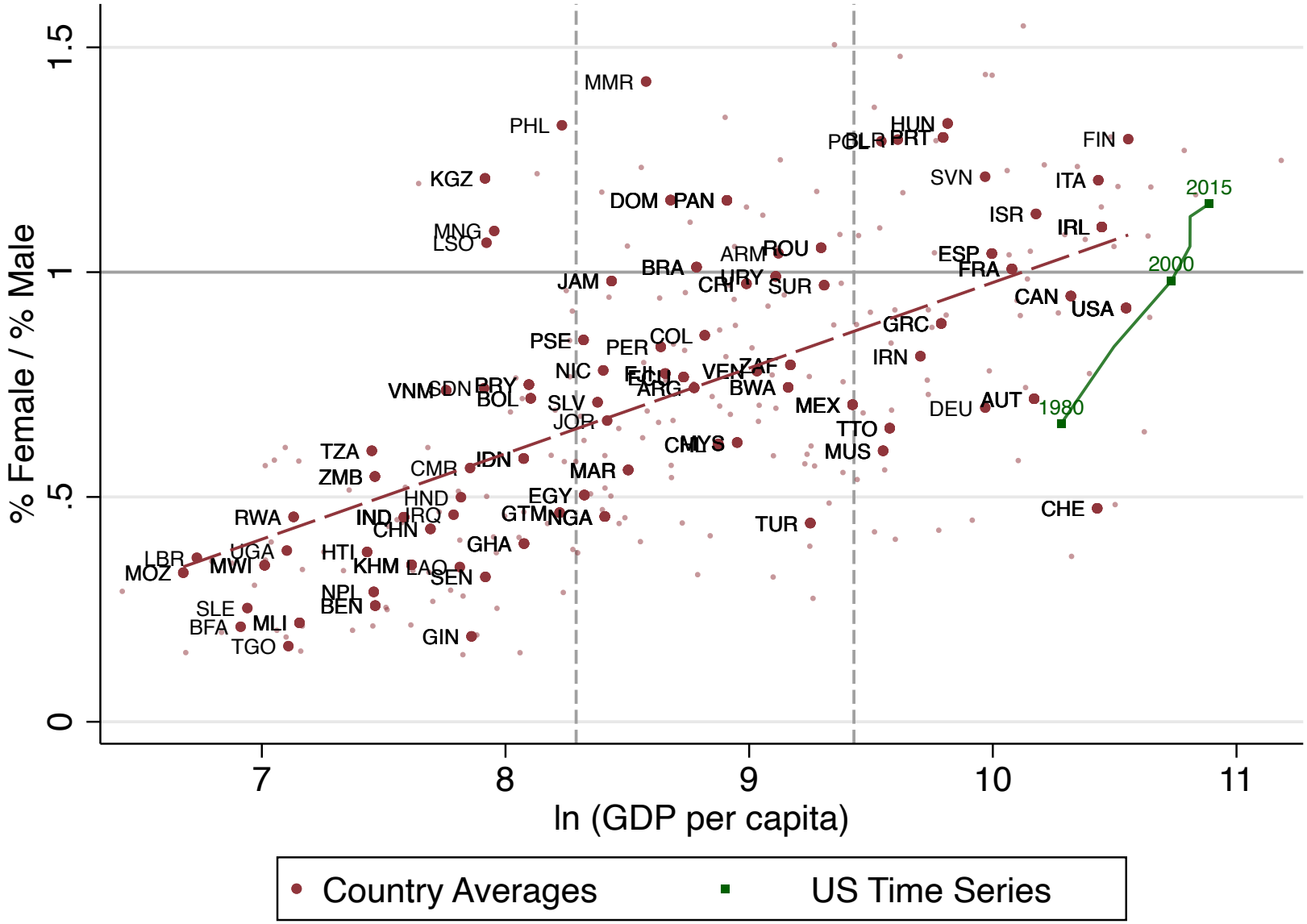
- Changing assortative matching probabilities - work against a closing gender gap
- Calibrated model suggests that females have comparative advantages in services (consistent with the literature)
- Mechanisms:
  - As structural transformation rises, more females work (in services)
  - With skill biased technological change, demand for skilled men and women increases in all sectors, but the service sector matters for female education
- Take-away I: SBTC in *services* is important to account for gender education gap patterns
- Take-away II: ST important for female LFPR patterns

Outline

Data

- Main cross-country data: IPUMS-International
  - national representative censuses and surveys
  - 256 country-year surveys across 84 countries
- US time-series data: IPUMS: USA from the year 1980 to 2017
- Benchmark analysis focuses on prime-age (25-54) male and females.
- We use individual level information on age, gender, educational attainment, employment status, and industry

