Does Skill Abundance Still Matter?

The Evolution of Comparative Advantage in the 21st Century

Shin Kikuchi, MIT

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Skill Abundance and Comparative Advantage

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  - Skill-abundant countries specialize in skill-intensive sectors
  - e.g. Electronics in the US v.s. Textiles in India

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  - Implications for globalization, technology, and inequality

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- **This paper: What about the 21st century?**

At a Glance: Skill Abundance and Comparative Advantage

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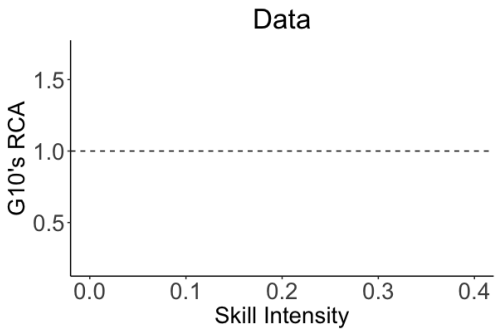

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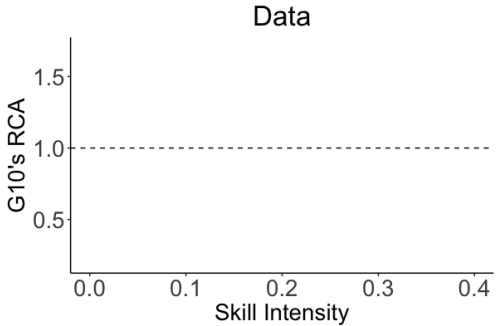

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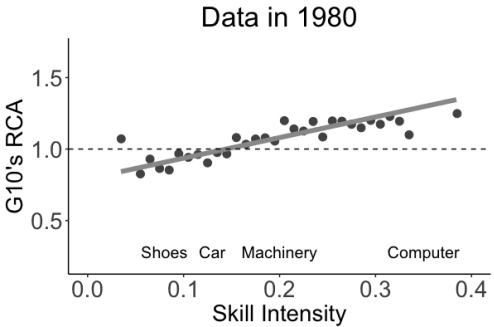

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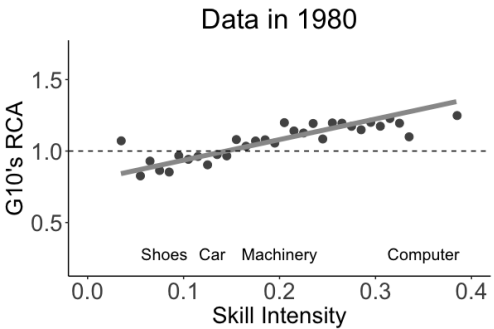

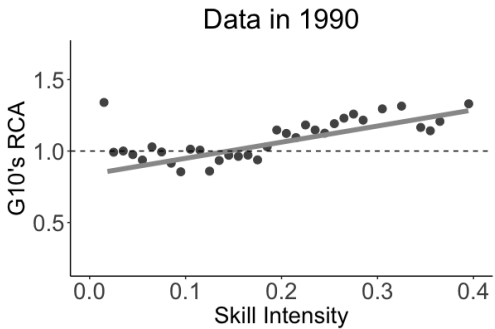

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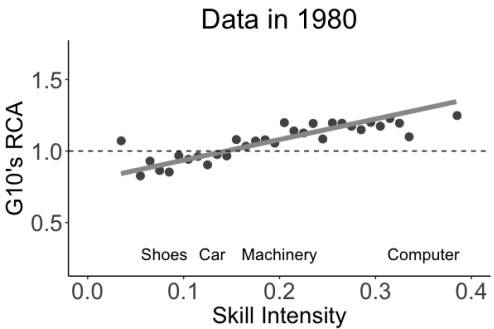

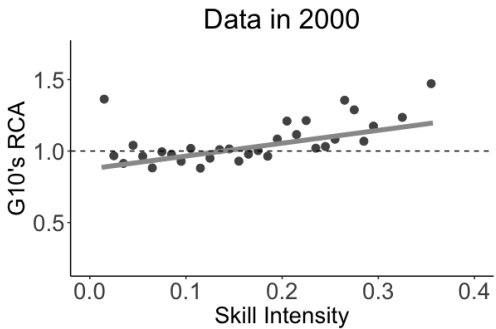

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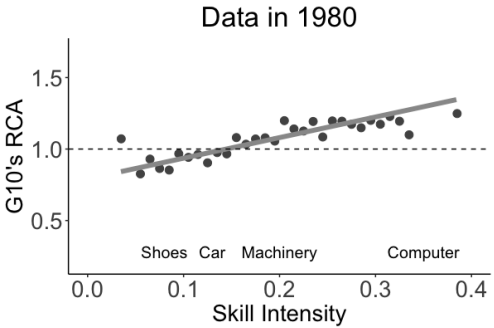

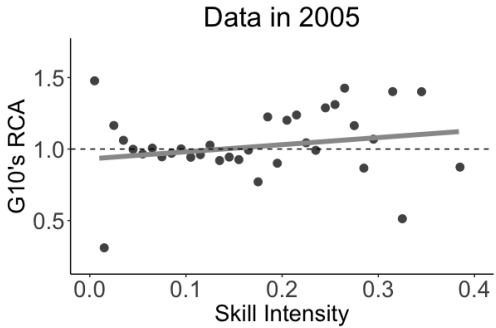

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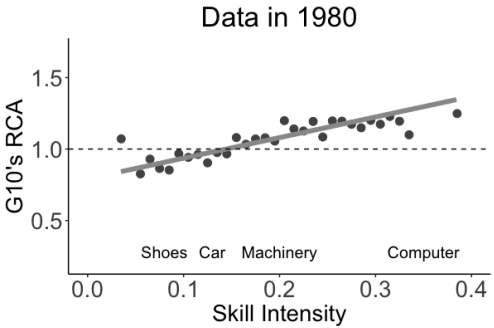

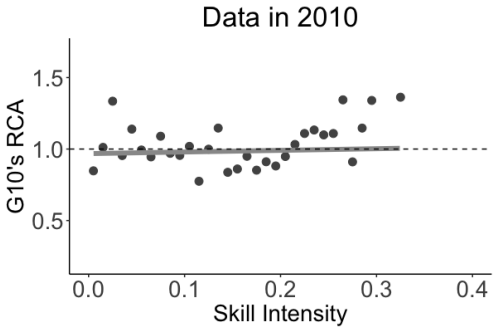

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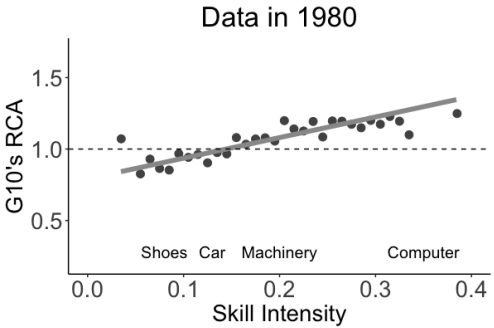

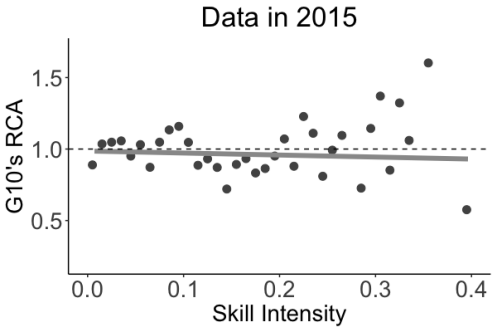

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This Paper

- Does skill abundance *systematically* matter for comparative advantage?
  - Yes and stable until 1990, No after 2000
- What can empirically and quantitatively explain the change in the pattern?
  - Automation, not offshoring
- What are the macro implications?
  - Manufacturing shifts to North; Inequality expands within & across countries

Preview (1/2) New Facts on Comparative Advantage

- Follow the literature's state-of-the-art specification
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  - No such heterogeneity from offshoring
- **Conditional on automation, HO-like predictions still survive**

Preview (2/2) Automation Explains the Change

- Quantitative analysis: Eaton-Kortum model with automation & offshoring
  - Task framework: Acemoglu & Restrepo + Grossman & Rossi-Hansberg
  - Low-skill labor can be replaced by machines or foreign labor

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- Implications of automation
  - Shifts of manufacturing from South to North
  - Increases in skill premia in North and welfare everywhere

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   - **HO:** Leamer (1980, 1984), Bowen et al (1987), Trefler (1993, 1995), Harrigan (1997), Davis & Weinstein (2001), Schott (2001), **Romalis (2004)**, Morrow (2010), **Chor (2010)**

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$\rightarrow$ **Skill abundance matter in 1980s; Not anymore post-2000.**

Key Contributions

1. New Facts on the sources of comparative advantage:
2. **Consequences of technology and globalization on inequality:**
   - **Technology:** Katz & Murphy (1992), Berman et al (1994), Acemoglu (2002), Autor et al (2003), Acemoglu & Autor (2011), Autor & Dorn (2013), **Acemoglu & Restrepo (2018,2022)**
   - **Offshoring: Feenstra & Hanson (1997, 1999, 2001), Grossman Rossi-Hansberg (2008, 2012)**, Hummels et al (2014), Boehm et al (2020)
   - **Interaction of Tech and Trade:** Xu (2001), Acemoglu (2002), Thoenig & Verdier (2003), Burstein et al (2013), Parro (2013), Burstein & Vogel (2017), Morrow & Trefler (2022)
   - **Automation and Trade:** Freud et al (2022), Artuc et al (2023), Fontagné et al (2024)

$\rightarrow$ **Automation** $\Rightarrow$ **Comparative Advantage and Inequality**

FACTS: SKILL ABUNDANCE NO LONGER MATTERS

Identifying Comparative Advantage: Refresher

- Multi-sector Eaton-Kortum Model (Chor (2010), Costinot et al (2012))

Exporter i, Importer j, Sector s: $\ln \text{Export}_{i,j,s} = \underbrace{-\theta}_{\text{Trade Elas.}} \underbrace{\ln c_{i,s}}_{\text{Unit Cost}} + \underbrace{\tilde{\eta}_{i,j} + \tilde{\eta}_{j,s}}_{\text{FEs}}$

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Canonical specification to identify the source of comparative advantage

Skill Abundance as a Source of Comparative Advantage

Do skill-abundant countries export more skill-intensive goods?

