

## **Decoupling and Sources of Structural Transformation of East Asian Economies: International Input-Output Decomposition Analysis**

Jong-Hwan Ko  
Pukyong National University, Korea  
[jonghko@pknu.ac.kr](mailto:jonghko@pknu.ac.kr)

Werner Pascha  
University of Duisburg-Essen, Germany  
[werner.pascha@uni-due.de](mailto:werner.pascha@uni-due.de)

This study aims to answer two questions: 1) Have East Asian emerging economies decoupled? 2) What are the sources of structural transformation of East Asian economies related to the first question? We use so-called input-output decomposition analysis by which the sources of structural changes in total outputs and value added of East Asian emerging economies can be identified. The sources of the shifts in total outputs and value added of East Asian economies between 1990 and 2000, as well as between 2000 and 2006 can be ascribed to changes in technology in terms of input coefficients and value added coefficients, domestic final demand, and intra-regional and extra-regional final demand. The magnitude of each factor of the sources is quantified by means of input-output decomposition analysis. We make use of Asian International Input-Output Tables for 1990 and 2000 compiled by the Institute of Developing Economies Japan External Trade Organization (IDE-JETRO) and Asian International Input-Output Table for 2006 updated by Pula and Peltonen (2009).

The main findings of the study are as follows. First, the changes in the impact of the final demand components on total output and value-added of emerging Asia show that since 1990, there is a trend of increasing dependence on exports, indicating no sign of “decoupling”, but rather an increasing integration of emerging Asian countries into global trade. In other words, the exposure of emerging Asia to extra-regional markets has increased. Second, even though this study does not support the decoupling of emerging Asia, there is a contrasting feature in the sources of structural changes in gross output and value-added between non-China emerging Asia and China. Dependence of non-China emerging Asia on intra-regional trade has increased, in line with the strengthening of economic integration in East Asia, but China has disintegrated from the region. Third, there have been differing trends in changes in the sources of extra-regional demand during 1990-2006. The contribution ratio of EU demand to changes in total output and value-added of emerging Asia increased between 1990-2000 and 2000-2006, while the shares of Japan and the United States declined. As a result, the dependence of emerging Asia’s output and value-added on the G3 economies decreased. However, the higher exposure of emerging Asia to extra-regional markets during 2000-2006 than 1990-2000 was due to stronger trade linkages with the rest of the world, with their higher share in emerging Asia’s total output and value-added.

**Keywords:** East Asian emerging economies, decoupling, Asian International Input-Output table, input-output decomposition analysis, factors of economic growth

**JEL classification:** F14, C67, E23

## **I. Introduction**

The “decoupling” thesis that East Asian region has become a self-contained economic zone with potential to maintain its own growth dynamism independent of global demand trends, which is driven mainly by autonomous changes in internal demand, has been a popular theme in the Asian policy circles.

The outbreak of the global financial crisis emanating from the collapse of the U.S. housing bubble since the second half of 2007 and the continuous strengthen of growth of East Asian emerging economies have set off the so-called “decoupling” debate on whether East Asian emerging economies have decoupled from the world business cycle. According to Asian Development Bank (2007), decoupling can be defined as “the emergence of a business cycle dynamic that is relatively independent of global demand trends and that is driven mainly by autonomous changes in internal demand”.

With respect to the ongoing debate on “decoupling” of East Asian economies, this paper examines whether East Asian emerging economies (i.e., China, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Taiwan (R.O.C.), and Thailand) have decoupled and makes a quantitative assessment of the sources of their structural changes related to the decoupling debate. We use so-called input-output decomposition analysis (I-ODA) by which the sources of structural changes in gross outputs and value added of East Asian economies can be identified. Using Asian International Input-Output (II-O) Tables for 1990, 2000 and 2006, the sources of the shifts in gross outputs and value added of East Asian emerging economies between 1990 and 2000, as well as between 2000 and 2006 can be ascribed to changes in technology in terms of input coefficients and value added coefficients, domestic final demand, intra-regional final demand, and extra-regional final demand.

We use Asian International Input-Output (II-O) Tables for 1990 and 2000 compiled by the Institute of Developing Economies Japan External Trade Organization (IDE-JETRO) and Asian II-O table for 2006 updated by Pula and Peltonen (2009).

The paper is organized as follows. Section 2 briefly reviews the related literature. In section 3, we discuss the methodology used in this study. Section 4 presents the sources of the shifts in total outputs and value added of East Asian emerging economies and Section 5 concludes with some remarks and suggestions for future work.

## **II. Literature Review**

The existing empirical evidence on the decoupling of East Asian emerging economies is ambiguous (Pula and Peltonen, 2009).

Literature review is based on the literature on decoupling of East Asian emerging economies, such as Hasebe and Shrestha (2006), IMF (2007), Dees and Vansteenkiste (2007), Mori and Sasaki (2007), ADB (2007, 2008), Athukorala and Kohpaiboon (2009), and Pula and Peltonen (2009). Additional description will be inserted here.

### III. Data and Methodology

#### 1. Data

We use II-O Tables for 1990 and 2000 compiled by the Institute of Developing Economies Japan External Trade Organization (IDE-JETRO) and the updated Asian II-O table for 2006 provided by Pula and Peltonen (2009)<sup>1</sup>. To date, the Asian II-O tables have been compiled for the years 1985, 1990, 1995 and 2000. The Asian II-O table for 2006 updated by Pula and Peltonen (2009) is the country-level update of the Asian II-O table for 2000, i.e., the Asian II-O table for 2006 is not disaggregated in sectors.

