

**East Asia in Global Value Chain:
Trade, Production, and Vertical Specializaion**

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1. INTRODUCTION

□ BACKGROUND

- Interdependency of national economies through international trade has deepened owing to reduction in trade barriers and transportation cost.
- East Asia is noted for its high intra-regional dependence on intermediate trade in manufacturing sectors and for its high inter-regional dependence on final manufacturing exports.
- Conventional trade statistics cannot provide an exact picture of the global division of labor because of production fragmentation and vertical specialization in the global production network.

□ Literature Review

- Koopman, Wang and Wei (2008): the share of foreign content in China's exports is about 50% on average, and much higher for sophisticated sectors.
- Wang, Power and Wei (2009): Developing East Asian countries became more deeply integrated into the regional production network, but an increase in their value shares was only evident in the labor-intensive sectors.
- Stehrer (2012): the trade surplus in terms of "trade in value added" of developing countries in trade with more developed countries is reduced as compared to "value added in trade."

□ Key Questions

- What is the changing role of East Asia in the global value chain, particularly the extent to which the rise of the Chinese economy has changed East Asia's integration with the global production network?
- What is the recent trend of vertical specialization if value added induced by final goods (not by intermediate goods) is taken into account?
- What is the relative trade efficiency of East Asian countries, i.e., the ratio of net value added divided by net exports in bilateral trade?

□ Major Findings

- China's value-added induced by foreign final demand increased 10.1 times during 1995–2009, much higher than the U.S. (1.9 times) and Japan (1.2 times). Meanwhile, other countries' value-added induced by China's final demand increased slightly.
- China's VAX, the ratio of domestic value-added in gross exports, has continuously decreased since 2001, while those of Japan and other Asia-Pacific countries have increased.
- China's net exports increased faster than net value-added, implying the worsening of China's trading efficiency since 2005, in spite of her central role in global imbalances.

2. Methodology

	Intermediate Demand						Final Demand						Total Output
	China	USA	Japan	Europe	Asia-Pacific*	ROW	China	USA	Japan	Europe	Asia-Pacific*	ROW	
China	X11	X12	X13	X14	X16	X16	F11	F12	F13	F14	F15	F16	X1
USA	X21	X22	X23	X24	X25	X26	F21	F22	F23	F24	F25	F26	X2
Japan	X31	X32	X33	X34	X35	X36	F31	F32	F33	F34	F35	F36	X3
Europe	X41	X42	X43	X44	X45	X46	F41	F42	F43	F44	F45	F46	X4
Asia-Pacific	X51	X52	X53	X54	X55	X56	F51	F52	F53	F54	F55	F56	X5
ROW	X61	X62	X63	X64	X65	X66	F61	F62	F63	F64	F65	F66	X6
Value-Added	V1	V2	V3	V4	V5	V6							
Total Output	X1	X2	X3	X4	X5	X6							

- The World Input-Output Database (1995-2009)
- Six regions: China, Japan, the Asia-Pacific (Korea, Taiwan, Indonesia, India, and Australia), Europe (the 27 EU member states, Russia and Turkey), the U.S., and the rest of the world (Brazil, Canada, Mexico, Row).
- Focusing on “Vertical Specialization” index developed by Wang, powers and Wei (2009) and the “VAX” (Value added exports to total exports) ratio developed by Johnson and Nogueraz (2012)

(A) Value-added of region s induced by foreign final demand

$$R = (V_s B_{s1} \ V_s B_{s2} \ V_s B_{s3} \ V_s B_{s4} \ V_s B_{s5} \ V_s B_{s6})_{(1 \times 6n)} (\overline{E}_s)_{(6n \times 1)}$$

$$\overline{E}_s = \begin{pmatrix} F_{11}^n + F_{12}^n + F_{13}^n + F_{14}^n + F_{15}^n + F_{16}^n \\ F_{21}^n + F_{22}^n + F_{23}^n + F_{24}^n + F_{25}^n + F_{26}^n \\ F_{31}^n + F_{32}^n + F_{33}^n + F_{34}^n + F_{35}^n + F_{36}^n \\ F_{41}^n + F_{42}^n + F_{43}^n + F_{44}^n + F_{45}^n + F_{46}^n \\ F_{51}^n + F_{52}^n + F_{53}^n + F_{54}^n + F_{55}^n + F_{56}^n \\ F_{61}^n + F_{62}^n + F_{63}^n + F_{64}^n + F_{65}^n + F_{66}^n \end{pmatrix} \begin{pmatrix} F_{1s}^n \\ F_{2s}^n \\ F_{3s}^n \\ F_{4s}^n \\ F_{5s}^n \\ F_{6s}^n \end{pmatrix}$$

