Whither IIT in East Asia?

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Abstract

Extensive intra-industry trade (IIT) in East Asia is widely attributed to growing cross-border production sharing and regional production networks. Nevertheless, East Asia's IIT is heavily concentrated in a subset of electronic goods and much less prevalent in other manufacturing industries. Moreover, the relationship between the electronics industry and regional IIT is changing rapidly, due primarily to the emergence of China as a major producer of information technology equipment. This paper analyzes the dynamics of IIT in East Asia during the past three decades and discusses its future prospects.

JEL Classification: F14, F15, F23
Keywords: Intra-industry trade, Grubel-Lloyd index, Fragmentation, Electronics, China

1. Introduction

The rapid growth of intra-regional trade in East Asia during the past three decades has been accompanied by an even more conspicuous expansion of intra-industry trade (IIT). The existing literature stresses the role of international production sharing, and attendant trade in intermediate goods, as the engine of IIT in the region (IMF 2007). A number of observers note that extensive IIT in intermediate goods is a unique feature of East Asia that reflects increasing integration of manufacturing activity in the region (Ando 2006; Wakasugi 2007).

Nevertheless, East Asia's IIT has been and still is heavily concentrated in a relatively narrow range of electronic products. As will be discussed in this paper, the rapid spread of IIT in East Asia during the 1980s and the 1990s was driven primarily by fragmentation trade in information and communications technology (ICT) hardware and semiconductor devices, with relatively limited contributions from other industries. Moreover, the past trend of increasing cross-border production sharing in the electronics industry has reversed itself recently, due primarily to industrial agglomeration in China. To the extent that this is the case, IIT and intermediate-good trade in East Asia may not continue growing as rapidly in the future as in the recent past.

The rest of the paper is organized as follows. The next section reviews the Grubel-Lloyd index of IIT, on which much of the subsequent analysis is based, and related

measurement issues. Section 3 looks at the evolution of IIT among East Asian countries and its broad sectoral composition during the past quarter of a century. Section 4 examines more closely recent changes in the relationship between regional IIT and the electronics industry, paying special attention to the emergence of China as a major ICT hardware producer. Section 5 explores the near-term prospects of IIT in East Asia and related policy issues. The last section provides a brief conclusion.

2. Measurement and data issues

Although there is debate about the definition and measurement of IIT, by far the most widely used indicator of its empirical importance is one proposed by Grubel and Lloyd (1971). At the most disaggregated level, the Grubel-Lloyd (GL) index simply measures trade overlaps between two countries within a specific industry. It is defined as

$$IIT_{ij}^{k} = \frac{(X_{ij}^{k}+M_{ij}^{k})-|X_{ij}^{k}-M_{ij}^{k}|}{X_{ij}^{k}+M_{ij}^{k}} = \frac{2\min[X_{ij}^{k}, M_{ij}^{k}]}{X_{ij}^{k}+M_{ij}^{k}}, \quad (1)$$

where X_{ij}^{k} and M_{ij}^{k} denote exports and imports by country i to (from) country j, respectively, of goods produced by industry k.

The above index is amenable to a variety of useful aggregations. For example, by summing the numerator and the denominator of Eq. (1) independently over all industries $k=1, 2, 3, ..$, one can define the following aggregate version of the GL index

$$IIT_{ij} = \frac{2\sum_{k}\min[X_{ij}^{k}, M_{ij}^{k}]}{\sum_{k}(X_{ij}^{k}+M_{ij}^{k})} = \sum_{k} w_{ij}^{k} IIT_{ij}^{k}, \quad (2)$$

where $w_{ij}^{k} = (X_{ij}^{k}+M_{ij}^{k})/\Sigma_{l}(X_{ij}^{l}+M_{ij}^{l}) = (X_{ij}^{k}+M_{ij}^{k})/(X_{ij}+M_{ij})$ is the share of industry k in the gross trade value between countries i and j. IIT_{ij} measures the share of IIT, as defined by Grubel and Lloyd, in the total bilateral trade between these two countries. This value can also be seen as a weighted average of the industry-by-industry GL indices $IIT_{ij}^{1}, IIT_{ij}^{2}, ...$

In what follows, we focus on trade within East Asia and therefore assume that both i and j are East Asian countries. Aggregating the numerator and the denominator of Eq. (2) for all East Asian countries $j=1, 2, 3, ...$, we define

$$IIT_{i} = \frac{2\sum_{j}\sum_{k}\min[X_{ij}^{k}, M_{ij}^{k}]}{\sum_{j}(X_{ij}+M_{ij})} = \sum_{j} w_{ij} IIT_{ij}, \quad (3)$$

where $w_{ij} = (X_{ij}+M_{ij})/\Sigma_{l}(X_{il}+M_{il}) = (X_{ij}+M_{ij})/(X_{i}+M_{i})$. IIT_{i} is the share of IIT in country i's trade with other East Asian countries, which coincides with a weighted sum of the bilateral GL indices $IIT_{i1}, IIT_{i2}, ...$ Note that $X_{i} = \Sigma_{l} X_{il}$ and $M_{i} = \Sigma_{l} M_{il}$ denote the total values of exports and imports of country i to (from) the other East Asian countries.

Lastly, by summing the numerator and the denominator of Eq. (3) over all East

Asian countries $i=1, 2, \ldots$, we define

$$IIT = \frac{2\sum_i \sum_j \sum_k \min[X_{ij}^k, M_{ij}^k]}{\sum_i (X_i+M_i)} = \frac{\sum_i \sum_j \sum_k \min[X_{ij}^k, M_{ij}^k]}{\sum_i X_i} = \sum_i w_i IIT_i, \quad (4)$$

where $w_i = (X_i+M_i)/\Sigma_l(X_l+M_l) = 0.5(X_i/\Sigma_l X_l + M_i/\Sigma_l M_l)$. This index measures the ratio of the sum of all bilateral, industry-by-industry IIT to the total value of intra-regional trade. As in the previous cases, this index can also be viewed as a weighted sum of the index in Eq. (3), with the weight being the share of country i in total regional trade, or more precisely the average between its export and import shares.

Although we have defined the indices of Eqs. (2), (3) and (4) by summing the disaggregated index of Eq. (1) over all industries, it is possible to define similar indices for a subset of these industries. For example, if we let ϕ denote the set of industries that belong to a particular sector (e.g., machinery) and define

$$IIT_i(\phi) = \frac{2\sum_j \sum_{k\in\phi} \min[X_{ij}^k, M_{ij}^k]}{\sum_j \sum_{k\in\phi} (X_{ij}^k+M_{ij}^k)}, \quad (5)$$

this index tells us the share of IIT in country i's total trade in machinery vis-à-vis the other East Asian countries. Using this index, we can write

$$IIT(\phi) = \sum_i w_i(\phi) IIT_i(\phi), \quad \text{where } w_i(\phi) = \frac{\sum_{k\in\phi}(X_i^k+M_i^k)}{\sum_l \sum_{k\in\phi}(X_l^k+M_l^k)}, \quad (6)$$

and therefore

$$IIT = \sum_\phi w(\phi) IIT(\phi), \quad \text{where } w(\phi) = \frac{\sum_l \sum_{k\in\phi}(X_l^k+M_l^k)}{\sum_l (X_l+M_l)}. \quad (7)$$

Eq. (7) says that the most aggregated regional GL index, *IIT*, can be seen as a weighted sum of both the corresponding *national* GL index in Eq. (3) and the *sectoral* GL index in Eq. (6).

The majority of existing studies examine IIT from national perspectives, using the indices of Eqs. (2) and (3) or their sectoral counterpart in Eq. (5). In contrast, this paper is primarily concerned with the role of IIT in East Asia *as a whole*. Therefore, we measure the importance of IIT in East Asia by the regional index of Eq. (4) and examine how and why its value has changed over time. However, as this index is a weighted sum of the national and sectoral indices, there will also be occasions to examine the latter.

Although the above indices are conceptually straightforward, calculating their values raises two practical issues. The first issue is how to define industries $k=1, 2, 3, \ldots$. Recent research on IIT tends to eschew the fundamental question of "what is 'industry'?" and define $k=1, 2, 3, \ldots$ in terms of the most detailed product categories in international trade statistics for which data are available. While doing so has the obvious merit of reducing aggregation bias (Lloyd 2002), it should be noted that products and industries are conceptually different objects. Moreover, since product codes on trade statistics are revised frequently, data at very detailed levels of

classification are often not consistent over time (Kumakura 2009).

The second issue is how to obtain accurate trade statistics that match the industry (or product) classification of one's choice. When computing IIT for a number of countries and for a long period of time, it is not practical to try to build the requisite dataset from scratch. One needs instead to make use of a secondary dataset that is standardized across countries and over time, such as the United Nations' Comtrade database. Although a number of existing studies indeed use Comtrade, this database has several shortcomings that are pertinent to East Asian countries, including the manner in which entrepôt and consignment trade is treated. Although these problems are often ignored, they are numerically so serious as to warrant serious attention (Ng and Yeats 2003; Kumakura 2009).

To address these two issues, this paper relies principally on *Comptes Harmonisés sur les Echanges et L'Economie Mondiale* (CHELEM) and *Base pour l'Analysis du Commerce International* (BACI), two datasets compiled by *Centre d'Études Prospectives et d'Informations Internationales* (CEPII), a French research institute. Although both CHELEM and BACI draw on Comtrade, they are supplemented with additional statistics from such countries as Hong Kong and Taiwan and are adjusted so that data from exporter countries always match the corresponding data from importer countries[1]. Although these datasets do not resolve all problems of Comtrade, our preliminary inspection suggests that they are much more desirable for our purposes[2].

We make use of both CHELEM and BACI since these two datasets are complementary for our purposes. CHELEM provides decades of bilateral trade statistics but in terms of fairly broad industrial categories, such as CEPII's 72 product categories and the International Standard Industrial Classification's (ISIC) 147 four-digit categories. On the other hand, BACI offers data disaggregated to six-digit categories of the Harmonized System (HS) but for a much shorter period. As for CHELEM, we primarily rely on statistics aggregated into CEPII's product categories, since its classification incorporates the notion of production stages and is suitable for our purposes[3]. As for BACI, we use the dataset classified according to the 1992 version of HS, which covers 1995-2005 and has approximately 5,000 product categories.

