Statistics to Measure Offshoring and its Impact

by

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Outline:

"First Generation" statistics to measure offshoring:

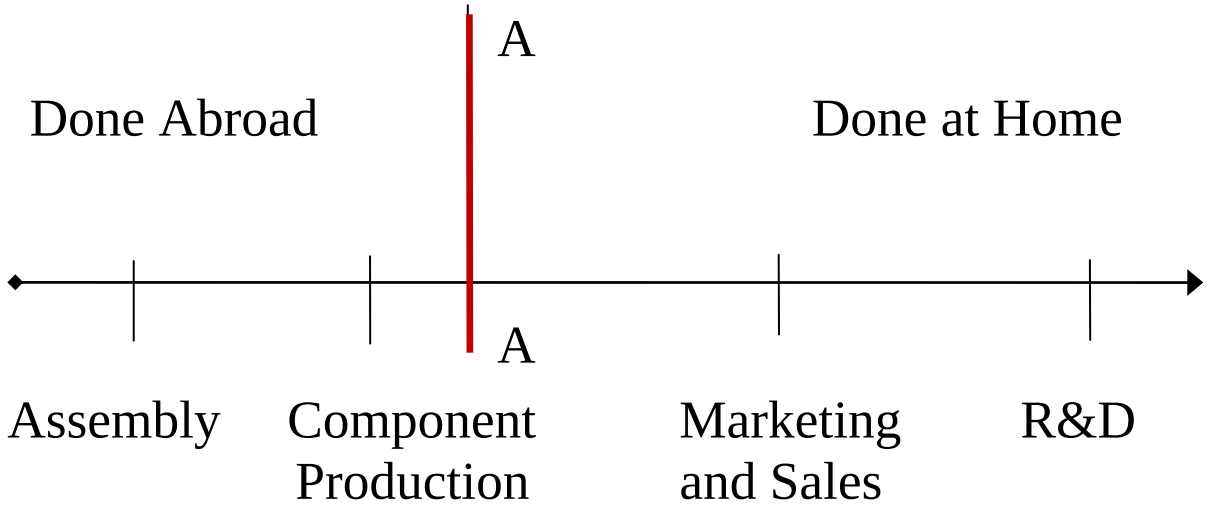
- Share of imported intermediate inputs in total material costs
- Using to measure the shift in labor demand

"Second Generation" statistics to measure offshoring:

- Global input-output tables, to measure value chains

Both of these need to be supplemented with ***price*** measures to determine the impact of offshoring on welfare and on growth

Simple Model of Offshoring



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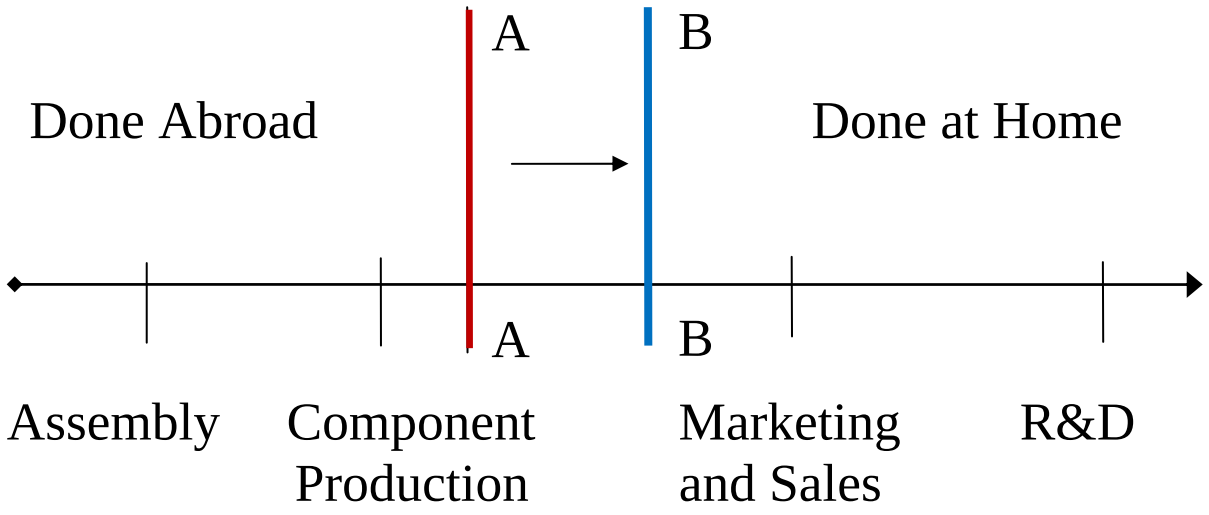