The structure of the Asian II-O table for 2000 is shown in Figure A.1 in the appendix. The Asian II-O table provides detailed information on trade and production linkages of 10 economies in the Asia-Pacific region: China, Indonesia, Malaysia, the Philippines, Singapore, Korea, Taiwan (R.O.C.), Thailand, Japan and the United States. In addition, the geographical breakdown for trade includes Hong Kong S.A.R., the European Union and the rest of the world. The Asian II-O table contains the input-output tables of these countries linked together through trade matrices. In general, the Asian II-O table has both a country and a sectoral dimension, which makes it possible to describe interdependences of various sectors of different countries. However, the Asian II-O table for 2006 used in this study is at a country level<sup>2</sup> and we will focus on the aggregated country level throughout the analysis.

Figure 1: The Asian II-O table in matrix notation

	Intermediate demand	Final demand	Exports	Statistical discrepancy	Total outputs
	(AI) (AM)...(AU)	(AI) (AM)...(AU)	(LH) (LO) (LW)	(QX)	(XX)
(AI) (AM) ... (AU)	<b>AD</b>	<b>FD</b>	<b>L</b>	<b>Q</b>	<b>X</b>
(BF) (CH) ... (DT)	<b>AM</b>	<b>FM</b>			
(VV)	<b>V</b>				
(XX)	<b>X</b>				

As seen in Figure 1, the Asian II-O table consists of 5 matrices and 4 vectors: the intermediate input transaction matrix of 10 endogenous countries<sup>3</sup> (**AD**), the exogenous intermediate input transaction matrix (**AM**) which is a matrix of imported intermediate inputs from exogenous countries such as Hong Kong, the EU and the rest of the world to the endogenous countries, the final demand matrix of the endogenous countries (**FD**) which is the transaction matrix of final goods and services among the endogenous countries, the exogenous final goods transaction matrix (**FM**) which is a matrix of imported final goods from the exogenous countries to the endogenous countries, the export matrix (**L**) of the endogenous countries to the exogenous ones, the value-added

<sup>1</sup> When we started to work on this paper, the Asian II-O table for 2005 was not available and scheduled to be published in 2011.

<sup>2</sup> Due to the limited availability of data, Pula and Peltonen (2009) updated the Asian II-O table of 2000 to one for 2006 at the country level only.

<sup>3</sup> The 10 endogenous countries include Indonesia, Malaysia, the Philippines, Singapore, Thailand, China, Taiwan, Korea, Japan and U.S.A.

vector (**V**) of the endogenous countries, a vector of total inputs (**X**), a vector of total outputs (**X**), and a vector of statistical discrepancy (**Q**).

The three main matrices of the Asian II-O table are the intermediate input transaction matrix (**AD**), the final demand matrix (**FD**) and the export matrix (**L**).

$$\text{Let } \alpha^{ij} = \frac{AD^{ij}}{X^j},$$

where  $\alpha^{ij}$  are input coefficients,  $AD^{ij}$  are intermediate inputs from the supplying country  $i$  used in the production of the demanding country  $j$ ,  $X^j$  are total productions of the demanding country  $j$ , and  $i$  and  $j$  are indices of the supplying and demanding countries (Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Taiwan, Korea, Japan and U.S.A).

The Asian II-O table can be written in a matrix form as:

$$\begin{bmatrix} \alpha^{II} & \alpha^{IM} & \cdot & \alpha^{IU} \\ \alpha^{MI} & \alpha^{MM} & \cdot & \alpha^{MU} \\ \cdot & \cdot & \cdot & \cdot \\ \alpha^{UI} & \alpha^{UM} & \cdot & \alpha^{UU} \end{bmatrix} X \begin{bmatrix} X^{II} \\ X^{MI} \\ \cdot \\ X^{UI} \end{bmatrix} + \begin{bmatrix} FD^{II} & FD^{IM} & \cdot & FD^{IU} \\ FD^{MI} & FD^{MM} & \cdot & FD^{MU} \\ \cdot & \cdot & \cdot & \cdot \\ FD^{UI} & FD^{UM} & \cdot & FD^{UU} \end{bmatrix} + \begin{bmatrix} L^{IH} & \cdot & L^{IW} \\ L^{MH} & \cdot & L^{MW} \\ \cdot & \cdot & \cdot \\ L^{UH} & \cdot & L^{UW} \end{bmatrix} + \begin{bmatrix} Q^I \\ Q^M \\ \cdot \\ Q^U \end{bmatrix} = \begin{bmatrix} X^I \\ X^M \\ \cdot \\ X^U \end{bmatrix}$$

This matrix notation can be rewritten as equation (1).

$$AX + FDt + Lt + Q = X \quad (1)$$

where  $t$  is a unit vector.

If we solve equation (1) to  $X$ , we get

$$X = (I - A)^{-1}(FDt + Lt + Q) \quad (2)$$

To simplify the notation, let  $Y = FDt + Lt + Q$  and  $R = (I - A)^{-1}$ . The equation (2) becomes

$$X = RY \quad (3)$$

where  $R$  is the Leontief inverse matrix. The  $R^{ij}$  element of the matrix indicates the number of units of production needed in the supplying country  $i$  to meet one unit of the sum of final demand of the demanding country  $j$  for goods and services supplied by country  $i$  and exports of country  $i$  to the exogenous countries.