(B) Foreign value-added induced by region s' final demand (s = 1)

$$R = \mathbf{i} \cdot \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ V_2 B_{21} & V_2 B_{22} & V_2 B_{23} & V_2 B_{24} & V_2 B_{25} & V_2 B_{26} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ V_6 B_{61} & V_6 B_{62} & V_6 B_{63} & V_6 B_{64} & V_6 B_{65} & V_6 B_{66} \end{pmatrix} \begin{pmatrix} F_{1s}^n \\ F_{2s}^n \\ F_{3s}^n \\ F_{4s}^n \\ F_{5s}^n \\ F_{6s}^n \end{pmatrix}$$

$$\mathbf{i} = (1 \ 1 \ 1 \ 1 \ 1 \ 1)$$

(C) Value-added of region s induced by foreign final demand for products of region s (excluding value-added of region s induced by foreign final demand for products produced in other regions)

$$R = \sum_{i \neq s}^6 V_s B_{si} F_{si}$$

(D) Foreign value-added induced by region s' final demand for foreign products ($s=1$)

$$R = \mathbf{i} \cdot \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ V_2 B_{21} & V_2 B_{22} & V_2 B_{23} & V_2 B_{24} & V_2 B_{25} & V_2 B_{26} \\ \vdots & & & & & \\ V_6 B_{61} & V_6 B_{62} & V_6 B_{63} & V_6 B_{64} & V_6 B_{65} & V_6 B_{66} \end{pmatrix}_{(6 \times 6n)} \cdot \begin{pmatrix} 0 + 0 + 0 + 0 + 0 + 0 \\ F_{21}^n + 0 + 0 + 0 + 0 + 0 \\ F_{31}^n + 0 + 0 + 0 + 0 + 0 \\ F_{41}^n + 0 + 0 + 0 + 0 + 0 \\ F_{51}^n + 0 + 0 + 0 + 0 + 0 \\ F_{61}^n + 0 + 0 + 0 + 0 + 0 \end{pmatrix}_{(6n \times 1)}$$

$$\mathbf{i} = (1 \ 1 \ 1 \ 1 \ 1 \ 1)$$

(E) The VAX ratio

The relative size of value-added induced in region i by the final demand of region j to the total exports (including intermediates and final demands) from region i to region j (**Johnson and Noguera (2012)**)

$$VAX_{ij} = \left(\frac{\alpha_i^v \cdot \sum_{j=1}^6 (r_{ij} \cdot F_j)}{x_{ij}} \right)_{(i,j=1,2,3,4,5,6)}$$

