

Globalization, Gender Wage Gap, and Female Labor Force Participation

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Motivation

- ▶ Developed economies from 1970s to 2010s:
 - Increase in relative female wages (35% to 75%)
 - Increase in female labor force participation rate (41% to 60%)

- ▶ Many factors played important role in this empirical pattern
 - Technological progress in home production (Greenwood, Seshadri, Yorukoglu, 2005)
 - Better social attitudes toward women working (Fernández, 2013)
 - Technological progress in medical equipments (Albanesi and Olivetti, 2016)
 - Increase in services sector (Ngai and Petrongolo, 2017)

- ▶ What about trade-induced globalization?
 - Increase in global trade ($\frac{\text{Trade}}{\text{GDP}}$: 10% to 30%)
 - Potential gender-neutral story important?

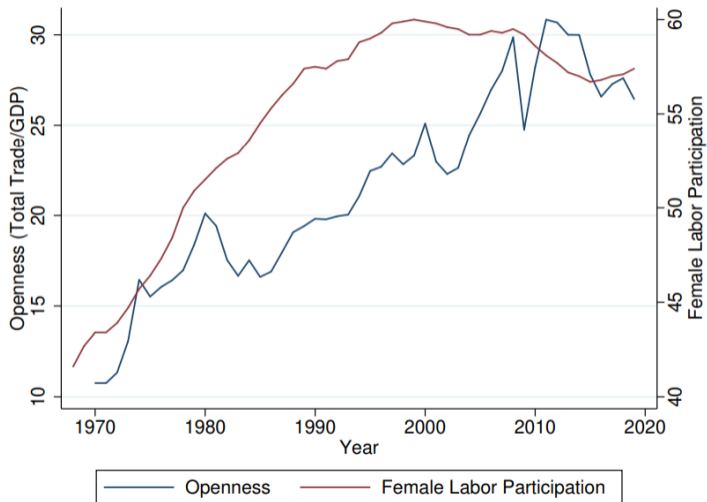
Research Question

What is the impact of international trade and trade-induced globalization on gender wage gap and female labor force participation?

- ▶ Effects of trade-induced structural change vs. domestic-driven structural change

A First Look at the Data (OECD Countries)

- ▶ Trade and female labor force participation are positively correlated



What We Do

Research Question: *What is the impact of trade on gender wage gap and female labor force participation?*

Empirics

- ▶ Establish empirical facts that connects trade and female employment changes
 - Establish potential channels how trade affects female employment and gender wage gap

Model

- ▶ Develop a multi-country, quantitative trade model with household decisions on labor supply
 - Use macroeconomic data (female and male employment and wages, etc.) for each country to match our model parameters
 - Conduct counterfactual analysis by fixing trade shocks and productivity shocks to stay at 1990 levels
 - ▶ Trade-induced vs. domestic-driven structural change

What We Find

Empirical Evidence

- ▶ Goods are more intermediate input-intensive than services
 - Essential channel in our model
- ▶ Increasing openness to trade & expansion of service sector and expanding female employment are positively correlated

Model & Quantification (Preliminary)

- ▶ Trade increases female labor demand
 - Increase in female market hours and relative female wages
- ▶ Effects of trade are as important as domestic-driven structural change

Related Literature & Contributions

Rise of female labor force participation:

- ▶ Greenwood et al. (2005), Fernández (2013), Albanesi and Olivetti (2016), Olivetti and Petrongolo (2016), Ngai and Petrongolo (2017), Hakobyan and McLaren (2018), Autor, Dorn, and Hanson (2019), Dinkelman and Ngai (2021), Guisinger and Sargent (2023)

⇒ Explaining through the lens of trade-induced globalization

Globalization and Inequality:

- ▶ Parro (2013), Sauré and Zoabi (2014), Burstein and Vogel (2017), Świecki (2017), Cravino and Sotelo (2019), Keller and Utar (2022)

⇒ Building a quantitative model studying gender inequality

Structural Change in Open Economy

- ▶ Matsuyama (2009), Uy, Yi, and Zhang (2013), Sposi, Yi, and Zhang (2018), Cravino and Sotelo (2019), Fajgelbaum and Redding (2022)

→ Considering interactions between structural transformation and marketization forces