While the CEPII's classification may look too broad to be used for analysis of IIT, this presumption is not entirely accurate. It is true that the GL indices are sensitive to the level of industry (product) aggregation, with more detailed classification almost always resulting in a lower index value (Lloyd 2002). However, as far as the East Asian countries are concerned, the *time-series* properties of the aggregate GL indices

1) See De Saint Vaulry (2008) and Gaulier et al. (2008) for CEPII's adjustment method.
2) Another well-known multi-country trade database that reconciles importer and exporter statistics is the NBER-United Nations Trade Data compiled by Robert C. Feenstra and his associates. However, this dataset covers up to 2000 only.
3) See Appendix Table A at the end of this paper for the list of the CEPII categories.

are not very sensitive to the extent of industry aggregation, in part because their IIT is so concentrated in a subset of electronic products. For example, even when evaluated in terms of six-digit HS products, about 40 percent of the total value of regional manufacturing IIT is accounted for by fewer than 10 electronic goods.

Incidentally, recent studies often distinguish horizontal and vertical IIT, by comparing unit export and import prices derived from relevant statistics on trade values and quantities (Greenery et al. 1995). Although BACI makes these implicit price data available, this paper refrains from using these statistics. In Comtrade, on which BACI is based, data on trade volume are often lacking or recorded in different units between importer and exporter countries, in which case one cannot distinguish horizontal and vertical IIT[4]. Although most existing studies simply exclude such cases from analysis, these incidents surely do not arise randomly. For example, when Comtrade provides a country's import or export values for a particular six-digit product category but no corresponding quantity data, this is typically because this country's original statistics has further categories under this six-digit group, and that these sub-products are sufficiently heterogeneous as to warrant different quantity units. Such cases are particularly common in fast-growing industries with rapid technological progress, of which electronics is a primary example[5]. Removing such industries from analysis carries the risk of turning a blind eye to the most dynamic and potentially most interesting part of international trade.

3. IIT and the electronics industry: a first look

We first examine the evolution of IIT in East Asia at a broad sectoral level, leaving detailed industry analysis to later sections. Throughout this and the following sections, we limit our attention to manufacturing products and exclude all unprocessed commodities from analysis. This is in part because IIT is largely a manufacturing phenomenon, and partly because the inclusion of primary goods with volatile prices makes our aggregate GL indices unstable and difficult to analyze. Among manufacturing products, we further exclude a small number of energy and service-intensive goods (e.g., printed materials) and those products whose trade is not subject to normal market mechanism (e.g., firearms and weaponry)[6]. In what follows, "East Asia" refers to 11 countries (customs territories) of China, Hong Kong, Indonesia, Japan,

4) Even when Comtrade provide volume data, there are numerous cases in which these data are not actual quantities but the UN's estimates that are derived using unit values from other countries. In such cases, dividing trade values by volume data merely reproduces the original unit values.

5) Although the product codes of the HS are revised every four to six years, each revision focuses on specific industries and leaves the product codes of other industries largely unchanged (Kumakura 2009).

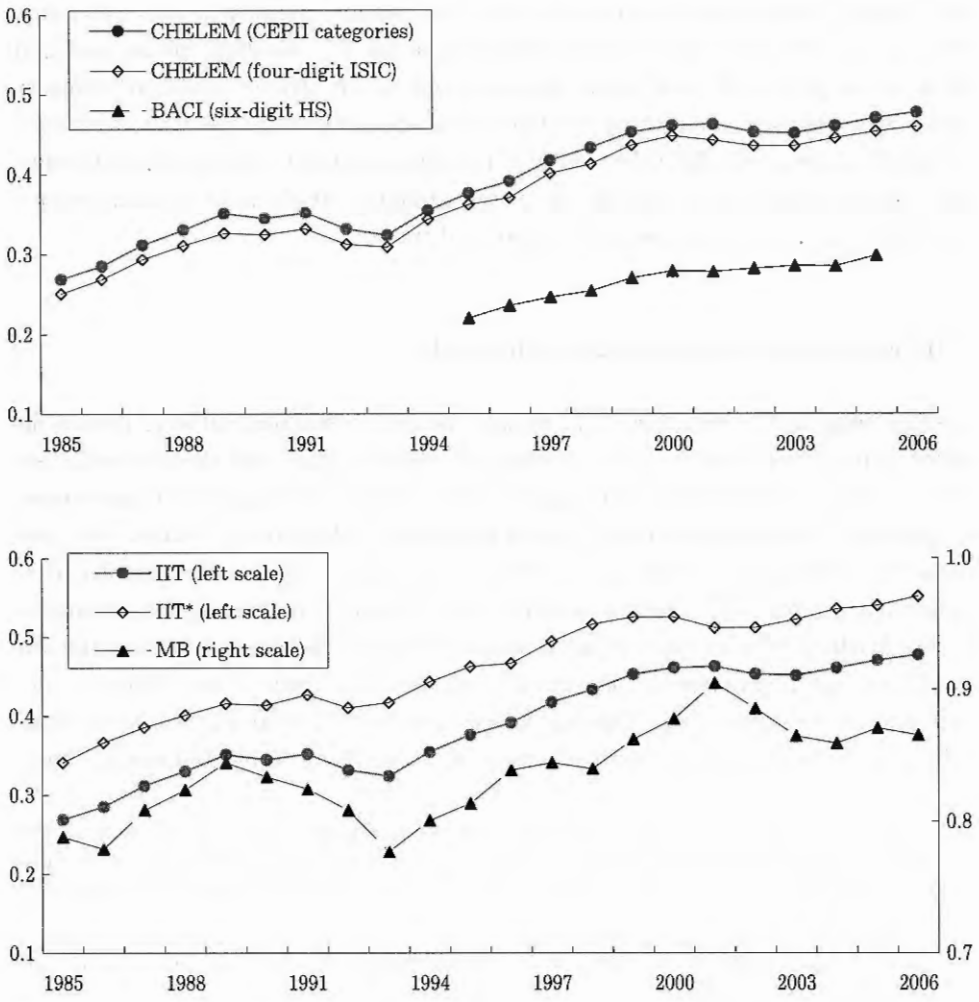
6) See Appendix Table A for the list of industries included in our analysis.

Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand and Vietnam.

The upper panel of Figure 1 plots three series of our regional GL index, of which two were computed from CHELEM and the remaining one from BACI. Among these, the series based on four-digit ISIC data is presented here for the sake of comparison and will not be analyzed further. Although the BACI-based index, which draws on the six-digit HS, has a smaller value than the other two indices, all three series exhibit an upward trend.

It is known that a country's aggregate GL index rises and falls over time not only because of changes in the product mix of its trade but also for reasons associated with its macroeconomic condition (Aquino 1978). In Eq. (3), for example, a widening gap between country i's aggregate exports and imports (X_i and M_i) would reduce

Figure 1. Evolution of Regional GL index



(Source) CHELEM; BACI; author's calculation.

the value of IIT_i even if there was no change in the commodity composition of its trade. Since our regional GL index is a weighted average of IIT_i, $i=1\ 2, \ldots, 11$, the former is also influenced by the macroeconomic conditions of individual countries. In this connection, Figure 1 indicates that the two CHELEM-based indices fell temporarily in the early 1990s, a period in which the trade surplus of Japan, then the largest trading nation in the region, grew significantly due to its post-bubble recession.

To examine the extent to which the time-series profiles of our GL indices are influenced by macroeconomic factors, let us rewrite Eq. (4) as follows:

$$IIT = \underbrace{\frac{\sum_i \min[X_i, M_i]}{\sum_i X_i}}_{MB} \times \underbrace{\frac{\sum_i \sum_j \sum_k \min[X_{ij}^k, M_{ij}^k]}{\sum_i \min[X_i, M_i]}}_{IIT^*}. \qquad (8)$$

In the above equation, the first term *MB* (macroeconomic balance) declines when the trade imbalances of individual countries widen vis-à-vis the other East Asian countries. The second term IIT^* can be viewed as the regional GL index adjusted for such aggregate trade imbalances.

The lower panel of Figure 1 plots the individual elements in Eq. (8), computed from data aggregated in terms of the CEPII product categories. As shown by the plot of *MB*, the regional trade balances of the East Asian countries deteriorated during the early 1990s and between 2002 and 2004. Nevertheless, IIT^* has followed the original GL index fairly closely and also exhibits a clear upward trend. From this observation it is tempting to conclude that an ever larger share of IIT is a firmly rooted tendency of trade in East Asia and will not be reversed anytime soon.

Nevertheless, this conclusion is premature. To understand why this is the case, let us next rewrite our regional GL index as follows:

$$IIT = \sum_{\phi=1}^{6} \frac{\sum_i \sum_j \sum_{k \in \phi} \min[X_{ij}^k, M_{ij}^k]}{\sum_i \sum_j \sum_k X_{ij}^k}, \qquad (9)$$

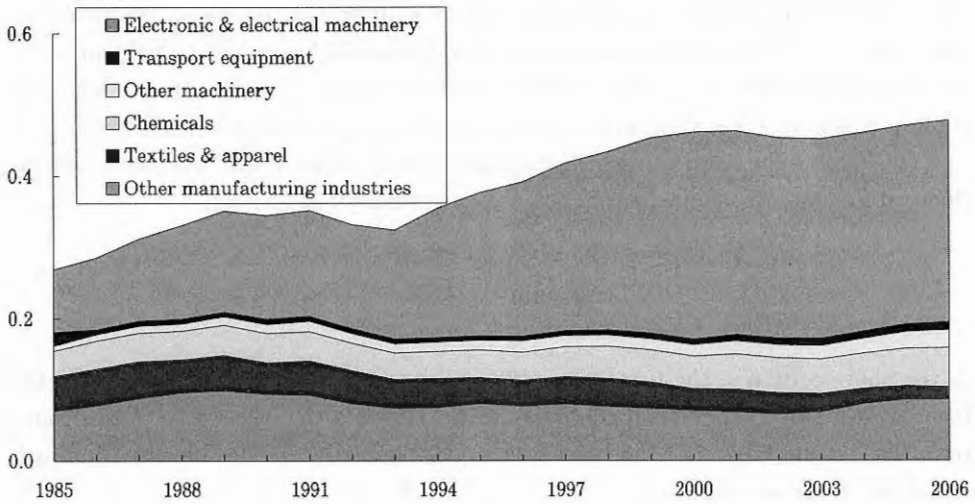
where $\phi=1, 2, \ldots, 6$ denote six broadly defined manufacturing sectors. Here we adopt the following groupings: 1 (electronic and electrical machinery); 2 (transport equipment); 3 (other machinery); 4 (chemicals); 5 (textiles and apparel); and 6 (other manufacturing industries)[7].