## 2. Methodology

Input-output decomposition analysis (I-ODA) can be defined as a method of distinguishing major shifts of the structure of an economy by means of comparative static changes in key sets of parameters (Rose and Miernyk, 1989). I-ODA was first developed by Chenery (1960) and Chenery, Shishido and Watanabe (1962). I-ODA is based on the input-output model that provides a useful framework which makes it possible to examine the sources of differences in the structure of an economy between two years (or between countries). The differences in gross outputs between the base

year 0 and the terminal year 1 can be identified in terms of two categories of structural changes that determine them: changes in the Leontief inverse matrix **B** and changes in the patterns of the final demand **Y**, as seen in equation (4).

$$\Delta X = X^1 - X^0 = R^1 Y^1 - R^0 Y^0 \quad (4)$$

The composition of changes in total outputs can be explained by the three transformations of equation (4) as follows.

$$\Delta X = (R^1 - R^0)Y^0 + R^1(Y^1 - Y^0) \quad (5)$$

$$\Delta X = (R^1 - R^0)Y^1 + R^0(Y^1 - Y^0) \quad (6)$$

$$\Delta X = (R^1 - R^0)Y^0 + R^0(Y^1 - Y^0) + (R^1 - R^0)(Y^1 - Y^0) \quad (7)$$

In equation (5), the differences in the Leontief inverse matrices are weighted with the base year's final demand, and the differences in final demand with the Leontief inverse of the terminal year<sup>4</sup>. In equation (6), the differences in the Leontief inverse matrices are weighted with the terminal year's final demand, and the differences in final demand with the base year's inverse matrix<sup>5</sup>. In comparisons over time, an analogy exists between the equations (5) and (6) and the Laspeyres and Paasche index formulae. In inter-country comparisons, equations (5) and (6) are equivalent (Balassa 1979; Fay and Fink 1976). In equation (7) which avoids the choice of weighting, the differences in the inverse matrices and final demand are multiplied with the base year's weights, and the joint effect of both differences is shown separately (Watanabe 1964 and 1969).

We use equation (5) in this study. Since  $R^1 - R^0 = R^1(\frac{1}{R^0} - \frac{1}{R^1})R^0 = R^1(A^1 - A^0)R^0$  and  $X^0 = R^0 Y^0$ , the composition of changes in total outputs can be untangled by equation (8).

$$\Delta X = R^1(A^1 - A^0)X^0 + R^1(Y^1 - Y^0) \quad (8)$$

Since  $Y = FDI + Lt + Q$ , equation (8) can be rewritten as

$$\Delta X = R^1(A^1 - A^0)X^0 + R^1(FDI^1 - FDI^0) + R^1(Lt^1 - Lt^0) + R^1(Q^1 - Q^0) \quad (9)$$

Each term in equation (9) can be interpreted as its relative contribution to total outputs of the supplying countries as follows:

$R^1(A^1 - A^0)X^0$ : changes in technical input coefficients of the endogenous countries

$R^1(FDI^1 - FDI^0)$ : expansion of final demand of the endogenous, demanding countries  
for goods and services provided by the supplying countries

---

<sup>4</sup> This approach was used by Chenery, Shishido and Watanabe (1962), Stäglin and Wessels (1972), Syrquin (1976), Weiss and Wessels (1981), Kubo and Robinson (1984), Skolka (1984, 1989), and Ko (1993).

<sup>5</sup> This approach was applied by Skolka (1975, 1977, 1979), by Nijhowne et al. (1984), and Rose and Chen (1987).

$R^1(L^1 - L^0)$ : expansion of exports to the exogenous, demanding countries

$R^1(Q^1 - Q^0)$ : changes in statistical discrepancy

Since this study analyzes to what extent East Asian emerging economies are dependent on domestic final demand, final demand from the region itself, from the advanced economies, in particular Japan, the United States, and the EU15, and from the rest of the world (ROW), the contributions of domestic final demand, intra-regional final demand, extra-regional final demand, and exports to the G3 and the ROW to total outputs of the supplying countries are computed. As the final demand for goods and services supplied by the 10 endogenous countries comes from the 10 endogenous countries and their exports go to 3 exogenous countries, the final demand of the 10 endogenous countries  $FD$  and their exports  $L$  are expressed by equations (10) and (11), respectively.

$$FD_t = F^I + F^M + F^P + F^S + F^T + F^C + F^N + F^K + F^J + F^U \quad (10)$$

$$L_t = L^H + L^O + L^W \quad (11)$$

where

$F^I$ : final demand of Indonesia;  $F^M$ : final demand of Malaysia;  
 $F^P$ : final demand of the Philippines;  $F^S$ : final demand of Singapore;  
 $F^T$ : final demand of Thailand;  $F^C$ : final demand of China;  
 $F^N$ : final demand of Taiwan;  $F^K$ : final demand of Korea;  
 $F^J$ : final demand of Japan;  $F^U$ : final demand of the U.S.A.  
 $L^H$ : exports to Hong Kong  
 $L^O$ : exports to the EU15  
 $L^W$ : exports to the ROW

Therefore, the differences in gross outputs between the base year 0 and the terminal year 1 are computed by equations (12).

$$\begin{aligned} \Delta X = & R^1(A^1 - A^0)X^0 + R^1(F^{I^1} - F^{I^0}) + R^1(F^{M^1} - F^{M^0}) + R^1(F^{P^1} - F^{P^0}) \\ & + R^1(F^{S^1} - F^{S^0}) + R^1(F^{T^1} - F^{T^0}) + R^1(F^{C^1} - F^{C^0}) + R^1(F^{N^1} - F^{N^0}) \\ & + R^1(F^{K^1} - F^{K^0}) + R^1(F^{J^1} - F^{J^0}) + R^1(F^{U^1} - F^{U^0}) + R^1(L^{H^1} - L^{H^0}) \\ & + R^1(L^{O^1} - L^{O^0}) + R^1(L^{W^1} - L^{W^0}) + R^1(Q^1 - Q^0) \end{aligned} \quad (12)$$

After the differences in gross outputs between the base year 0 and the terminal year 1 are computed by equations (12), the dependence of total outputs of East Asian emerging economies on domestic final demand, final demand from the region itself, from the G3 countries, and from the rest of the world is calculated. By doing so, we get some measures to be used to answer the two questions raised as the aims of this study, with respect to changes in gross outputs of East Asian emerging economies.