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Expect $\beta > 0$: Skill-abundant countries export skill-intensive goods more

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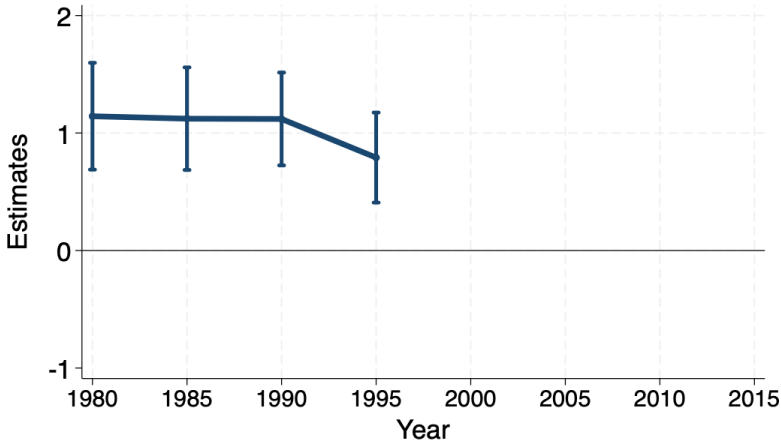

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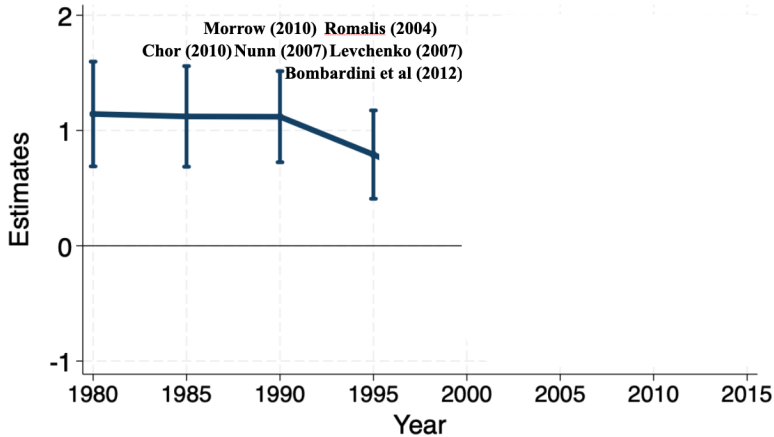
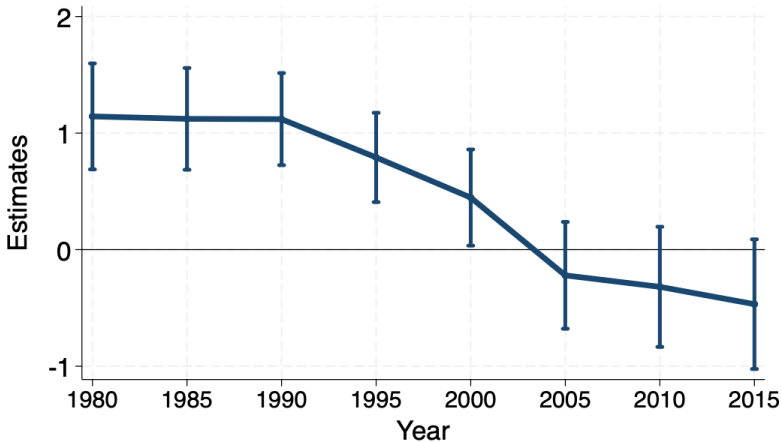


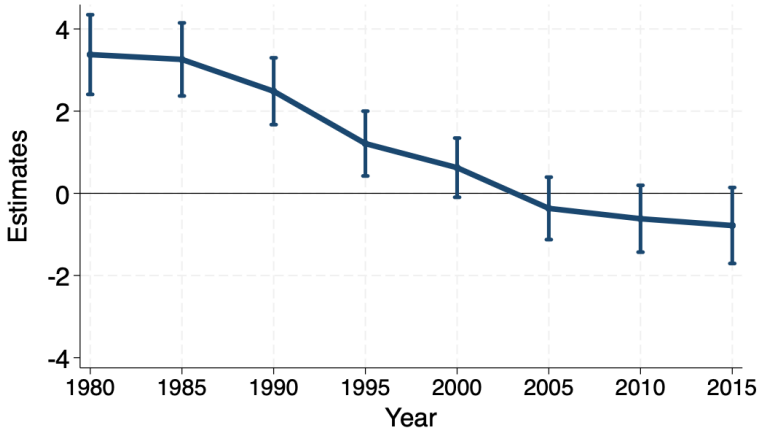
Skill Abundance $\not\Rightarrow$ CA in Skill-Intensive Sectors after 2000

$$\ln \text{Exports}_{i,j,s,t} = \beta_t \left[\text{Skill Intensity}_{s,t} \times \text{Skill Abundance}_{i,t}\right] + \eta_{i,j,t} + \eta_{j,s,t},$$



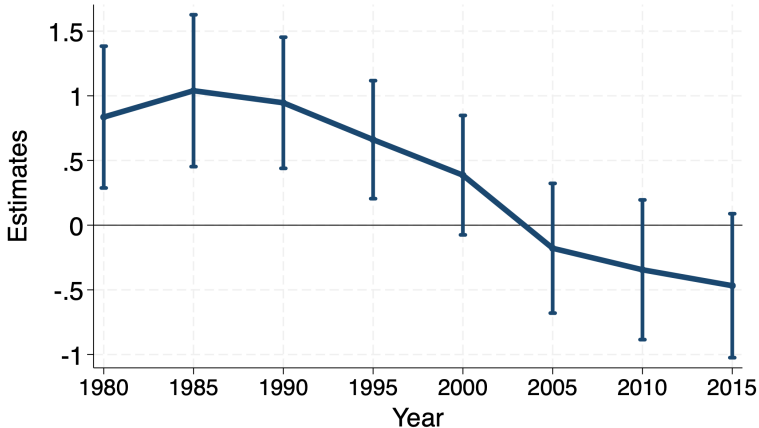
Change in Patterns of CA Comes from Exports

$$\ln \text{Exports}_{i,j,s,t} = \beta_t \left[\text{Skill Intensity}_{s,\mathbf{1980}} \times \text{Skill Abundance}_{i,\mathbf{1980}}\right] + \eta_{i,j,t} + \eta_{j,s,t},$$



NOT Driven by Attenuating Skill Measurement

$$\ln \text{Exports}_{i,j,s,t} = \beta_t \left[\text{Skill Intensity}_{s,\mathbf{2015}} \times \text{Skill Abundance}_{i,\mathbf{2015}}\right] + \eta_{i,j,t} + \eta_{j,s,t},$$



Robustness Checks

- Other sources of comparative advantage? ‣ Capital ‣ Institution
- Driven by small countries? ‣ Weighted
- Some exporter-sector unobserved het., or IRS? ‣ Pool years and FEs
- Different skill measures? ‣ High School ‣ Predicted by Demographics
- Total exports, instead of bilateral exports (Romalis 2004, Nunn 2007,...) ‣ go
- Different measures of sectoral factor intensity (Chor 2010)
  - $\ln(H_S/L_S)$, instead of α_S^H ($\equiv$ Skilled Payroll Share to Value-Added) ‣ go

POTENTIAL HYPOTHESES: AUTOMATION AND OFFSHORING

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- What can make domestic skill abundance less relevant for CA after the 1990s?

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- What can make domestic skill abundance less relevant for CA after the 1990s?
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  - Automation: Replace low-skill labor with machines
  - Offshoring: Replace low-skill labor with foreign inputs
- This section: Explore heterogeneous effects across countries and sectors
  - Descriptive analysis for heterogeneous effects (for now)
  - Causal analysis using the model (later)

Specification for Heterogeneous Effects: Automation

$$\ln \text{Exports}_{i,j,s,t} = \underbrace{\beta_t^0 \left(1 + \beta_t^A HA_{i,s}\right)}_{=\beta_t} \cdot \left[\text{Skill Intensity}_{s,t} \times \text{Skill Abundance}_{i,t}\right] + \eta_{i,j,t} + \eta_{j,s,t},$$

- $HA_{i,s}$: High-automation dummy (below/above the median robot adoption)
  - Robot adoption: Robot stock per workers from IFR & WIOD

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- $HA_{i,s}$: High-automation dummy (below/above the median robot adoption)
  - Robot adoption: Robot stock per workers from IFR & WIOD
- Expect β_t^A to decrease if there is a relationship btw change & automation

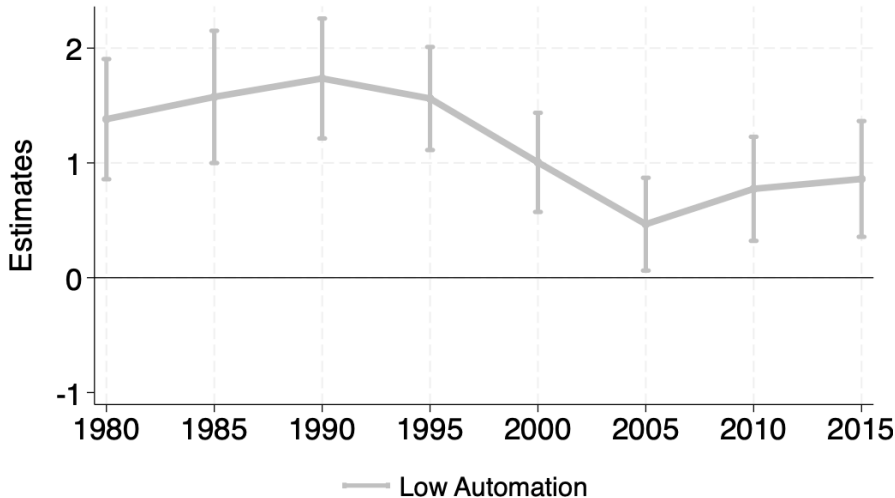
Specification for Heterogeneous Effects: Offshoring

$$\ln \text{Exports}_{i,j,s,t} = \underbrace{\beta_t^0 \left(1 + \beta_t^O HO_{i,s}\right)}_{=\beta_t} \cdot \left[\text{Skill Intensity}_{s,t} \times \text{Skill Abundance}_{i,t}\right] + \eta_{i,j,t} + \eta_{j,s,t},$$

- $HO_{i,s}$: High-offshoring dummy (below/above the median offshoring)
  - Offshoring share: (Intermediate imports) / (Total intermediates) from WIOD
- Expect β_t^O to decrease if there is a relationship btw change & offshoring

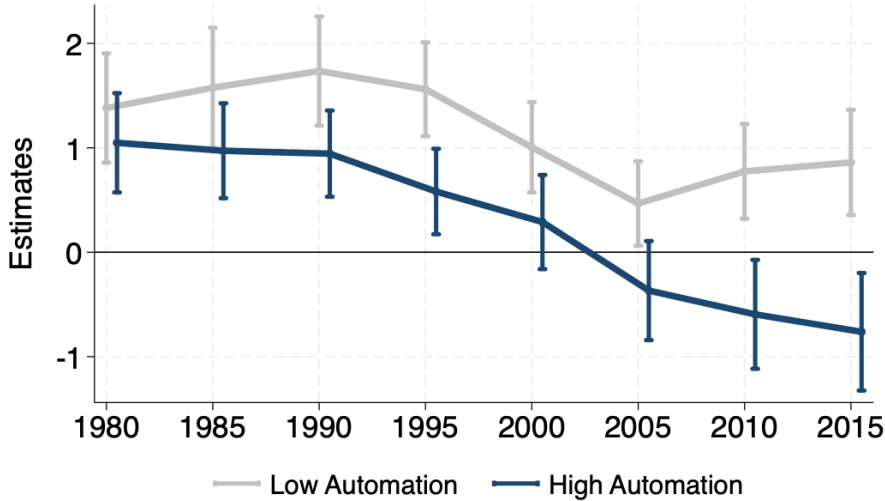
Skill Abundance Still Matters Absent Automation

