

# EXPORTS AND EMPLOYMENT IN CHINA, JAPAN, KOREA, AND INDONESIA

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# Summary

- This paper examines the effects of exports on employment in China, Indonesia, Japan and Korea.
- The paper draws on the World Input-Output Database (WIOD) for the period from 1995 to 2009, which enables us to estimate the effects of exports
  - on each industry's employment (i.e. **direct effects**)
  - and on other industries' employment through intra-industry linkages (i.e. **indirect effects**).

# Summary

There are **4** major findings:

- ① At the aggregate level, the implied employment from exports - employment created through both direct and indirect effects from exports - increased in China, Japan and Korea.
- ② At the industry level, exports and the shares of implied employment from exports increased in machinery-related industries such as *Machinery (NEC)*, *Electrical and Optical Equipment*, and *Transport Equipment* in China, Indonesia and Korea.
- ③ Although more than 80% of exports in the four study countries are from manufacturing industries, the effects of exports on employment are not limited to manufacturing industries.
- ④ In 2009, the share of implied employment from Chinese final demand exceeded that from the US final demand in both Japan and Korea.

# Introduction

- With the growth of exports in the world economy, the effect of exports on employment is one of the major concerns for business leaders and policy makers in many countries.
- This tendency is particularly true in East and Southeast Asian countries after the financial turbulence in 2008, whose effect was initially expected to be rather small but turned out to be quite large.
- In light of the importance of the relationship between exports and employment, this paper examines the effects of exports on employment in China, Indonesia, Japan and Korea.

# Introduction

- We focus on China, Japan and Korea for two reasons.
  - ① Participation in global value chains has increased notably in these three countries.
  - ② These countries are sometimes compared with each other due to their regional proximities and their similarities and differences in economic performances.
- For the purpose of comparative analysis, the paper also focuses on one of the emerging economies in this region: Indonesia.
  - This enables us to compare countries in different income levels in the East and Southeast Asia.

# Related Literature

Our motivation comes from two strands of research.

- 1 One is the literature on the effects of exports on employment, which utilises a national input-output (IO) table:
  - Feenstra and Hong (2010, U. of Chicago Press Book) for China; Kiyota (2012, CEP) for Japan
- 2 A second strand in the literature examines vertical linkages and international trade (e.g., value added trade) using global IO tables:
  - Timmer, Los, Stehrer, and Vries (2013, EP); Foster-McGregor and Stehrer (2013, EL)

## Related Literature

- Both strands of research have made significant contributions to the literature.
- However, the effects of exports through international vertical linkages on employment have not been fully explored yet.
  - ① The first line of the study in the literature lacks the perspectives of international comparison.
  - ② The second line did not pay much attention to the effects on employment.
- This paper thus attempts to integrate and extend these two strands of study, focusing on China, Indonesia, Japan and Korea.
  - That is, we examine the effects of exports on employment, taking into account of inter-industry and inter-country vertical linkages.

# Terminological Matters

Before starting, some terminological matters need to be clarified.

- ① Following Feenstra and Hong (2010), we call employment created through both direct and indirect effects “**implied employment**”.
  - ② This paper focuses on **exports for final use**.
- In other words, the effects of exports mean the effects of exports for final use because the exports of intermediate inputs are “endogenously” determined as we will explain later.



# Data

This paper utilises WIOD data for the period from 1995 to 2009 (Timmer, 2012, Working Paper).

- The WIOD is built on national accounts data which were developed within the 7th Framework Programme of the European Commission.
  - The WIOD provides time-series of global IO tables for 27 EU countries, 13 other major countries, and the rest-of-the-world (ROW).
  - The 13 countries include non-EU OECD member countries such as Japan and the United States and emerging economies such as China, Indonesia and Mexico.
  - The database consists of 35 industries.