Figure 2 depicts our CHELEM-based regional GL index as the sum of the six terms in Eq. (9). As is clear from this figure, the electronic and electrical machinery sector (henceforth abbreviated to EE machinery) accounts for a disproportionately large share of regional IIT. IIT in EE machinery expanded significantly between 1985 and 1989 and between 1993 and 2000, during which the aggregate GL index also rose sharply. However, Figure 2 also reveals that the share of EE machinery stopped increasing in 2000 and has since remained virtually flat. These observations

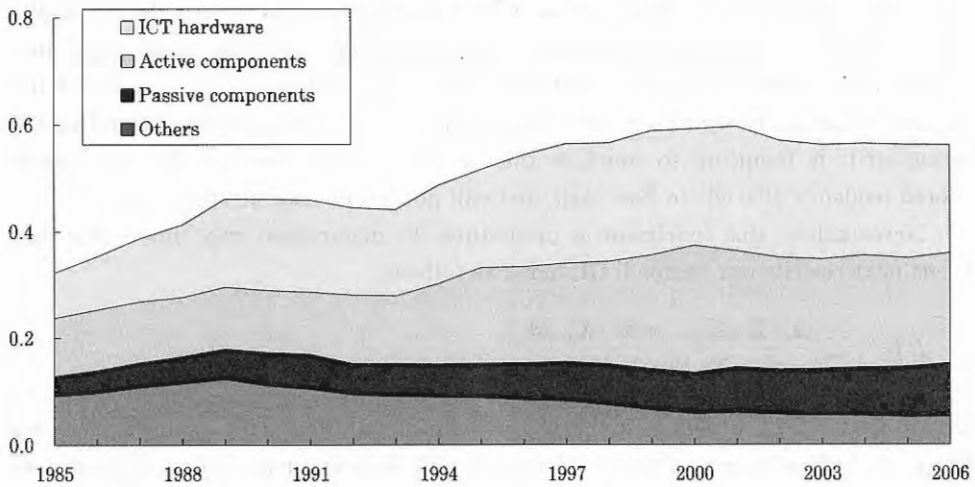
7) See Appendix Table A for the compositions of these sectors.

Figure 2. Sectoral breakdown of regional GL index

(i) All manufacturing products



(ii) Electronic and electrical machinery



(Source) CHELEM; author's calculation.

suggest that important structural changes have taken place behind what appeared to be a secular upward movement in the aggregate IIT indices in Figure 1.

We next examine the relationship between our regional GL index and the above six sectors more closely. As was shown in Eq. (7), our aggregate GL index can be seen as a weighted sum of the sectoral GL indices, the weight being each sector's share in the regional manufacturing trade. Evaluating both sides of Eq. (7) at two points in time, taking the difference between the two, and collecting terms, we obtain

$$\Delta IIT_t = \sum_{\phi=1}^{6} [\Delta w_t(\phi) IIT_s(\phi) + w_s(\phi)\Delta IIT_t(\phi) + \Delta w_t(\phi)\Delta IIT_t(\phi)], \quad (10)$$

where subscripts refer to time ($t>s$) and Δ is the difference operator (e.g., $\Delta w_t(\phi) = w_t(\phi) - w_s(\phi)$). By defining $IIT_s^*(\phi) = IIT_s(\phi) - IIT_s$, we can rewrite Eq. (10) as

$$\begin{aligned}\Delta IIT_t &= \sum_{\phi=1}^{6} \{\Delta w_t(\phi)[IIT_s + IIT_s^*(\phi)] + w_s(\phi)\Delta IIT_t(\phi) + \Delta w_t(\phi)\Delta IIT_t(\phi)\} \\ &= \sum_{\phi=1}^{6} \Big[\underbrace{\Delta w_t(\phi) IIT_s^*(\phi)}_{(a)} + \underbrace{w_s(\phi)\Delta IIT_t(\phi)}_{(b)} + \underbrace{\Delta w_t(\phi)\Delta IIT_t(\phi)}_{(c)}\Big]. \quad (11)\end{aligned}$$

This equation indicates that each sector affects the aggregate GL index through: (a) a change in its share in the total value of regional manufacturing trade; (b) a change in its own GL index; and (c) interaction between (a) and (b). Note that term (a) in Eq. (11) takes on a positive value not only when the trade share increases in sectors whose GL index was initially higher than the overall manufacturing GL index, but also when the trade share shrinks in sectors whose GL ratio was initially lower than the overall index.

Eq. (11) was computed at a 5-year interval using CHELEM. The calculated values are summarized in Table 1. As is shown in the top part of this table, the share of EE machinery in the regional manufacturing trade rose progressively between 1985 and 2000 but increased only marginally between 2000 and 2005. The sharp increase in the share of EE machinery during 1985-2000 was accompanied by falling shares of all other sectors but chemicals. The second part of the table indicates that the GL index of the EE machinery sector stood at 33.8 percent in 1985 but rose at a much faster speed than those of the other sectors during the following 15 years, reaching 59.2 percent in 2000. Between 2000 and 2005, however, the GL index for EE machinery *fell* by 3.0 percent, despite the fact that those of most other sectors continued rising.

The remaining parts of Table 1 present individual terms in Eq. (11). In the bottom part showing the sum of (a), (b) and (c), the values in the first line for "All manufacturing industries" correspond to the left hand side of Eq. (11). Between 1990 and 2000, the sum of (a), (b) and (c) for EE machinery remained positive and accounted for sizable portions of the movement of the overall manufacturing index, whereas those of the other sectors were comparatively small and unstable over time. During 1985 to 2000, both the trade share and the GL index of EE machinery rose sharply, which made its (a), (b) and (c) all positive and numerically large. Between 2000 and 2005, however, the GL index for EE machinery fell sharply while its trade share rose only marginally. Consequently, the sum of its (a), (b) and (c) turned negative, significantly denting the increase in the overall GL index. These observations suggest that the EE machinery sector has played a central role not only in the rapid increase in the share of IIT in regional trade during the 1980s and the 1990s but also in its slowdown in the 2000s.

Table 1. Dynamic decomposition of regional GL index

Series	Sector	1985	1990	1995	2000	2005
w (%)	All manufacturing industries	100.0	100.0	100.0	100.0	100.0
w (%)	Electronic & electrical machinery	28.0	31.6	38.7	47.9	49.8
w (%)	Transport equipment	8.1	5.3	5.1	3.2	3.7
w (%)	Other machinery	10.7	11.0	10.6	7.3	7.7
w (%)	Chemicals	11.8	11.8	11.2	11.8	13.0
w (%)	Textiles & apparel	14.6	15.5	11.2	11.8	7.6
w (%)	Other manufacturing industries	26.9	24.9	11.2	18.0	18.2
IIT (%)	All manufacturing industries	27.7	34.9	37.4	45.9	46.9
IIT (%)	Electronic & electrical machinery	33.8	46.0	51.5	59.2	56.2
IIT (%)	Transport equipment	14.6	12.8	11.9	24.8	28.0
IIT (%)	Other machinery	7.7	11.9	13.5	22.9	30.1
IIT (%)	Chemicals	31.7	35.5	34.6	40.0	40.5
IIT (%)	Textiles & apparel	34.5	30.5	28.0	27.6	25.1
IIT (%)	Other manufacturing industries	27.6	38.2	37.1	39.4	46.1
(a)	All manufacturing industries		0.0	0.0	0.0	0.0
(a)	Electronic & electrical machinery		0.2	0.8	1.3	0.3
(a)	Transport equipment		0.4	0.0	0.5	-0.1
(a)	Other machinery		-0.1	0.1	0.8	-0.1
(a)	Chemicals		0.0	0.0	0.0	-0.1
(a)	Textiles & apparel		0.1	0.2	-0.1	0.8
(a)	Other manufacturing industries		0.0	-0.4	0.0	0.0
(b)	All manufacturing industries		7.2	2.5	8.5	1.1
(b)	Electronic & electrical machinery		3.4	1.7	3.0	-1.4
(b)	Transport equipment		-0.2	0.0	0.7	0.1
(b)	Other machinery		0.4	0.2	1.0	0.5
(b)	Chemicals		0.4	-0.1	0.6	0.1
(b)	Textiles & apparel		-0.6	-0.4	0.0	-0.3
(b)	Other manufacturing industries		2.9	-0.3	0.3	1.2
(c)	All manufacturing industries		0.0	0.0	0.0	0.0
(c)	Electronic & electrical machinery		0.4	0.4	0.7	-0.1
(c)	Transport equipment		0.1	0.0	-0.3	0.0
(c)	Other machinery		0.0	0.0	-0.3	0.0
(c)	Chemicals		0.0	0.0	0.0	0.0
(c)	Textiles & apparel		0.0	0.1	0.0	0.1
(c)	Other manufacturing industries		-0.2	0.1	0.2	0.0
(a) + (b) + (c)	All manufacturing industries		7.2	2.5	8.5	1.1
(a) + (b) + (c)	Electronic & electrical machinery		4.1	2.9	5.0	-1.2
(a) + (b) + (c)	Transport equipment		0.3	0.0	0.9	0.0
(a) + (b) + (c)	Other machinery		0.4	0.3	1.5	0.5
(a) + (b) + (c)	Chemicals		0.4	-0.1	0.6	0.0
(a) + (b) + (c)	Textiles & apparel		-0.6	-0.1	-0.1	0.6
(a) + (b) + (c)	Other manufacturing industries		2.6	-0.6	0.4	1.2

(Note) Trade shares and GL indices are computed in terms of a two-sided three-year average so as to reduce the effect of transitory factors.
(Source) CHELEM; author's calculation.