Plot $\widehat{\beta}_t^0$



Skill Abundance Still Matters Absent Automation

Plot $\widehat{\beta}_t^0$ and $\widehat{\beta}_t^0 + \widehat{\beta}_t^A$



Skill Abundance does not Matter Even Absent Offshoring

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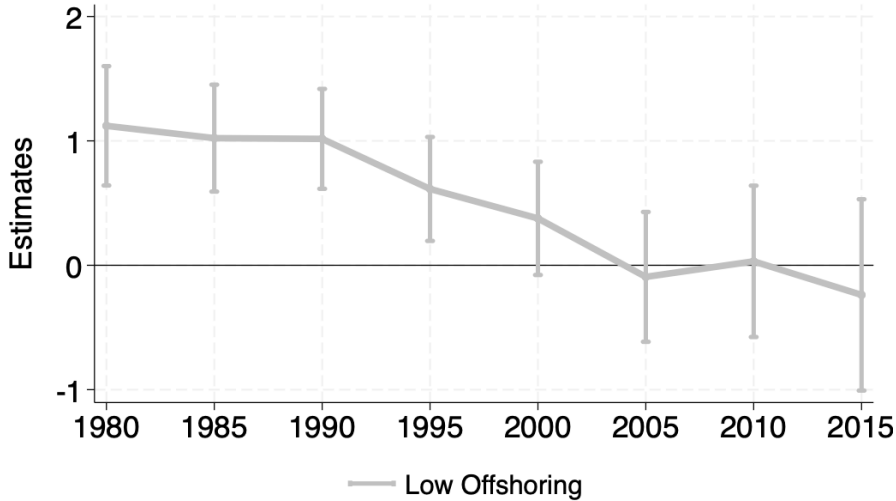

Skill Abundance does not Matter Even Absent Offshoring

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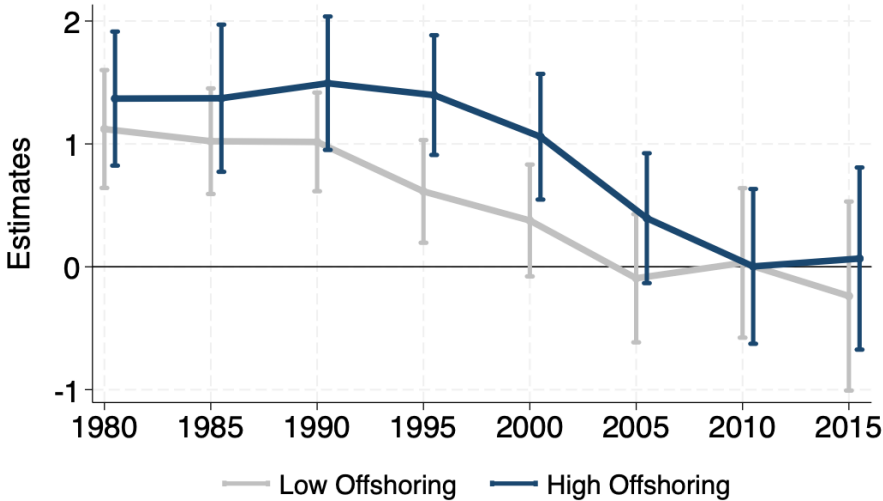

Same Results from Continuous Measures

$$\ln \text{Exports}_{i,j,s,t} = \beta_t^0 \left(1 + \beta_t^A \text{Auto}_{i,s} + \beta_t^O \text{Ofs}_{i,s}\right) \cdot \left[\text{Skill Int.}_{s,t} \times \text{Skill Abd.}_{i,t}\right] + \eta_{i,j,t} + \eta_{j,s,t}$$

	1995	2010	1995	2010
Skill Intensity x Abundance	1.26	-0.33		
	(0.23)	(0.28)		
x Automation (log robot stock)				
x Offshoring Share (×100)				

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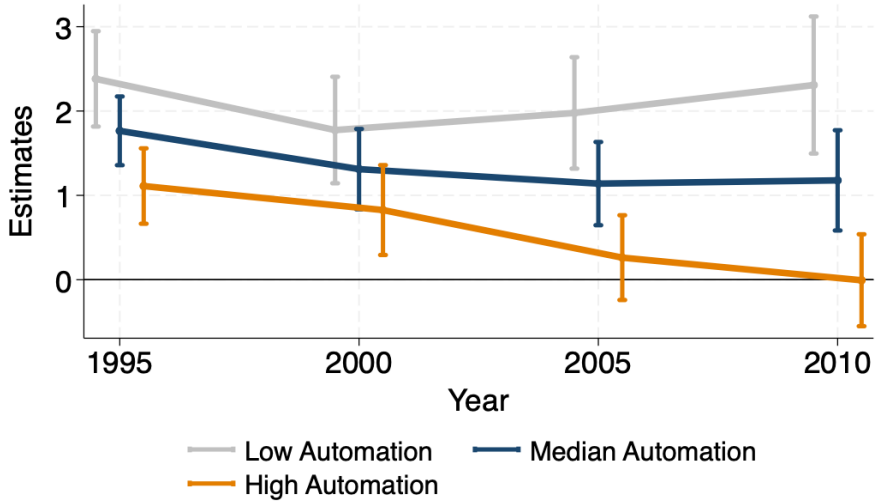
	1995	2010	1995	2010
Skill Intensity x Abundance	1.26	-0.33	3.00	**3.49**
	(0.23)	(0.28)	(0.41)	(0.57)
x Automation (log robot stock)			-0.19	**-0.35**
			(0.05)	(0.06)
x Offshoring Share (×100)			0.04	0.05
			(0.05)	(0.07)

Note: Automation measure: 12.2 for German cars, 2.3 for Indian textiles

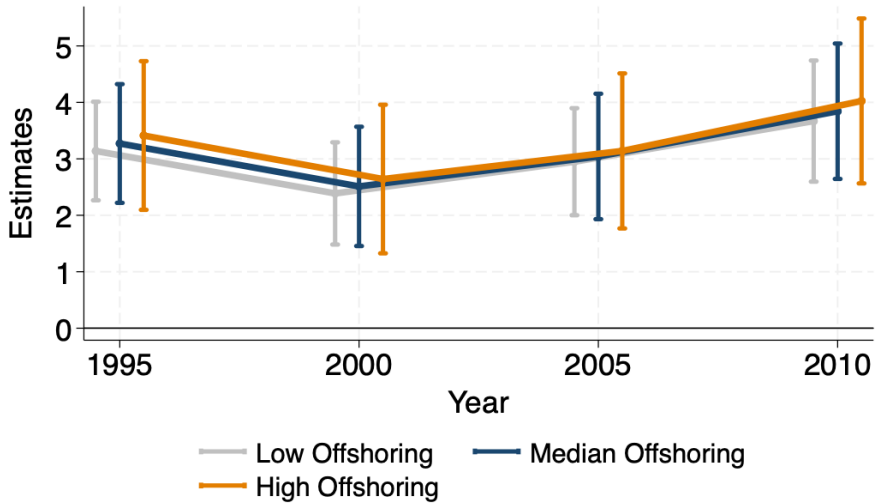
Skill Abundance Still Matters Absent Automation

Fitted values for groups with automation of 10th, 50th, and 90th percentiles



Offshoring Seems Unrelated to Change in Pattern

Fitted values for groups with offshoring of 10th, 50th, and 90th percentiles



Controlling China Shock does not Change Results

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x China's RCA				

Controlling China Shock does not Change Results

	1995	2010	1995	2010
Skill Intensity x Abundance	1.26	-0.33	2.43	**3.51**
	(0.23)	(0.28)	(0.45)	(0.46)
x Automation (log robot stock)			-0.15	**-0.31**
			(0.05)	(0.05)
x Offshoring Share (×100)			0.03	0.11
			(0.05)	(0.06)
x China's RCA			0.20	**0.34**
			(0.12)	(0.13)

Takeaway: **China shocks strengthen the Heckscher-Ohlin force**

Summary of Empirical Facts

- **Skill abundance becomes less important in comparative advantage** over time
  - Less important with higher **automation**
  - Offshoring has surprisingly no relationship

MODEL: TRADE WITH AUTOMATION AND OFFSHORING

Overview

- Multi-sector Eaton-Kortum model with input-output linkages

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Overview

- Multi-sector Eaton-Kortum model with input-output linkages
  - **New: Task framework for automation and offshoring**
- Primary factors:
  - Labor: $H_{i,s}$ (high-skilled), $L_{i,s}$ (low-skilled)
- Additional production factors (produced using outputs: roundabout)
  - Automation Capital: $A_{i,s}$
  - Intermediate: $X_{i,s}$ (domestic), $O_{i,s}$ (foreign, offshored)
    - ⋆ including non-automation capital (buildings, land)

Demand: Standard Multi-Sector Eaton Kortum Model

- Country i, j, Sector s
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- Country i, j, Sector s
- Preference across sectors: Cobb-Douglas with expenditure share of $\mu_{j,s}$
- Trade share (gravity equation) within sectors:

$$\pi^{F}_{i,j,s} = \frac{(c_{i,s} \cdot \tau_{i,j,s})^{-\theta}}{\sum_{l}^{\mathcal{I}} (c_{l,s} \cdot \tau_{l,j,s})^{-\theta}}$$

  - Unit cost: $c_{i,s}$—endogenously determined from production processes (next)
  - Trade cost: $\tau_{i,j,s}$
  - Trade elasticity $\theta > 0$

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- Production function for each task ($\psi_{i,s}^f(x)$ task-specific tech)

$$T_{i,s}(\omega, x) = \underbrace{\psi_{i,s}^A(x) A_{i,s}(\omega, x)}_{\text{Automation Capital}} + \underbrace{\psi_{i,s}^L(x) L_{i,s}(\omega, x)}_{\text{Production Labor}} + \underbrace{\psi_{i,s}^X(x) X_{i,s}(\omega, x)}_{\text{Domestic Input}} + \underbrace{\psi_{i,s}^O(x) O_{i,s}(\omega, x)}_{\text{Foreign Input}}$$

Suppl 2/2: Task Allocation $\mathcal{T}^f_{i,s}$, Task Share $\Gamma^f_{i,s}$

- Task production cost using factor f: $c^f_{i,s}(z) \equiv w^f_{i,s} / (\psi^f_{i,s}(z))$ for $f \in \{A, L, X, O\}$

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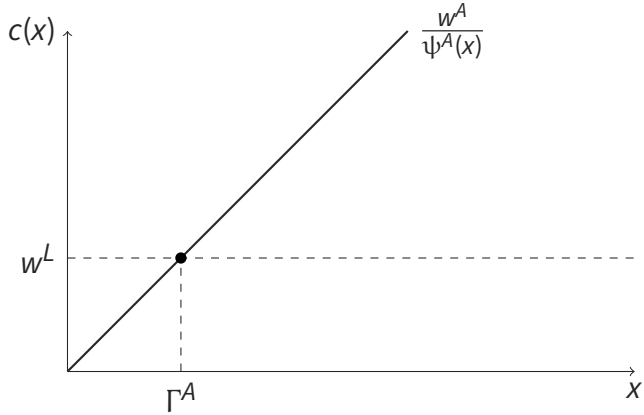
At Glance: Task Allocation and Task Share

For given w_i^L and $w_{i,s}^A$, consider automation shock $\psi^A(x)$ from $\psi^{A'}(x)$



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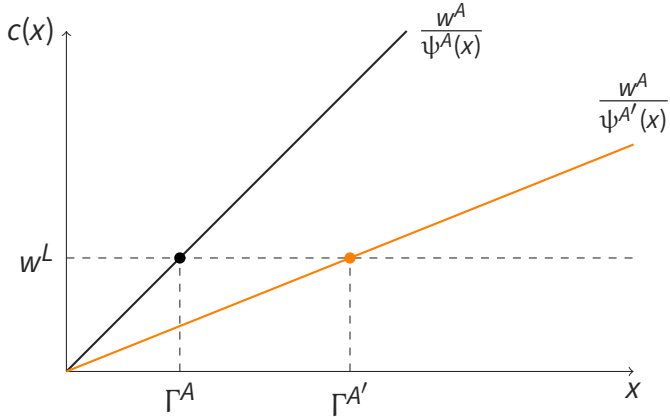