Figure 2. Structure of World Input-Output Table: Two Countries and the Rest of the World

		Country 1	Country 2	ROW	Country 1	Country 2	ROW	Total
		Intermediate	Intermediate	Intermediate	Final demand	Final demand	Final demand	
		<i>Industry</i>	<i>Industry</i>	<i>Industry</i>				
Country 1	<i>Industry</i>	Intermediate use of domestic output	Intermediate use by Country 2 of exports from Country 1	Intermediate use by ROW of exports from Country 1	Final use of domestic output	Final use by Country 2 of exports from Country 1	Final use by ROW of exports from Country 1	Output in Country 1
Country 2	<i>Industry</i>	Intermediate use by Country 1 of exports from Country 2	Intermediate use of domestic output	Intermediate use by ROW of exports from Country 2	Final use by Country 1 of exports from Country 2	Final use of domestic output	Final use by ROW of exports from Country 2	Output in Country 2
Rest of the World (ROW)	<i>Industry</i>	Intermediate use by Country 1 of exports from ROW	Intermediate use by Country 2 of exports from ROW	Intermediate use of domestic output	Final use by Country 1 of exports from ROW	Final use by Country 2 of exports from ROW	Final use of domestic output	Output in ROW
Value added		Value added	Value added	Value added				
		Output in Country 1	Output in Country 2	Output in ROW				

# Data

- An advantage of the use of the WIOD is that it provides Socio Economic Accounts which include annual data such as employment at the industry level.
  - This enables us to examine the effects of exports on employment more precisely.
- Moreover, throughout the data collection effort, harmonisation procedures were applied to ensure international comparability of the data.
  - This ensures data quality and enables us to conduct comparative analysis at the industry and national levels.

# Methodology

- Suppose that there are  $M$  production factors and  $S$  industries in  $N$  countries.
- Output in each country-industry is produced using domestic production factors and intermediate inputs, which are sourced domestically or from abroad.
- Output is used to satisfy final demand (either at home or abroad) or used as intermediate input in production (either at home or abroad as well).

# Methodology

- To trace the transactions of intermediate and final goods, it is necessary to define source and destination country-industries.
  - $i$ : the source country;  $j$ : the destination country
  - $s$ : the source industry;  $t$ : the destination industry
  - $y_i(s)$ : the value of output in industry  $s$  of country  $i$
  - $f_{ij}(s)$ : the value of output exported from industry  $s$  in country  $i$  for the final use in any country  $j$
  - $x_{ij}(s, t)$ : the value of output exported from industry  $s$  in country  $i$  to the intermediate use by industry  $t$  in country  $j$
- The goods market clearing condition is written as:

$$y_i(s) = \sum_j \sum_t x_{ij}(s, t) + \sum_j f_{ij}(s). \quad (1)$$

Figure 1. Three-Country Global Input-Output Table

		Country 1	Country 2	Country 3	Country 1	Country 2	Country 3	Total
		Intermediate	Intermediate	Intermediate	Final demand	Final demand	Final demand	
		<i>Industry</i>	<i>Industry</i>	<i>Industry</i>				
Country 1	<i>Industry</i>	$x_{11}(s, t)$	$x_{12}(s, t)$	$x_{13}(s, t)$	$f_{11}(s)$	$f_{12}(s)$	$f_{13}(s)$	$y_1(s)$
Country 2	<i>Industry</i>	$x_{21}(s, t)$	$x_{22}(s, t)$	$x_{23}(s, t)$	$f_{21}(s)$	$f_{22}(s)$	$f_{23}(s)$	$y_2(s)$
Country 3	<i>Industry</i>	$x_{31}(s, t)$	$x_{32}(s, t)$	$x_{33}(s, t)$	$f_{31}(s)$	$f_{32}(s)$	$f_{33}(s)$	$y_3(s)$
Value added		$v_1(t)$	$v_2(t)$	$v_3(t)$				
		$y_1(t)$	$y_2(t)$	$y_3(t)$				