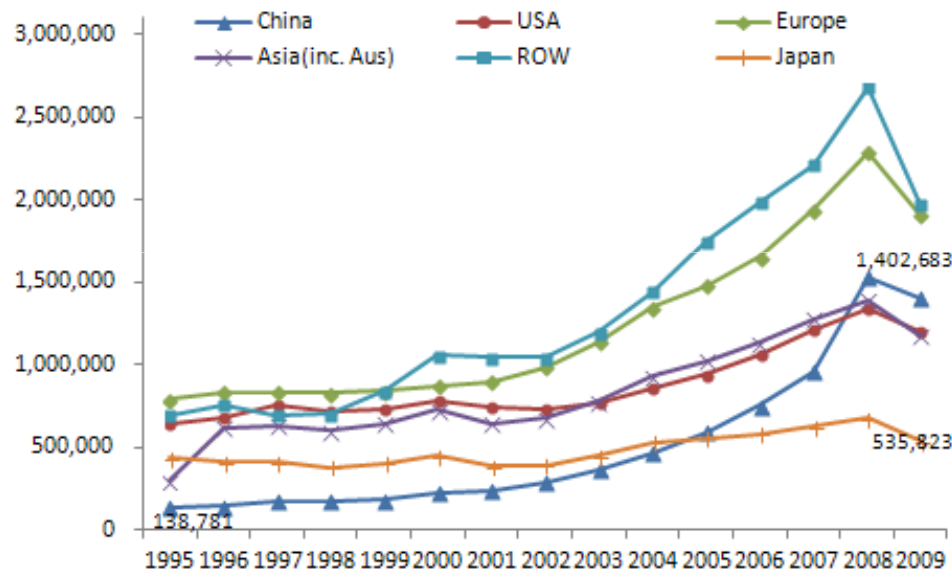
(F) The Relative Trade Efficiency

$$RTE(js) = \text{Net Value Added}(js) / \text{Net Exports}(js)$$

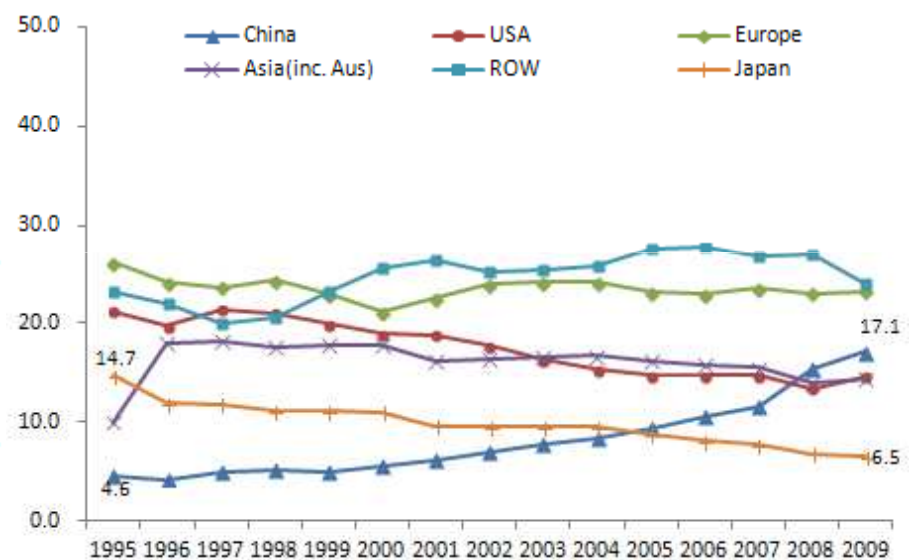
3. Empirical results

A: Region s' Value-Added by Foreign Final Demand (Figure 2)

(amount: million US\$)



(share: %)

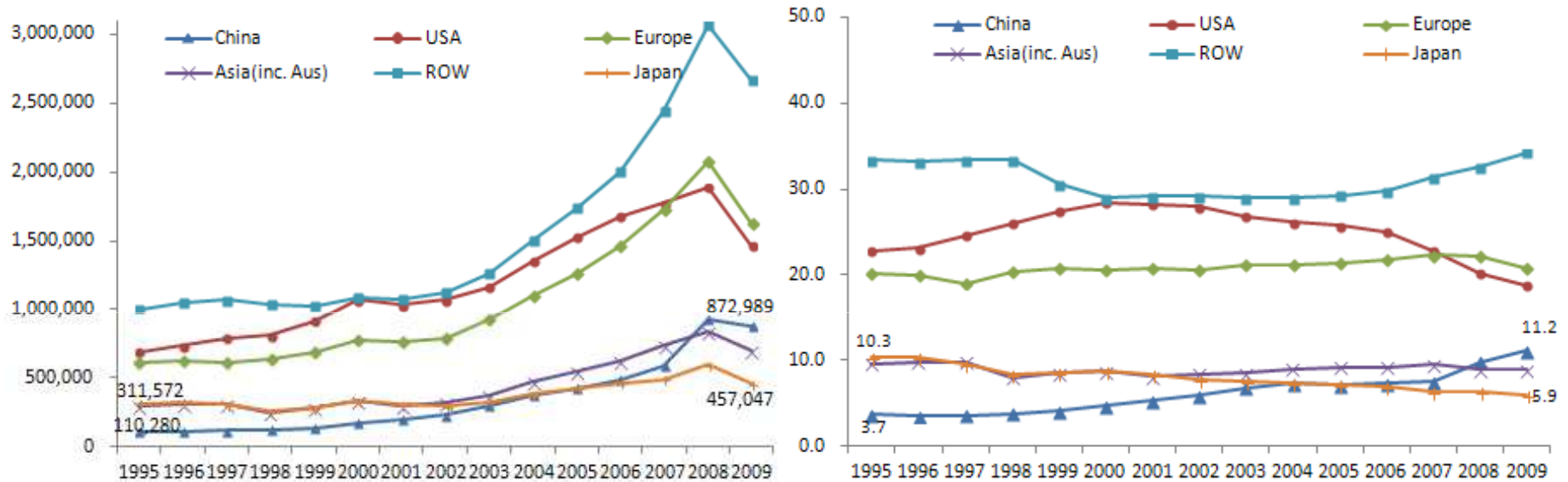


- China's value-added induced by foreign final increased by 10.1 times , while her share in the world's value-added increased from 4.6% to 17.1%.
- Japan's value-added increased only 1.2 times, and her share decreased from 14.7% to 6.5%.

