Trade, Technology and the Rise of Non-Routine Jobs

Gaaitzen de Vries
(joint work with Laurie Reijnders)

Groningen Growth and Development Centre, University of Groningen

GGDC 25th Anniversary Conference, June 2017

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)

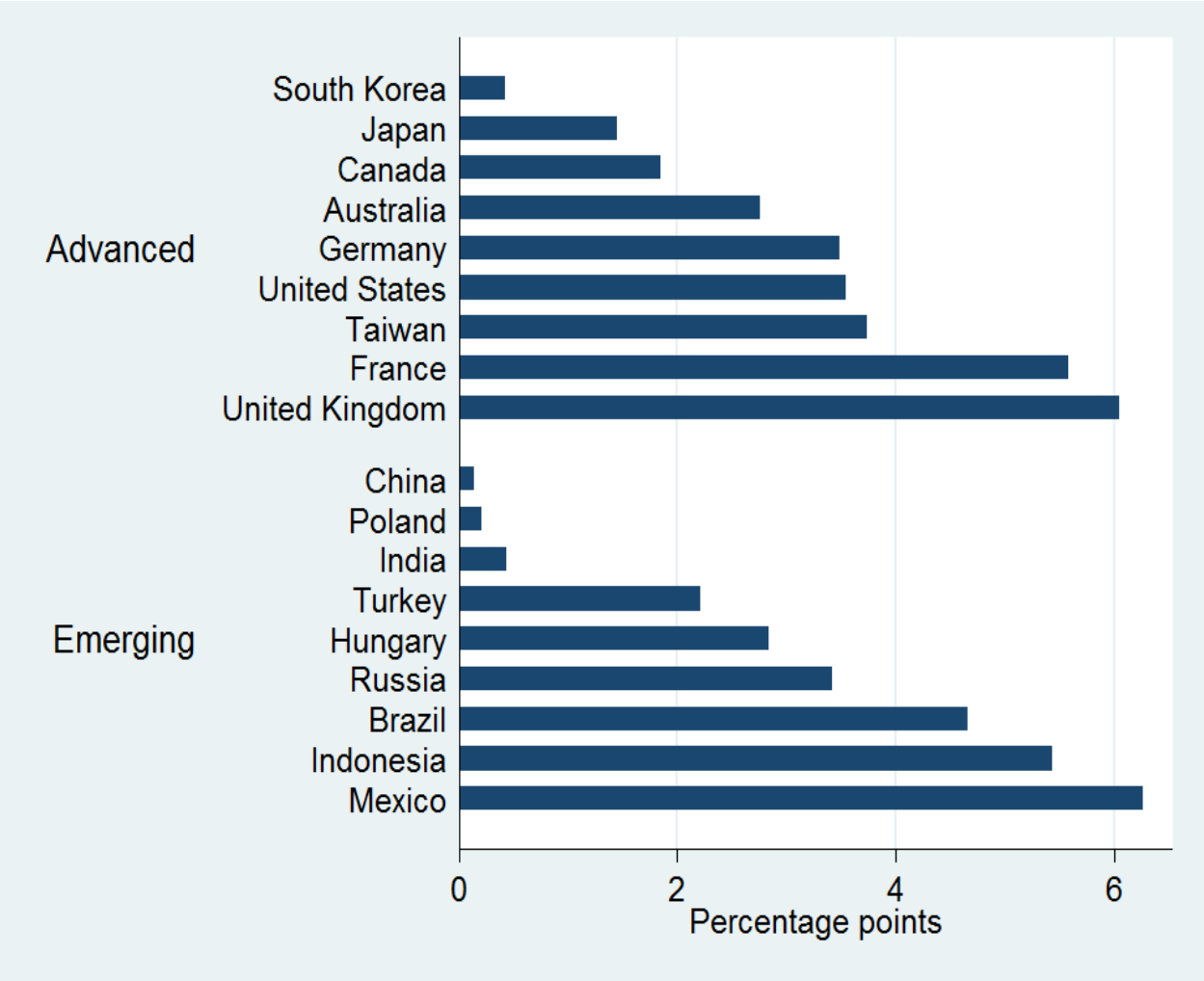
2. Computers and robots displacing labour in performing routine and non-cognitive tasks (Autor et al. 2003)

- 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:

$$T_{jv} = \sum_c T_{jv}^c$$

- Production function of task j in country c:

$$T_{jv}^c = A^c G_{jv}(K_{jv}^c, N_{jv}^c)$$

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

$$N_{jv}^{c} = \frac{N_{jv}^{c}}{p_v Y_v} \frac{p_v Y_v}{W} W$$

(1) *within*: occupational labour per dollar of output $N_{jv}^{c}/[p_v Y_v]$
(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