Let  $A^{vj} = \frac{V^j}{X^j}$ , where  $A^{vj}$  are value-added coefficients, and  $V^j$  are value-added of the demanding country  $j$ . If the logic of equation (5) is applied, the difference in value-added between two periods can be expressed as

$$\begin{aligned}
\Delta V &= V^1 - V^0 \\
&= \hat{A}^{v1} X^1 - \hat{A}^{v0} X^0 \\
&= (\hat{A}^{v1} - \hat{A}^{v0}) X^0 + \hat{A}^{v1} (X^1 - X^0) \\
&= (\hat{A}^{v1} - \hat{A}^{v0}) X^0 + \hat{A}^{v1} \Delta X
\end{aligned} \tag{13}$$

where  $\hat{A}^v$  is a diagonal matrix consisting of the elements of  $a^{vj} = V^j / X^j$ .

If equation (9) is inserted into equation (13), the composition of changes in value-added can be untangled by equation (14).

$$\begin{aligned}
\Delta V &= (\hat{A}^{v1} - \hat{A}^{v0}) X^0 + \hat{A}^{v1} R^1 (A^1 - A^0) X^0 \\
&\quad + \hat{A}^{v1} R^1 (FDt^1 - FDt^0) + \hat{A}^{v1} R^1 (Lt^1 - Lt^0) + \hat{A}^{v1} R^1 (Q^1 - Q^0)
\end{aligned} \tag{14}$$

Each term in equation (14) can be interpreted as its relative contribution to value-added of the supplying countries as follows:

- $(\hat{A}^{v1} - \hat{A}^{v0}) X^0$ : changes in value-added coefficients of the endogenous countries
- $\hat{A}^{v1} R^1 (A^1 - A^0) X^0$ : changes in technical input coefficients of the endogenous countries
- $\hat{A}^{v1} R^1 (FDt^1 - FDt^0)$ : expansion of final demand of the endogenous countries  
for goods and services provided by the supplying countries
- $\hat{A}^{v1} R^1 (Lt^1 - Lt^0)$ : expansion of exports to the exogenous countries
- $\hat{A}^{v1} R^1 (Q^1 - Q^0)$ : changes in statistical discrepancy

If the components of the final demand and destinations of exports are considered, as in equations (10) and (11), the differences in value-added between the base year 0 and the terminal year 1 can be computed by equation (15).

$$\begin{aligned}
\Delta V &= (\hat{A}^{v1} - \hat{A}^{v0}) X^0 + \hat{A}^{v1} R^1 (A^1 - A^0) X^0 + \hat{A}^{v1} R^1 (F^{I^1} - F^{I^0}) + \hat{A}^{v1} R^1 (F^{M^1} - F^{M^0}) \\
&\quad + \hat{A}^{v1} R^1 (F^{P^1} - F^{P^0}) + \hat{A}^{v1} R^1 (F^{S^1} - F^{S^0}) + \hat{A}^{v1} R^1 (F^{T^1} - F^{T^0}) + \hat{A}^{v1} R^1 (F^{C^1} - F^{C^0}) \\
&\quad + \hat{A}^{v1} R^1 (F^{N^1} - F^{N^0}) + \hat{A}^{v1} R^1 (F^{K^1} - F^{K^0}) + \hat{A}^{v1} R^1 (F^{J^1} - F^{J^0}) + \hat{A}^{v1} R^1 (F^{U^1} - F^{U^0}) \\
&\quad + \hat{A}^{v1} R^1 (L^{H^1} - L^{H^0}) + \hat{A}^{v1} R^1 (L^{O^1} - L^{O^0}) + \hat{A}^{v1} R^1 (L^{W^1} - L^{W^0}) + \hat{A}^{v1} R^1 (Q^1 - Q^0)
\end{aligned} \tag{15}$$

After the differences in value-added between the base year 0 and the terminal year 1 are computed by equation (15), the dependence of value-added of East Asian emerging economies on domestic final demand, final demand from the region itself, from the G3 countries, and from the rest of the world is calculated. By doing so, we get some measures to be used to answer the two questions raised as the aims of this study, with regard of changes in value-added of East Asian emerging economies.

#### **IV. Results of I-ODA of Gross Output and Value-Added of East Asian Emerging Economies**

The main findings of I-ODA of gross outputs and value-added of East Asian emerging economies are summarized in Tables 1-2. Table 1 shows the results of I-ODA of total outputs of East Asian emerging economies.

Table 1 presents six factors contributing to changes in total outputs of East Asian emerging economies between two periods of time, 1990-2000 and 2000-2006: technical input coefficients, domestic demand, intra-regional demand (the sum of exports to emerging Asian economies), the G3 demand (exports to the EU, Japan and the United States), exports to the rest of the world, and statistical discrepancy.

The contribution ratios are presented separately for the following supplying countries: emerging Asia (columns 2 and 3), emerging Asia without China (i.e., NIE3 and ASEAN4) (columns 4 and 5), and China (column 6).

The contribution ratio of the sum of domestic final demand and intra-regional final demand to gross output of emerging Asia between the two periods of time, 1990-2000 and 2000-2006, decreased from 72.5 percent to 59.2 percent, while those of final demand from the G3 and the rest of the world increased from 25.4 percent to 29.6 percent. The changes in the impact of the final demand components show that since 1990, there is a trend of increasing dependence on exports, indicating no sign of “decoupling”, but rather an increasing integration of emerging Asian countries into global trade. In other words, the exposure of emerging Asia to extra-regional markets has increased.