B: Foreign Value-Added Induced by Country s' Final Demand (Figure 3)

(amount: million US\$)

(share: %)

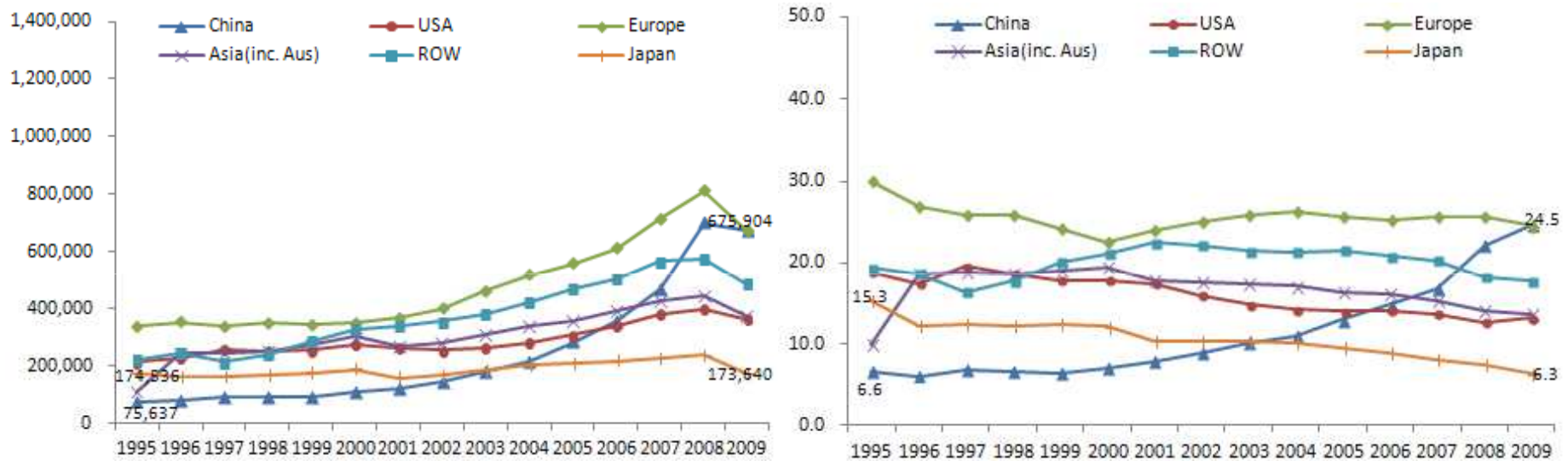


- In the case of China, it increased 7.9 times, smaller than the increase of China's value added by foreign final demand by 10.1 times. This implies that China benefitted from the growth of the global economy, but its contribution to foreign value-added is not that much.
- The share for China increase from 4.6% to 11.2%, while that of Japan decreased from 10.3% to 5.9%.

C: Region s' Value-Added Induced by Foreign Final Demand for its Products (Figure 4)

(amount: million US\$)

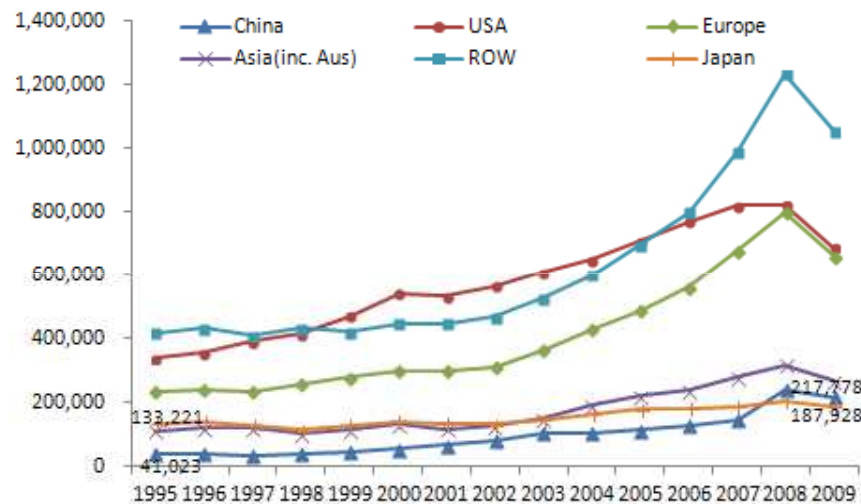
(share: %)