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- Unit cost of production:

$$c_{i,s} = \Lambda_s \cdot (w^H_i)^{\alpha^H_s} \cdot \left[\left(\frac{w^A_{i,s}}{\Gamma^A_{i,s}} \right)^{\Gamma^A_{i,s}} \cdot \left(\frac{w^L_i}{\Gamma^L_{i,s}} \right)^{\Gamma^L_{i,s}} \cdot \left(\frac{w^X_{i,s}}{\Gamma^X_{i,s}} \right)^{\Gamma^X_{i,s}} \cdot \left(\frac{w^O_{i,s}}{\Gamma^O_{i,s}} \right)^{\Gamma^O_{i,s}} \right]^{1-\alpha^H_s}$$

Equilibrium Conditions ▸ Two Country

Given factor endowments $\{H_i, L_i\}$, an equilibrium is a set of wages $\{w_i^H, w_i^L\}$

- Consumers maximize utility by choosing from which countries to buy
  $\rightarrow$ trade share $\pi_{i,j,s}$, as a function of unit cost $\{c_{i,s}\}$
- Unit cost, $c_{i,s}$, as a function of $\{w_i^H, w_i^L\}$
  - $\{w_{i,s}^A, w_{i,s}^X, w_{i,s}^O\}$ are functions of $\{w_i^H, w_i^L\}$ with IO coef.
- Goods and Labor Markets Clear

QUANTIFICATION

Quantitative Analysis: Hat Algebra

- Two Exercises:
  1. Can changes in $\Gamma^{A}_{i,s,t}$ (automation) and $\Gamma^{O}_{i,s,t}$ (offshoring) explain $\widehat{\beta}_t$?
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$$p^A_{i,s,t}A_{i,s,t} = \underbrace{p^K_{i,s,t0}K_{i,s,t0}}_{\text{Capital Income}} \cdot \underbrace{\frac{p^M_{US,s,t0}M_{US,s,t0}}{p^K_{US,s,t0}K_{US,s,t0}}}_{\text{Machine-Capital Ratio}} \cdot \underbrace{\frac{p^R_{i,s,t}R_{i,s,t}}{p^R_{i,s,t0}R_{i,s,t0}}}_{\text{Increases in Robots}} \cdot$$

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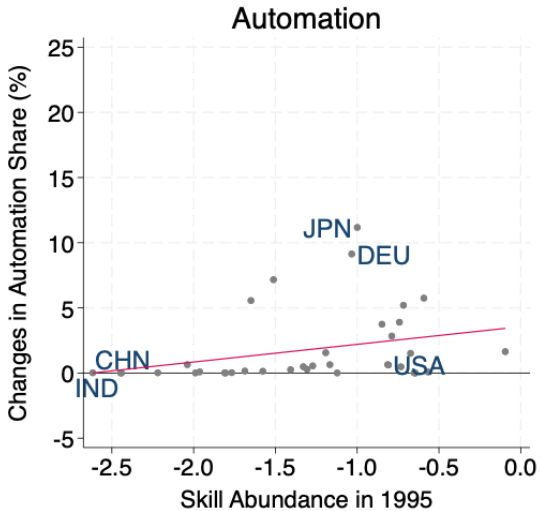
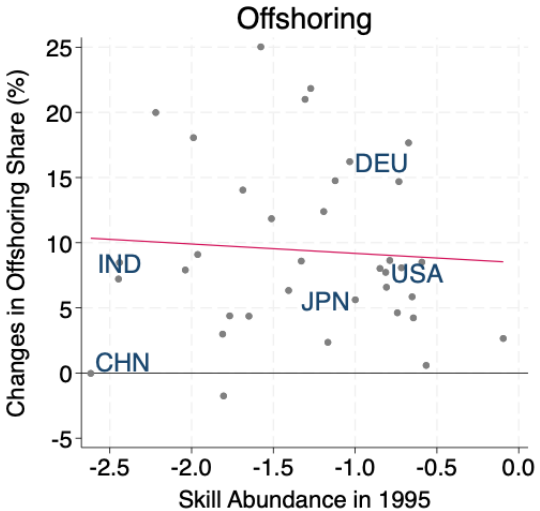
  - Adjust $\Gamma^{L}_{i,s,t}$ (low-skilled labor share) to make $\sum_{F=L,A,X,O} \Gamma^{F}_{i,s,t} = 1$

Data: More Automation in Skill-Abundant Countries





Calibration

Description	Parameter	Value & Source
Panel A: Time-Invariant Parameters (fixed in 1995)		
Trade Elas.	θ	4 (Standard)
Expenditure Share	$\mu_{i,s}$	Data (WIOT)
Factor Endowment	H_i, L_i	Data (WIOT)
Factor Share	$\alpha^H_{i,s}$	Data (WIOT)
Input-Output Coef.	$\alpha^X_{i,r,s}, \alpha^A_{i,r,s}$	Data (WIOT) & Ding (2023)
Panel B: Time-Variant Shocks		
Automation Productivity	$\overline{\psi^A_{i,s}}$	Match $\Gamma^A_{i,s}$
Offshoring Cost	$\overline{\tau^X_{i,s}}$	Match $\Gamma^O_{i,s}$

RESULTS: CHANGES IN COMPARATIVE ADVANTAGE

1. Automation and Offshoring on Changes in $\widehat{\beta}$

- Question: How much can $\Gamma^{A}_{i,s,t}$ and $\Gamma^{O}_{i,s,t}$ explain the path of $\widehat{\beta}_t$?

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1. Calibrate the model to 1995 and shock the economy
2. Construct counterfactual trade flow: $(X_{i,j,s,t})'$
   - Data (World Input-Output Database, incl. Service)
   - Case 1. Only Automation: Change $\Gamma^{A}_{i,s,t}$
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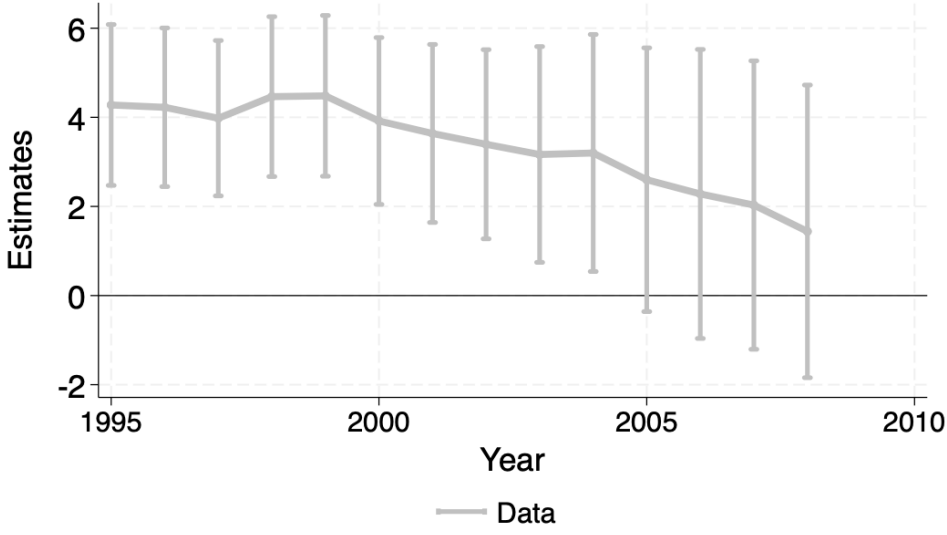
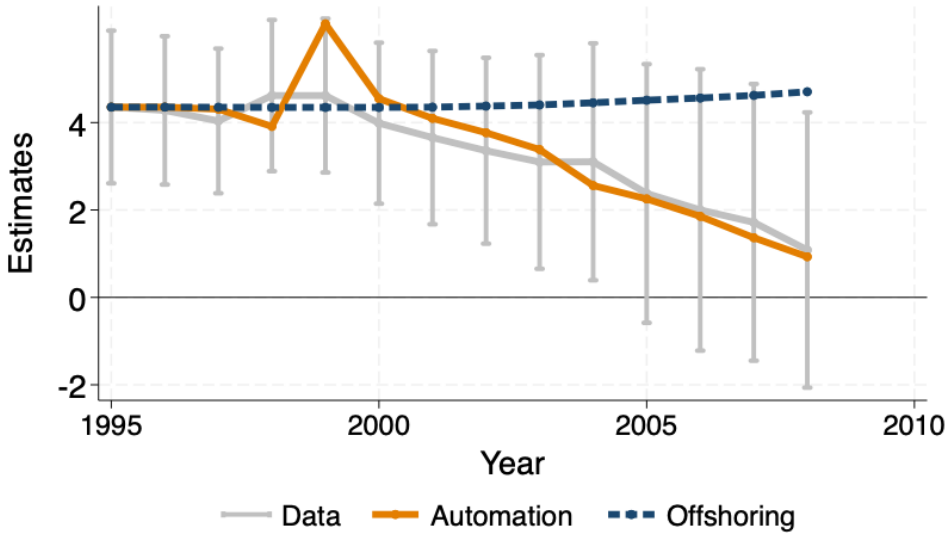
3. Run the same regression as in data but for counterfactual economies

$$\ln(X_{i,j,s,t})' = \beta_t \left[\alpha^{H}_{s,t_0} \times \ln\left(\frac{H_{i,t_0}}{L_{i,t_0}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t} + \varepsilon_{i,j,s,t}.$$

$\widehat{\beta}_t$ Decreases Even Using WIOD



Automation, Not Offshoring, Causes the Decline



Why Automation?

- Sizes of automation are smaller than offshoring
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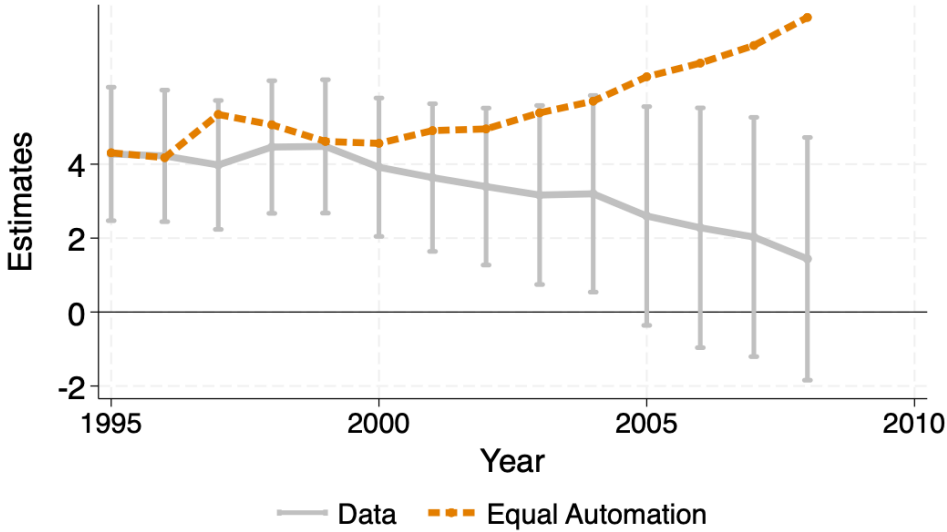
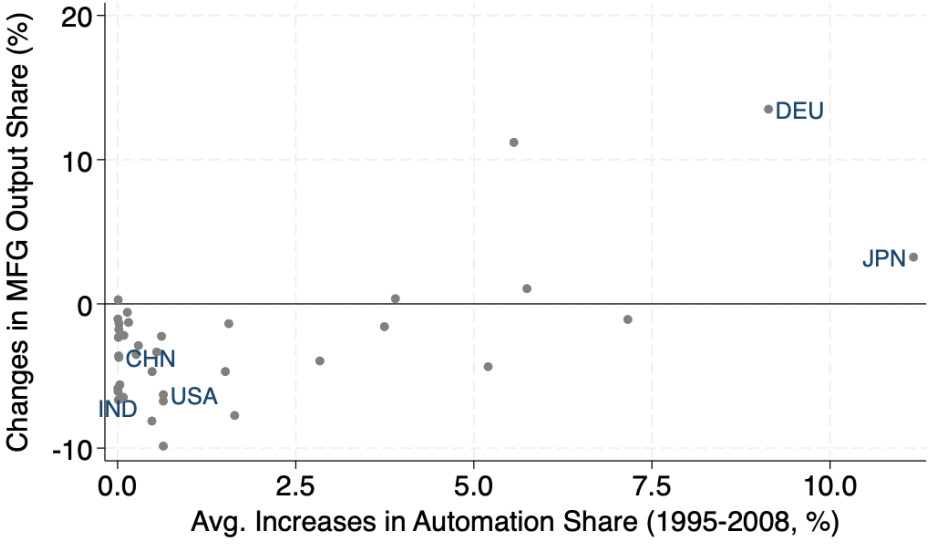
- Experiment: Suppose all the countries increase automation equally...