# Methodology

- **y**: the vector of production, which is obtained by stacking output levels  $y_i(s)$  in each country-industry
- **f**: the vector that is constructed by stacking world final demand for output from each country-industry
$$f_i(s) \equiv \sum_j f_{ij}(s)$$
- **A**: a global intermediate input coefficients matrix whose element  $a_{ij}(s, t) \equiv x_{ij}(s, t)/y_j(t)$ 
  - This element indicates the output from industry  $s$  in country  $i$  used as the intermediate input by industry  $t$  in country  $j$  as the share of output in the latter industry.
  - The matrix **A** describes how the goods of each country-industry are produced using a combination of domestic and foreign intermediate inputs.

# Methodology

- Equation (1) is rewritten as  $\mathbf{y} = \mathbf{A}\mathbf{y} + \mathbf{f}$ .
- Rearranging this, the following fundamental IO identity is obtained:

$$\mathbf{y} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f}, \quad (2)$$

where  $\mathbf{I}$  is an identity matrix and  $(\mathbf{I} - \mathbf{A})^{-1}$  is so-called Leontief inverse (Leontief, 1936) whose element in row  $s$  and column  $t$  of this matrix means the total production value of industry  $s$  needed for production of one unit of final output in industry  $t$ .



# Methodology

There are two remarks in Equation (2):

- ① In the IO analysis, final demand sectors  $\mathbf{f}$  are called **exogenous** sectors while intermediate input sectors are called **endogenous** sectors.
  - All the changes in the endogenous sectors of an IO table are the results of changes in the exogenous sectors.
  - Note that, in a global IO table, the exports of intermediate inputs are captured in the endogenous sectors.
  - In this sense, the exports of intermediate inputs are determined endogenously in the global IO analysis.

# Methodology

There are two remarks in Equation (2):

- Equation (2) captures all the direct and indirect effects through the domestic vertical linkages between industries within a country (i.e.,  $j = i$ ) and the international vertical linkages between countries (i.e.,  $j \neq i$ ).
  - Equation (2) is decomposed into:

$$\mathbf{y} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f} = (\mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \dots)\mathbf{f} = \mathbf{I}\mathbf{f} + \mathbf{A}\mathbf{f} + \mathbf{A}^2\mathbf{f} + \dots$$

- As the the power of  $\mathbf{A}$  increases ( $\dots, \mathbf{A}^7, \mathbf{A}^8, \dots$ ), the terms multiplying  $\mathbf{f}$  become insignificantly different from zero.
- The individual terms in the power series approximation represents the magnitudes of the round-by-round effects (e.g.,  $\mathbf{I}\mathbf{f}$  is the direct effect while  $\mathbf{A}\mathbf{f} = \mathbf{A}(\mathbf{I}\mathbf{f})$  means the first round (indirect) effect from the one unit of final demand).

# Effects of Exports on Employment

There are four major findings:

- ① At the aggregate level, the implied employment from exports - employment created through both direct and indirect effects from exports - increased in China, Japan and Korea.
- ② At the industry level, exports and the shares of implied employment from exports increased in machinery-related industries such as *Machinery (NEC)*, *Electrical and Optical Equipment*, and *Transport Equipment* in China, Indonesia and Korea.
- ③ Although more than 80% of exports in the four study countries are from manufacturing industries, the effects of exports on employment are not limited to manufacturing industries.
- ④ In 2009, the share of implied employment from Chinese final demand exceeded that from the US final demand in both Japan and Korea.

Table 3. Evolution of Implied Employment from Exports in China, Indonesia, Japan, and Korea

	Number of persons engaged (millions)				Growth (1995 = 100)				Share (implied employment from exports to total final demand = 100%)			
	1995	2000	2005	2009	1995	2000	2005	2009	1995	2000	2005	2009
China	63.2	58.4	91.4	81.3	100	92	145	129	9.3	8.1	12.1	10.4
Japan	1.9	2.3	2.6	2.0	100	122	139	105	3.5	4.3	4.8	4.0
Korea	1.7	2.3	2.1	2.4	100	132	123	139	8.5	10.8	9.3	10.2
Indonesia	3.8	6.9	5.6	4.4	100	179	145	115	4.4	7.4	5.9	4.1

- ① At the aggregate level, the implied employment from exports - employment created through both direct and indirect effects from exports - increased in China, Japan and Korea.