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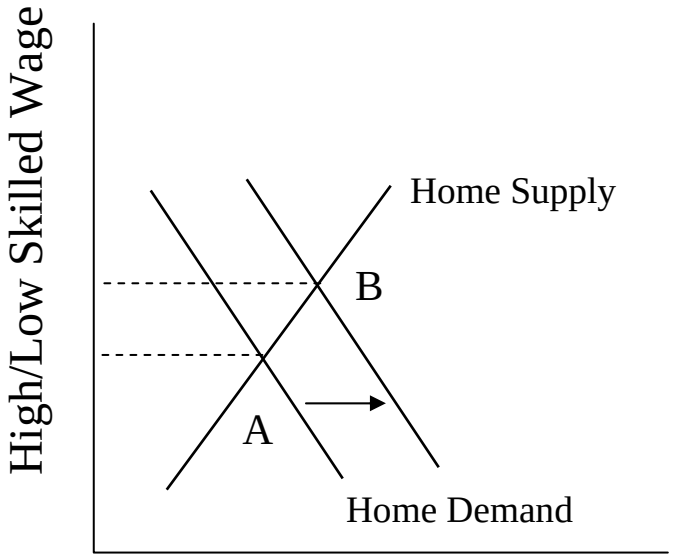
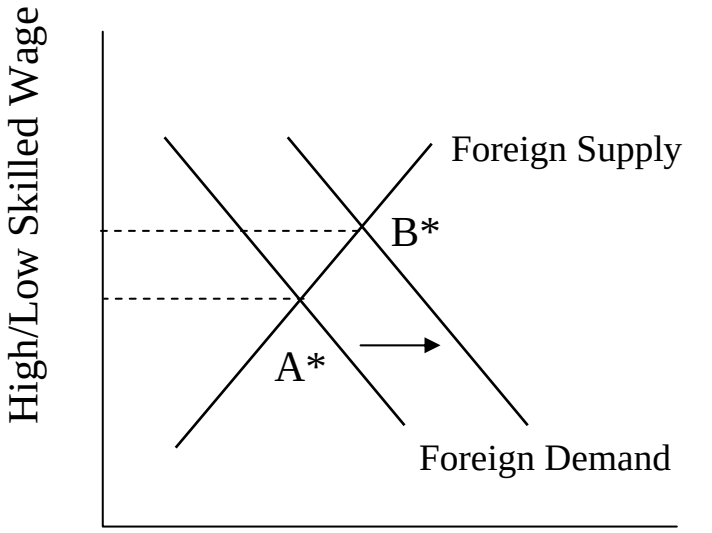
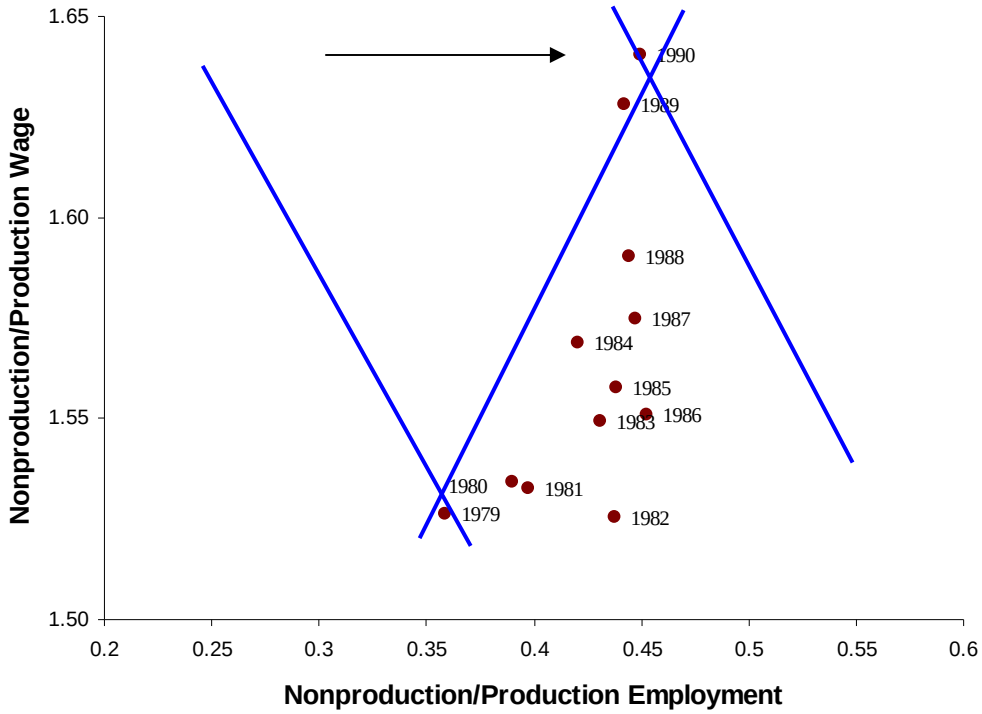