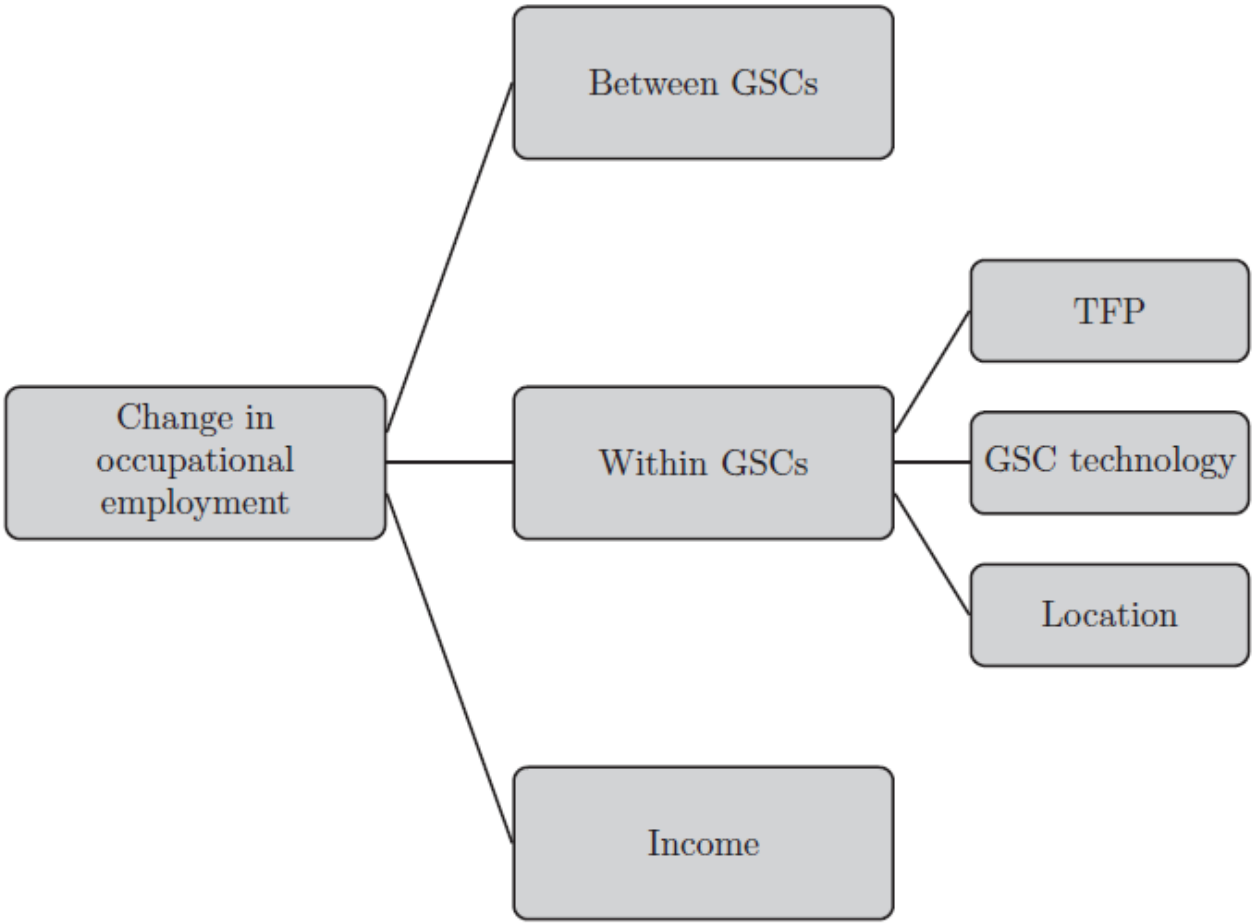
(1b) *GSC technology*: occupational efficiency units per dollar of output