Even though this study does not support the decoupling of emerging Asia, there is a contrasting feature in the sources of structural changes in gross outputs between non-China emerging East Asia and China. Whereas the contribution ratios of the sum of domestic final demand and intra-regional final demand to gross outputs of China between 1990-2000 and 2000-2006 declined from 79 percent to 57 percent, those of non-China emerging Asia rose from 62.9 percent to 65.3 percent. Dependence of non-China emerging Asia on intra-regional trade has increased, in line with the strengthening of economic integration in East Asia, but China has disintegrated from the region. In particular, the contribution ratio of intra-regional demand to China’s outputs declined from 3.2 percent during 1990-2000 to -0.1 percent during 2000-2006. This contrasting feature of structural changes in total outputs between non-China emerging Asia and China can also be seen in that, whereas the contribution ratios of final demand from the G3 and the rest of the world to gross outputs of non-China emerging Asia between 1990-2000 and 2000-2006 dropped from 34.9 percent to 27.6 percent, those of final demand from the G3 and the rest of the world to gross outputs of China augmented from 18.8 percent to 30.2 percent.

There have been differing trends in changes in the sources of extra-regional demand during 1990-2006. The contribution ratio of EU demand to changes in total outputs of emerging Asia increased between 1990-2000 and 2000-2006 from 5.8% to 6.9%, while the shares of Japan and the United States declined from 3.5% to 0.8% and from 6.3% to 5%, respectively. As a result, the dependence of emerging Asia’s outputs on the G3 economies decreased from 15.6% to 12.8%. However, the higher exposure of emerging Asia to extra-regional markets during 2000-2006 was due to stronger trade linkages with



the rest of the world, with their share in emerging Asia's total outputs increasing 9.8% to 16.8% between 1990-2000 and 2000-2006.

Table 1: Results of I-ODA of gross outputs of East Asian emerging economies

	Emerging Asia		Emerging Asia except China		China	
	1990-2000	2000-2006	1990-2000	2000-2006	1990-2000	2000-2006
1) Technical coefficients	3.5	12.5	2.5	6.2	4.2	14.7
2) Domestic demand	65.9	55.7	51.5	51.5	75.8	57.1
3) Intra-regional demand	6.6	3.5	11.4	13.8	3.2	-0.1
4) G3	15.6	12.8	19.8	8.3	12.7	14.3
EU	5.8	6.9	8.7	4.8	3.8	7.7
Japan	3.5	0.8	4.0	-0.3	3.1	1.2
U.S.A.	6.3	5.0	7.1	3.8	5.7	5.4
5) ROW	9.8	16.8	15.1	19.3	6.1	15.9
6) Statistical discrepancy	-1.3	-1.2	-0.4	1.0	-1.9	-1.9
Total	100	100	100	100	100	100

Table 2: Results of I-ODA of value-added of East Asian emerging economies

	Emerging Asia		Emerging Asia except China		China	
	1990-2000	2000-2006	1990-2000	2000-2006	1990-2000	2000-2006
1) Value-added coeff.	-3.6	-13.3	-2.2	-6.8	-4.9	-17.2
2) Technical coefficients	3.4	13.3	2.2	6.6	4.4	17.2
3) Domestic demand	67.5	63.2	53.6	57	79.5	66.9
4) Intra-regional demand	7.2	5.2	11.6	14.2	3.4	-0.1
5) G3	16.5	13.7	20.2	8.5	13.3	16.7
EU	6.2	7.5	8.8	4.9	4.0	9.0
Japan	3.7	0.8	4.1	-0.3	3.3	1.4
U.S.A.	6.6	5.4	7.2	3.9	6.0	6.4
6) ROW	10.5	19.0	15.2	19.7	6.4	18.7
7) Statistical discrepancy	-1.3	-1.1	-0.5	0.9	-2.0	-2.2
Total	100	100	100	100	100	100

Changes in input coefficients have also contributed to gross outputs of the emerging East Asian economies. The contribution ratios of changes in input coefficients of the emerging Asia to its gross output grew from 3.5 percent to 12.5 percent between 1990-2000 and 2000-2006.

Table 2 presents seven factors contributing to changes in value-added of East Asian emerging economies between 1990-2000 and 2000-2006: value-added coefficients, input coefficients, domestic demand, intra-regional demand, the G3 demand, exports to

the rest of the world and statistical discrepancy.

Whereas changes in value-added coefficients of emerging Asia resulted in a decrease in its value-added, but changes in input coefficients contributed to an increase in its value-added. The contribution ratio of value-added coefficients to emerging Asia's value-added decreased from -3.6% to -13.3% between 1990-2000 and 2000-2006, but that of input coefficients increased from 3.4% to 13.3%.

Results of I-ODA of value-added of emerging Asia by domestic demand, intra-regional demand, and extra-regional demand in Table 2 are quite similar to those of total outputs in Table 1 except for China's dependence on the U.S. market with its higher contribution ratio during 2000-2006 than 1990-2000 (6.4% vs. 6%). Table 2 indicates no sign of decoupling of emerging Asia in terms of value-added as well. The contribution ratio of the sum of domestic final demand and intra-regional final demand to value-added of emerging Asia between 1990-2000 and 2000-2006 decreased from 74.7 percent to 68.4 percent, while that of final demand from the G3 and the rest of the world increased from 27 percent to 32.7 percent.

The comparison of China with non-China emerging Asia by the sources of demand reveals a contrasting pattern. Dependence of non-China emerging Asia on domestic demand and intra-regional demand increased, but dependence of China on them decreased. In more detail, contribution ratio of the sum of domestic demand and intra-regional demand to value-added of non-China emerging Asia rose from 65.2% to 71.2%, but that to value-added of China dropped from 82.9% to 66.8%, indicating the strengthened economic integration of non-China emerging Asia within the region, with a higher degree of China's dependence on extra-regional export markets.