## Tables 4-7. Evolution of Exports and Implied Employment from Exports in China, Indonesia, Japan, and Korea, by Industry

- ② At the industry level, exports and the shares of implied employment from exports increased in machinery-related industries such as *Machinery (NEC)*, *Electrical and Optical Equipment*, and *Transport Equipment* in China, Indonesia and Korea.
- **China:** The export share of of *Electrical and Optical Equipment* grew from 21.1% to 39.3% between 1995 and 2009. (Table 4)
  - **Indonesia:** the implied employment from exports in Electrical and Optical Equipment increased slightly from 0.6% to 1.2% over the period. (Table 5)
  - **Japan:** The overall share of implied employment from exports in the above three major industries remained relatively large despite a decrease from 43.9% in 1995 to 35.1% in 2009. (Table 6)
  - **Korea:** The share of implied employment from exports in above three industries increased from 26.2% to 30.6% between 1995 and 2009. (Table 7)

Tables 4-7. Evolution of Exports and Implied Employment from Exports in China, Indonesia, Japan, and Korea, by Industry

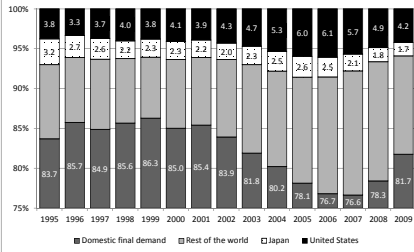
		Exports (All industry = 100%)					Implied employment (All industry = 100%)				
		1995	2000	2005	2008	2009	1995	2000	2005	2008	2009
CHN	M	90.9	90.0	91.6	92.6	92.6	32.3	35.9	36.0	38.5	38.9
	Non-M	9.1	10.0	8.4	7.4	7.4	67.7	64.1	64.0	61.5	61.1
JPN	M	89.8	88.6	86.6	87.5	85.3	63.5	61.4	58.4	55.8	54.4
	Non-M	10.2	11.4	13.4	12.5	14.7	36.5	38.6	41.6	44.2	45.6
KOR	M	87.1	87.2	89.3	88.3	89.5	56.9	49.9	49.7	47.1	47.1
	Non-M	12.9	12.8	10.7	11.7	10.5	43.1	50.1	50.3	52.9	52.9
IDN	M	87.7	92.7	86.9	84.1	83.6	36.2	37.7	41.0	37.8	37.4
	Non-M	12.3	7.3	13.1	15.9	16.4	63.8	62.3	59.0	62.2	62.6

M: Manufacturing; Non-M: Non-manufacturing

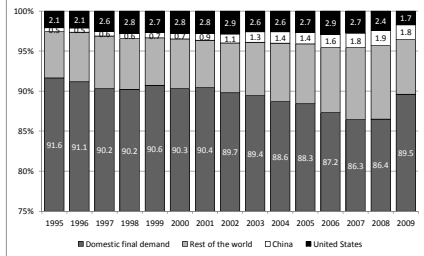
- 3 Although more than 80% of exports in the four study countries are from manufacturing industries, the effects of exports on employment are not limited to manufacturing industries.