Outline

Empirical Evidence

Model

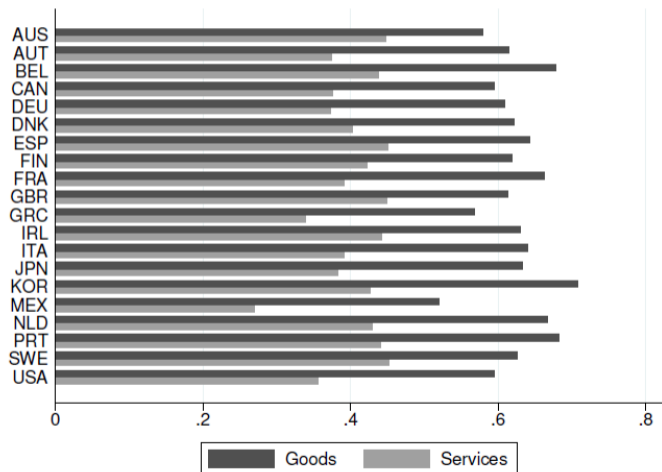
Mapping the Model to Data (Quantification)

Conclusion

Observation I: Manufacturing Sector Uses Intermediate Products More

► Observation I

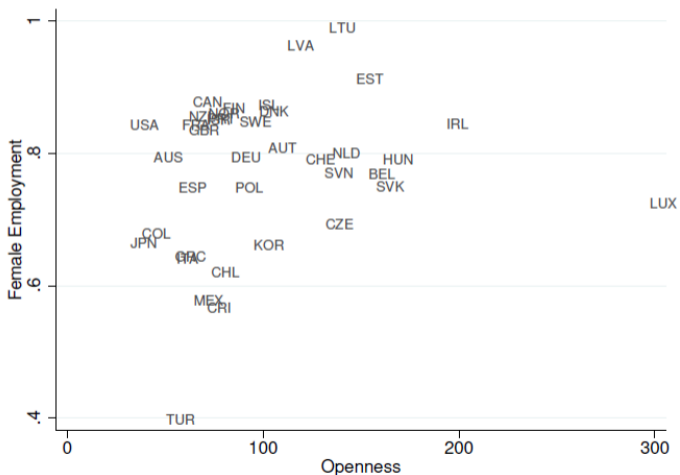
- The goods sector has higher intermediate intensity when compared to the services sector



Observation II: Trade and Female Employment Are Positively Correlated

► Observation II

- Countries that trade more tend to have higher female workers who are employed



Observation III: More Women Are in the Services Sector

► Observation III

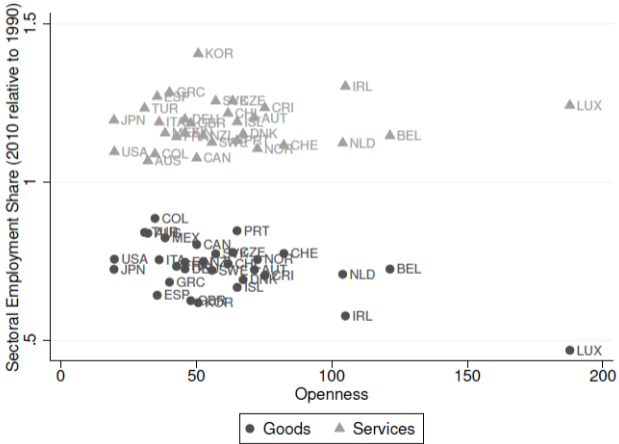
- The services sector, which has higher female presence, expands; and the goods sector, which has lower female presence, shrinks



Observation V: As Globalization Happens, Services Sector Grows Faster

► Observation V

- Countries with higher openness to trade have faster growing service sector and faster shrinking goods sector



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Model Setup

- ▶ N countries: $i, n \in \{1, \dots, N\}$
- ▶ Two market sectors: $j \in \{\text{manufacturing}(g), \text{services}(s)\}$
 - Manufacturing is traded, services is not
 - Varieties $\omega \in [0, 1]$ within sector j
- ▶ Two types of labor: $L_{i,f}, L_{i,m}$
- ▶ $d_{i,n}^j$: Iceberg trade costs between origin i and destination n
- ▶ Final goods are *not* traded
- ▶ Perfect competition in all markets
- ▶ Households: consume home production and leisure (both are non-market activities)

