Trade, Technology and the Rise of Non-Routine Jobs

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Fostered by revolutionary advances in ICT, production processes have been unbundled across national borders (Baldwin, 2016)

1. Offshoring of tasks that can be summarized in set of well-specified rules and no need for face-to-face contact (Levy and Murnane 2004; Blinder 2009)


- What are the employment structure changes in routine and non-routine jobs?
- How to disentangle the role of trade and technology in driving employment changes?
Occupations database

- Employment data from Annual Labour Force Surveys and Population Censuses

- Countries covered are the 27 members of the EU (per January 2007) plus Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Russia, South Korea, Taiwan, Turkey and the US

- National occupation classifications mapped to a common harmonized occupation classification

- Country-industry-occupation-year specific employment shares that match with the countries and industries distinguished in the World Input-Output Database (Timmer et al. 2015)
The Rise of Non-Routine Jobs

Note: Change in the employment share of non-routine jobs between 1999 and 2007
What accounts for the rise of non-routine jobs?

We provide new evidence on the role of technological change and production relocation.

- Advanced and emerging countries are linked through Global Supply Chains.
- We can determine for each GSC and each occupation:
  - changes in demand (GSC technology)
  - changes in the distribution across countries (relocation)
  - other factors
Task-based model of production

- Production function of GSC $v$:
  \[ Y_v = F_v(T_{1v}, \ldots, T_{jv}, \ldots, T_{Jv}) \]

  If tasks are perfect complements then $T_{jv} = \alpha_{jv} Y_v$.

- Task division across countries:
  \[ T_{jv} = \sum_c T^c_{jv} \]

- Production function of task $j$ in country $c$:
  \[ T^c_{jv} = A^c G_{jv}(K^c_{jv}, N^c_{jv}) \]
GSC technology

Three types of ‘technology’:

(i) Total Factor Productivity (TFP) in a country $A^c$
(ii) Overall production function for a supply chain $F_v$
(iii) Task production functions for a supply chain $G_{jv}$

We refer to (ii) and (iii) together as ‘GSC technology’.
Occupational labour demand

If tasks coincide with occupations then $N_{jv}^c$ is the demand for occupation $j$ in country $c$ by GSC $v$.

This corresponds to $A^c N_{jv}^c$ efficiency units of labour.

If capital and labour are perfect complements in task production then effective labour demand per unit of task output is the same across countries:

$$
\frac{A^c N_{jv}^c}{T_{jv}^c} = e_{jv} \quad \Rightarrow \quad N_{jv}^c = \frac{1}{A^c} e_{jv} T_{jv}^c
$$
Decomposition

\[ N^c_{jv} = \frac{N^c_{jv}}{p_v Y_v} \frac{p_v Y_v}{W} W \]

(1) *within*: occupational labour per dollar of output \( N^c_{jv}/[p_v Y_v] \)

(2) *between*: GSC share \( p_v Y_v/W \)

(3) *income*: world income \( W \)
Further decomposition of within component

\[
\frac{N_{jv}^c}{p_v Y_v} = \frac{1}{A^c} \frac{e_{jv} T_{jv}}{p_v Y_v} \frac{T_{jv}^c}{T_{jv}}
\]

(1a) **TFP**: Total Factor Productivity \( A^c \)

(1b) **GSC technology**: occupational efficiency units per dollar of output

\[
\frac{e_{jv} T_{jv}}{p_v Y_v} = \frac{e_{jv} \alpha_{jv}}{p_v} = \sum_c \frac{A^c N_{jv}^c}{p_v Y_v}
\]

(1c) **Location**: task share

\[
\frac{T_{jv}^c}{T_{jv}} = \frac{A^c N_{jv}^c}{\sum_c A^{c'} N_{jv}^{c'}}
\]
Decomposition of changes in occupational employment

1. Change in occupational employment
   - Between GSCs
   - Within GSCs
     - TFP
     - GSC technology
     - Location
   - Income
The role of trade and technology

Note: Change in the employment share of non-routine jobs due to trade and technology between 1999 and 2007
Concluding remarks

- Technological change drives demand for non-routine jobs in advanced and emerging countries.

- Needs to be recognized and prioritized by policy makers:
  - Education and job training system to prepare humans with skills that are complemented by rather than substituted for technological change
  - Life long learning and retraining currently much more common among high-educated compared to mid-educated. That should change
Intuition: Harmonized occupations data

Country A

Country B

Country A

Country B
Intuition: Technological change

Country A

Country B

Country A

Country B
Intuition: Task relocation