Equal Automation Cannot Explain the Decline

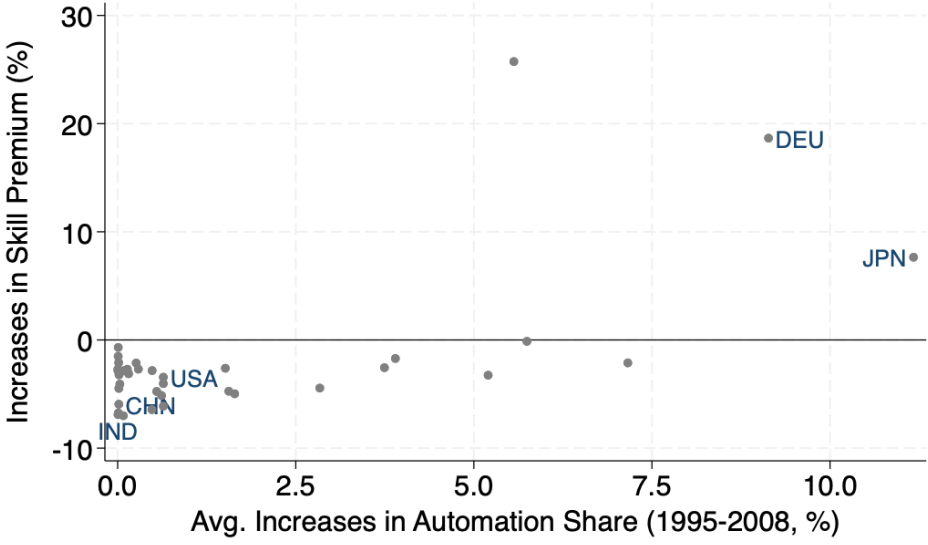


RESULTS: MACRO IMPLICATIONS OF AUTOMATION

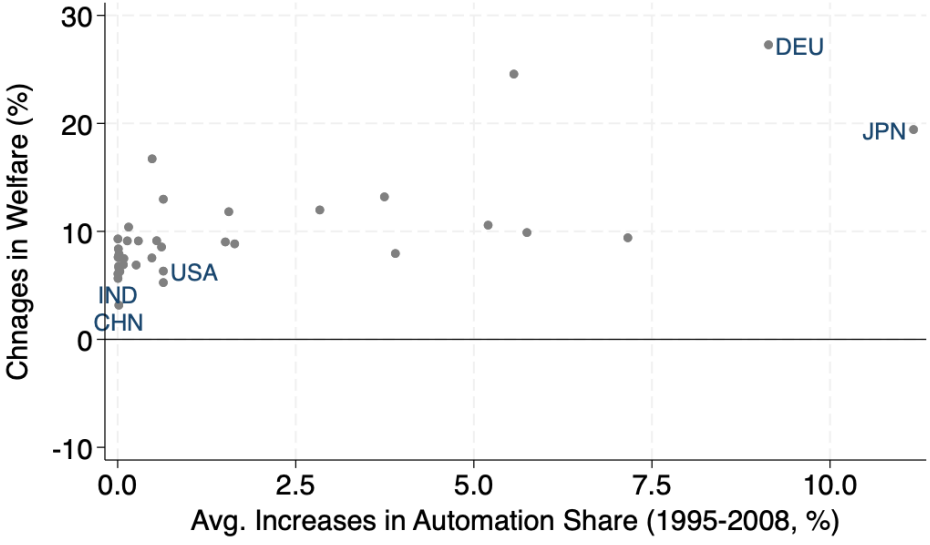
Manufacturing Shifts to High-Automation Countries



Skill Premia Increases Only in High-Automation Countries

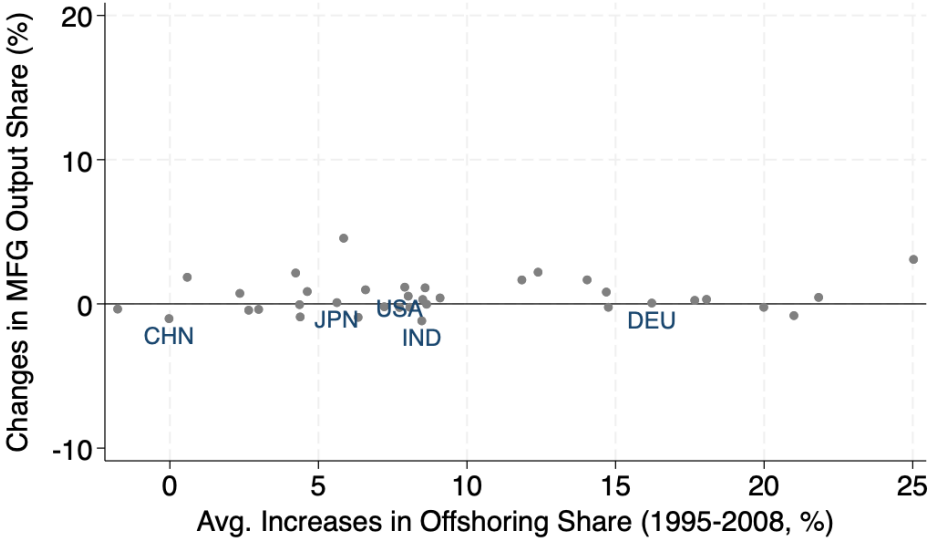


Welfare Increases Everywhere

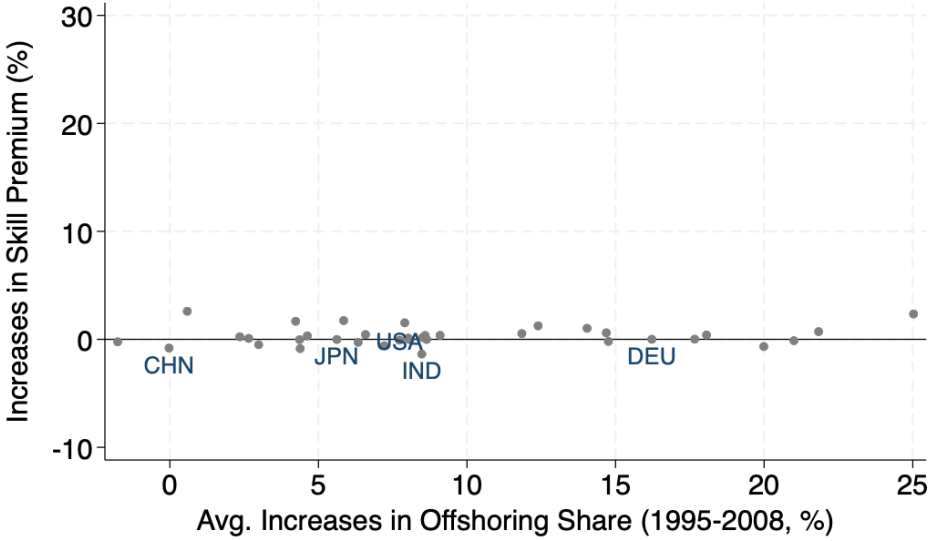


RESULTS: MACRO IMPLICATIONS OF OFFSHORING

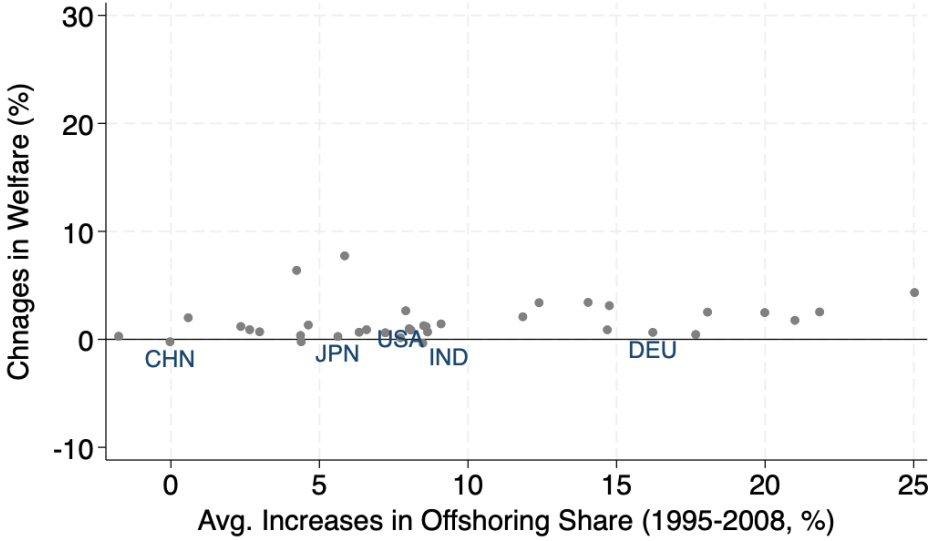
Manufacturing Shifts Less



Skill Premia Increases Everywhere, but Less



Welfare Increases Everywhere, but Less



CONCLUSION

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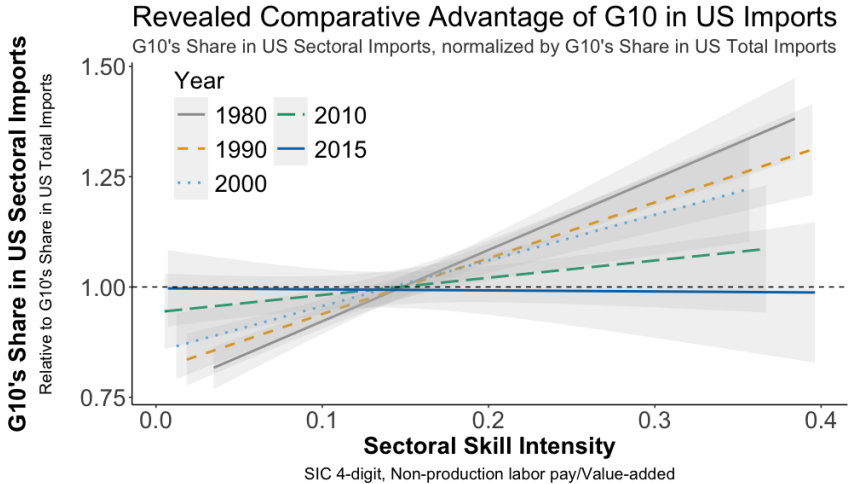
- Automation relocates manufacturing from South to North
  - Inequality within & across countries increases

- Work in progress:
  - Does a robot tax *import* China shocks and backfire in an open economy?
  - Does automation facilitate reshoring and reduce the costs of decoupling?
  - Will clean technology erode the comparative advantage of oil-rich countries?

