

Technology, Trade and Structural Change

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Structural changes and job polarization

- Advanced economies have undergone rapid structural change across sectors over the last decades.
 - Share of French employment in services: 55% in the 1980s, 75% in the 2010s.

⇒ Manifested in terms of industry, occupational composition, and in terms of the wage distribution.

⇒ Can lead to *Job Polarization*.

- **Decline in employment share in middle-wage jobs, growth in both high and low-wage jobs.**
- Solidly documented in UK, US, continental Europe (Goos-Manning '07; Autor *et al.* 08, Autor & Dorn '13; Goos *et al.* '14).

Main drivers of polarization

- Technology: "Routinization hypothesis"
 - Diffusion of information and communication technology (ICT) lowers demand for routine occupation employment.
 - ICT complements non-routine cognitive occupation employment.
 - Occupations at the bottom of the wage distribution are less affected by ICT in a direct manner.

→ One of the most important forces shaping the workforce (e.g., Autor *et al.* '15; Goos *et al.* '14, Michaels *et al.* '14),

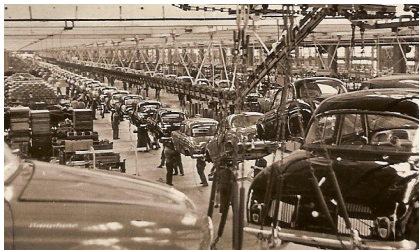
Main drivers of polarization

- Globalization
 - Offshoring: domestic labor is replaced by labor abroad (e.g., Feenstra and Hanson '96, Grossman and Rossi-Hansberg '08, Rodriguez-Clare '10, Blinder and Krueger '13).
 - Exporting may contribute to job polarization by increasing demand for high-skill workers.

Globalization and technological changes

Renault (-Nissan)

France (1960s)
Boulogne-Billancourt



India (2010s)
Chennai



⇒ Analyze the causes of changes in the structure of employment through the lens of the firm.

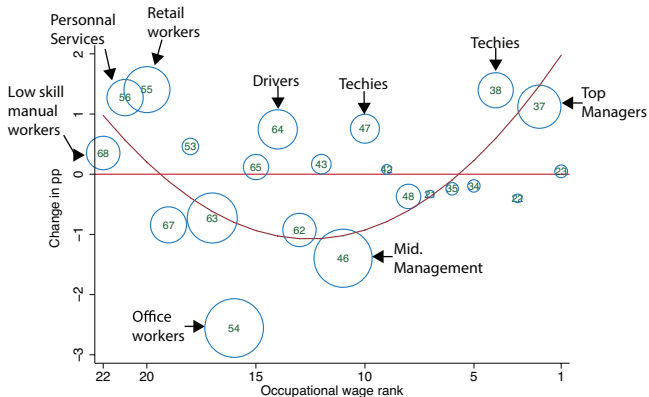
Identifying the impacts of globalization and technology

- Most economic activities are organized by firms.
 - Changes in the composition and internal organization of firms are important factors that drive structural change in the economy.
- Firms make decisions on labor demand.
 - Employment, occupational composition and the distribution of wages.
- Industry level analysis masks substantial variation across firms.
 - Exports, imports and foreign direct investments activities vary by firms and across industries.

Identifying the impacts of globalization and technology

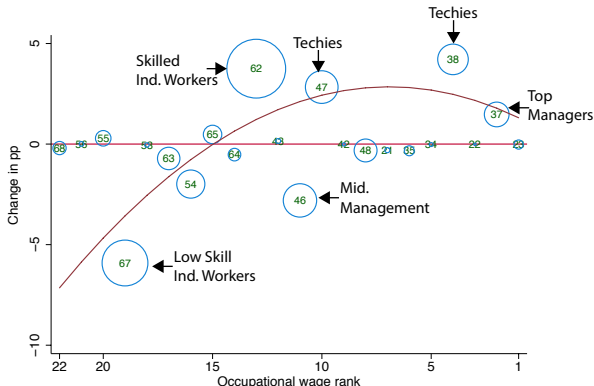
- Berman-Bound-Griliches (1994): within-industry changes explains 70% of the increase in relative demand for nonproduction workers in U.S.
 - Globalization cannot account for much of this change.
- Bernard and Jensen (1997): using Berman et al.'s underlying firm-level data \implies Variation in firm sizes explains 60% of the increase, and that this is driven primarily by firms that trade.
 - Effect mostly driven by firms that trade.
- I analyze the impacts of globalization and technological changes in a series of research papers with James Harrigan, Ariell Reshef and other colleagues