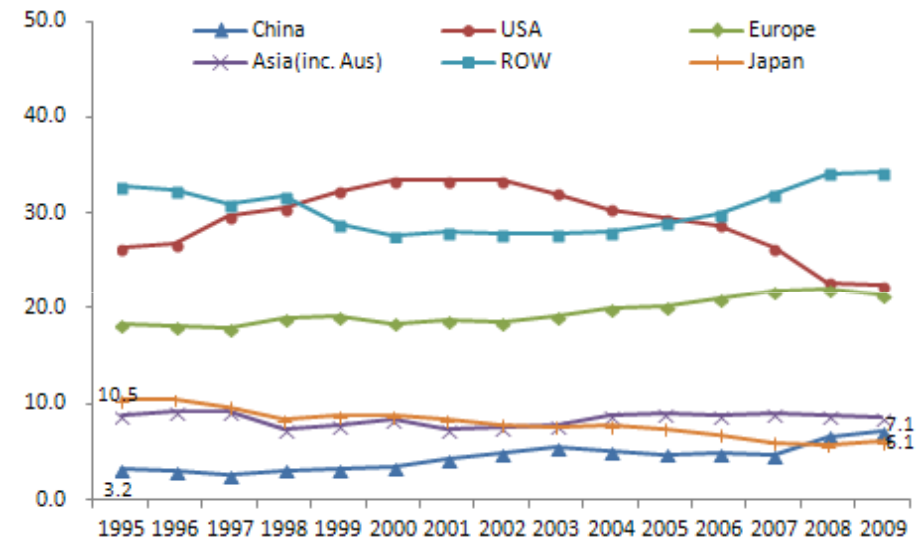
- The value increased by 8.9 times for China, while the values of the U.S. and EU only doubled during the same period.
- China's share increased from 6.6% in 1995 to 24.5% in 2009, implying that China's economic growth was driven by a rapid increase in her exports.

D: Foreign value-added induced by region s' final demand for foreign products (Figure 5)

(amount: million US\$)



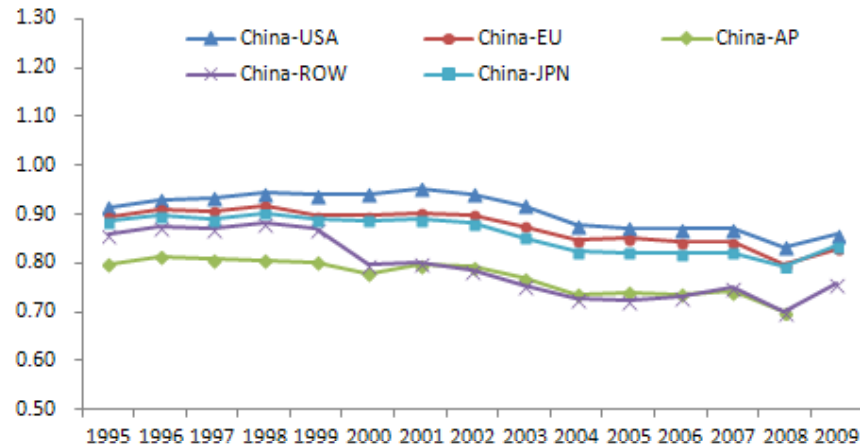
(share: %)



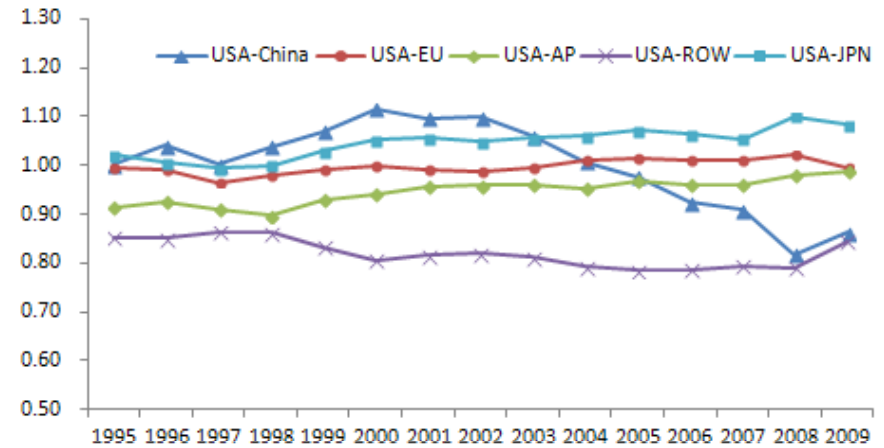
- In spite of a rapid increase of the value for China by 5.3 times, China's share in the total was still at the lowest level (7.1% in 2009).
- The share of Japan decreased from 10.5% in 1995 to 6.1% in 2009.
- China's contribution to creating foreign value-added is relatively small.