## **V. Concluding Remarks**

In this paper we examined whether East Asian emerging economies have decoupled by making a quantitative assessment of the sources of their structural changes in gross output and value added of East Asian economies related to the decoupling debate using Input-Output decomposition analysis based on Asian International Input-Output tables for 1990, 2000 and 2006. In particular, we investigated the dependence of emerging Asia's outputs and value-added through production and trade linkages on value-added coefficients and input coefficients, on domestic demand and intra-regional demand, and on demand from the advanced economies, especially the EU, Japan and the United States.

The main findings of the study are as follows. First, the changes in the impact of the final demand components on total output and value-added of emerging Asia show that since 1990, there is a trend of increasing dependence on exports, indicating no sign of "decoupling", but rather an increasing integration of emerging Asian countries into global trade. In other words, the exposure of emerging Asia to extra-regional markets has increased. Second, even though this study does not support the decoupling of emerging Asia, there is a contrasting feature in the sources of structural changes in gross output and value-added between non-China emerging Asia and China. Dependence of non-China emerging Asia on intra-regional trade has increased, in line with the strengthening of economic integration in East Asia, but China has disintegrated from the region. Third, there have been differing trends in changes in the sources of extra-regional demand during 1990-2006. The contribution ratio of EU demand to changes in total output and value-added of emerging Asia increased between 1990-2000 and 2000-2006, while the shares of Japan and the United States declined. As a result, the dependence of

emerging Asia's output and value-added on the G3 economies decreased. However, the higher exposure of emerging Asia to extra-regional markets during 2000-2006 than 1990-2000 was due to stronger trade linkages with the rest of the world, with their higher share in emerging Asia's total output and value-added.

As it is evident from the analysis, the paper finds no support for the decoupling view at the macroeconomic level. The picture at the industry level may look different. If the Asian II-O table for 2005 is available sooner or later, another study for the same purpose at the sectoral level will be conducted.

## References

- Asian Development Bank (2007), Uncoupling Asia: Myth and Reality, *Asian Development Outlook 2007*.
- Asian Development Bank (2008), The Global Slowdown in Emerging Asia, *Asian Development Outlook 2008*.
- Athukorala, P. and A. Kohpaiboon (2009), Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges, ADBI Working Paper No. 177, December.
- Balassa, B. (1979), Accounting for Economic Growth: The Case of Norway, *Oxford Economic Papers* 41(3), 415-436.
- Chenery, H.B. (1960), "Patterns of Industrial Growth," *The American Economic Review*, Vol. 50, 624-654.
- Chenery, H.B., S. Shishido and T. Watanabe (1962), "The Pattern of Japanese Growth," 1914-1954, *Econometrica*, 30(1), 98-139.
- Dees, S. and I. Vansteenkiste (2007), The Transmission of US Cyclical Developments to the Rest of the World, ECB Working Paper No. 798, August.
- Fay, J. and Fink, G. (1976), Ein Input-Output-Vergleich der Brutto-Produktionsstruktur nach Wirtschaftsbereichen zwischen Österreich und Ungarn, Wiener Institut für internationale Wirtschaftsvergleiche, Vienna.
- Hasebe, Y. and N. Shrestha (2006), "Economic Integration in East Asia: An International Input-Output Analysis," *The World Economy*, 1709-1735.
- International Monetary Fund (2007), Decoupling the Train? Chapter 4 in the *World Economy Outlook 2007*, April.
- Institute of Developing Economies Japan External Trade Organization (IDE-JETRO) (1998, 2006), *Asian International Input-Table 1990*, and *Asian International Input-Table 2000*, Tokyo.
- Ko, J.-H. (1993), *Ökonomische Analyse von Energie- und Volkswirtschaft auf der Basis allgemeiner Gleichgewichtsmodelle*, Europäische Hochschulschriften, Bd. 1420, Verlag Peter Lang: Frankfurt/Wien/ Paris/New York.
- Leontief, W. (1941), *The Structure of American Economy, 1919-1929: An Empirical Application of Equilibrium Analysis*, Cambridge, MA, Harvard University Press.
- Mori, T. and H. Sasaki (2007), Interdependence of Production and Income in Asia-Pacific Economies: An International Input-Output Approach, Bank of Japan Working Paper No. 102, April.
- Pula, G. and T.A. Peltonen (2009), Has Emerging Asia Decoupled? An Analysis of Production and Trade Linkages Using the Asian International Input-Output Table, Working Paper Series No. 993, European Central Bank, January 2009.
- Rose, A. and W. Miernyk (1989), "Input-Output Analysis: The First Fifty Years," *Economic*

*Systems Research*, 1(2), 245-264.

Watanabe, T. (1964), An Experimental Comparison of Production Structures: EEC Countries and Japan, *Weltwirtschaftliches Archiv* 92(1), 409-425.

Watanabe, T. (1969), Approaches to the Problem of Intercountry Comparison of Input-Output Relations. A Survey and Suggestions for Further Research, in United Nations, *International Comparisons of Interindustry Data*, New York, pp. 187-201.