APPENDIX

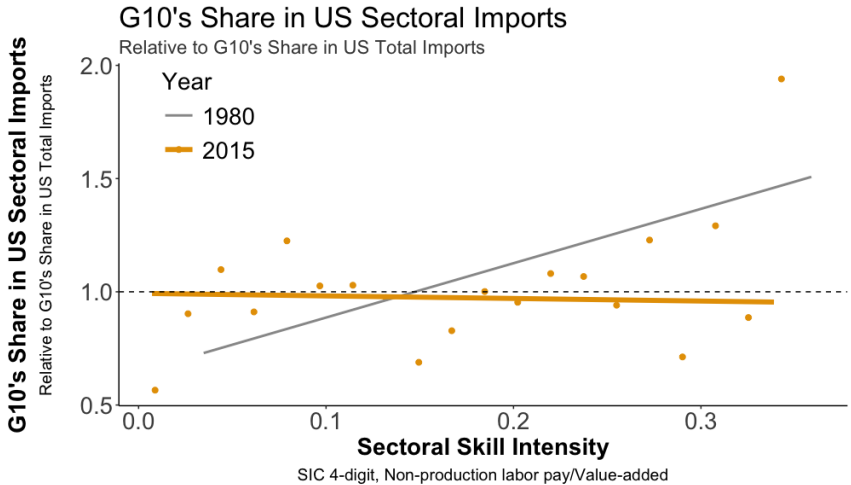
FACTS

It’s Not Just 1980 vs 2015. It’s the Trend!



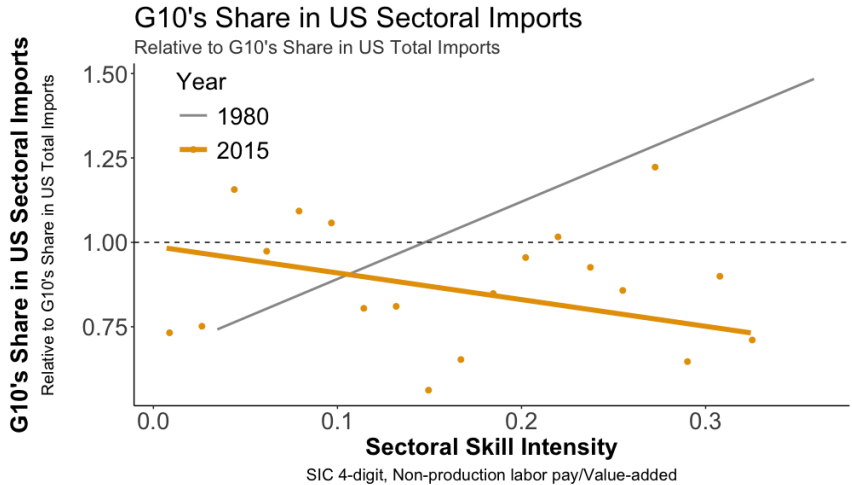
▸ Back

Dropping China Does Not Change the Result



▸ Back

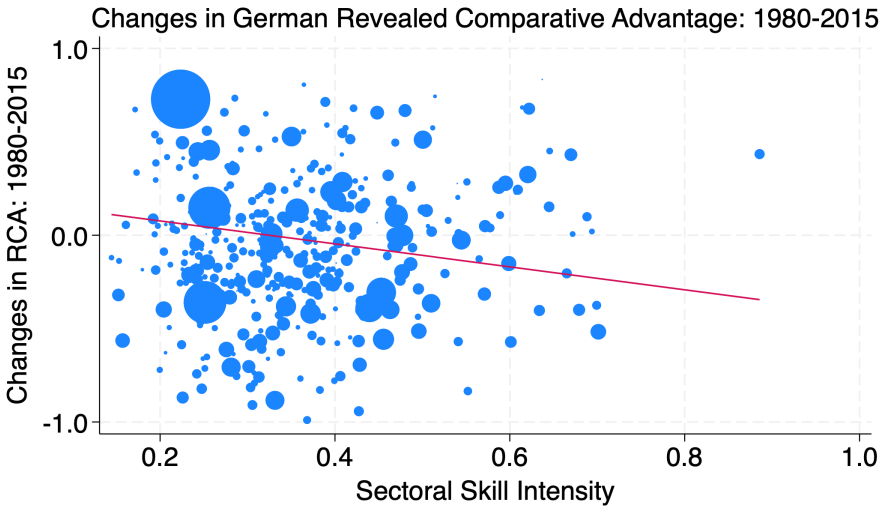
Dropping Japan Does Not Change the Result (if any, cleaner)



▸ Back

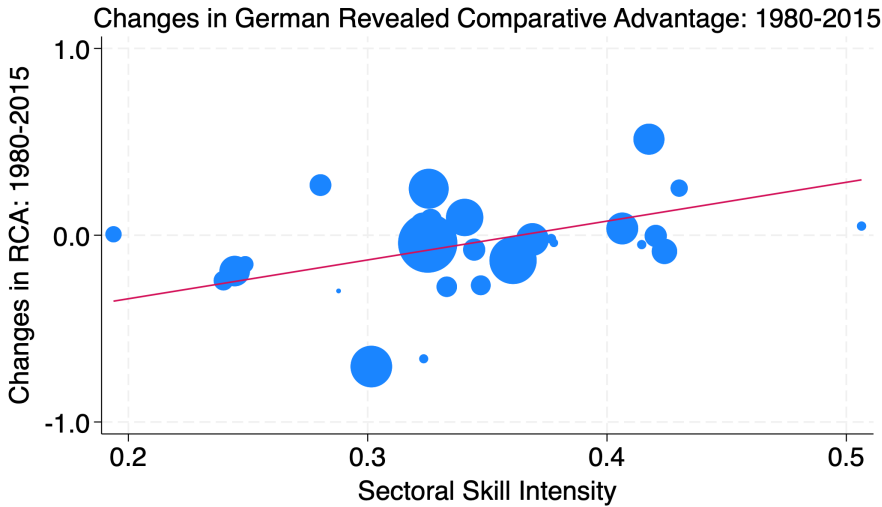
Germany

back



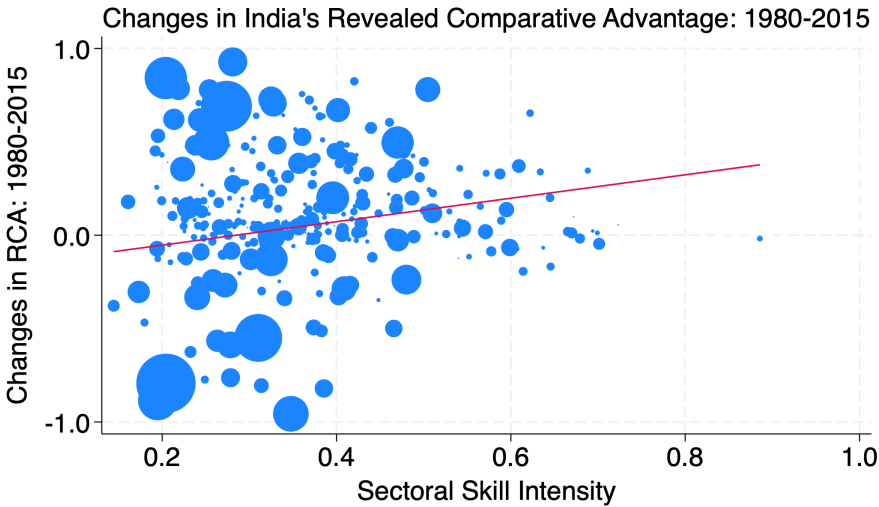
Germany (Low-Automation)

back



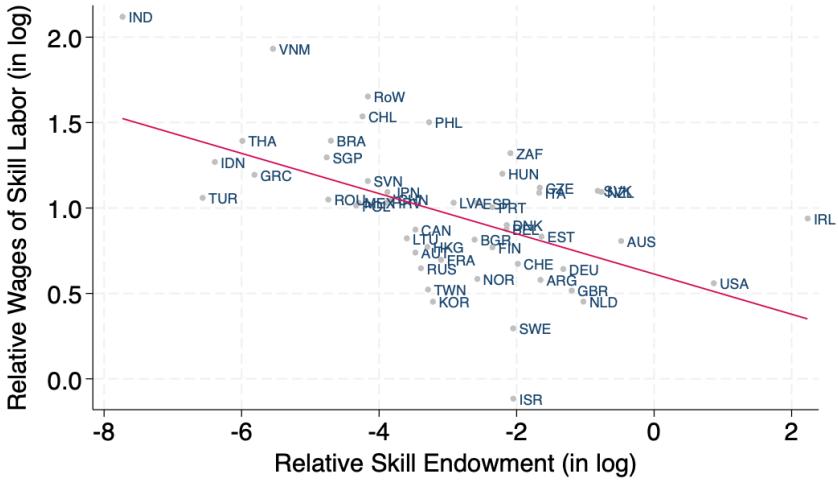
India

back


Changes in India's Revealed Comparative Advantage: 1980-2015
Changes in RCA: 1980-2015
1.0
0.0
-1.0
0.2
0.4
0.6
0.8
1.0
Sectoral Skill Intensity

Relative Skilled Wages Decreasing in Skill Endowment

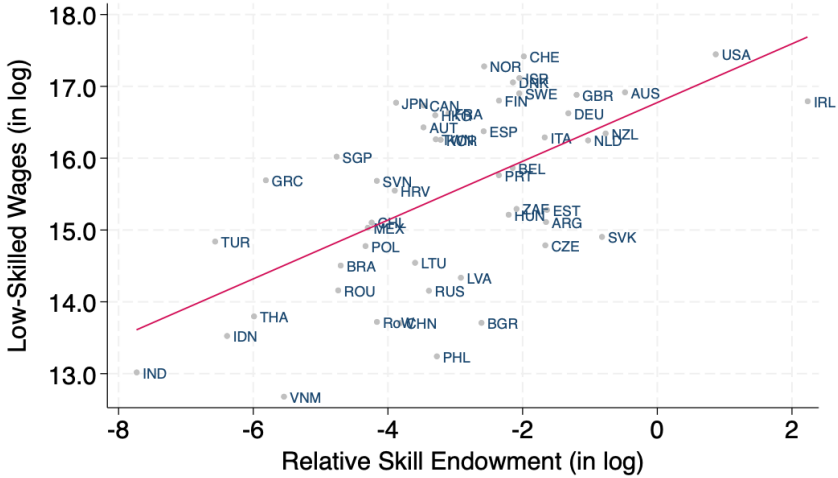
back



Note: Data from GTAP, 2004

Unskilled Wages Increasing in Skill Endowment

back



Note: Data from GTAP, 2004

REGRESSION

Simplified Structural Interpretation

- Gravity Equation + Unit Production Cost

$$X_{i,j,s} = \left((c_{i,s}\tau_{i,j}\tau_{j,s})\right)^{1-\sigma} \cdot (P_{j,s})^{\sigma-1} X_{j,s}, \quad \ln X_{i,j,s} = (1-\sigma) \cdot \ln c_{i,s} + \mu_{i,j} + \mu_{j,s}$$

$$c_{i,s} = (w_i^H)^{\alpha_s^H} (w_i^L)^{1-\alpha_s^H}, \quad \ln c_{i,s} = \underbrace{\frac{d\ln(w^H/w^L)}{d\ln(H/L)}}_{\equiv \epsilon^w\text{: Rel. Wage Elas.<0}} \cdot \alpha_s^H \cdot \ln\left(\frac{H_i}{L_i}\right) + \ln w_i^L$$