Gender Gap in University Completion

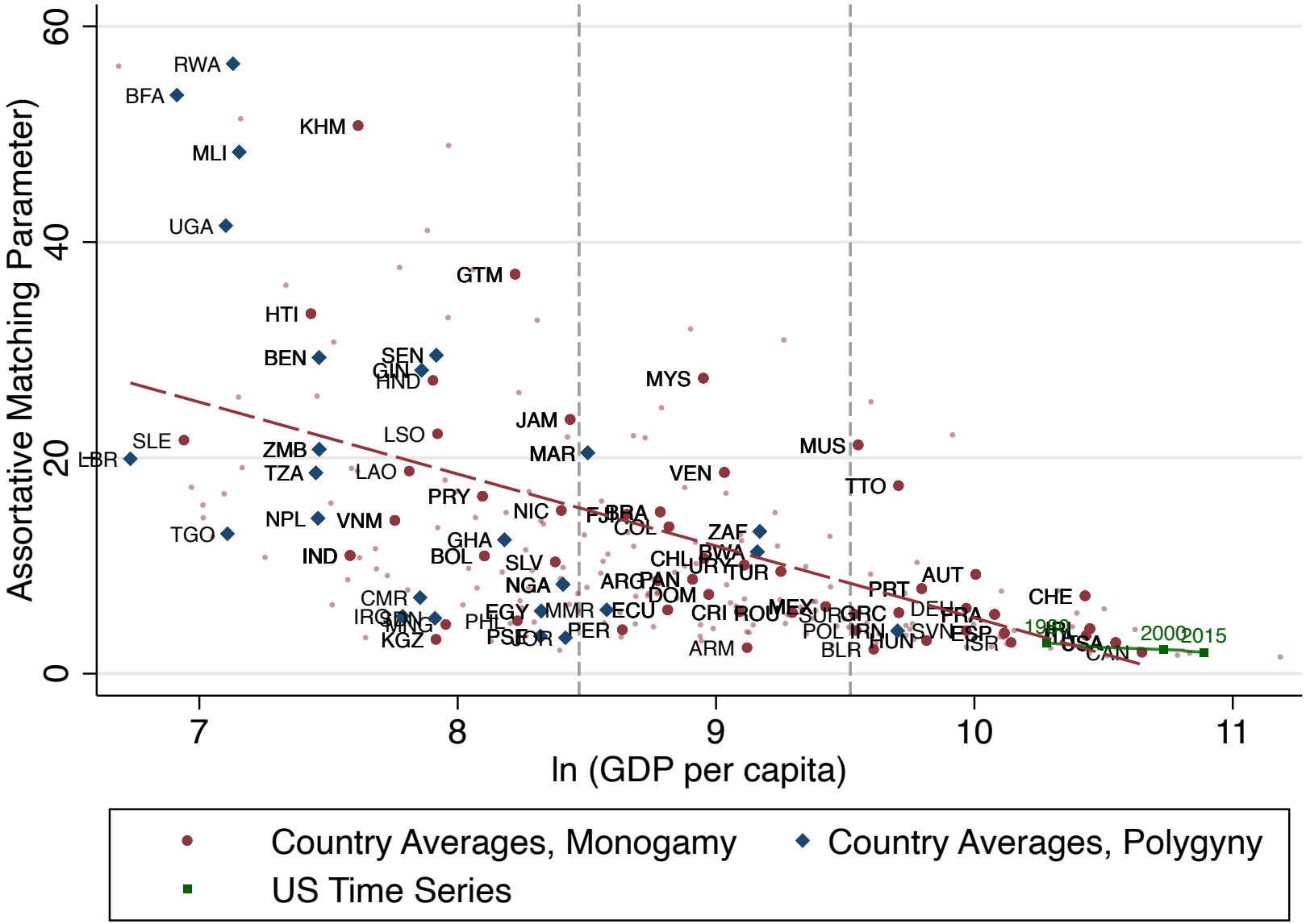


Marriage Markets

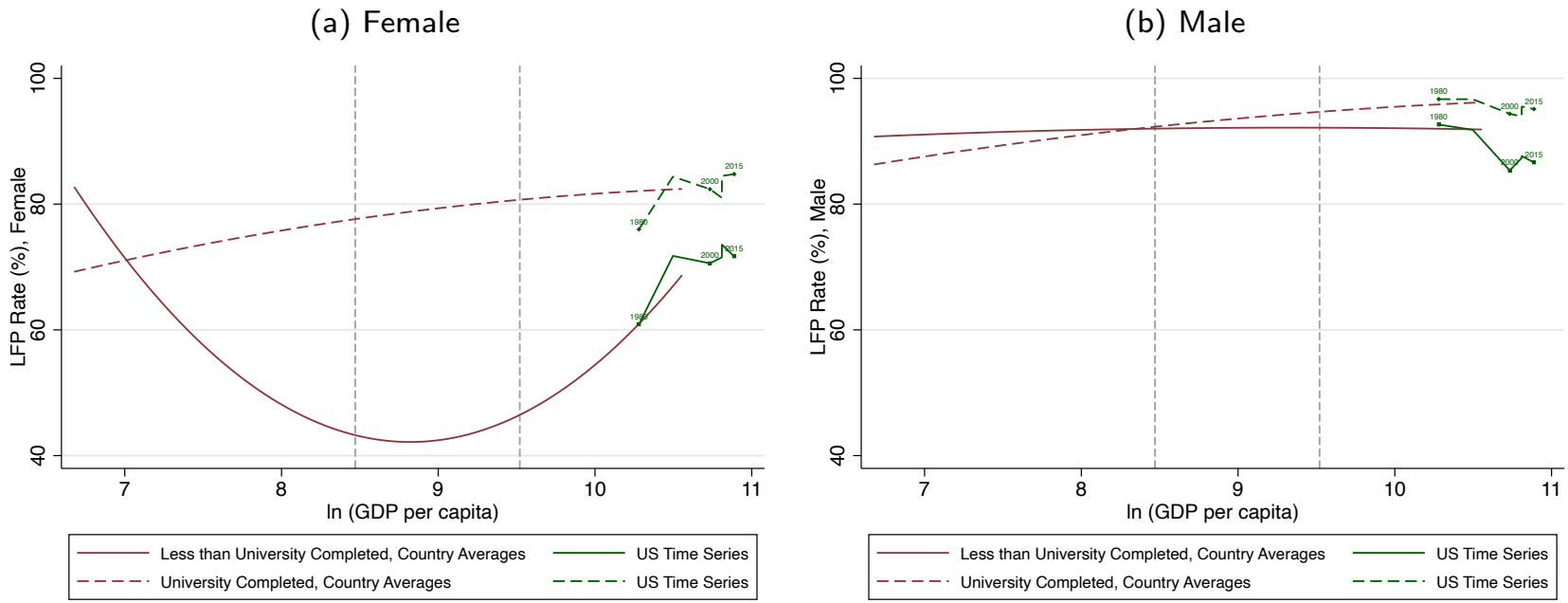
- Distribution of four types of couples' education combination ($\alpha > 1$):

$$
\begin{aligned}
\%(EE) =& \alpha \Gamma(a^{*m})\Gamma(a^{*f}) \\
\%(EN) =& \Gamma(a^{*m})(1-\Gamma(a^{*f})) + (1-\alpha)\Gamma(a^{*m})\Gamma(a^{*f}) \\