4. Changing IIT dynamics and the electronics industry

Although the previous analysis found the dominant role of the EE machinery sector in the dynamics of the regional GL index, EE machinery trade in East Asia is in

fact concentrated in a subset of electronic products, which are also responsible for the recent U-turn in its sectoral GL index. This section first establishes these facts quantitatively and then highlights the crucial role of China in the changing relationship between the EE machinery sector and regional IIT.

While the CEPII classification has ten product categories within the EE machinery sector, it is neither informative nor efficient to analyze these categories individually. Therefore, we first aggregate these ten categories into four product groups (subsectors) and examine how their respective trade shares and GL indices have evolved over time. These four groups are: (i) ICT products (computer and office equipment; telecommunications equipment; optical instruments[8]); (ii) other electronic and electrical products (precision instruments; clocks and watches; consumer electronics; domestic electrical appliances; heavy electrical eqnipment); (iii) active electronic components; and (iv) other components. Note that (i) and (ii) include not only completed products but also their parts and accessories, whereas (iii) and (iv) are more basic components whose final use cannot be ascertained from trade statistics. Between the latter, active components refer to devices that change the amplitude of signals in electronic circuits, whereas "other components" include both passive components that assist the function of active components and other disparate items.

Now let $IIT(\phi)$ denote the regional GL index for all EE machinery, and $IIT(\phi^1)$, $IIT(\phi^2)$, $IIT(\phi^3)$ and $IIT(\phi^4)$ the corresponding indices for the above four subgroups. As in Eq. (11), the change in $IIT(\phi)$ between years s and t can be expressed as

$$\Delta IIT_t(\phi) = \sum_{i=1}^{4}\left[\underbrace{\Delta w_t(\phi^i) IIT_s^*(\phi^i)}_{(a)} + \underbrace{w_s(\phi^i)\Delta IIT_t(\phi^i)}_{(b)} + \underbrace{\Delta w_t(\phi^i)\Delta IIT_t(\phi^i)}_{(c)}\right] \quad (12)$$

where $IIT_s^*(\phi^i) = IIT_s(\phi^i) - IIT_s(\phi)$ denotes the difference between the GL index for sub-group i and that for all EE machinery, both evaluated in year s.

Table 2 shows the result of this decomposition. To save space, this table omits individual values of (a), (b) and (c) and only reports the sum of these terms. The top part of Table 2 shows that ICT products and active electronic components assume a large proportion of EE machinery trade, with their combined share rising from 51.6 percent in 1985 to 72.7 percent in 2000. However, the increase in their shares has slowed down recently, rising by only 0.8 percent between 2000 and 2005. In the middle part of the table, we find that the GL indices for these two sub-sectors moved closely in line with the overall index, increasing progressively during 1985 to 2000 but falling sharply thereafter. Lastly, the bottom part indicates that ICT products and active components played a dominant role in both the progressive increase between 1990 and 2000 and the subsequent decline in the GL index for all EE machin-

8) Although optical instruments include both electronic and non-electronic products, a large fraction of trade in East Asia concerns liquid crystal devices and their components.

Table 2. Dynamic decomposition of the regional GL index for EE machinery

Series	Product group	1985	1990	1995	2000	2005
w (%)	All electronic & electrical machinery	100.0	100.0	100.0	100.0	100.0
w (%)	ICT products	27.5	31.4	32.5	36.7	37.2
w (%)	Other electronic & electrical products	32.4	25.5	19.1	12.7	10.7
w (%)	Active electronic components	24.1	26.7	32.5	36.0	36.3
w (%)	Other components	16.0	16.4	15.9	14.6	15.7
IIT (%)	All electronic & electrical machinery	33.8	46.0	51.5	59.2	56.2
IIT (%)	ICT products	33.6	54.1	59.3	62.1	55.9
IIT (%)	Other electronic & electrical products	29.6	44.2	46.1	47.6	49.5
IIT (%)	Active electronic components	46.2	43.6	52.0	62.0	56.8
IIT (%)	Other components	24.6	37.4	41.3	55.1	60.4
(a) + (b) + (c)	All electronic & electrical machinery		12.2	5.5	7.7	-3.0
(a) + (b) + (c)	ICT products		6.4	1.8	1.4	-2.3
(a) + (b) + (c)	Other electronic & electrical products		4.0	0.5	0.5	0.4
(a) + (b) + (c)	Active electronic components		-0.4	2.6	3.6	-1.9
(a) + (b) + (c)	Other components		2.1	0.7	2.1	0.8

(Note and Source) See Table 1.

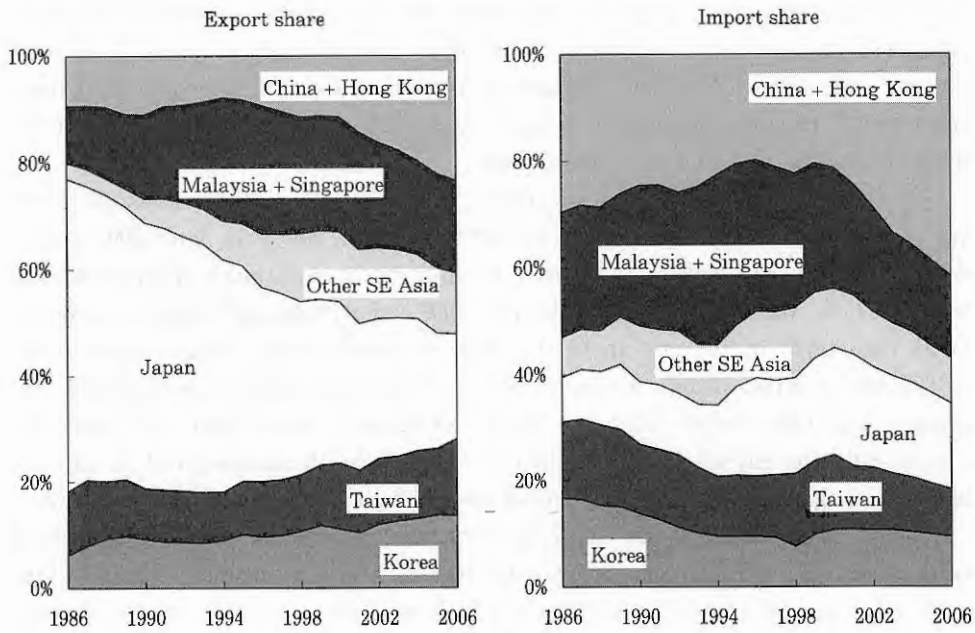
ery.

While not shown in Table 2, more than half of the ICT hardware trade in East Asia concerns intermediate products, of which the most important are parts and components of computer and office equipment. Meanwhile, trade in active components is dominated by semiconductor devices, of which the bulk is accounted for by electronic integrated circuits (ICs) that constitutes the key devices for such ICT products. Table 2 also indicates that the GL index of "other components" has also risen sharply, although the value of their trade has remained relatively modest. While this category includes a variety of products, its trade in East Asia is highly concentrated in items that are used intensively in ICT equipment, such as printed circuit boards. To the extent that this is the case, trade in intermediate ICT products and its components seems to have been the central force behind the dynamics of manufacturing IIT in East Asia throughout much of the past two decades.

Figure 3 graphs the evolution of country shares in the regional trade of EE machinery[9]. In the left panel of Figure 3, the most salient long-term trend is the declining export share of Japan, which stood at 71.7 percent in 1985 but fell to less than 20 percent by 2006. During the 1980s and much of the 1990s, the shrinkage of the export share of Japan was matched mainly by rising shares of Malaysia, Singapore and other Southeast Asian countries, whose combined shares rose progressively from 13.3 percent in 1985 to 34.7 percent in 2000. As shown in the right panel, the ris-

9) This figure combines the shares of China and Hong Kong and those of Malaysia and Singapore, respectively, considering their close economic relations and associated difficulties in accurately delineating their trade with other countries. We also aggregate the shares of the other four Southeast Asian countries since these countries individually account for small shares but are collectively an important player in regional electronics trade.

Figure 3. Country share in regional trade of EE machinery



(Note) "Other SE Asia" denotes Indonesia, the Philippines, Thailand and Vietnam.
(Source) CHELEM; author's calculation.

ing export shares of the Southeast Asian countries were accompanied by a similarly large increase in their import shares. As the last decade came to a close, however, their export and import shares started to decline, whereas those of China (and Hong Kong) began rising sharply.

As is widely documented, foreign multinationals play a decisive and often dominant role in electronics production in Southeast Asia. A collection of countries with diverse wage rates, Southeast Asia once provided an ideal venue for multinational firms seeking the benefits of cross-country production sharing. As successive waves of home-currency appreciation forced firms in the United States (in 1981-1985), Japan (in 1985-1988) and Taiwan (in 1986-1989) to shift their production overseas, Southeast Asia emerged as a global supplier of computer equipment and a subset of semiconductor devices (Ernst 2000; Dicken 2007)[10].

The period between the mid-1980s and the mid-1990s also coincided with the time when the market for personal computers (PCs) took off in advanced countries, together with the demand for electronic ICs that constituted their primary inputs. In this period, moreover, heated trans-Pacific trade disputes resulted in the US-Japan

10) Although the shift of production to Southeast Asia by US and Japanese electronics firms dates back to earlier years, investment until the 1970s mostly concerned simple assembly operations that generated limited auxiliary trade within the region (Ernst 2000; Brown et al. 2006).

Semiconductor Trade Agreement, which had the effect of both keeping the international prices of memory chips at high levels and prompting Japanese IC firms to take their manufacturing operations abroad to prevent their products from been squeezed out of the US market. The simultaneous expansion of the world PC market and regional production networks helped the rapid increase in regional IIT and the shares of Southeast Asian countries therein.

By the end of the 1990s, however, China started to reverse this process of growing cross-border production sharing for ICT hardware. Since the late 1990s, major electronics multinationals have started to shift their investment from Southeast Asia to China, first in response to the 1997-1998 Asian crisis and China's successive tariff reductions in the run-up to its entry into the World Trade Organization (WTO), but then increasingly to tap the country's growing domestic demand and burgeoning high-tech clusters (Hamada 2008). Nonetheless, since China's ICT industry was initially concentrated in final assembly operations, the explosion of its exports has also invoked a surge in its imports of intermediate goods (more on this below).