1. Polarization within non-manufacturing, 1994-2007



- Clear pattern, consistent with routinization hypothesis.
- Drivers (64) not replaceable by computers (yet).

2. Skill Upgrading within manufacturing, 1994-2007



- Importance of techies, drop of mid-level professionals.
- Within blue collar skill upgrading (62 vs. 67).

3. Within-between firm decomposition of occupational change, 1994-2007

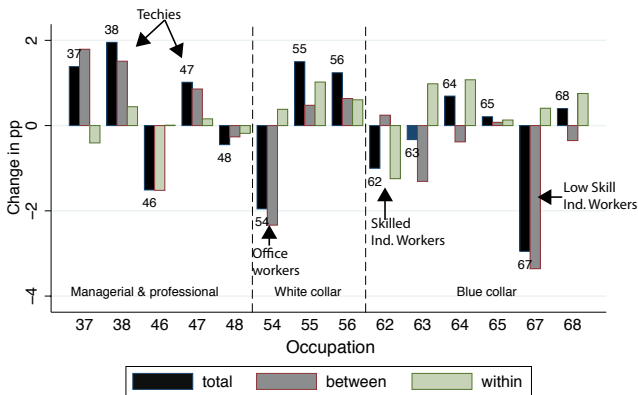
- The change in the share of hours in occupation o in the economy S_{ot} can be decomposed into:
 - Changes in the size of firms λ_{ft} with different s_{fot} ("between" changes).
 - Changes in s_{fot} within firms.

$$\Delta S_o = \underbrace{\sum_f \Delta \lambda_f \bar{s}_{fo}}_{\text{Between}} + \underbrace{\sum_f \bar{\lambda}_f \Delta s_{fo}}_{\text{Within}}$$

- Between (composition/competitiveness)*: Large when firm growth occurs in o -intensive firms.
- Within (substitution)*: Large when o -intensity increases in large firms.

3'. Changes in hours share 1994-2007: All firms

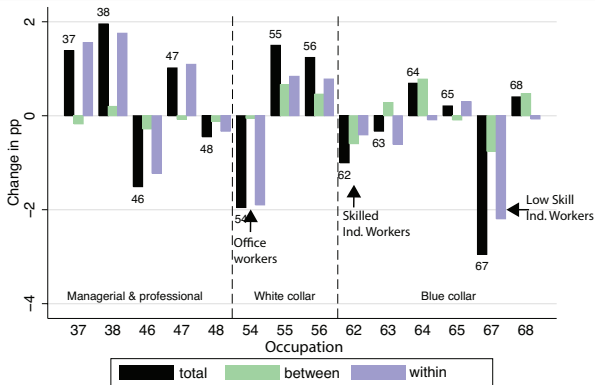
Within-between firm decomposition of occupational change



- Substitution within broad PCS fits routinization hypothesis
- **Between** dominates for many important PCS.

3''. Changes in hours share 1994-2007: All firms

Within-between industries decomposition of occupational change



- Large within industry effects.