\%(NE) =& (1-\Gamma(a^{*m}))\Gamma(a^{*f}) + (1-\alpha)\Gamma(a^{*m})\Gamma(a^{*f}) \\
\%(NN) =& (1-\Gamma(a^{*m}))(1-\Gamma(a^{*f})) + (\alpha-1)\Gamma(a^{*m})\Gamma(a^{*f})
\end{aligned}
$$

Assortative Matching (University Completion)

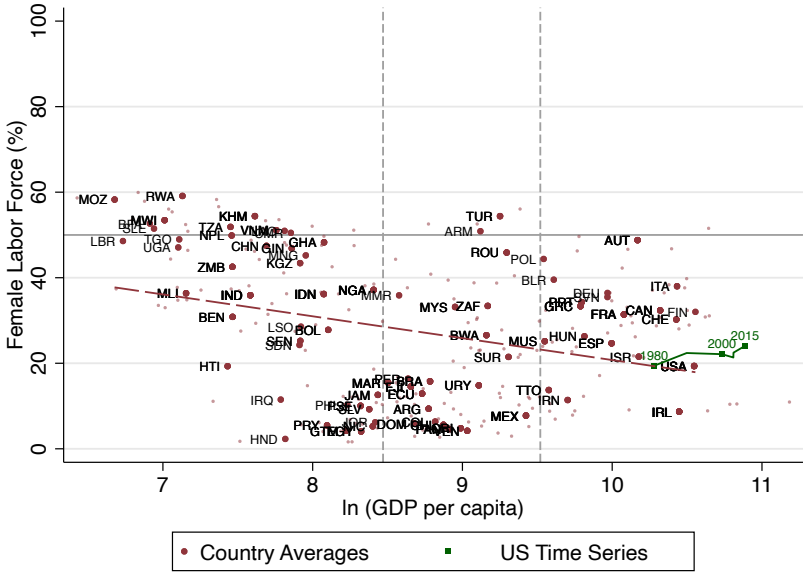


Labor Force Participation Rate by Gender and Edu.