Let us next examine the changing structure of regional production sharing more closely using BACI's disaggregated statistics. While the country shares in Figure 3 refer to trade in all EE machinery, it is instructive to compute the corresponding shares for specific product groups. Table 3 shows the export and import shares of individual countries, together with the difference between the two, for the following four product categories: [A] completed ICT products; [B] intermediate ICT products; [C] active electronic components; and [C] other components. In this table, the previous category of ICT hardware is divided into two sub-groups of final and intermediate goods, by referring to the correspondence table between the six-digit HS and the United Nation's Broad Economic Categories (BEC). Since BACI covers only 1995-2005, our analysis in this part is limited to these years.

As shown in Table 3, although the *import* share of China and Hong Kong is high and rising in all four product categories, their *export* shares vary considerably from one category to another. In final ICT products, the export shares of China and Hong Kong more than doubled between 1999 and 2005 while their import shares increased by a much smaller proportion, turning them from a large net importer to a net exporter. In intermediate ICT goods and passive components, the export share of China and Hong Kong has risen sharply in recent years but still falls behind their import share. Finally, their export share of active components increased only marginally whereas the corresponding import share more than doubled between 1995 and 2005, making their net imports in 2005 as large as 32.6 percent of the total regional trade.

Table 3 [A] indicates that the rising export share of China and Hong Kong has been accompanied by sharp declines in those of Japan, Malaysia, Singapore and Taiwan, suggesting that final ICT assembly migrated to China mainly from these countries. In [B] and [C], the widening excess imports of China and Hong Kong coincided

Table 3. Country shares of regional trade in electronics (%)

[A] ICT (final products)

Country / region	Series	1995	1997	1999	2001	2003	2005
Japan	Export (E)	22.6	16.6	12.0	9.3	7.2	3.9
Japan	Import (M)	26.9	25.9	30.8	27.1	25.4	22.9
Japan	E - M	-4.3	-9.3	-18.9	-17.8	-18.2	-19.0
Korea	Export (E)	3.9	4.6	10.2	12.5	15.5	10.5
Korea	Import (M)	5.8	4.8	6.0	6.2	6.2	6.1
Korea	E - M	-2.0	-0.2	4.3	6.3	9.3	4.4
Taiwan	Export (E)	12.1	10.7	11.7	11.9	9.3	5.1
Taiwan	Import (M)	5.8	7.9	9.9	8.6	6.6	4.8
Taiwan	E - M	6.2	2.8	1.8	3.4	2.7	0.4
Malaysia + Singapore	Export (E)	31.8	30.5	29.6	24.5	16.8	16.1
Malaysia + Singapore	Import (M)	23.7	23.9	18.3	19.2	16.7	17.6
Malaysia + Singapore	E - M	8.1	6.7	11.3	5.2	0.1	-1.4
Other Southeast Asia	Export (E)	9.2	14.8	13.1	12.2	12.5	13.7
Other Southeast Asia	Import (M)	5.5	5.1	3.6	5.7	6.9	6.8
Other Southeast Asia	E - M	3.7	9.6	9.5	6.5	5.6	6.9
China + Hong Kong	Export (E)	20.5	22.7	23.4	29.6	38.7	50.6
China + Hong Kong	Import (M)	32.2	32.3	31.4	33.3	38.2	41.9
China + Hong Kong	E - M	-11.8	-9.6	-8.1	-3.6	0.5	8.7

[B] ICT (intermediate products)

Country / region	Series	1995	1997	1999	2001	2003	2005
Japan	Export (E)	29.4	24.4	24.0	21.1	22.3	19.1
Japan	Import (M)	13.5	12.1	14.4	15.5	12.4	11.6
Japan	E - M	15.8	12.3	9.6	5.6	9.9	7.4
Korea	Export (E)	4.9	4.7	5.8	7.1	11.4	11.2
Korea	Import (M)	5.1	4.6	6.3	6.6	5.3	5.1
Korea	E - M	-0.2	0.1	-0.6	0.5	6.1	6.1
Taiwan	Export (E)	9.9	9.0	10.1	10.3	9.7	9.4
Taiwan	Import (M)	6.0	6.3	9.3	7.7	6.3	5.0
Taiwan	E - M	3.9	2.7	0.8	2.5	3.3	4.4
Malaysia + Singapore	Export (E)	22.5	25.4	19.3	19.6	13.2	12.9
Malaysia + Singapore	Import (M)	34.6	32.7	26.3	22.1	18.4	17.9
Malaysia + Singapore	E - M	-12.1	-7.4	-7.1	-2.5	-5.2	-4.9
Other Southeast Asia	Export (E)	13.2	12.9	16.6	13.7	10.8	9.4
Other Southeast Asia	Import (M)	11.0	14.0	10.9	10.0	9.2	8.1
Other Southeast Asia	E - M	2.2	-1.1	5.6	3.7	1.6	1.2
China + Hong Kong	Export (E)	20.2	23.7	24.3	28.1	32.5	38.1
China + Hong Kong	Import (M)	29.8	30.4	32.8	38.0	48.3	52.3
China + Hong Kong	E - M	-9.6	-6.7	-8.5	-9.9	-15.8	-14.2

[C] Active components

Country / region	Series	1995	1997	1999	2001	2003	2005
Japan	Export (E)	39.6	31.8	26.4	23.6	20.5	15.8
Japan	Import (M)	9.6	8.7	9.4	10.8	8.6	7.9
Japan	E - M	30.0	23.1	17.0	12.8	11.8	7.9
Korea	Export (E)	15.1	14.0	13.2	10.9	10.8	12.5
Korea	Import (M)	8.5	8.5	9.9	11.0	9.9	8.1
Korea	E - M	6.6	5.5	3.3	0.0	0.9	4.5
Taiwan	Export (E)	8.3	10.9	13.2	17.8	19.9	25.4
Taiwan	Import (M)	15.0	14.3	14.7	11.8	11.1	10.0
Taiwan	E - M	-6.7	-3.4	-1.5	5.9	8.8	15.4
Malaysia + Singapore	Export (E)	24.7	26.1	25.4	25.2	24.7	22.2
Malaysia + Singapore	Import (M)	37.4	34.9	30.5	26.2	21.5	22.1
Malaysia + Singapore	E - M	-12.7	-8.8	-5.1	-1.0	3.2	0.1
Other Southeast Asia	Export (E)	5.1	10.0	13.4	13.1	13.8	11.4
Other Southeast Asia	Import (M)	8.3	10.5	10.0	8.0	7.4	6.6
Other Southeast Asia	E - M	-3.2	-0.5	3.4	5.1	6.4	4.8
China + Hong Kong	Export (E)	7.3	7.1	8.4	9.4	10.4	12.7
China + Hong Kong	Import (M)	21.3	23.1	25.5	32.2	41.5	45.3
China + Hong Kong	E - M	-14.0	-16.0	-17.1	-22.8	-31.1	-32.6

[D] Other components

Country / region	Series	1995	1997	1999	2001	2003	2005
Japan	Export (E)	42.9	37.7	37.2	33.1	29.6	27.4
Japan	Import (M)	9.6	11.9	13.3	14.0	13.9	13.5
Japan	E - M	33.3	25.8	24.0	19.1	15.7	13.9
Korea	Export (E)	5.0	4.4	4.0	4.7	6.4	7.0
Korea	Import (M)	7.7	7.9	9.2	8.5	8.9	9.1
Korea	E - M	-2.7	-3.4	-5.2	-3.8	-2.5	-2.1
Taiwan	Export (E)	12.0	11.7	11.2	11.1	11.5	10.7
Taiwan	Import (M)	9.0	9.0	9.4	8.0	7.4	6.6
Taiwan	E - M	3.0	2.7	1.8	3.1	4.1	4.1
Malaysia + Singapore	Export (E)	13.9	14.3	12.0	10.6	9.0	8.2
Malaysia + Singapore	Import (M)	28.1	24.3	21.4	19.5	15.1	14.3
Malaysia + Singapore	E - M	-14.2	-10.1	-9.4	-8.9	-6.0	-6.1
Other Southeast Asia	Export (E)	6.0	8.3	9.2	10.6	9.6	9.7
Other Southeast Asia	Import (M)	15.5	15.9	12.8	12.9	11.6	10.6
Other Southeast Asia	E - M	-9.5	-7.6	-3.5	-2.2	-2.0	-0.9
China + Hong Kong	Export (E)	20.2	23.6	26.3	29.9	33.8	37.0
China + Hong Kong	Import (M)	30.1	31.1	33.9	37.2	43.1	45.9
China + Hong Kong	E - M	-9.9	-7.4	-7.6	-7.3	-9.2	-8.9

(Source) BACI; author's calculation.

with a sharp increase in the net exports of Korea and Taiwan, apparently because China depends on these countries for critical intermediate inputs. The excess imports of these intermediate electronics by China and Hong Kong seem to have been a major factor behind the recent declines in the regional GL indices for ICT hardware and active components in Table 2.

This last point can be ascertained by means of dynamic decomposition similar to Eqs. (11) and (12). Here we split the set of EE products ϕ into two groups, ϕ^1 and ϕ^2, which refer to the sets of final and intermediate EE goods, respectively. Accordingly, $IIT(\phi^1)$ and $IIT(\phi^2)$ now represent the regional GL indices for final and intermediate EE machinery. Note that ϕ^2 includes not only active and other components but also more advanced intermediate products.

Now recall from Section 2 that our regional GL index can be expressed as a weighted sum of the corresponding country indices. Therefore, both $IIT(\phi^1)$ and $IIT(\phi^2)$ can be written as

$$IIT(\phi^l) = \sum_{i=1}^{11} w_i(\phi^l) IIT_i(\phi^l), \tag{13}$$

where $w_i(\phi^l)$, $l=1, 2$ refer to the shares of country i in the total regional trade of final and intermediate EE machinery, respectively. By manipulating this equation similarly as in Eqs. (11) and (12), we obtain

$$\Delta IIT_t(\phi^l) = \sum_{i=1}^{11} \left[\underbrace{\Delta w_{i,t}(\phi^l) IIT^*_{i,s}(\phi^l)}_{(a)} + \underbrace{w_{i,s}(\phi^l) \Delta IIT_{i,t}(\phi^l)}_{(b)} + \underbrace{\Delta w_{i,t}(\phi^l) \Delta IIT_{i,t}(\phi^l)}_{(c)} \right] \tag{14}$$

where $IIT^*_{i,s}(\phi^l) = IIT_{i,s}(\phi^l) - IIT_s(\phi^l)$ is the gap between the national and regional GL indices for ϕ^l in year s. We compute both sides of (13) and (14) at a two-year interval between 1995 and 2005, using BACI's disaggregated dataset.