Home country



Foreign country

Relative Wage and Employment of Nonproduction/Production Workers in U.S. Manufacturing, 1979-1990



Source: NBER productivity database

"First Generation" statistics to measure offshoring:

Shift in Relative Labor Demand measured by:

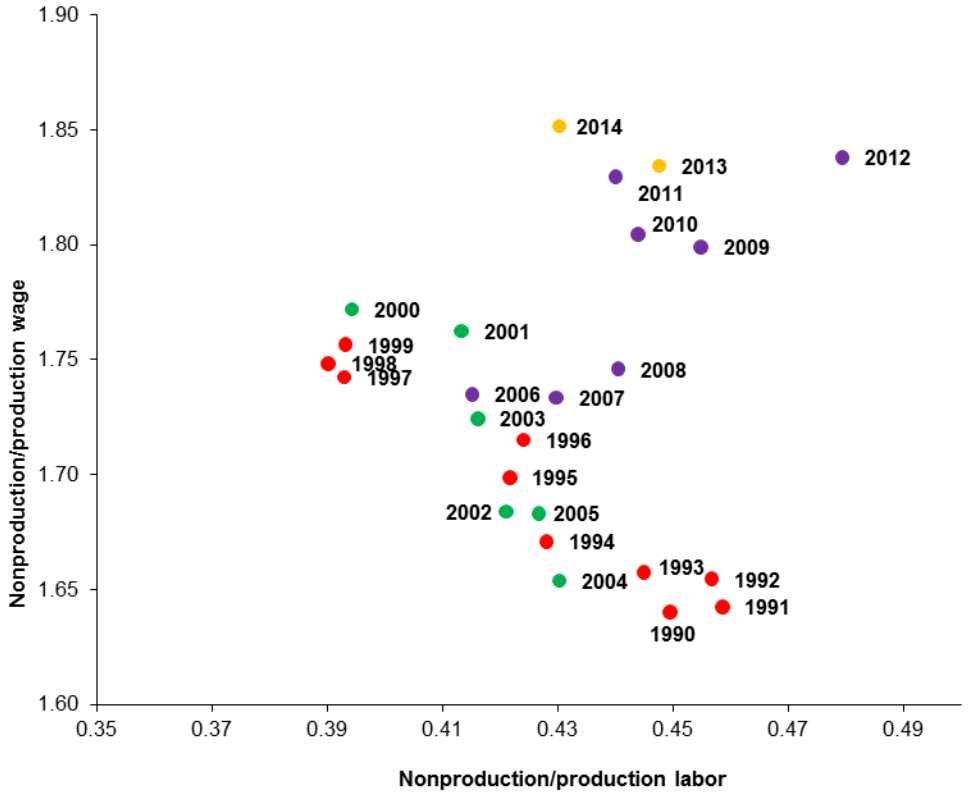
- Share of imported intermediate inputs in total costs (relies on *proportionality assumption* that import share of each input in each industry is the same as for the whole economy)
- *SBTC* measured by share of capital in high tech equipment (can measure share of capital *stock* or *flow*, *i.e. new investment)*
- We find that both imported inputs and capital devoted to high tech equipment are important, depending on measures used.