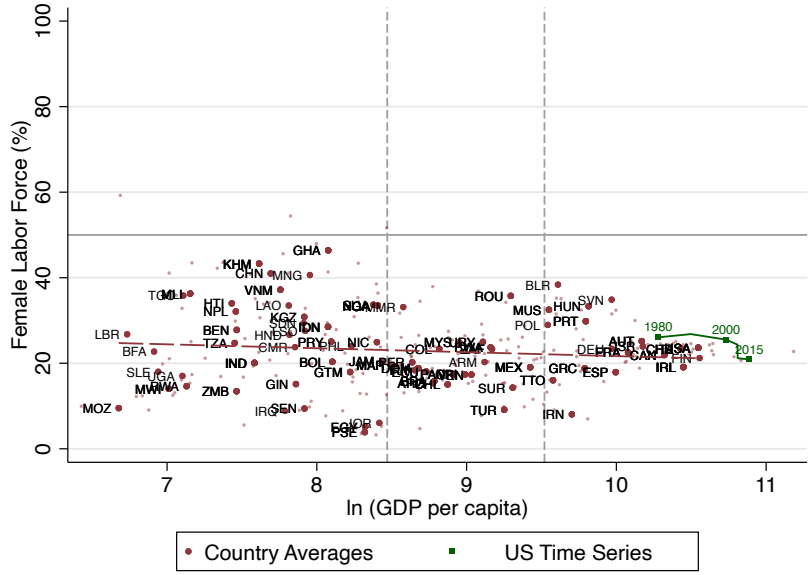


Female shares in Sectoral Labor Force Shares

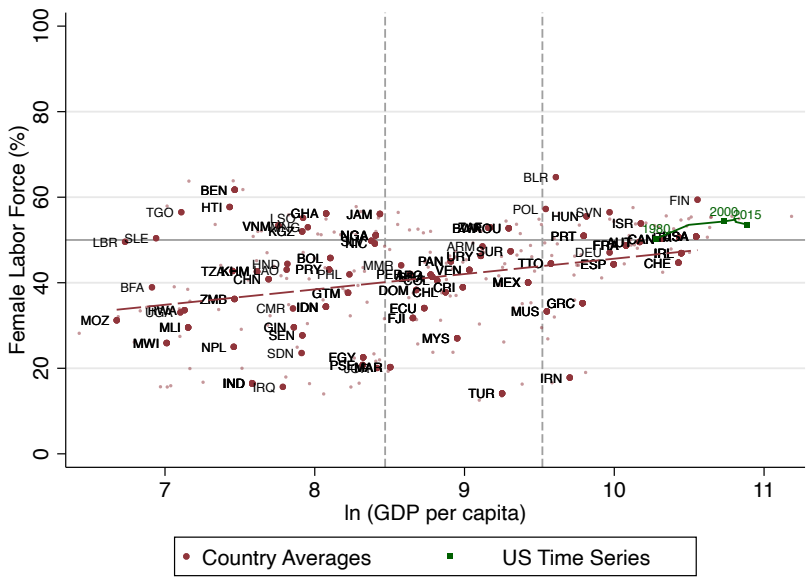
(a) Agricultural



(b) Manufacturing



(c) Service



Slopes of Female Labor Force Share within Sector on log GDP Per Capita

		By Education Group	
	Aggregate	Not University	University
Agriculture	-4.88***	-5.00***	5.32***
	(1.57)	(1.57)	(1.02)
Manufacturing	-0.29	-0.54	4.22***
	(.88)	(.90)	(.78)
Services	3.42***	3.05**	8.30***
	(1.20)	(1.29)	(1.10)

Outline

Environment of the Model

- Unit measure of female and male workers
  - Heterogeneous in cost of study $a \sim \Gamma(a)$
  - Make endogenous education and labor supply decisions
  - $\mathbb{O} = \{NS, ES, NG, EG, NB, EG\}$ describes the education-occupation set
- Production in three market sectors: agriculture, manufacturing, and services
  - $Y_k = A_k H_k, k = B, G, S$
  - Total labor input H_k is a composite of edu (j) and gender (g) workers
  - Perfect mobility of labor across sectors
- Countries differ in A_k and in the skill intensity of H_k