Model: Market Production

- ▶ Production technology for a variety ω in sector g :

$$q_i^g(\omega) = A_i^g z_i^g(\omega) \left(\left[\xi_i^g [L_{i,f}^g(\omega)]^{\frac{\eta^g-1}{\eta^g}} + (1 - \xi_i^g) [L_{i,m}^g(\omega)]^{\frac{\eta^g-1}{\eta^g}} \right]^{\frac{\eta^g}{\eta^g-1}} \right)^{\alpha_i^g} \left(\prod_{j \in \{g,s\}} (M_i^{g,j})^{\gamma_i^{g,j}} \right)^{1-\alpha_i^g}$$

- ▶ Production technology for service (sector s):

$$q_i^s = A_i^s \left(\left[\xi_i^s [L_{i,f}^s]^{\frac{\eta^s-1}{\eta^s}} + (1 - \xi_i^s) [L_{i,m}^s]^{\frac{\eta^s-1}{\eta^s}} \right]^{\frac{\eta^s}{\eta^s-1}} \right)^{\alpha_i^s} \left(\prod_{j \in \{g,s\}} (M_i^{s,j})^{\gamma_i^{s,j}} \right)^{1-\alpha_i^s}$$

- $z_i^g(\omega)$: Variety specific productivity
 - η^j : Elasticity of substitution b/w female and male labor
 - A_i^j : Aggregate productivity in sector j
 - ξ_i^j : Relative female productivity in sector j
- ▶ Key assumption: $\xi_i^s > \xi_i^g$

Model: Non-market (Home) Production

- ▶ Home production (h) is considered as non-market services sector
- ▶ Combines female and male hours used:

$$Q_i^h = A_i^h \left[\xi_i^h (L_{i,f}^h)^{\frac{\eta^h - 1}{\eta^h}} + (1 - \xi_i^h) (L_{i,m}^h)^{\frac{\eta^h - 1}{\eta^h}} \right]^{\frac{\eta^h}{\eta^h - 1}}$$

where

- A_i^h : Home production productivity
 - η^h : Elasticity of substitution b/w female and male hours
-
- ▶ Assumption: $\xi_i^h = 0.5$ (women and men equally productive)

Model: Household Leisure

- ▶ Combine female and male leisure hours to get household leisure:

$$L_i^\ell = \left[\xi_i^\ell [L_{i,f}^\ell]^{\frac{\eta^\ell}{\eta^\ell - 1}} + (1 - \xi_i^\ell) [L_{i,m}^\ell]^{\frac{\eta^\ell}{\eta^\ell - 1}} \right]^{\frac{\eta^\ell}{\eta^\ell - 1}}$$

where

- η^ℓ : Elasticity of substitution b/t female and male leisure hours
- ξ_i^ℓ : Relative leisure-preference shifter for females

Model: Households

Three-tier utility structure:

- (1) Household chooses consumption and leisure
- (2) Consumption between goods and services bundle (CES)
 - Goods and services are complements
- (3) Consumption services bundle b/w market services and non-market (home) services (CES)
 - Market and non-market services are substitutes

► Household utility function:

$$U_i = (1 - \phi) \ln C_i + \phi \ln L_i^\ell$$

such that

$$P_i^g C_i^g + P_i^s C_i^s = w_{i,f} [L_{i,f} - L_{i,f}^h - L_{i,f}^\ell] + w_{i,m} [L_{i,m} - L_{i,m}^h - L_{i,m}^\ell].$$

where

- L_i^ℓ : Household leisure
- C_i : Household consumption

Model: Household Consumption

- ▶ Combine goods and services-bundle consumption to obtain aggregate consumption:

$$C_i = \left[\psi (C_i^g)^{\frac{\varepsilon-1}{\varepsilon}} + (1 - \psi) (C_i^z)^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

- ▶ Assumption: $\varepsilon < 1$, goods and services-bundle are complements
- ▶ Combine market services and non-market (home) services to obtain services-bundle:

$$C_i^z = \left[\zeta (C_i^s)^{\frac{\rho-1}{\rho}} + (1 - \zeta) (C_i^h)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}}$$