E: The VAX Ratio for Bilateral Trade (Figure 6)

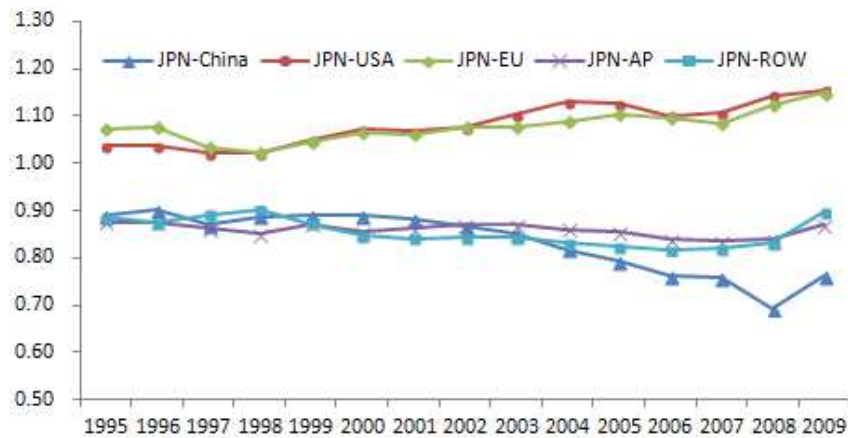
Between China and others



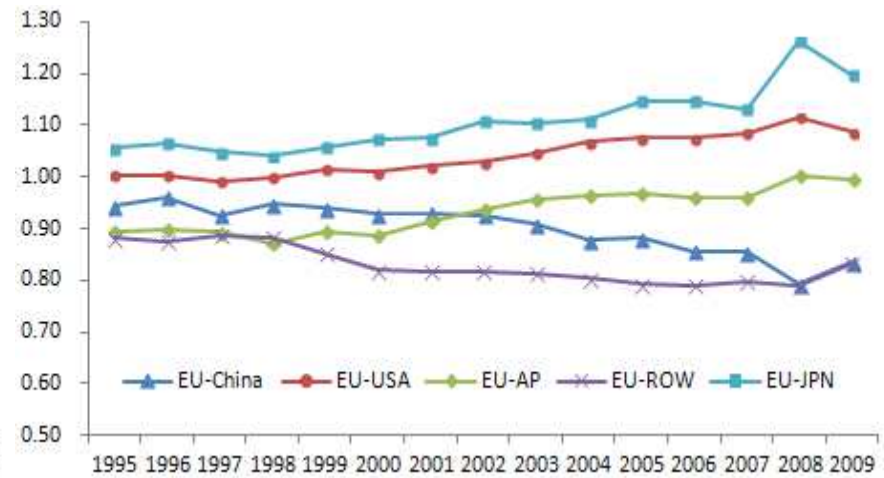
Between the U.S. and others



Between Japan and others



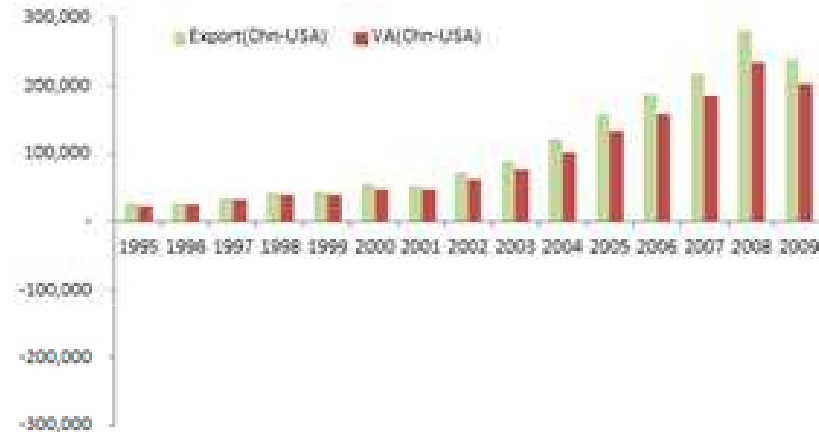
Between Europe and others



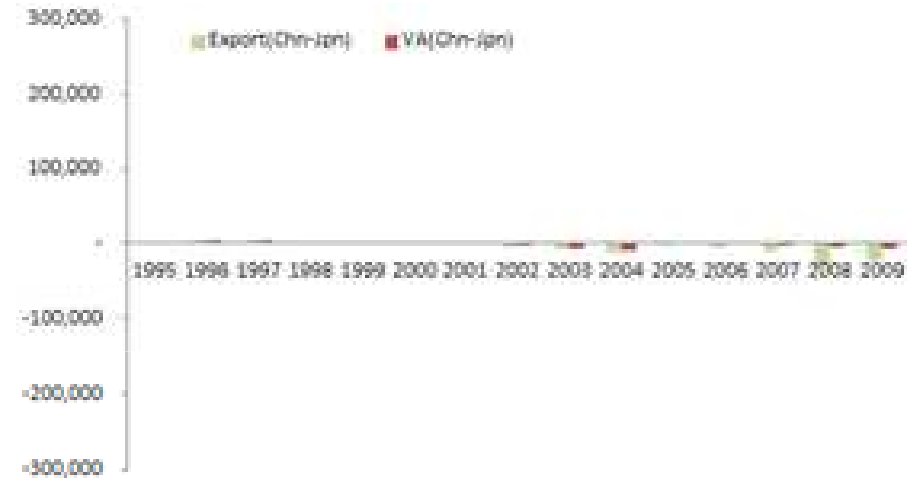
- China had a lower VAX level than others, and it has continuously decreased since 2001. China's exports of intermediate goods seems to have increased faster than exports of final goods.
- Europe's VAX to Japan, US, and Asia-Pacific significantly increased; by contrast, its VAX to China continuously decreased.
- Japan's VAX to the U.S. and Europe continuously increased and stayed at a high level, while its VAX to China significantly decreased.