Table 1: Impact on the Relative Wage of Nonproduction Labor in U.S. Manufacturing, 1979-1990

	Percent of Total Increase Explained by each Factor	
	Offshoring	High-technology Equipment
Measurement of high-tech equipment:		
As a share of the capital stock	21 – 27%	29 – 32%
Share of capital flow (i.e. new investment)	12%	99%

Source: Robert C. Feenstra and Gordon H. Hanson, "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the U.S., 1979-1990," *Quarterly Journal of Economics*, August 1999, 114(3), 907-940.

But later, from 1989-2014:



Source: NBER productivity database.

But later, from 1989-2014:

- **1990-2000**: increase in the relative wage of high-skilled labor but a *reduction* in its relative employment
  - due to polarization of the labor market OR offshoring of nonproduction workers in service activities
  - Measure these use O*NET data
- **2000-2005**: this trend reverses itself
- **2006-2012**: increase in relative wage and employment
- Erratic movements after that

Limitations of First Generation Statistics

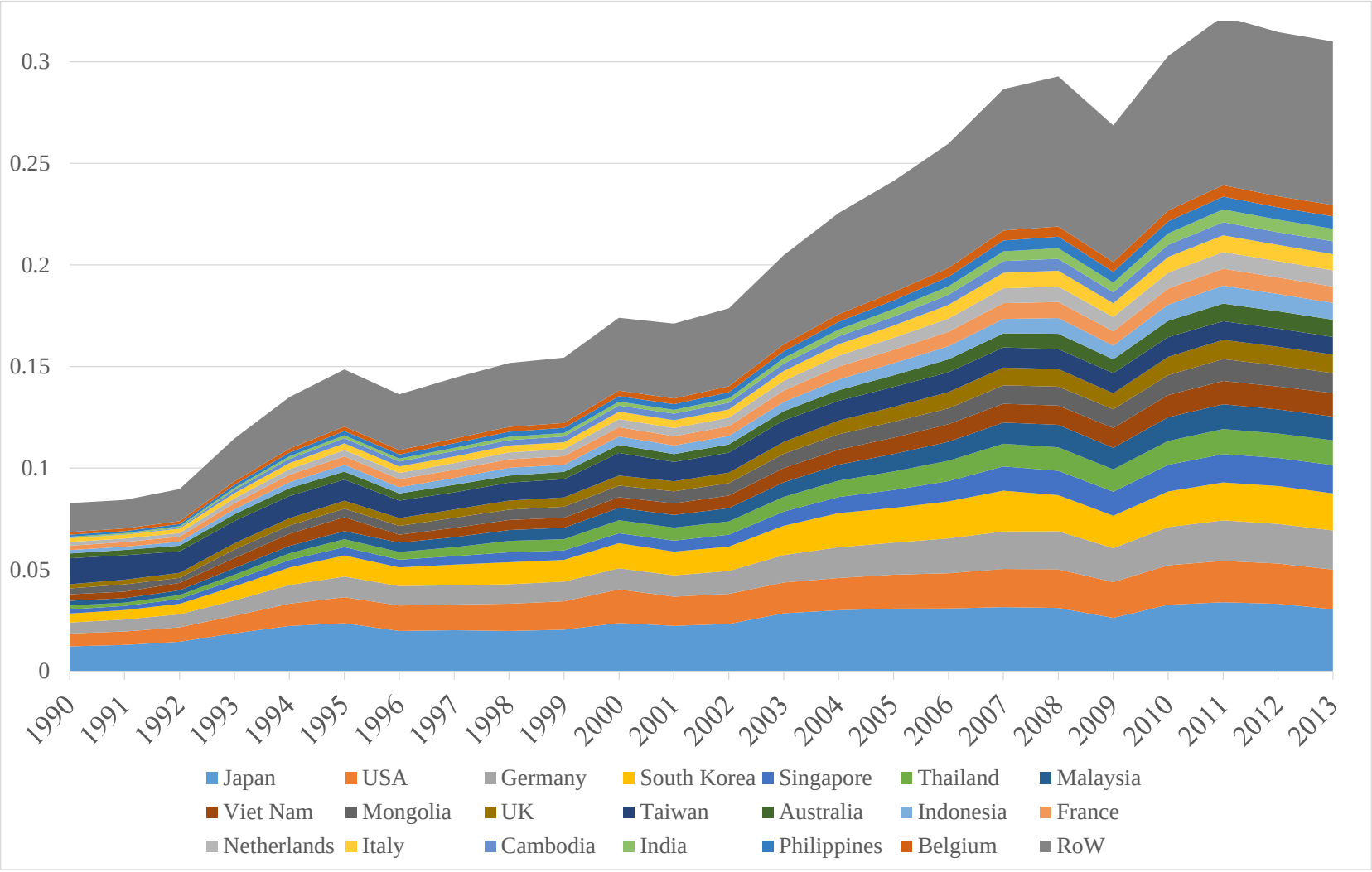
- What is the welfare impact? Real versus relative wage?
- Should use price-based measures of offshoring, otherwise a terms of trade improvement is inaccurately attributed to productivity growth. E.g. Housman et al. (2011):
  - This bias may have accounted for *one-fifth to one-half* of the growth in real value added in manufacturing (excluding the computer industry).
- Feenstra et al. (2013): terms of trade gain is *one-fifth* of the reported 1996-2006 increase in U.S. productivity growth
- Reinsdorf and Yuskavage (2016): *one-tenth* of the speedup in productivity over 1997-2007 can be explained by this bias.