The result is shown in Table 4[11]. In this table, we first notice that $IIT(\phi^1)$ and $IIT(\phi^2)$ moved very differently over 1995-2005. The former index, which represents the share of IIT in final EE machinery, remained stable until 2001 but rose measurably between 2001 and 2005. On the other hand, the latter index, which measures the IIT share in intermediate EE machinery, increased between 1995 and 2001 but fell sharply thereafter. Recall from Tables 1 and 2 that the overall GL index for EE machinery increased progressively during the 1980s and the 1990s but has since dropped substantially. According to Table 4, its movement has reflected principally the change in the trade structure of intermediate products.

Table 4 [A] also indicates that the recent upturn in $IIT(\phi^1)$ is mainly attributable to China. Between 2001 and 2005, China's GL index has increased considerably

11) As in Figure 3 and Table 3, this table reports the result not for individual countries but in terms of the six country groups to facilitate inspection. The trade share of each group refers to the simple sum of those of individual countries in the group, whereas its GL index is the average of the country indices weighted by their trade shares.

Table 4. Dynamic decomposition of the GL indices for EE machinery

[A] Final products

Series	Country (group)	1995	1997	1999	2001	2003	2005
w (%)	All East Asia	100.0	100.0	100.0	100.0	100.0	100.0
w (%)	Japan	24.4	23.3	23.2	21.5	19.1	17.8
w (%)	Korea	6.1	6.0	7.1	8.1	8.3	7.8
w (%)	Taiwan	7.9	8.4	9.7	9.4	9.1	8.6
w (%)	Malaysia + Singapore	23.7	22.3	19.8	17.6	14.5	13.4
w (%)	Other Southeast Asia	8.5	8.9	8.2	8.5	8.7	8.6
w (%)	China + Hong Kong	29.3	31.2	32.1	34.8	40.2	43.8
IIT (%)	All East Asia	26.1	26.2	26.1	26.3	27.5	29.3
IIT (%)	Japan	27.0	26.4	25.2	25.0	25.3	25.4
IIT (%)	Korea	27.6	28.0	28.5	32.6	35.1	36.2
IIT (%)	Taiwan	32.7	31.0	28.3	30.7	32.5	30.3
IIT (%)	Malaysia + Singapore	27.7	29.2	31.3	31.9	32.6	32.8
IIT (%)	Other Southeast Asia	21.0	18.5	18.1	18.6	21.6	21.0
IIT (%)	China + Hong Kong	23.4	24.5	24.4	23.6	25.2	29.8
(a) + (b) + (c)	All East Asia		0.1	-0.1	0.2	1.2	1.8
(a) + (b) + (c)	Japan		-0.1	-0.3	0.0	0.1	0.0
(a) + (b) + (c)	Korea		0.0	0.1	0.4	0.2	0.0
(a) + (b) + (c)	Taiwan		-0.1	-0.2	0.2	0.1	-0.2
(a) + (b) + (c)	Malaysia + Singapore		0.3	0.3	0.0	-0.1	0.0
(a) + (b) + (c)	Other Southeast Asia		-0.2	0.0	0.0	0.2	0.0
(a) + (b) + (c)	China + Hong Kong		0.3	-0.1	-0.3	0.5	1.9

[B] Intermediate products

Series	Country (group)	1995	1997	1999	2001	2003	2005
w (%)	All East Asia	100.0	100.0	100.0	100.0	100.0	100.0
w (%)	Japan	23.3	21.1	19.8	18.7	16.8	15.4
w (%)	Korea	8.6	8.2	8.7	9.0	9.3	9.4
w (%)	Taiwan	10.4	10.7	11.8	12.1	12.3	12.7
w (%)	Malaysia + Singapore	27.4	26.4	24.2	22.1	19.0	17.9
w (%)	Other Southeast Asia	9.7	11.5	11.9	10.8	10.1	9.4
w (%)	China + Hong Kong	20.7	22.1	23.6	27.3	32.5	35.2
IIT (%)	All East Asia	43.2	45.2	46.1	47.0	45.2	44.0
IIT (%)	Japan	37.6	41.7	45.6	47.0	47.5	48.3
IIT (%)	Korea	43.2	46.8	52.0	57.7	55.3	54.6
IIT (%)	Taiwan	46.2	49.1	51.2	49.4	46.8	45.3
IIT (%)	Malaysia + Singapore	49.5	51.0	50.4	52.6	51.1	49.4
IIT (%)	Other Southeast Asia	39.1	39.2	40.0	41.5	41.3	41.2
IIT (%)	China + Hong Kong	41.6	42.2	40.3	40.1	38.5	36.8
(a) + (b) + (c)	All East Asia		2.0	0.9	0.9	-1.8	-1.2
(a) + (b) + (c)	Japan		1.0	0.8	0.3	0.1	0.1
(a) + (b) + (c)	Korea		0.3	0.5	0.5	-0.2	0.0
(a) + (b) + (c)	Taiwan		0.3	0.3	-0.2	-0.3	-0.2
(a) + (b) + (c)	Malaysia + Singapore		0.3	-0.3	0.4	-0.5	-0.4
(a) + (b) + (c)	Other Southeast Asia		-0.1	0.1	0.2	0.0	0.0
(a) + (b) + (c)	China + Hong Kong		0.1	-0.5	-0.3	-0.9	-0.8

(Note) See Table 1.
(Source) BACI; author's calculation.

while those of the other countries have either remained flat or risen only marginally[12]. Although not shown here, an inspection of BACI's detailed statistics reveals that until the 1990s there had been a number of final EE products for which China had no meaningful exports. It seems that starting to export goods that it had only imported in previous years helped increase China's GL index.

According to Table 4 [B], China is also responsible for the recent drop in the regional GL index for intermediate EE machinery. The upward trend of this index during 1995 to 2001 was mainly attributable to Japan and Korea, whose excess exports of active components shrank progressively (recall Table 3 [C]). On the other hand, the trade share of China and Hong Kong has increased throughout 1995 to 2005 whereas their GL index has been falling. Although the net contribution from China and Hong Kong to the regional index for intermediate EE machinery has been negative every year since 1997, its quantitative effect has become particularly sizable in recent years, reflecting their growing excess imports of ICT intermediates and active components[13]. Since more than two-thirds of EE machinery trade in East Asia concerns intermediate products, the widening trade imbalances of China and Hong Kong in these products have clearly been an important factor behind the recent decline in the overall regional IIT index for EE machinery, as well as the slowdown in the upward movement of the corresponding index for all manufacturing industries.

5. Future prospects

According to the analysis in Sections 3 and 4, the structure of regional trade in EE machinery is changing rapidly because of the emergence of China as a new center of ICT hardware production. How far will this process evolve in the future? Will the slowdown in EE machinery IIT start, at some point, to reverse the long-standing trend of a rising share of IIT in regional trade? Or will other industries take over the role that the EE machinery sector had played until the 1990s and continue to expand two-way trade in East Asia?

There has recently been much talk about "triangular trade," whereby China imports intermediate production inputs from other East Asian countries and exports final products to the rest of the world (Ahearne et al. 2006). Although the analysis in Section 4 is broadly consistent with this view, it should be noted that the structure of so-called triangular trade is changing very rapidly. As we saw in Table 3, for example, the export share of China (and Hong Kong) has been rising rapidly not only in final ICT products but also in intermediate ICTs and non-active components, suggest-

12) The GL index of Hong Kong changed little between 1995 and 2005.

13) Since the growing net imports of China were matched principally by the expanding net exports of such countries as Korea and Taiwan, the GL indices of the latter countries have fallen simultaneously.

ing that China is no longer a mere assembly house for foreign multinationals. Moreover, the country shares in Table 3 refer only to trade within East Asia and do not take account of its trade vis-à-vis the rest of the world. Bringing the latter into the picture reveals far-reaching effects that China is currently exerting to global trade in electronics, which have important implications for future trade patterns in East Asia and elsewhere.

To illustrate this last point, Table 5 reports the shares of major countries in the *global* trade of the same four EE product categories as in Table 3. As can be seen in this table, in terms of trade vis-à-vis all foreign countries, China (and Hong Kong) is already a sizable net exporter in *all product categories but active components.* Since the early 2000s, the global export share of China has risen sharply not only in completed ICT equipment but also in ICT intermediates and other electronic components, whereas those of the other East Asian countries have either fallen or remained stagnant. Table 5 clearly indicates that China's electronics industry is rapidly expanding the realm of its activity from final assembly operations to more upstream segments, albeit with the notable exception of the production of active components. In this last product category, the increase in the export share of China has so far remained modest while its import share has more than tripled between 1995 and 2005. As is shown in Table 5 [C], its excess demand for active components is met mainly by exports from Korea and Taiwan, suggesting that not all East Asian countries are benefiting from triangular trade to the same extent.

Table 6 provides additional statistics on China's trade in electronics that are compiled from its detailed customs statistics. Exports and imports in this table refer to those of China vis-à-vis all foreign countries, including Hong Kong. In Table 6 [A], we find that China's trade balance in computer equipment was already in surplus in 2001. Moreover, its exports of completed data processing units have been growing at a phenomenal speed, with the export-to-import ratio rising from 0.79 in 2001 to 31.84 in 2007[14]. Similarly, China's net exports of completed telephone sets stood at 37.0 billion dollars in 2007, whereas its trade balance in intermediate telecommunication equipment has also remained in surplus every year since 2005. According to the dynamic decomposition in Table 4 [A], the effect of China (and Hong Kong) on the regional GL index for final EE machinery was positive between 2001 and 2005, reflecting the fact that, as discussed above, China's trade balance turned from a large deficit to a surplus in a number of products during this period. However, the increasingly unilateral nature of China's trade in end-user ICT equipment suggests that this effect is no longer operative.

In contrast, Table 6 [B] indicates that China's trade balance remains in deficit for all the major categories of electronic components. In value terms, however, the

14) Statistics compiled by Hamada (2008) show that China accounted for 85 percent of the global output of personal computer units in 2006.