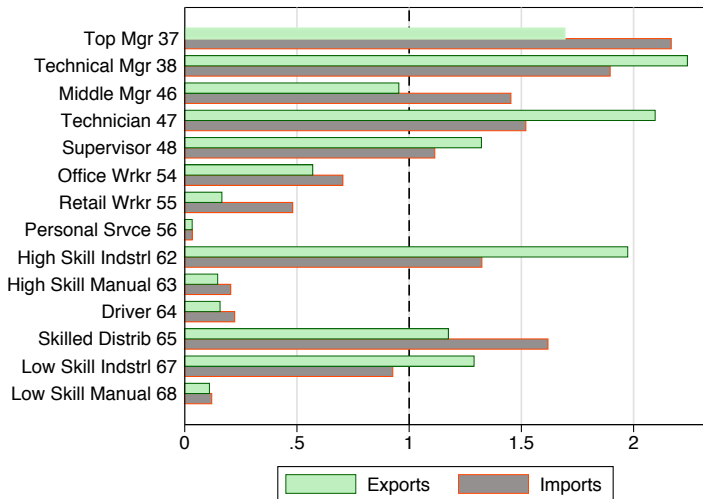
⇒ Change in occupational shares occurs between firms within industries.

Main drivers of occupational changes

- Trade at firm-level: Exports and Imports.
- Technology at firm-level: Techies.
 - Techies develop, install, maintain ICT & other technology.
 - ITC share of techies is about 50% in non-manuf and about 25% in manuf. R&D share of techies is about 3% in non-manuf and about 18% in manuf.
 - Crucial link between economy-wide technological progress and firm level technology adoption (Tambe & Hitt, '14; Brynjolfsson & Hitt, '03).

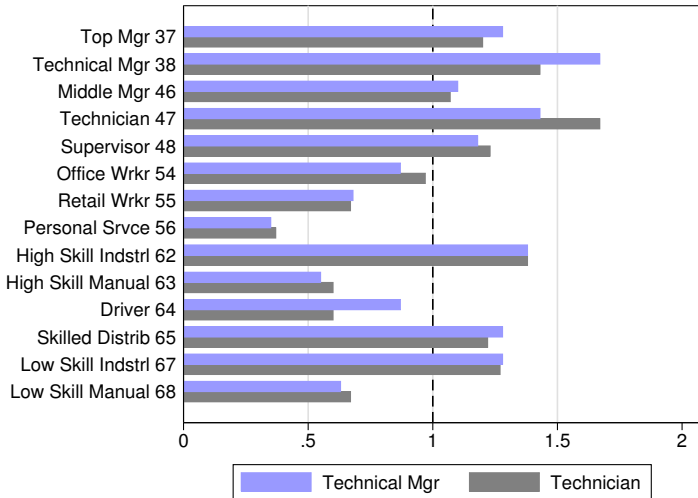
Exposure to trade

Occupational share of trade relative to occupational share of hours



Exposure to techies

Share of hours worked exposed to techies related to economy-wide exposure



Impact of techies and trade on firm-level employment growth

Competitiveness effect

- **Techies** caused faster growth...
 - ... Both in manufacturing and non-manufacturing.
- No China effect.
- **Exporting** has no effect.
- **Importing** has no overall effect.
- Imports of intermediates or from poor countries reduce growth in manufacturing firms.
 - Consistent with offshoring of replacing labor.

Magnitude of the competitiveness effect

- Compare firms at the 50th and zero percentile of the techie share of hours, the former experiences
 - 23% faster employment growth in manufacturing.
 - 11% faster employment growth in non-manufacturing.
- Comparing firms in manufacturing at the 50th and zero percentile of trade in intermediate inputs: the former experiences
 - 20% slower employment growth relative to the latter.

Within-firm (substitution) effects

- **Techies** cause:
 - ① Skill upgrading in nonmanufacturing.
 - ② Polarization in manufacturing.
- **Importing** cause blue-collar skill upgrading in manufacturing.
 - Consistent with offshoring of least skill-intensive tasks.
- **Exporting** cause:
 - Faster growth in managers consistent with higher nonproduction/production ratio among exporters, found repeatedly.
 - Blue collar skill downgrading not previously estimated.

Similar effects in other European countries?