"Second Generation" statistics to measure offshoring:

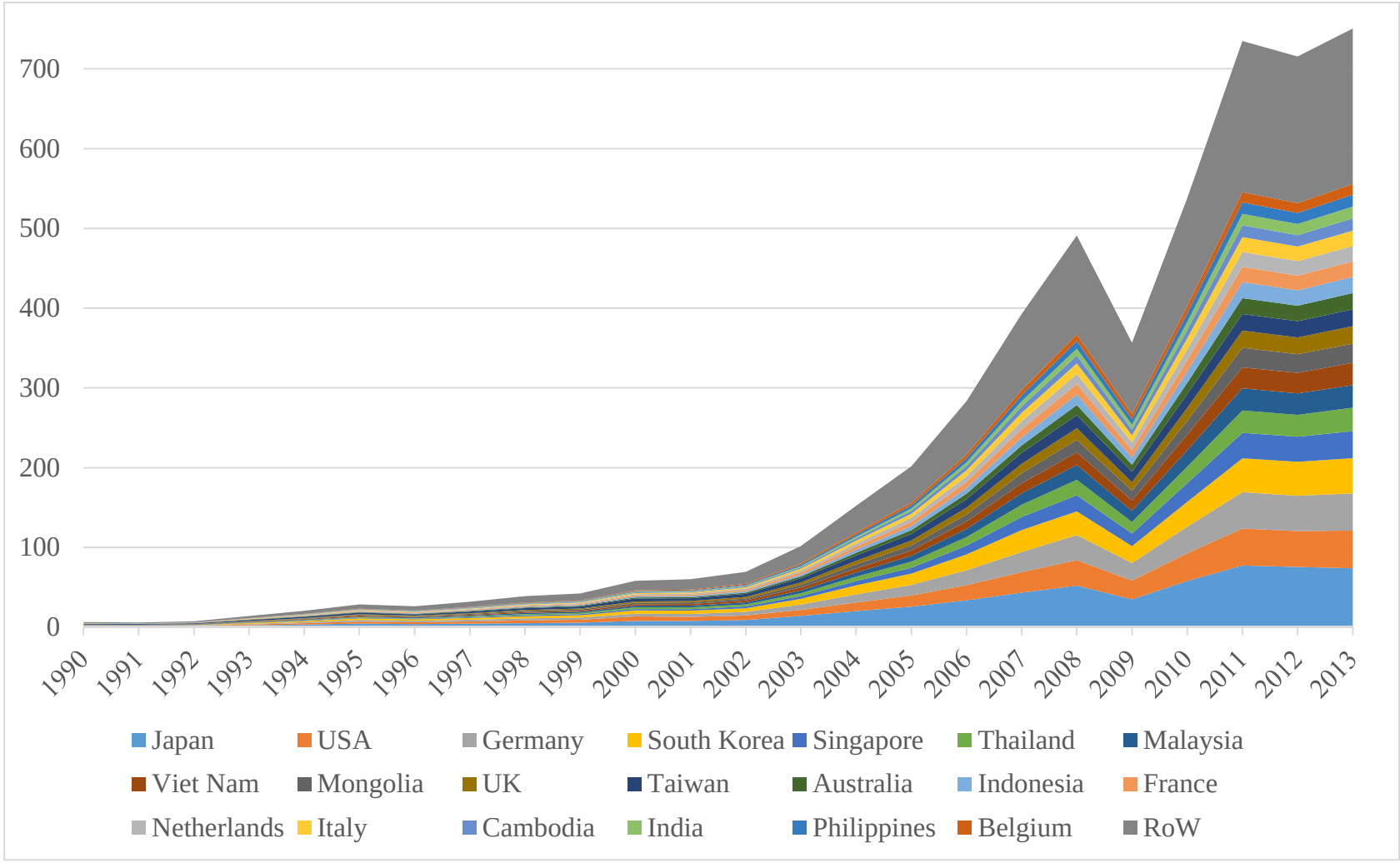
- World Input-Output Database (WIOD), or EORA
- Can construct the *domestic value-added in exports* and its counterpart, *foreign value-added in exports FVAiX*, to indicate the extent to which countries are tied into global supply chains.
- We illustrate *FVAiX* for China and its supplying countries, including those of Southeast Asia (using EORA): Bangladesh, Cambodia, Laos, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Singapore, Thailand and Vietnam, in addition to China, Indonesia, Japan, South Korea, and Taiwan, which are included in WIOD