## Appendix

Figure A.1: The schematic layout of the Asian II-O table for 2000

**Figure A.1.** The schematic layout of the 2000 Asian international Input-Output Table

The schematic image of the 2000 Asian international input-output table

	Intermediate Demand (A)										Final Demand (F)										Export (L)			Statistical Discrepancy	Total Outputs
	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Export to Hong	Export to EU	Export to R.O.W.		
code	(AI)	(AM)	(AP)	(AS)	(AT)	(AC)	(AN)	(AK)	(AU)	(AU)	(FI)	(FM)	(FP)	(FS)	(FT)	(FC)	(FN)	(FK)	(FJ)	(FU)	(LH)	(LO)	(LW)	(QX)	
Indonesia	A <sup>II</sup>	A <sup>IM</sup>	A <sup>IP</sup>	A <sup>IS</sup>	A <sup>IT</sup>	A <sup>IC</sup>	A <sup>IN</sup>	A <sup>IK</sup>	A <sup>IU</sup>	A <sup>IU</sup>	F <sup>II</sup>	F <sup>IM</sup>	F <sup>IP</sup>	F <sup>IS</sup>	F <sup>IT</sup>	F <sup>IC</sup>	F <sup>IN</sup>	F <sup>IK</sup>	F <sup>IJ</sup>	F <sup>IU</sup>	L <sup>IH</sup>	L <sup>IO</sup>	L <sup>IW</sup>	X <sup>I</sup>	
Malaysia	A <sup>MI</sup>	A <sup>MM</sup>	A <sup>MP</sup>	A <sup>MS</sup>	A <sup>MT</sup>	A <sup>MC</sup>	A <sup>MN</sup>	A <sup>MK</sup>	A <sup>MU</sup>	A <sup>MU</sup>	F <sup>MI</sup>	F <sup>MM</sup>	F <sup>MP</sup>	F <sup>MS</sup>	F <sup>MT</sup>	F <sup>MC</sup>	F <sup>MN</sup>	F <sup>MK</sup>	F <sup>MJ</sup>	F <sup>MU</sup>	L <sup>MH</sup>	L <sup>MO</sup>	L <sup>MW</sup>	X <sup>M</sup>	
Philippines	A <sup>PI</sup>	A <sup>PM</sup>	A <sup>PP</sup>	A <sup>PS</sup>	A <sup>PT</sup>	A <sup>PC</sup>	A <sup>PN</sup>	A <sup>PK</sup>	A <sup>PJ</sup>	A <sup>PJ</sup>	F <sup>PI</sup>	F <sup>PM</sup>	F <sup>PP</sup>	F <sup>PS</sup>	F <sup>PT</sup>	F <sup>PC</sup>	F <sup>PN</sup>	F <sup>PK</sup>	F <sup>PJ</sup>	F <sup>PU</sup>	L <sup>PH</sup>	L <sup>PO</sup>	L <sup>PW</sup>	X <sup>P</sup>	
Singapore	A <sup>SI</sup>	A <sup>SM</sup>	A <sup>SP</sup>	A <sup>SS</sup>	A <sup>ST</sup>	A <sup>SC</sup>	A <sup>SN</sup>	A <sup>SK</sup>	A <sup>SJ</sup>	A <sup>SJ</sup>	F <sup>SI</sup>	F <sup>SM</sup>	F <sup>SP</sup>	F <sup>SS</sup>	F <sup>ST</sup>	F <sup>SC</sup>	F <sup>SN</sup>	F <sup>SK</sup>	F <sup>SJ</sup>	F <sup>SU</sup>	L <sup>SH</sup>	L <sup>SO</sup>	L <sup>SW</sup>	X <sup>S</sup>	
Thailand	A <sup>TI</sup>	A <sup>TM</sup>	A <sup>TP</sup>	A <sup>TS</sup>	A <sup>TT</sup>	A <sup>TC</sup>	A <sup>TN</sup>	A <sup>TK</sup>	A <sup>TJ</sup>	A <sup>TJ</sup>	F <sup>TI</sup>	F <sup>TM</sup>	F <sup>TP</sup>	F <sup>TS</sup>	F <sup>TT</sup>	F <sup>TC</sup>	F <sup>TN</sup>	F <sup>TK</sup>	F <sup>TJ</sup>	F <sup>TU</sup>	L <sup>TH</sup>	L <sup>TO</sup>	L <sup>TW</sup>	X <sup>T</sup>	
China	A <sup>CI</sup>	A <sup>CM</sup>	A <sup>CP</sup>	A <sup>CS</sup>	A <sup>CT</sup>	A <sup>CC</sup>	A <sup>CN</sup>	A <sup>CK</sup>	A <sup>CJ</sup>	A <sup>CJ</sup>	F <sup>CI</sup>	F <sup>CM</sup>	F <sup>CP</sup>	F <sup>CS</sup>	F <sup>CT</sup>	F <sup>CC</sup>	F <sup>CN</sup>	F <sup>CK</sup>	F <sup>CJ</sup>	F <sup>CU</sup>	L <sup>CH</sup>	L <sup>CO</sup>	L <sup>CW</sup>	X <sup>C</sup>	
Taiwan	A <sup>NI</sup>	A <sup>NM</sup>	A <sup>NP</sup>	A <sup>NS</sup>	A <sup>NT</sup>	A <sup>NC</sup>	A <sup>NN</sup>	A <sup>NK</sup>	A <sup>NJ</sup>	A <sup>NJ</sup>	F <sup>NI</sup>	F <sup>NM</sup>	F <sup>NP</sup>	F <sup>NS</sup>	F <sup>NT</sup>	F <sup>NC</sup>	F <sup>NN</sup>	F <sup>NK</sup>	F <sup>NJ</sup>	F <sup>NU</sup>	L <sup>NH</sup>	L <sup>NO</sup>	L <sup>NW</sup>	X <sup>N</sup>	