F: Net Exports and the Net Value-Added in Bilateral Trade: Relative Trade Efficiency (Figure 7)

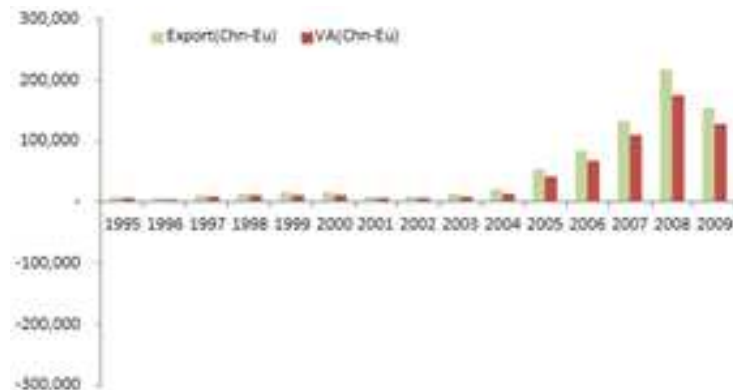
Between China and the U.S.



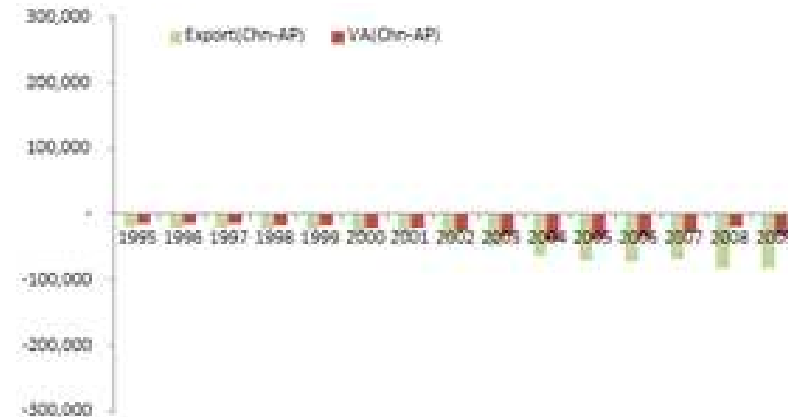
Between China and Japan



Between China and Europe



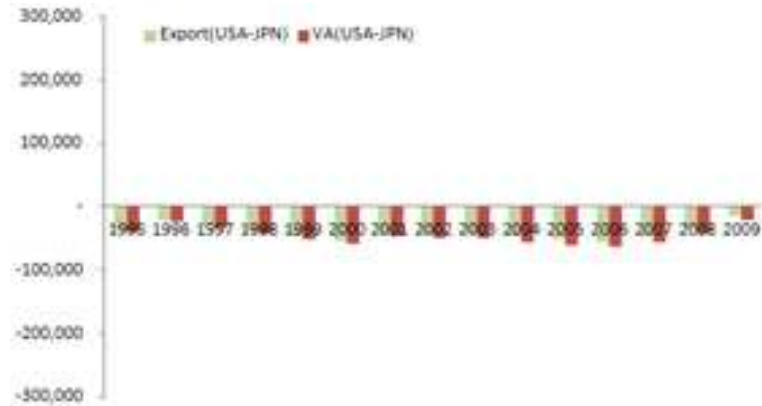
Between China and Asia-Pacific



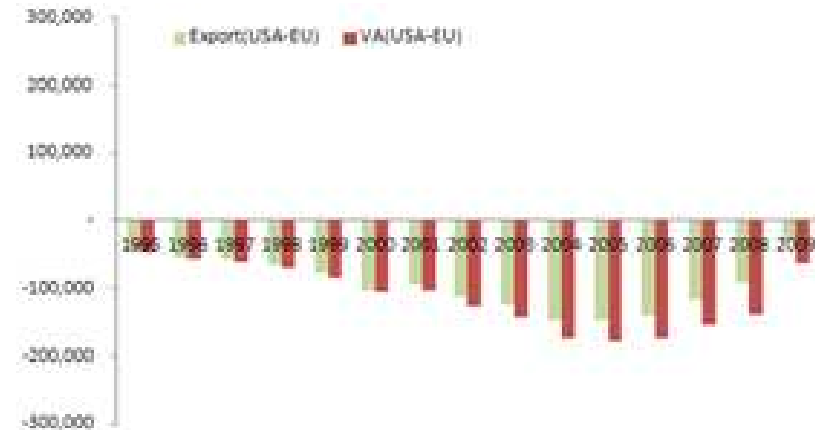
- China ran a substantial surplus in net exports and net value-added against the U.S. and Europe, but the net value added was smaller than net exports in both cases. This implies that China was not efficient in creating value-added by exporting to the U.S. and Europe.
- In the case of trade with Japan, China ran deficits in both the net-value added and net exports.
- China ran deficits in both the net-value added and net exports against the Asia-Pacific.

F: Relative Trade Efficiency (continued)

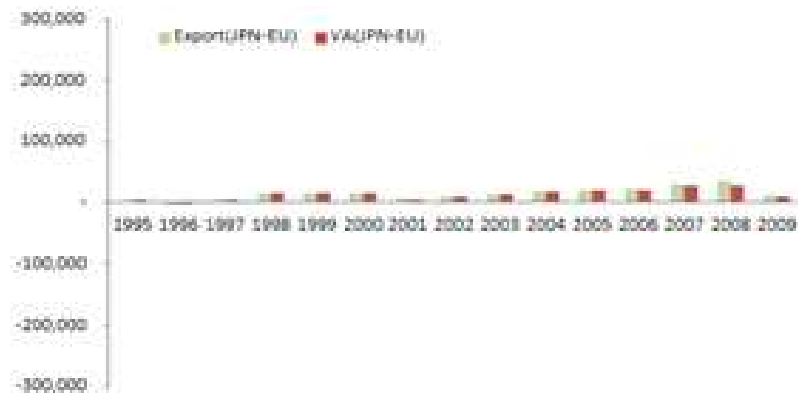
Between the U.S. and Japan



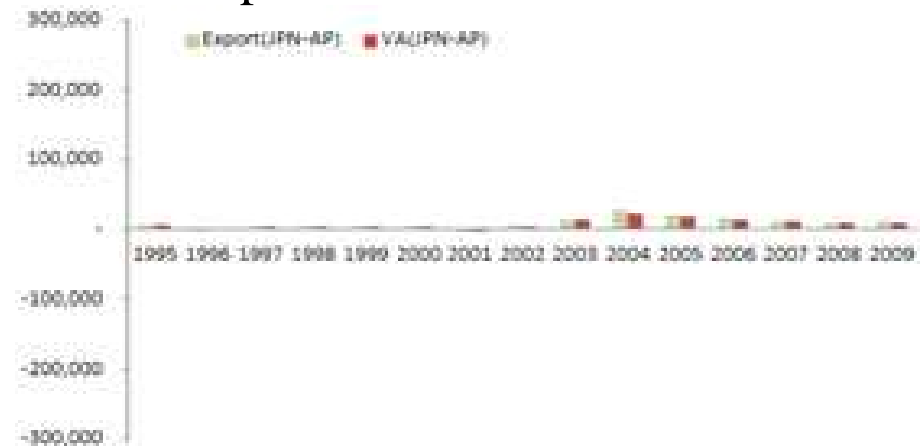
Between the U.S. and Europe



Between Japan and Europe



Between Japan and the Asia-Pacific



- The U.S. ran a trade deficit against all her trading partners, but the size of deficit in net exports began to decrease since 2006 against Japan and Europe. The relative trade efficiency index was smaller than 1 in both cases.
- Japan ran a deficit against China, but a surplus against the U.S. and Europe. Japan's relative trade efficiency, it was smaller than 1 in the case of Europe.
- Europe's net exports and the net value added in trading with the Asia-Pacific turned from surplus to deficit since 1999. Europe ran a huge surplus in trading with ROW, but relative trade efficiency was smaller than 1.

4. Concluding Remarks

- 1) The visibility of East Asia in the global value chain must have increased following the growth of the China's exports to the global market. However, China's VAX ratio remains smaller than others, reflecting a rapid increase of exports of intermediate goods rather than final goods.
- 2) The global imbalances between the U.S. and East Asia may be exaggerated, taking into consideration the China's worsening trade efficiency against the U.S.

- 3) China's relative trade efficiency against the Asia-Pacific and the Asia-Pacific's against China have decreased. This fact may imply the deepening vertical specialization in trade between China and the Asia-Pacific countries.

- 4) It remains to be seen how the regional division of labor has changed among China, Japan and East Asia's emerging market economies, particularly at the industry level, and hopefully why.