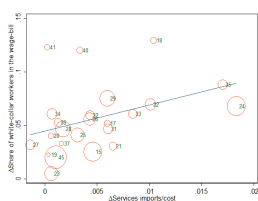
- Falling ICT prices raise the competitiveness of firms.
 - OECD countries (Graetz & Michaels, '16), European countries (Goos, Manning, & Salomons, '14; Gregory, Salomons, & Zierahn, '16).
- Impacts of offshoring.
 - Import competition with China accounts for about 17% of the aggregate decline in mid-wage employment in Denmark (Keller & Utar, 16).

Similar effects for trade in services?

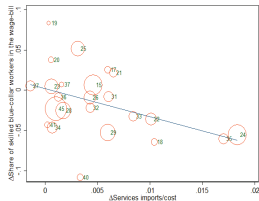
- Many services are skill-intensive and are performed by highly educated individuals.
 - Service offshoring should exert a downward pressure on skilled labour demand (Crinó, '09).
- Amiti and Wei (2005): jobs previously insulated from foreign competition may potentially be imported from abroad.

Change in services offshoring and change in share of:

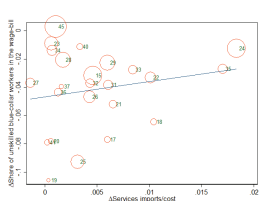
White-collar workers



Skilled blue-col.



Unskilled blue-col.



Import competition and relocation

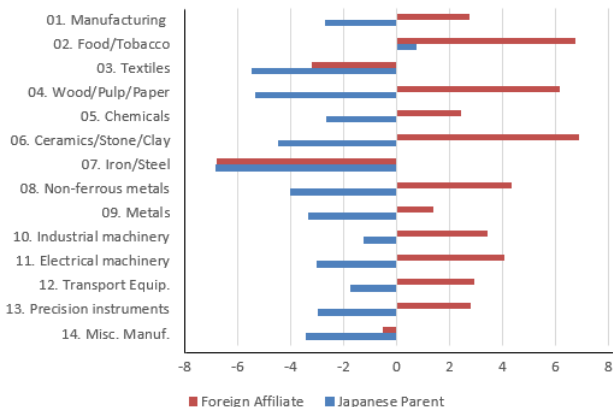
The role of multinational firms (MNEs)

- Multinational firms account for a large share of domestic employment (24% of total French manuf. employment).
- Debate over the possible adverse effect of multinational firms on employment (Harrison & McMillan, 2011).
 - Add to the process of deindustrialization in their countries of location by shifting manufacturing jobs to locations with lower wages or lower labor standards.
 - Substitute domestic unskilled labour intensive manufacturing activities by relatively more skilled labor intensive activities.

Analysis at the impact of Japanese MNEs on domestic employment (1980-2000)

- Drop in domestic employment might be due to a host of confounding factors unrelated to overseas investments.
- Identifying the effect is challenging as all firms reduced domestic employment during the sample period.
 - Comparing average differences in employment before and after overseas investments.
 - Account for post-1991: *the lost decade*.

Average Annual Percentage Change in Parent and Overseas Affiliate Employment (1991-2000)



Analysis at the impact of Japanese MNEs on domestic employment

- Multinational firms have no significant effect on the hollowing out process over 1980-2000.
- Negative impact of Japanese multinationals on their domestic employment in the post-1991 period.
 - Magnitude of the effect is small.
 - Japanese multinationals have reduced their domestic employment by 0.17% per year from 1992 to 2001.
 - Effect is mostly due to vertical fragmentation in East-Asia.

How does the firm-level analysis help?

- Most economic activity is organized by firms.
- Important factors that drive structural change and changes in the wage distribution.
 - Changes in types of firms (Domestic, exporter, importer, MNE).
 - Internal organization (Offshoring, occupational mix).
 - Distribution of firms over time (Size and competitiveness effects).
- Allows distinguishing among competing theories about the determinants of structural change and how it affects the distribution of income.
- While the focus is on the demand side mechanisms, supply shifts are also important factors

Policy implications

- Better assessment of firms that are more likely to affect the overall patterns of employment and wages.
- Targeting these firms may be more effective than blanket policies in mitigating the underlying demand-side driving factors.
- Targeting these firms may keep the costs of labor market regulation low.