# Figure 3. Implied Employment from Final Demand, by Country

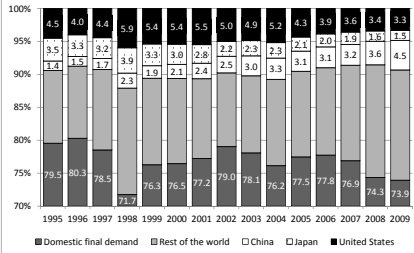
China



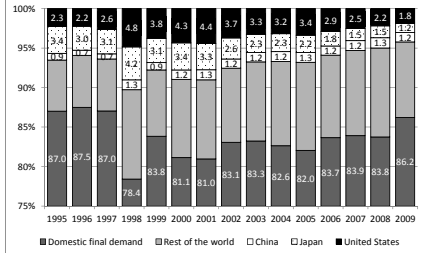
Japan



Korea

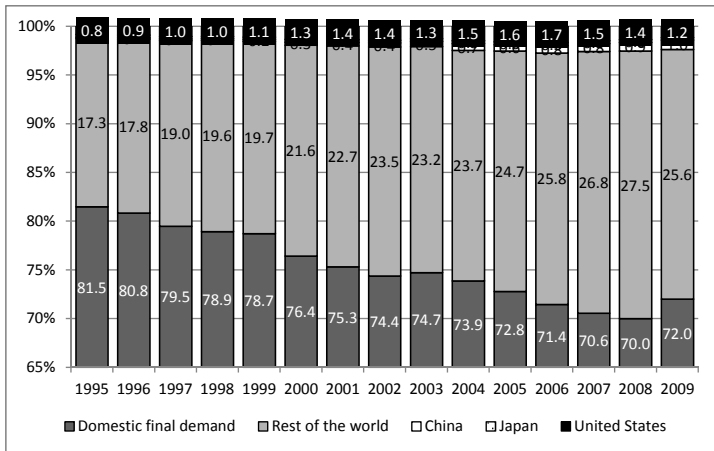


Indonesia



4 In 2009, the share of implied employment from Chinese final demand exceeded that from the US final demand in both Japan and Korea.

## Implied Employment from Final Demand, by Country: **Germany**



- The share of the implied employment from domestic final demand declined notably from 1995 to 2009.
- Exports are commonly important for employment in Germany and Japan (i.e., **common challenges!**) but the effect of exports is getting more significant in Germany.



# Summary

- This paper examines the effects of exports on employment in China, Indonesia, Japan and Korea.
- The paper draws on the World Input-Output Database (WIOD) for the period from 1995 to 2009, which enables us to estimate the effects of exports:
  - on each industry's employment (i.e. **direct effects**)
  - and on other industries' employment through intra-industry linkages (i.e. **indirect effects**).

# Summary

There are **4** major findings:

- ① At the aggregate level, the implied employment from exports - employment created through both direct and indirect effects from exports - increased in China, Japan and Korea.
- ② At the industry level, exports and the shares of implied employment from exports increased in machinery-related industries such as *Machinery (NEC)*, *Electrical and Optical Equipment*, and *Transport Equipment* in China, Indonesia and Korea.

→ Although this result does not necessarily mean that direct competition between developed and developing countries is increasing over the period, provides an indication that may be important for firms in developed countries to differentiate their products via quality upgrading or by moving up the value chain.

# Summary

- ③ Although more than 80% of exports in the four study countries are from manufacturing industries, the effects of exports on employment are not limited to manufacturing industries.
  - A significant number of workers in non-manufacturing industries depend upon manufacturing exports through vertical inter-industry linkages.
- ④ In 2009, the share of implied employment from Chinese final demand exceeded that from the US final demand in both Japan and Korea.
  - This result implies that the effects of the final demand of China are outpacing those of Japan and the United States.

# Policy Implications

- Even in cases where an industry is not particularly directly export-oriented, the industry may still be subject to potential effects – positive or negative – of changes in export demand.
  - An industry's export dependence will be large if downstream customers are highly export dependent.
  - Producers need to be aware not only of the export dependence of their industry but also of the export dependence of their upstream producers and downstream customers in different industries.
  - Even non-exporters can be significantly affected by external changes in demand through such intra-industry linkages.
- In identifying the potential risks of negative external shocks, it is important for policy makers to identify how much employment is created indirectly as well as directly by exports.