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

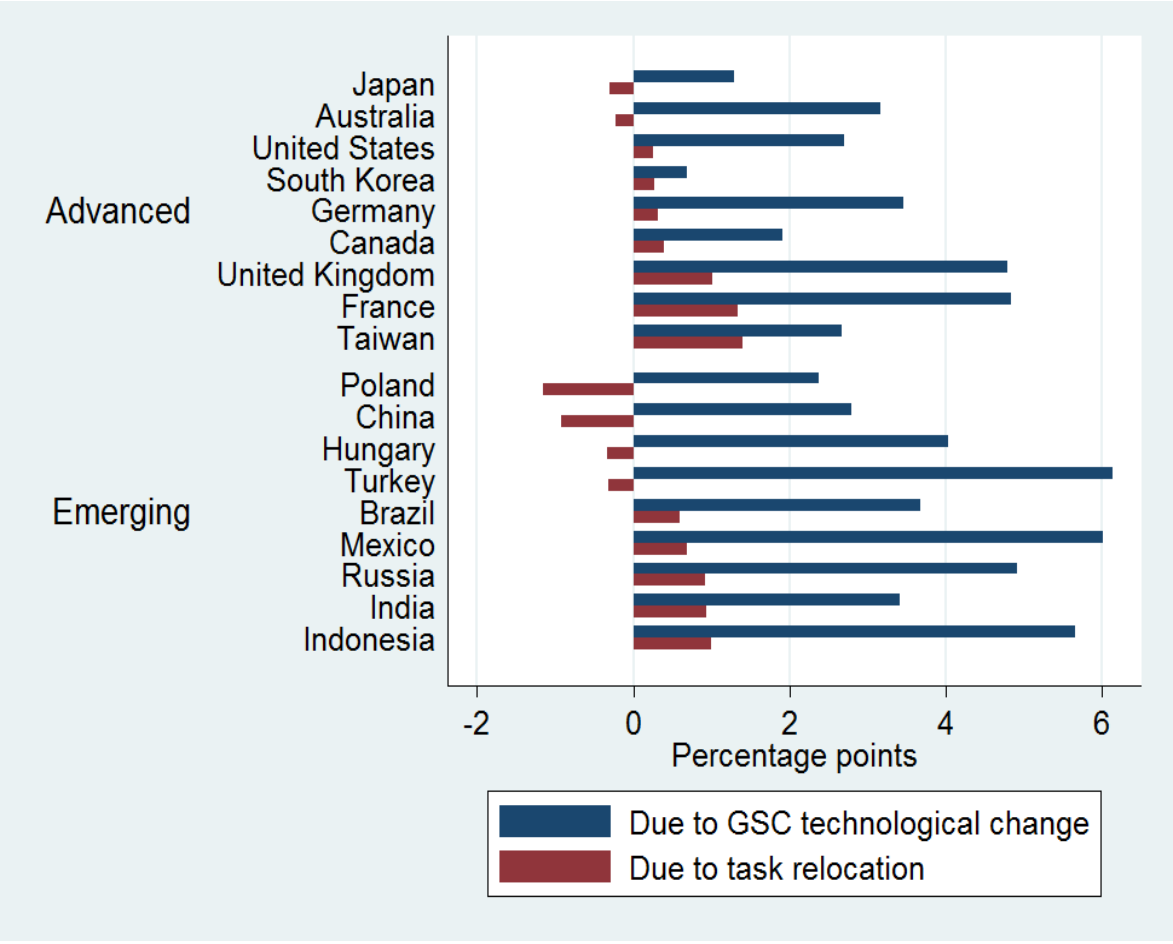
(1c) *Location*: task share

$$\frac{T_{jv}^c}{T_{jv}} = \frac{A^c N_{jv}^c}{\sum_{c'} A^{c'} N_{jv}^{c'}}$$

Decomposition



The role of trade and technology



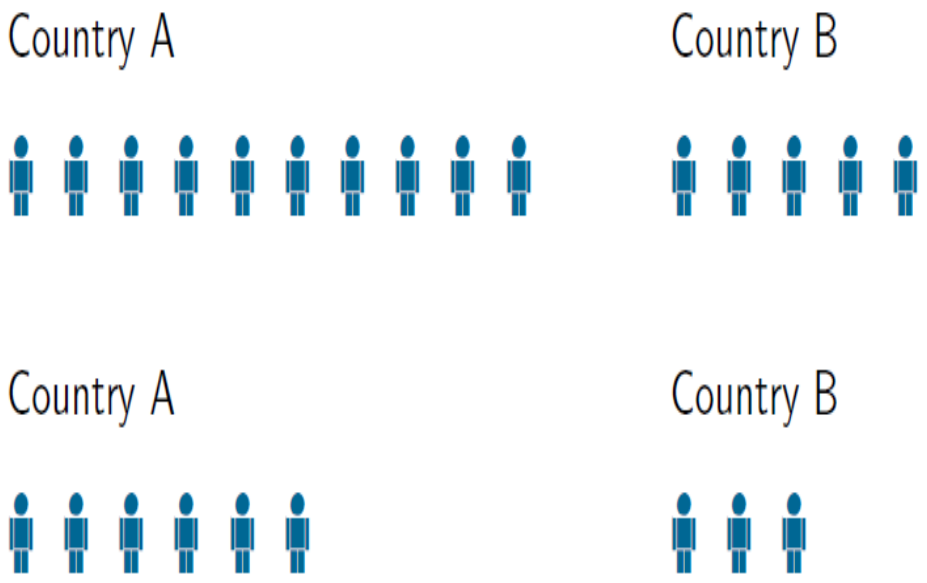
Note: Change in the employment share of non-routine jobs due to trade and technology between 1999 and 2007

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

Intuition: Technological change



Intuition: Task relocation