- Regression

$$\ln X_{i,j,s} = (1-\sigma)\epsilon^w \left[\alpha_s^H \times \ln\left(\frac{H_i}{L_i}\right)\right] + \mu_{i,j} + \mu_{j,s} + \ln w_i^L$$

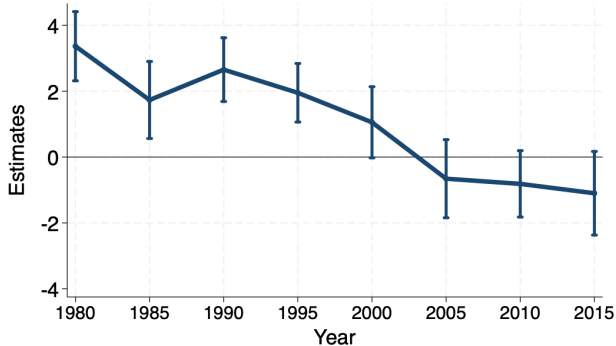
▸ back

ROBUSTNESS

Controlling Capital Intensity

back

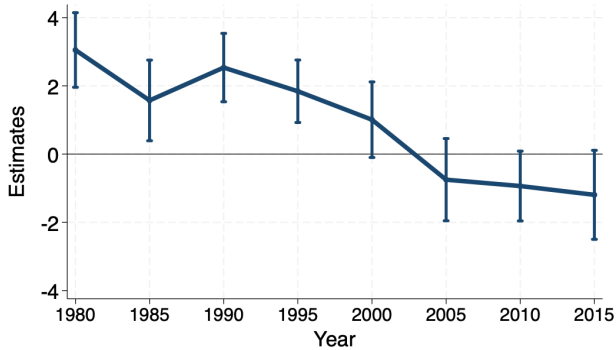
$$\ln X_{i,j,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \beta^K_t \left[\alpha^K_{s,t} \times \ln \left(\frac{K_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t}$$



Controlling Capital Intensity and Institutions

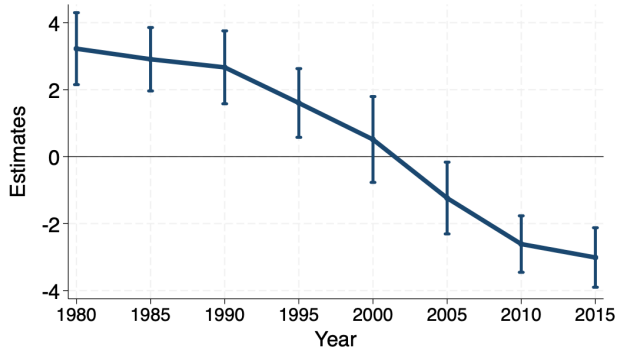
back

$$\ln X_{i,j,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \sum_{f \in \{K,l\}} \beta^F_t \left[\alpha^F_{s,t} \times \ln \left(\frac{F_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t}$$



Weighted by Country Export

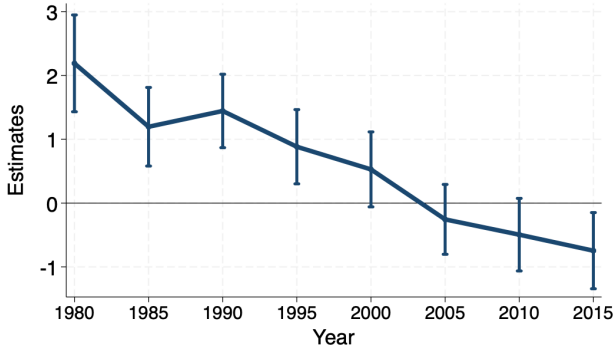
back



Pool and control Origin-Sector FEs

back

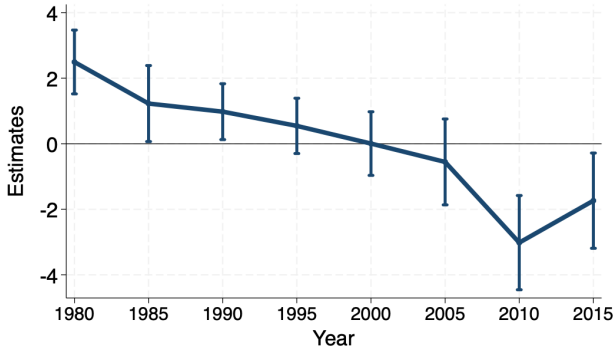
$$\ln X_{i,j,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,s} + \eta_{i,j,t} + \eta_{j,s,t}$$



High-school Graduates as Skilled

back

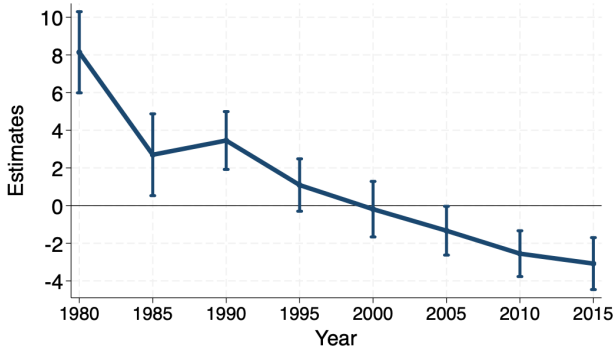
$$\ln X_{i,j,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{HS_{i,t}}{NHS_{i,t}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t}$$



Instrument Skill Endowment by Cohort IV

back

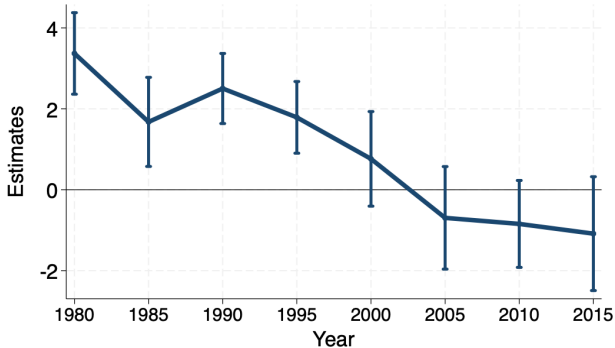
$$\ln X_{i,j,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t}$$



Romalis (2004): Total Export

back

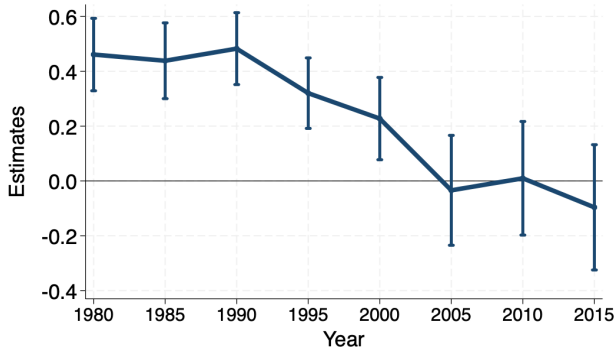
$$\ln X_{i,s,t} = \beta_t \left[\alpha^H_{s,t} \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,t} + \eta_{s,t}$$



Chor (2011): Num of Workers as Factor Intensity

back

$$\ln X_{i,j,s,t} = \beta_t \left[\ln \left(\frac{H_{s,t}}{L_{s,t}} \right) \times \ln \left(\frac{H_{i,t}}{L_{i,t}} \right) \right] + \eta_{i,j,t} + \eta_{j,s,t}$$

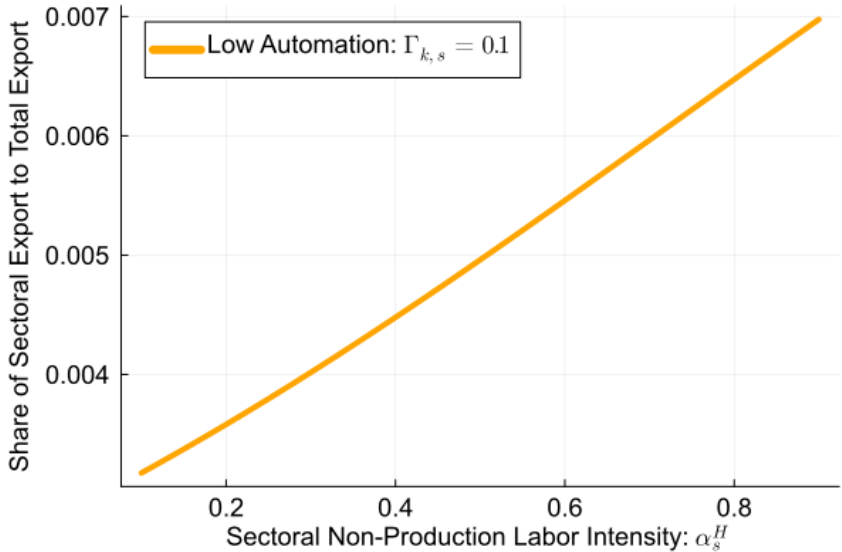


TWO COUNTRY ILLUSTRATION: AUTOMATION

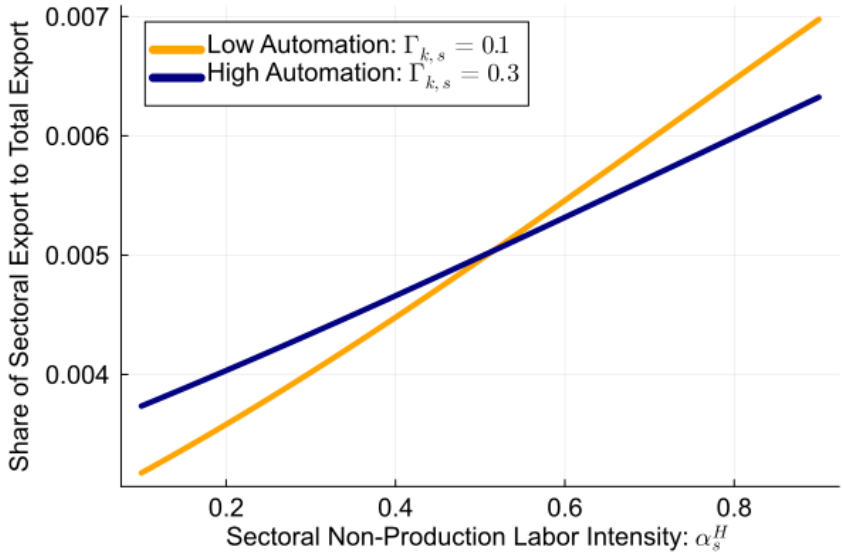
Two Country Illustration: Automation

- North (40% are H) and South (25% are H)
- Actual factor intensity across 397 SIC sectors
- Set $\alpha_s^G = \alpha_s^M = 0$ (focus on value-added)
- Exogenous changes in factor intensity common across sectors & countries
  - Automation: Increase $\Gamma_{i,s}^K = 0.1$ to 0.3
- Show export share of each sector in North against α_s^H – Slope is β^H