Figure 8: Foreign Value Added in Exports of China: Aggregate

A: Foreign value added by country (share)



B: Foreign value-added by country (value, billion US$)



- Possible to extend the analysis to employment and growth in *supplying countries* of Southeast Asia

Limitations of Second-Generation Offshoring Statistics

- Take as exogenous the increase in exports and other changes in final demand, while in fact, such changes are endogenous
- For example, Los et al. (2015) calculate that over 2001-2006 the surge in China exports accounted for 71 million jobs.
- Related to this limitation, it is unclear how *FVAiX* would impact *relative wage* or *employment* of high-skilled workers.
    - *Reijnders, Timmer & Ye (2016) argue that SBTC & offshoring contribute equally important to declining employment*

- One way to make progress on both these concerns is to focus future attention on the *price* side of global input-output models.

Price-Based Measure of Global Offshoring

The **import-based ERP** (effective rate of protection):

$$MERP_j = \frac{t_j - \sum_i t_i (a_{ij} + a_{ij}^*)}{1 - \sum_i (a_{ij} + a_{ij}^*)}.$$

- a_{ij} denotes the amount of input *i* that is *domestically* sourced;
- a_{ij}^* denotes input *i* that is sourced from *all foreign* countries for \$1 output in industry *j*.

- Suppose that there is a *pass-through coefficient* of $\beta \in [0,1]$ from changes in tariffs to changes in the prices of *domestically-produced* goods. In this case, the ERP becomes,

$$ERP_j = \frac{1+\beta(t_j-1)-\sum_i [1+\beta(t_i-1)]a_{ij}+t_i a_{ij}^*}{1-\sum_i (a_{ij}+a_{ij}^*)}.$$