- ▶ Assumption: $\rho > 1$, market and non-market services are substitutes

Model: Equilibrium and Market Clearing

- ▶ Use the shadow price of labor, leisure and home production to rewrite the household's problem
- ▶ Each country's female (and male, analogously) labor markets need to clear:

$$\underbrace{w_{i,f} L_{i,f}}_{\text{Female labor income}} = \underbrace{\underbrace{s_{i,f}^g}_{\text{Share of payments}} \overbrace{\sum_{n=1}^N \pi_{in}^g X_n^g}_{\text{Output in goods}} + s_{i,f}^s Y_i^s + s_{i,f}^h Y_i^h + s_{i,f}^\ell Y_i^\ell}_{\text{Female labor demand in goods}}$$

where

- $s_{i,f}^j$: Share of payments to female in sector j in country i
- Y_i^j : Total output of sector j in country i
- $Y_i^g = \sum_{n=1}^N \pi_{in}^g X_n^g$: World's goods market clearing condition

Labor allocation in each sector by gender:

$$L_{i,f}^j = \frac{s_{i,f}^j Y_i^j}{\sum_k s_{i,f}^k Y_i^k} \times L_{i,f}, \quad L_{i,m}^j = \frac{s_{i,m}^j Y_i^j}{\sum_k s_{i,m}^k Y_i^k} \times L_{i,m}$$

Model: Equilibrium

A competitive equilibrium is a vector of $\{w_{i,f}, w_{i,m}\}_{i=1}^N$ that solves

- ▶ *firm optimization problem;*
- ▶ *household optimization problem;*
- ▶ *equilibrium trade shares;*
- ▶ *market clearing conditions.*

We solve the model using the hat-algebra approach.

- ▶ Many parameters are not estimated and calibrated.
- ▶ A competitive equilibrium become a vector of $\{\hat{w}_{i,f}, \hat{w}_{i,m}\}_{i=1}^N$ that solves equilibrium conditions in relative changes given certain initial moments.

Model: Economic Mechanism

- ▶ Economic activities are broken down to two sectors
 - Services (non-tradable, labor-intensive)
 - Goods (tradable, intermediate-intensive)

- ▶ Female presence is very different across sectors in the data
 - Services (more female presence)
 - Goods (less female presence)

- ▶ Impact of globalization
 - Increase in trade \implies Intermediate inputs become cheaper
 - Labor re-allocated to services sector
 - Goods and services are complements (Female has more presence in services sector)
 - Increase in female labor demand (*structural change + marketization*) \implies Increase in female labor force and relative female wages

Outline

Empirical Evidence

Model

Mapping the Model to Data (Quantification)

Conclusion

Data

- ▶ Data on median female and male wages, female and male employment, bilateral trade between countries, production in each sector

Data sources

- ▶ Long-run input-output table from WIOD: multi-country, multi-sector
- ▶ OECD STAN database and International Labour Organization (ILO)
 - Labor force by gender
 - Gender pay gap

Map the model with 10 countries that we have information about gender pay gap at 1990

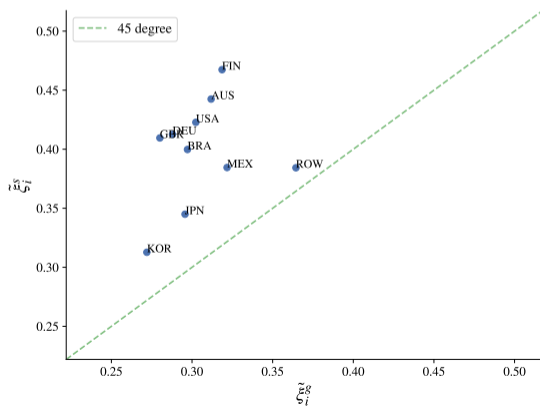
- ▶ Australia, Brazil, Germany, Finland, UK, Japan, Korea, Mexico, USA, and ROW.

Parameters

Parameter	value	Meaning	Source
α_i^j	-	labor shares	IO table
$\gamma_i^{k,j}$	-	IO linkages	IO table
ξ_i^h	0.5	female prod. in h	N&P (2017)
ξ_i^l	0.29	female prod. in l	N&P (2017)
$\eta^j, j \in \{g, s, h\}$	2.27	elasticity of subs. in j	N&P (2017)
η^l	0.19	elasticity of subs. in l	N&P (2017)

Gender Presence in g and s

- ▶ Note that we assume higher female presence in s : $\xi_i^s > \xi_i^g$, but ξ_i^s and ξ_i^g are removed from hat-algebra equilibrium conditions.
- ▶ Given relative wages, and relative payment shares, we can retrieve the corresponding ξ_i^s and ξ_i^g using our model structure.