Table 5. Country shares of global trade in electronics (%)

[A] ICT (final prodncts)

Country / region	Series	1995	1997	1999	2001	2003	2005
North America	Export (E)	19.7	19.7	18.6	19.1	12.6	9.9
North America	Import (M)	27.9	28.6	29.1	29.4	27.9	25.8
North America	E - M	-8.2	-8.9	-10.5	-10.2	-15.3	-15.9
Europe	Export (E)	30.5	31.8	34.5	32.7	30.5	29.6
Europe	Import (M)	42.1	41.0	44.4	41.6	41.1	40.2
Europe	E - M	-11.6	-9.2	-10.0	-8.9	-10.6	-10.6
Japan	Export (E)	17.3	13.0	10.3	7.9	6.1	4.6
Japan	Import (M)	6.3	5.9	5.4	5.9	5.5	4.9
Japan	E - M	11.0	7.1	4.9	2.0	0.6	-0.3
Korea + Taiwan	Export (E)	8.9	9.3	11.0	12.1	13.7	12.0
Korea + Taiwan	Import (M)	3.3	3.6	4.0	3.7	3.6	3.4
Korea + Taiwan	E - M	5.7	5.6	7.1	8.4	10.1	8.5
Southeast Asia	Export (E)	15.8	17.5	15.5	14.8	15.0	13.3
Southeast Asia	Import (M)	6.0	6.1	3.7	4.9	4.7	4.7
Southeast Asia	E - M	9.8	11.4	11.8	9.9	10.3	8.6
China + Hong Kong	Export (E)	6.5	7.3	8.8	11.9	20.8	29.3
China + Hong Kong	Import (M)	6.0	6.2	5.4	7.2	9.2	10.6
China + Hong Kong	E - M	0.5	1.1	3.4	4.7	11.5	18.7

[B] ICT (intermediate products)

Country / region	Series	1995	1997	1999	2001	2003	2005
North America	Export (E)	22.6	23.7	21.1	20.0	15.0	12.2
North America	Import (M)	24.5	23.4	25.3	22.7	21.3	20.1
North America	E - M	-1.9	0.2	-4.1	-2.8	-6.3	-7.9
Europe	Export (E)	25.3	24.9	26.6	25.6	22.1	20.6
Europe	Import (M)	36.0	35.2	37.7	35.0	31.9	30.9
Europe	E - M	-10.6	-10.3	-11.0	-9.5	-9.8	-10.4
Japan	Export (E)	17.7	14.4	13.7	13.0	13.8	13.0
Japan	Import (M)	5.8	5.9	5.8	6.4	5.8	5.5
Japan	E - M	12.0	8.5	7.9	6.5	8.0	7.5
Korea + Taiwan	Export (E)	10.4	10.2	10.7	10.6	12.9	13.0
Korea + Taiwan	Import (M)	3.7	4.1	4.8	5.2	5.2	4.6
Korea + Taiwan	E - M	6.7	6.1	5.9	5.4	7.8	8.4
Southeast Asia	Export (E)	14.9	16.4	16.4	15.8	14.8	15.1
Southeast Asia	Import (M)	14.1	15.2	11.1	11.4	11.6	11.4
Southeast Asia	E - M	0.8	1.2	5.3	4.4	3.2	3.6
China + Hong Kong	Export (E)	7.6	9.0	10.1	13.5	20.2	25.2
China + Hong Kong	Import (M)	9.5	9.4	9.8	13.6	19.2	21.2
China + Hong Kong	E - M	-1.8	-0.4	0.3	-0.1	1.0	3.9

[C] Active components

Country / region	Series	1995	1997	1999	2001	2003	2005
North America	Export (E)	20.2	22.3	22.3	20.6	15.4	12.6
North America	Import (M)	26.6	24.2	23.9	20.1	13.1	11.3
North America	E - M	-6.4	-1.9	-1.6	0.5	2.3	1.3
Europe	Export (E)	15.5	16.5	15.4	16.7	14.8	13.9
Europe	Import (M)	20.5	22.0	19.4	21.9	19.1	17.1
Europe	E - M	-5.0	-5.5	-4.0	-5.2	-4.3	-3.2
Japan	Export (E)	24.1	17.7	15.6	14.2	13.3	11.4
Japan	Import (M)	6.5	6.2	6.0	6.6	6.0	5.7
Japan	E - M	17.6	11.5	9.6	7.6	7.2	5.7
Korea + Taiwan	Export (E)	16.1	16.0	17.0	17.3	20.3	25.8
Korea + Taiwan	Import (M)	11.5	13.5	15.0	13.6	14.9	13.5
Korea + Taiwan	E - M	4.6	2.4	2.0	3.7	5.4	12.3
Southeast Asia	Export (E)	19.5	22.8	24.1	24.7	28.2	26.1
Southeast Asia	Import (M)	23.3	21.8	21.4	19.9	20.3	21.0
Southeast Asia	E - M	-3.8	1.0	2.7	4.8	7.9	5.2
China + Hong Kong	Export (E)	4.0	4.0	4.8	5.3	7.0	9.3
China + Hong Kong	Import (M)	9.2	9.7	11.8	15.2	23.9	28.5
China + Hong Kong	E - M	-5.3	-5.8	-7.0	-10.0	-16.9	-19.3

[D] Other components

Country / region	Series	1995	1997	1999	2001	2003	2005
North America	Export (E)	20.1	23.2	24.5	23.9	19.7	16.9
North America	Import (M)	24.5	26.5	29.4	29.3	25.2	23.6
North America	E - M	-4.3	-3.3	-4.9	-5.4	-5.5	-6.7
Europe	Export (E)	43.2	41.7	40.0	38.3	39.8	38.6
Europe	Import (M)	43.1	40.0	40.4	39.1	40.2	38.6
Europe	E - M	0.1	1.8	-0.4	-0.8	-0.4	0.1
Japan	Export (E)	15.0	12.7	12.3	11.5	10.8	10.9
Japan	Import (M)	2.8	3.3	3.4	3.6	3.9	4.0
Japan	E - M	12.1	9.4	8.9	7.9	6.9	6.8
Korea + Taiwan	Export (E)	7.5	6.1	5.8	6.2	6.5	6.9
Korea + Taiwan	Import (M)	4.2	4.3	4.2	4.0	4.5	4.8
Korea + Taiwan	E - M	3.3	1.8	1.6	2.2	2.0	2.0
Southeast Asia	Export (E)	5.5	6.1	5.8	6.1	6.1	6.5
Southeast Asia	Import (M)	10.4	10.1	7.9	7.8	7.5	7.7
Southeast Asia	E - M	-4.8	-4.1	-2.1	-1.7	-1.4	-1.2
China + Hong Kong	Export (E)	6.4	7.7	9.0	10.9	13.9	16.8
China + Hong Kong	Import (M)	6.7	7.1	7.2	8.6	11.5	13.3
China + Hong Kong	E - M	-0.3	0.6	1.8	2.4	2.4	3.5

(Note) Shares of countries outside North America, Europe and East Asia are small and therefore omitted to save space. (Source) BACI; author's calculation.

Table 6. China's trade balance in electronics

[A] Computer equipment

Export (USD billion)	2001	2003	2005	2007
(A) Final products	13.1	41.0	76.4	123.7
(A-1) Data processing units	1.4	15.1	34.5	68.0
(A-2) Peripheral units & accessories	11.7	25.9	41.9	55.8
(B) Parts & components	8.0	18.2	28.4	32.3
(C) Total	21.1	59.2	104.7	156.0

Import (USD billion)	2001	2003	2005	2007
(A) Final products	5.0	11.4	18.0	22.4
(A-1) Data processing units	1.8	2.0	2.2	2.1
(A-2) Peripheral units & accessories	3.2	9.4	15.8	20.3
(B) Parts & components	6.6	11.5	15.7	16.8
(C) Total	11.6	22.9	33.7	39.2

Export - Import (USD billion)	2001	2003	2005	2007
(A) Final products	8.1	29.6	58.4	101.3
(A-1) Data processing units	-0.4	13.1	32.3	65.8
(A-2) Peripheral units & accessories	8.5	16.5	26.1	35.5
(B) Parts & components	1.4	6.7	12.7	15.4
(C) Total	9.5	36.3	71.0	116.8

Export / Import (%)	2001	2003	2005	2007
(A) Final products	263.2	359.3	423.8	552.3
(A-1) Data processing units	79.1	753.6	1,536.8	3,183.9
(A-2) Peripheral units & accessories	364.8	275.4	265.3	275.1
(B) Parts & components	120.5	158.6	180.8	191.7
(C) Total	181.7	258.6	310.7	397.6

[B] Electronic components

Export (USD billion)	2001	2003	2005	2007
(A-1) Insulated cables, printed circuit boards & switches	5.0	7.9	15.5	29.2
(A-2) Capacitors	0.7	1.0	1.4	2.2
(B-1) Diodes, transistors & other semiconductors	1.0	1.7	3.4	8.8
(B-2) Electronic integrated circuits	2.5	6.4	14.4	23.6
(C) Total	9.1	17.0	34.7	63.8

Import (USD billion)	2001	2003	2005	2007
(A-1) Insulated cables, printed circuit boards & switches	7.1	12.0	19.8	30.9
(A-2) Capacitors	1.7	2.9	4.2	6.9
(B-1) Diodes, transistors & other semiconductors	2.9	5.9	8.6	11.7
(B-2) Electronic integrated circuits	16.6	41.1	81.6	128.5
(C) Total	28.3	61.9	114.2	177.9

Export - Import (USD billion)	2001	2003	2005	2007
(A-1) Insulated cables, printed circuit boards & switches	-2.1	-4.0	-4.3	-1.7
(A-2) Capacitors	-1.0	-2.0	-2.8	-4.7
(B-1) Diodes, transistors & other semiconductors	-2.0	-4.1	-5.2	-2.9
(B-2) Electronic integrated circuits	-14.1	-34.7	-67.2	-104.9
(C) Total	-19.2	-44.9	-79.5	-114.2

Export / Import (%)	2001	2003	2005	2007
(A-1) Insulated cables, printed circuit boards & switches	70.0	66.2	78.1	94.5
(A-2) Capacitors	39.7	33.5	34.1	31.4
(B-1) Diodes, transistors & other semiconductors	32.9	29.5	39.3	75.2
(B-2) Electronic integrated circuits	15.0	15.6	17.7	18.4
(C) Total	32.1	27.5	30.4	35.8

(Note) In the right table, (B-1) and (B-2) are active electronic components while (A-1) and (A-2) are passive and supportive components.
(Source) China Customs Statistics; author's calculation.

country's component imports are highly concentrated in ICs, for which excess imports have more than trebled between 2003 and 2007[15]. Whereas the Chinese government has been trying to boost domestic IC output by courting foreign manufacturers with an array of tax and other incentives, major international firms have so far remained cautious about establishing integrated production facilities in the mainland, because of regulations in their home countries and concerns about technology leakage (Brown and Linden 2006). Although the number of indigenous Chinese IC firms is increasing, most of these firms are engaged in either final assembly-and-testing operations or the manufacturing of chips that are far behind those at the international technological frontier (Hamada 2008). To the extent that this is the case, it is likely that China's growing exports of end-user ICT machinery will be matched by increasing imports of active components for at least some time to come, reinforcing the mechanism that has been behind the recent deceleration of regional IIT.

