Job Dynamics and Global Supply Chains

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Introduction

- What affects the demand for skilled workers?
  - International trade
    - In final goods
    - In intermediate goods (offshoring and inshoring)
  - Technological change
    - Skill-biased technological change (SBTC) (Autor, Levy, Murnane 2003)
    - Sector-biased technological change
  - Consumption
    - non-homothetic preferences

- Conclusion of older literature: SBTC is dominant explanation for relative increase in skilled jobs (see e.g. Feenstra, 2010)
This paper

- But recently debate heated up again (Autor, Dorn and Hanson 2012; Goos, Manning and Salomons, 2011);

- Aim of this paper: to develop a simple accounting framework to assess the relative importance of the possible determinants of employment demand (by skill type and sector) in advanced economies;

- Explicitly accounting for offshoring of activities within global supply chains (GSC) through modeling of the input-output structure of the world economy in a multi-regional setting

- Use the new World Input-Output Database (WIOD).

Approach

- See the world economy as a network of Global Supply Chains (GSC)

- A Global Supply Chain of product \( v \) delivered by country \( w \) is the set of all activities in any country that are directly and indirectly needed to produce final output \((v,w)\).

- Let industry be indexed by \((n)\); country by \((j)\); skill classes by \((i)\). The number of workers denoted by \(W\), final output by \(Y\)

- We decompose the change in \(W(i,n,j)\) in two steps:
  - Change in \(W(i,n,j)\) needed to produce one unit of final output of industry \(v\) in country \(w\) (Within global supply chain effects)
  - Changes in final demand for \((v, w)\), summed over all \((v, w)\) (Size effect)
Step 1: Size Effects

- A Global Supply Chain gains in size if final demand for its defining product (e.g., cars produced in France) increases. In our accounting framework, this can be due to
  1. Change in overall consumption (e.g., demand for French cars will increase faster than demand for Chinese cars when aggregate consumption in Switzerland rises)
  2. Change in the composition of consumption of countries (Engel curve effects)
  3. Changes in the relative competitiveness of final products (e.g., German cars might take a larger share of final demand for cars, if they are considered more attractive than French cars)

Step 2: Within Effects

- Within a GSC, labor provided by an industry in a country (per unit of output of the GSC) can change as a consequence of three changes:
  1. Technological change in the GSC: \( l_i' \equiv (\pi \cdot l_i)' B \) (labor requirements expressed in ‘efficiency units’)
  2. Change in shares of “country-industries” in activities intensive in labor type \( i \): \( R_i = \left( \hat{\pi}_i B \right)_i^{\prime -1} \) (changing patterns in intermediate inputs trade)
  3. Changes in labor productivity levels relative to US (if a “country-industry” becomes relatively more productive, the same output will be delivered with less labor)
Methodology

We can express the employment of skill type $i$ in period 0 in the focal country as

$$x_{i0} = u_k^i \hat{\pi}_0^{-1} R_{i0} \hat{l}_{i0} \left[ T_0^* \circ (S_0^i \cdot \hat{c}_0) \right] u$$

$$R_{i} = \left[ \hat{\pi} \hat{l}_i B \right] \hat{l}_i^{-1}$$

$$B = (I - A)^{-1}$$

Where $\pi$ is the productivity level relative to the US;

$A$ is intermediate inputs requirements per unit of gross output;

$l$ is number of workers of skill type $i$;

$S^*$ is a matrix of final demand shares for each of the $n$ outputs;

$T^*$ is a matrix of final product trade coefficients

$c$ is a vector of total final demand exerted by country $i$.

$u$ is summation vector

$\bullet$ This decomposition is not unique, since weights can be chosen differently (see Dietzenbacher and Los, 1998). We take arithmetic average over (6a-f) and its so-called polar form, in which all initial year weights in (6a-f) have been replaced by final year weights and the other way round.
Data

- Data for 41 countries for 1995-2008

- World input output tables for global production structure (A) and final demand (f), see www.wiod.org

- WIOTs construction steps (see Timmer et al., 2012):
  - Harmonizing national supply and use tables (SUTs)
  - Estimating time-series of SUTs consistent with industry gross output and value added, and final demand categories from the National Accounts
  - Breakdown of imports by partner country using (extended) BEC
  - Transform international SUTs into WIOT using “fixed product-sales structure”

### Global Value Chain in a WIOT

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|          |        |         |      |        |      |     |     |
| Value added |      |         |      |        |      |     |     |
| Total     |        |         |      |        |      |     |     |

### World input-output tables and satellite accounts
Data

• Quantities of labor used by skill, industry and country taken from the Socio-economic accounts from WIOD, based on country specific sources with harmonized classifications:
  
  • Low-skilled labor (LS, 1997-ISCED 1 and 2)
  • Medium-skilled labor (MS, ISCED 3 and 4)
  • High-skilled labor (HS, ISCED 5 and 6).

• Efficiency levels of labor of a skill type across countries \((\pi)\) taken as productivity level in country relative to US in each year, based on output PPPs from GGDC productivity level database (Inklaar and Timmer, 2010).

Example: Numbers of jobs in the global supply chain for German transport equipment (in thousands)
Example: Numbers of jobs in the global supply chain for German transport equipment by skill-type (in thousands), 1995 and 2008 counterfactuals

Accounting for Dynamics in Manufacturing Jobs

Numbers of jobs in manufacturing in advanced world by skill-type (in thousands), 1995 and 2008 counterfactuals
Accounting for Dynamics in Market Services Jobs

Numbers of jobs in market services in advanced world by skill-type (in thousands), 1995 and 2008 counterfactuals

Conclusions and Next Steps

- Preliminary conclusions:
  - New measure of biased technological change in a global supply chain system context
  - Find strong evidence of skill-bias in global production
  - This seems to be the most important determinant of changes in relative demand for jobs of different skill-types

- Next steps:
  - Results for individual countries
  - Chain indices
  - Role of domestic outsourcing (from manufacturing to services)

Thank you

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