Korea	A <sup>KI</sup>	A <sup>KM</sup>	A <sup>KP</sup>	A <sup>KS</sup>	A <sup>KT</sup>	A <sup>KC</sup>	A <sup>KN</sup>	A <sup>KK</sup>	A <sup>KJ</sup>	A <sup>KJ</sup>	F <sup>KI</sup>	F <sup>KM</sup>	F <sup>KP</sup>	F <sup>KS</sup>	F <sup>KT</sup>	F <sup>KC</sup>	F <sup>KN</sup>	F <sup>KK</sup>	F <sup>KJ</sup>	F <sup>KU</sup>	L <sup>KH</sup>	L <sup>KO</sup>	L <sup>KW</sup>	X <sup>K</sup>	
Japan	A <sup>JI</sup>	A <sup>JM</sup>	A <sup>JP</sup>	A <sup>JS</sup>	A <sup>JT</sup>	A <sup>JC</sup>	A <sup>JN</sup>	A <sup>JK</sup>	A <sup>JJ</sup>	A <sup>JJ</sup>	F <sup>JI</sup>	F <sup>JM</sup>	F <sup>JP</sup>	F <sup>JS</sup>	F <sup>JT</sup>	F <sup>JC</sup>	F <sup>JN</sup>	F <sup>JK</sup>	F <sup>JJ</sup>	F <sup>JU</sup>	L <sup>JH</sup>	L <sup>JO</sup>	L <sup>JW</sup>	X <sup>J</sup>	
U.S.A.	A <sup>UI</sup>	A <sup>UM</sup>	A <sup>UP</sup>	A <sup>US</sup>	A <sup>UT</sup>	A <sup>UC</sup>	A <sup>UN</sup>	A <sup>UK</sup>	A <sup>UJ</sup>	A <sup>UJ</sup>	F <sup>UI</sup>	F <sup>UM</sup>	F <sup>UP</sup>	F <sup>US</sup>	F <sup>UT</sup>	F <sup>UC</sup>	F <sup>UN</sup>	F <sup>UK</sup>	F <sup>UJ</sup>	F <sup>UU</sup>	L <sup>UH</sup>	L <sup>UO</sup>	L <sup>UW</sup>	X <sup>U</sup>	
Freight and Insurance	BA <sup>I</sup>	BA <sup>M</sup>	BA <sup>P</sup>	BA <sup>S</sup>	BA <sup>T</sup>	BA <sup>C</sup>	BA <sup>N</sup>	BA <sup>K</sup>	BA <sup>J</sup>	BA <sup>J</sup>	BF <sup>I</sup>	BF <sup>M</sup>	BF <sup>P</sup>	BF <sup>S</sup>	BF <sup>T</sup>	BF <sup>C</sup>	BF <sup>N</sup>	BF <sup>K</sup>	BF <sup>J</sup>	BF <sup>U</sup>					
Import from Hong Kong	HI	HM	HP	A <sup>HS</sup>	A <sup>HT</sup>	A <sup>HC</sup>	A <sup>HN</sup>	A <sup>HK</sup>	A <sup>HJ</sup>	A <sup>HJ</sup>	F <sup>HI</sup>	F <sup>HM</sup>	F <sup>HP</sup>	F <sup>HS</sup>	F <sup>HT</sup>	F <sup>HC</sup>	F <sup>HN</sup>	F <sup>HK</sup>	F <sup>HJ</sup>	F <sup>HU</sup>					
Import from EU	O <sup>I</sup>	O <sup>M</sup>	O <sup>P</sup>	A <sup>OS</sup>	A <sup>OT</sup>	A <sup>OC</sup>	A <sup>ON</sup>	A <sup>OK</sup>	A <sup>OJ</sup>	A <sup>OJ</sup>	F <sup>OI</sup>	F <sup>OM</sup>	F <sup>OP</sup>	F <sup>OS</sup>	F <sup>OT</sup>	F <sup>OC</sup>	F <sup>ON</sup>	F <sup>OK</sup>	F <sup>OJ</sup>	F <sup>OU</sup>					
Import from the R.O.W.	W <sup>I</sup>	W <sup>M</sup>	W <sup>P</sup>	A <sup>WS</sup>	A <sup>WT</sup>	A <sup>WC</sup>	A <sup>WN</sup>	A <sup>WK</sup>	A <sup>WJ</sup>	A <sup>WJ</sup>	F <sup>WI</sup>	F <sup>WM</sup>	F <sup>WP</sup>	F <sup>WS</sup>	F <sup>WT</sup>	F <sup>WC</sup>	F <sup>WN</sup>	F <sup>WK</sup>	F <sup>WJ</sup>	F <sup>WU</sup>					
Duties and Import																									
Commodity Taxes	DA <sup>I</sup>	DA <sup>M</sup>	DA <sup>P</sup>	DA <sup>S</sup>	DA <sup>T</sup>	DA <sup>C</sup>	DA <sup>N</sup>	DA <sup>K</sup>	DA <sup>J</sup>	DA <sup>J</sup>	DF <sup>I</sup>	DF <sup>M</sup>	DF <sup>P</sup>	DF <sup>S</sup>	DF <sup>T</sup>	DF <sup>C</sup>	DF <sup>N</sup>	DF <sup>K</sup>	DF <sup>J</sup>	DF <sup>U</sup>					
Value Added	V <sup>I</sup>	V <sup>M</sup>	V <sup>P</sup>	V <sup>S</sup>	V <sup>T</sup>	V <sup>C</sup>	V <sup>N</sup>	V <sup>K</sup>	V <sup>J</sup>	V <sup>J</sup>															
Total Inputs	X <sup>I</sup>	X <sup>M</sup>	X <sup>P</sup>	X <sup>S</sup>	X <sup>T</sup>	X <sup>C</sup>	X <sup>N</sup>	X <sup>K</sup>	X <sup>J</sup>	X <sup>J</sup>															

\* Each cell of A\*\* and F\*\* represents a matrix of 76 x 76 and 76 x 4 dimension, respectively.

\* Each cell of A\*\* and F\*\* represents a matrix of 76 x 76 and 76 x 4 dimension, respectively.

Source: Institute of Developing Economies Japan External Trade Organization (IDE-JETRO) (2006), *Asian International Input-Table 2000*, Tokyo.