- Setting $\beta = 0$ to hold exports prices fixed & full pass-through to imported input prices, we obtain the ***ERP for exports***:

$$XERP_j = \frac{1-\sum_i (a_{ij}+t_i a_{ij}^*)}{1-\sum_i (a_{ij}+a_{ij}^*)}.$$

Figure 9: Chinese $MERP_j$ for 10 sectors in EORA

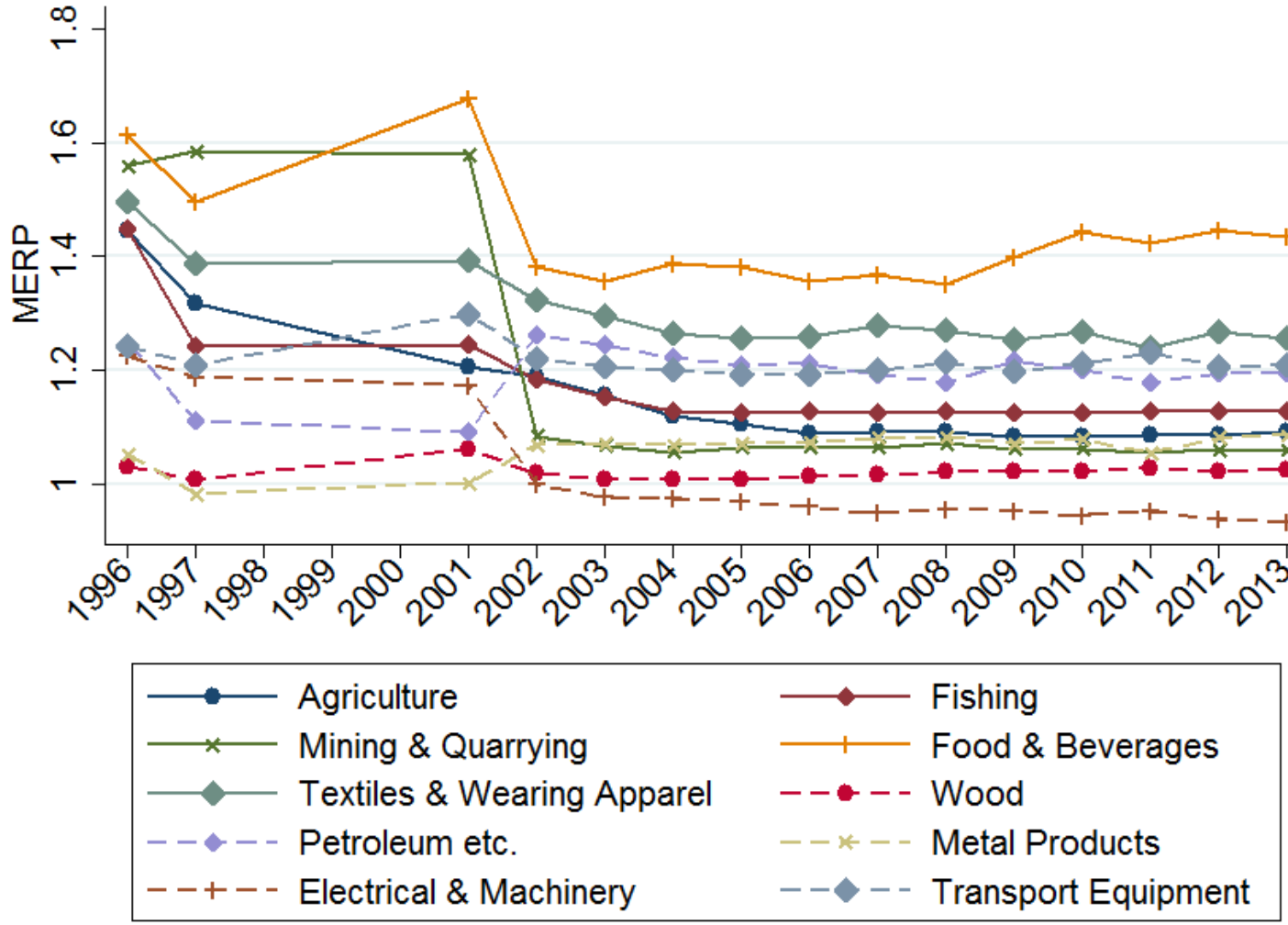
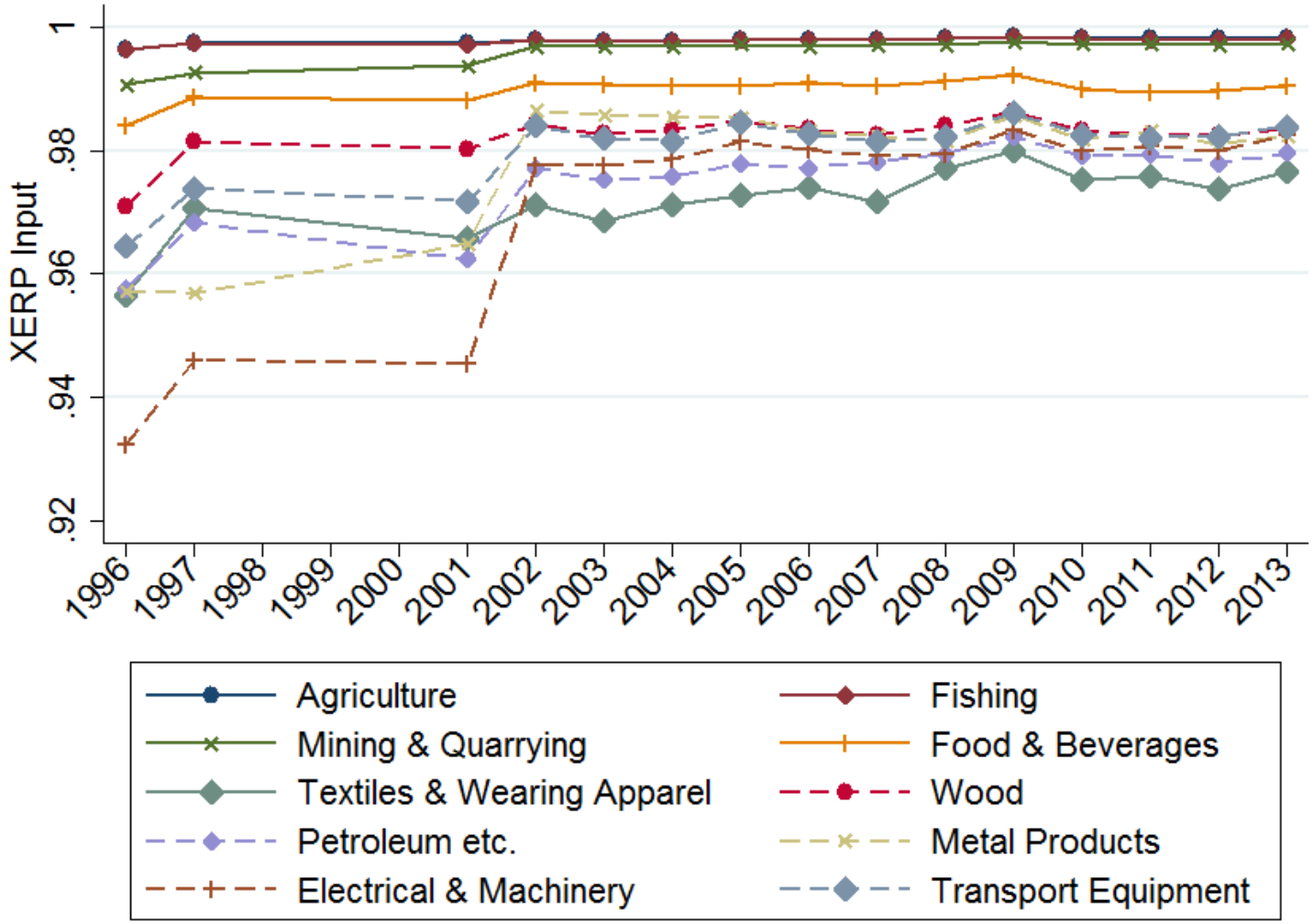


Figure 10: Chinese $XERP_j$ for 10 sectors in EORA



Conclusions:

"First Generation" statistics to measure offshoring:

- Using to measure the shift in labor demand
- Need to be supplemented with measures to measure the impact of offshoring on *price* and therefore on welfare

"Second Generation" statistics to measure offshoring:

- Useful to measure the magnitude of global value chains
- Need to understand how labor demand is affected
- Also need to be supplemented with price measures, as I have illustrated for China

Appendix: Nominal Rate of Protection in China