Counterfactuals (Simulation)

Counterfactual exercises

- ▶ What is the impact of globalization through trade on gender wage gap and female labor force participation?
 - Suppose trade barriers did not go down after 1990 \implies Less globalization across developed economies
 - Suppose productivity shocks did not grow from 1990 \implies No asymmetric productivity growth b/w goods and services

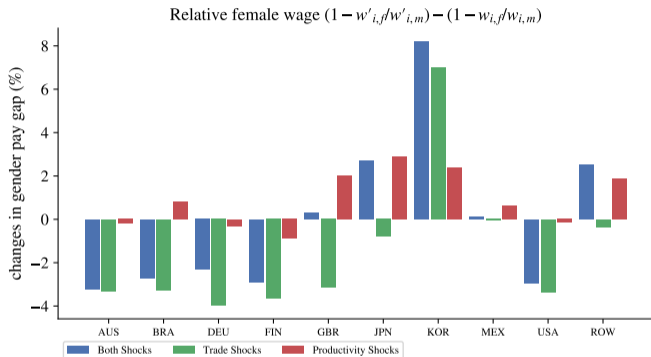
Trade-induced structural change

- ▶ Use Head-Ries: $\hat{d}_{i,n}^g = \hat{d}_{n,i}^g = \left[\frac{\hat{\pi}_{i,n}^{g,data} \times \hat{\pi}_{n,i}^{g,data}}{\hat{\pi}_{n,n}^{g,data} \times \hat{\pi}_{i,i}^{g,data}} \right]^{-\frac{\theta^g}{2}}$

Domestic-driven structural change

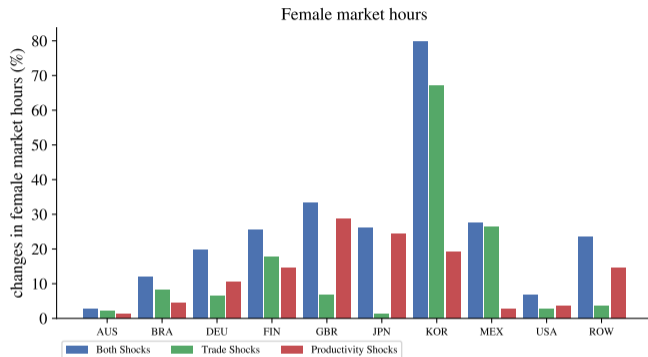
- ▶ OECD STAN dataset to retrieve \hat{A}_i^g and \hat{A}_i^s .

Main Results: Gender Wage Gap



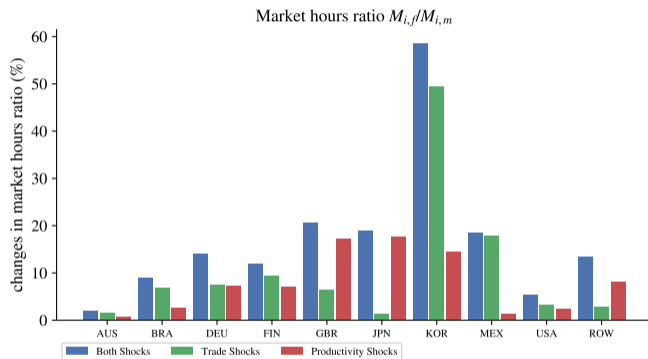
- ▶ Trade Shrink gender pay gaps.
- ▶ Domestic Structural change has mixed effect on gender pay gaps.

Main Results: Female Market Hours



- ▶ Both trade and domestic structural change increase female market hours.
- ▶ The effect of trade on female labor force participation is as important as domestic structural change.

Main Results: Female Market Hours Relative Male Market Hour



- ▶ Female market hour increase more relative to male market hour

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What we ask:

- ▶ What is the impact of trade liberalization/globalization on gender wage gap and female labor force participation?

What we do:

- ▶ Empirical evidence of the relationship between trade and rise in female employment
- ▶ Propose a mechanism through a lens of a quantitative macro-trade model
 - Globalization helps to shrink gender wage gap overall
 - ▶ Important role for intermediate goods trade
 - Globalization induces higher female labor force participation