Households Types

- Timeline: Education decision $\rightarrow$ mechanical matching $\rightarrow$ consumption and labor supply decisions
- Each household (j, j') is composed of one male with edu (j) and one female (j') with one assortative mating parameter α
- Distribution of four types of couples' education combination ($\alpha > 1$).
- We assume males supply one unit of labor inelastically
- Females can supply market labor ($c_H = \psi_j x$), $\psi_j < 1$ or provide only home production $c_H = x \sim \mathcal{N}_j(\bar{H}_j, \sigma_j^2)$; Let $W \equiv I_{jj'}^f = 1$ if the female works, 0 otherwise.

Consumption and Education Decisions

- Market consumption is a CES of sectoral consumption

$$c = \left(\phi_G^{\frac{1}{\nu}} c_G^{\frac{\nu-1}{\nu}} + \phi_S^{\frac{1}{\nu}} \hat{c}_S^{\frac{\nu-1}{\nu}} + \phi_B^{\frac{1}{\nu}} (c_B - \underline{B})^{\frac{\nu-1}{\nu}} \right)^{\frac{\nu}{\nu-1}},$$

where $\hat{c}_S = c_S + c_H$

- Households maximise

$$\max_{c_G, c_S, c_B, l^f} U(c)$$

$$\text{s.t.} \sum_{i=G,S,B} p_i c_i \leq w_j^m + w_{j'}^f l_{jj'}^f \equiv y_{jj'} W$$

- Individual obtains education if $\mathbb{E}_E^g \left(U(c, c_H) \right) - a > \mathbb{E}_N^g \left(U(c, c_H) \right)$

  - Two cutoff values of marginal agents who obtain education a^{*g}

Firm's production $Y_k = A_k H_k, k = B, G, S$

- Total sectoral labor input is a CES of uneducated (and educated) labor

$$H_k = \left(\chi_k H_{Ek}^{\frac{\theta-1}{\theta}} + (1-\chi_k) H_{Nk}^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}, \text{ for } k = G, S, B.$$

- Each education labor input being a CES of men and women, $k = G, S, B$

$$H_{jk} = \left(\zeta_{jk} (H_{jk}^f)^{\frac{\eta-1}{\eta}} + (1-\zeta_{jk}) (H_{jk}^m)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$$

- Labor are paid their marginal products. In equilibrium, $w_{Ek}^f = w_E^f$, $w_{Nk}^f = w_N^f$, $w_{Ek}^m = w_E^m$ and $w_{Nk}^m = w_N^m$.

- Firm's optimization problem: $\max_{\left\{H_{jk}^g\right\}} p_k Y_k - \sum_{jg} w_j^g H_{jk}^g$

Model Predictions

- Mechanisms that affects female's education attainment:

1. Skill-biased transformation within services (increase in χ_S) $\Rightarrow \uparrow$
2. Structural transformation (lower growth rate of A_S compared to A_G) $\Rightarrow \uparrow$
3. Less assortative matching (decrease in α) $\Rightarrow \downarrow$

- Additional mechanisms for alternative calibration:
  - Gender biased technological change (variations in ζ_{jk})
  - Home productivity technological change (variations in $\overline{H}_j$)

Outline

Overview of Quantitative Analysis

- Calibrate most parameters to match the U.S. data in year 1980 and 2005

  - All preference parameters are imposed to be the same except for the levels of A_k, SBTC, and α

  - Decompose the quantitative effects of the three mechanisms above

- Let (A_S, A_G, A_B), (χ_S, χ_G, χ_B), α vary to match cross-country differences in:

  – GDP per capita, employment shares of the agriculture and services

  – Share of educated workers in Agriculture, manufacturing, and services

  – fraction of four types of couples by education type

- Compute model's predictions for gender edu. gap in agg. and by sector

Model Decomposition for the U.S. between 1980 and 2005

	Female Labor Force Participation		
	Gender Edu. Gap	University	Not University
Δ P.P. in Data	-39.4	5.0	10.6
Δ P.P. in Model	-39.5	5.3	10.4
Contributions to Empowering Women in Model			
(i) Only ST	56.7%	183.2%	381.0%
(ii) Only SBTC	32.4%	-143.5%	-406.7%
(iii) Only SBTC in Services	34.3%	-85.5%	-319.8%
(iv) ST and SBTC	132.5%	92.6%	152.1%

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