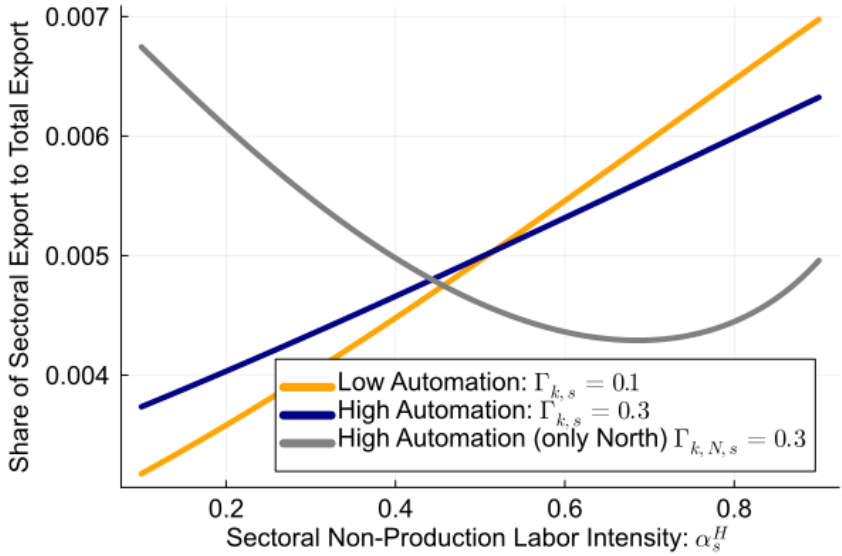
North Specialize in Skill-Intensive Sectors



Automation Makes Skills Less Important

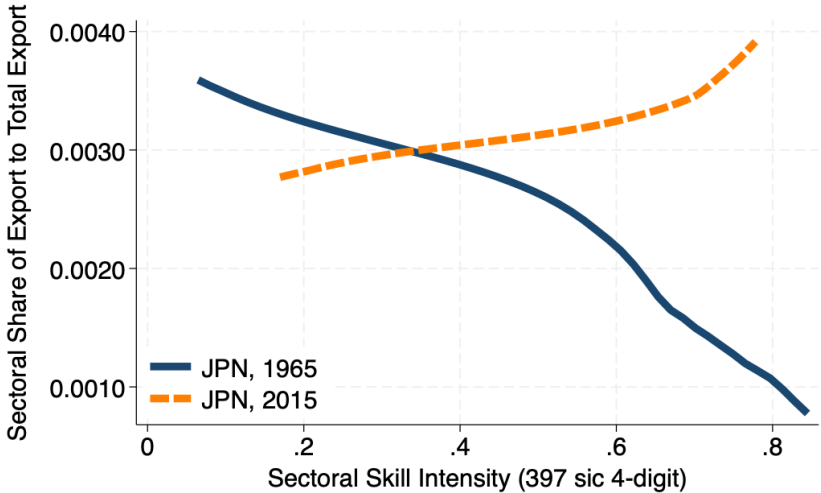


If Only North Automates, Sign Flips



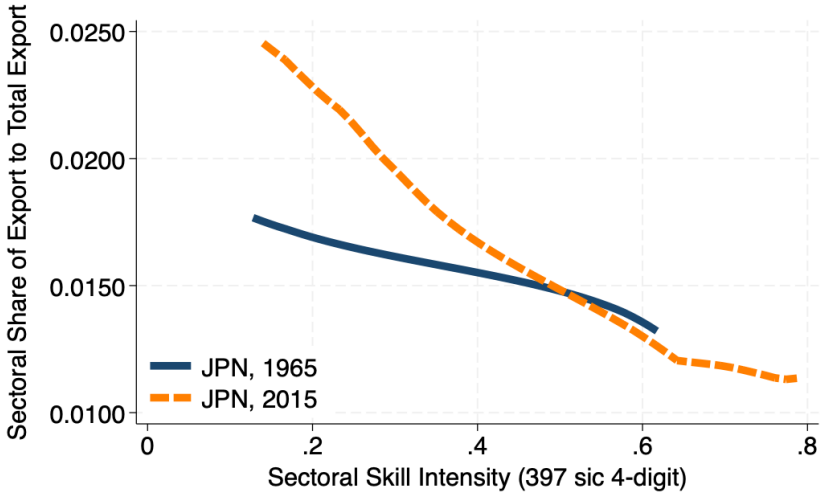
Example: Within Low-Automation Sectors, Japan Specializes in Skill Intensive Industries

Back



Example: Within High-Automation Sectors, Japan Specializes in Low-Skill Intensive Industries

Back



TOY MODEL: TASK AND COMPARATIVE ADVANTAGE

Model

- Small open economy with two sectors ($s = 1, 2$)
- Demand

$$q_S = (c_S)^{1-\sigma} \cdot \overline{Q_S}$$

- Production (micro-foundation = task framework)

$$Y_S = \zeta \cdot (H_S)^{\alpha_S} \left((L_S)^{\Gamma} (M_S)^{1-\Gamma} \right)^{1-\alpha_S}, \quad \alpha_1 = 1 - \alpha_2 = \alpha > 1/2$$

  - M_S: machines or foreign factors supplied at a fixed price r

- Factor market clearing

$$\sum_{s=1,2} H_S = H, \quad \sum_{s=1,2} L_S = L$$

Equilibrium

- Wages $\{w^L, w^H\}$ that satisfy

$$w^L L = \Gamma(1-\alpha)(c_1)^{1-\sigma} + \Gamma\alpha(c_2)^{1-\sigma}, \quad w^H H = \alpha(c_1)^{1-\sigma} + (1-\alpha)(c_2)^{1-\sigma}$$

- Unit cost

$$c_s = \left(w^H\right)^{\alpha_s} \left((w^L)^{\Gamma}(r)^{1-\Gamma}\right)^{1-\alpha_s}$$

Comparative Advantage

- A change in factor endowment $\widehat{H} = -\widehat{L}$ (=compare two small countries)
- Up to 1st order, CA in H-intensive sector ($s = 1$)

$$\widehat{c_2} - \widehat{c_1} = \underbrace{-(2\alpha - 1)\widehat{\omega}}_{\text{Skill Premium<0}} \underbrace{-(1 - \Gamma)(2\alpha - 1)\widehat{w^L}}_{\text{Task Displacement}}$$

- Skill premium ($\widehat{\omega} \equiv \widehat{w^H} - \widehat{w^L}$) and wages

$$\widehat{\omega} = \underbrace{-2\widehat{H}}_{\text{Labor Supply}} + \underbrace{(2\alpha - 1)(\sigma - 1)\left(\widehat{c_2} - \widehat{c_1}\right)}_{\text{GE Effect}}, \quad \widehat{w^L} = \frac{(\sigma - 1)(2\alpha - 1) - 1}{2 + (1 - \Gamma)(\sigma - 1)(2\alpha - 1)}\widehat{\omega}$$

Comparative Advantage if $\Gamma = 1$

Proposition 1: Rybczynski (1955)

An increase in skilled labor $\widehat{H} > 0$ strengthens comparative advantage in a skill-intensive sector.

$$\widehat{c_2} - \widehat{c_1} = \frac{2(2\alpha - 1)}{1 + (2\alpha - 1)^2(\sigma - 1)}\widehat{H}$$

Comparative Advantage if $\Gamma < 1$

Proposition 2: Acemoglu-Restrepo meets Rybczynski

An increase in skilled labor $\widehat{H} > 0$ strengthens comparative advantage in a skill-intensive sector. However, the elasticity is lower when labor share Γ is lower.

$$\widehat{c_2} - \widehat{c_1} = \frac{2(2\alpha - 1)}{\frac{1}{\eta(\Gamma)} + (2\alpha - 1)^2(\sigma - 1)}\widehat{H} \tag{1}$$

where $\eta(\Gamma) = 1 - \frac{1-(\sigma-1)(2\alpha-1)}{\frac{2}{1-\Gamma}+(\sigma-1)(2\alpha-1)} \in (0, 1)$ is increasing in Γ.

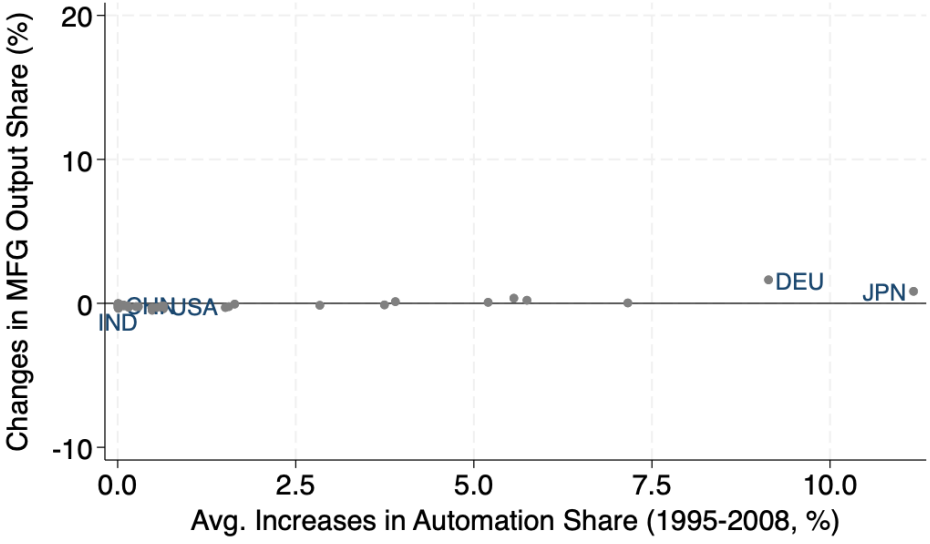
Automation, Globalization, and Inequality

- Automation $\rightarrow$ shifts MFG to High-Automation countries
- Demand for H increases in High-Automation countries
- Demand for L increases in Low-Automation countries
  - Move to Service sectors, which are more L–intensive

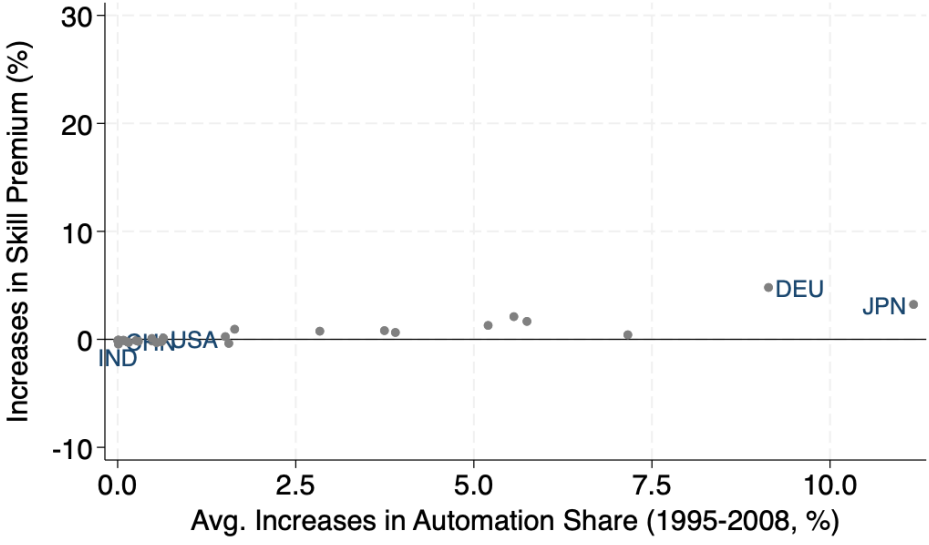
Automation, Globalization, and Inequality

- Automation $\rightarrow$ shifts MFG to High-Automation countries
- Demand for H increases in High-Automation countries
- Demand for L increases in Low-Automation countries
  - Move to Service sectors, which are more L–intensive
- Roles of Trade?
  - Now, set the trade elasticity $\theta = 1$, instead of $\theta = 4$
  - This kills sectoral reallocation via expenditure switch across countries

$\theta = 1$: Lower Elas. Makes MFG Shifts Less



$\theta = 1$: Skill Premia Increases Everywhere



$\theta = 1$: Welfare Increases Everywhere, but Less