The above analysis suggests that the regional GL index for the entire manufacturing sector may start falling soon, unless IIT expands sufficiently quickly in non-EE machinery industries. In this connection, it is of interest that Table 1 indicates that the sectoral GL index has been rising recently in such sectors as "Transport equipment", "Other machinery" and "Other manufacturing industries." While a detailed analysis of what is taking place in these industries is beyond the scope of this paper, let us examine a few additional statistics to assess the likelihood that the rising share of IIT in these sectors be maintained in the future.

Table 7 reports the trade shares and the GL indices of individual countries (or country groups) in the above three sectors. To facilitate comparison, all the values in this table were computed in the same manner as those in Table 4, grouping BACI's six-digit products into two sets of final and intermediate goods. According to Table 7, the regional and country GL indices for the three sectors are generally on an upward trend, both in final and intermediate products. Nevertheless, the index values for these sectors still remain considerably lower than those for EE machinery. In all three sectors, moreover, the GL indices for final products are much smaller than those for intermediate products, with the gap between the two widening rather than narrowing over time. Although not shown here, the increase in the final-good GL indices are primarily due to growing IIT in capital goods used for manufacturing activity, whereas two-way trade in consumer goods remains relatively anemic. It seems, therefore, that IIT among the East Asian countries largely remains a corporate phenomenon, with their consumer markets less integrated internationally.

Although one might suppose that end-user products are inherently less amenable to IIT than intermediate goods, it is not clear whether this is the case. Table 8 compares the extent of regional IIT in East Asia with that of North America and

15) In 2007, the net imports of ICs were roughly of the same value as the combined net exports of completed computer and telecommunication units.

Table 7. Trade shares and GL indices for non-EE machinery sectors by country

[A] Transport equipment

Series	Country / region	Final products				Intermediate products			
		1996	1999	2002	2005	1996	1999	2002	2005
w (%)	All East Asia	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
w (%)	Japan	32.0	29.3	29.9	28.3	38.2	32.6	32.5	28.6
w (%)	Korea + Taiwan	12.7	14.6	12.9	15.9	16.2	19.1	15.5	17.4
w (%)	Malaysia + Singapore	18.6	18.5	15.2	16.0	9.9	11.1	10.7	10.1
w (%)	Other Southeast Asia	15.6	13.7	14.8	15.3	23.5	18.0	22.6	20.8
w (%)	China + Hong Kong	21.1	23.8	27.1	24.4	12.2	19.2	18.7	23.1
IIT (%)	All East Asia	4.6	5.1	5.5	6.6	12.8	23.5	23.3	23.6
IIT (%)	Japan	2.6	3.8	4.6	3.1	9.3	17.9	18.2	21.4
IIT (%)	Korea + Taiwan	3.5	3.7	4.8	5.2	17.9	20.2	20.9	19.9
IIT (%)	Malaysia + Singapore	7.8	6.2	4.0	5.7	21.0	26.2	26.8	27.3
IIT (%)	Other Southeast Asia	4.6	5.3	8.8	17.4	7.9	24.8	25.3	24.5
IIT (%)	China + Hong Kong	5.6	6.7	5.9	5.3	20.1	33.8	29.8	26.4

[B] Other machinery

Series	Country / region	Final products				Intermediate products			
		1996	1999	2002	2005	1996	1999	2002	2005
w (%)	All East Asia	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
w (%)	Japan	33.0	32.1	29.4	27.4	34.7	32.9	32.1	30.4
w (%)	Korea + Taiwan	21.8	25.8	23.4	25.9	17.4	18.1	18.6	20.0
w (%)	Malaysia + Singapore	12.5	10.9	8.4	6.6	13.8	12.9	11.1	8.9
w (%)	Other Southeast Asia	11.6	8.8	8.7	7.6	14.8	12.5	12.2	11.2
w (%)	China + Hong Kong	21.0	22.5	30.1	32.5	19.4	23.6	26.0	29.4
IIT (%)	All East Asia	9.9	13.9	16.4	19.0	22.5	27.4	31.0	32.3
IIT (%)	Japan	7.0	11.3	13.5	15.3	19.3	26.2	28.6	32.0
IIT (%)	Korea + Taiwan	8.2	11.0	13.6	15.6	22.5	24.0	26.0	27.3
IIT (%)	Malaysia + Singapore	15.2	20.2	24.7	24.2	27.7	26.6	35.4	35.6
IIT (%)	Other Southeast Asia	7.3	12.9	13.8	14.4	15.1	25.7	25.6	29.2
IIT (%)	China + Hong Kong	14.2	18.5	19.8	24.8	30.0	33.2	38.4	36.2

[C] Other manufacturing industries

Series	Country / region	Final products				Intermediate products			
		1996	1999	2002	2005	1996	1999	2002	2005
w (%)	All East Asia	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
w (%)	Japan	23.9	24.6	24.5	23.9	25.1	23.9	23.8	23.1
w (%)	Korea + Taiwan	13.4	12.5	12.1	12.2	20.6	21.3	21.4	22.5
w (%)	Malaysia + Singapore	14.3	13.1	11.6	11.1	13.1	12.1	10.7	9.3
w (%)	Other Southeast Asia	11.2	10.7	10.6	10.5	14.0	13.6	13.9	13.7
w (%)	China + Hong Kong	37.2	39.1	41.2	42.2	27.2	29.1	30.2	31.4
IIT (%)	All East Asia	15.4	14.0	14.4	17.3	16.9	17.7	18.2	21.1
IIT (%)	Japan	13.0	12.5	12.4	14.9	16.7	18.7	18.3	21.1
IIT (%)	Korea + Taiwan	20.3	20.7	23.0	25.1	18.1	18.2	17.9	22.2
IIT (%)	Malaysia + Singapore	20.5	20.3	20.8	23.1	18.0	18.7	21.4	22.4
IIT (%)	Other Southeast Asia	9.1	9.1	10.9	13.9	9.3	10.5	11.7	12.7
IIT (%)	China + Hong Kong	15.2	12.1	12.2	15.6	19.6	19.3	20.1	23.5

(Note) See Section 3 and Table A for the definition of individual sectors.
(Source) BACI; author's calculation.

Table 8. Trade share and GL indices in regional trade (2005)

Sector	East Asia		North America		Europe	
	w (%)	IIT (%)	w (%)	IIT (%)	w (%)	IIT (%)
All manufacturing industries	100.0	29.8	100.0	49.1	100.0	40.2
Final products	34.2	23.3	44.9	46.1	47.4	39.6
Intermediate products	65.8	33.1	55.1	51.5	52.6	40.8
Electronic & electrical machinery	50.9	39.8	21.0	47.6	18.0	41.7
Final products	16.5	31.1	11.3	40.2	10.7	36.6
Intermediate products	34.4	44.0	9.7	56.2	7.3	49.2
Other manufacturing industries	49.1	19.3	79.0	49.5	82.0	39.9
Final products	17.6	16.0	33.7	48.1	36.7	40.5
Intermediate products	31.4	21.2	45.4	50.5	45.3	39.5

(Note) "Other manufacturing industries" refer to all manufacturing industries other than electronic & electrical machinery.
(Source) BACI; author's calculation.

Europe. The trade shares and the GL indices in this table are derived from BACI's six-digit statistics and refer to 2005. As is clear from this table, East Asia's GL index is roughly comparable to those of North America and Europe only in the EE machinery sector, and remains at much lower levels in other industries. In North America and Europe, moreover, there is little systematic difference between final and intermediate products in the share of IIT in non-EE machinery industries. Although East Asia differs from North America and Europe in terms of economic and other conditions[16], Table 8 suggests that the former still has ample room for expanding regional IIT in non-EE machinery sectors, both in final and intermediate products.

Existing studies tend to attribute extensive international fragmentation and IIT in the electronics industry to the characteristics of goods produced by this industry, such as relatively standardized component interfaces, diverse factor intensities among different stages of production, and high value-to-weight ratios (Nordås 2007). It should be noted, however, that these features of the electronics industry resulted in extensive production networks in East Asia because they were supported by commitment by the region's governments to a liberal trade and investment regime. For example, all 11 countries examined in this paper are signatories to the Information Technology Agreement (ITA) and are committed to duty-free imports of a wide range of ICT products, not only from other signatories but also from all WTO member countries. A few existing studies report that tariff reductions under the ITA have helped promote trade and cross-border production sharing in electronics,

16) The East Asian countries vary more widely in terms of the income level and are on average more geographically dispersed than countries in North America and Europe. According to existing literature, the negative effect of geographical distance on trade volume is stronger in IIT than in inter-industry trade, whereas bilateral income disparities are associated with a lower ratio of horizontal to vertical IIT.

both in East Asia and elsewhere (Suh and Poon 2006; Mann and Liu 2009).

In East Asia, there have recently been a number of initiatives for regional economic integration, including an array of free trade agreements (FTAs) and investment treaties. As noted by existing studies, however, protectionism still abounds in politically sensitive industries, such as food and automobiles, limiting the scope of both vertical and horizontal divisions of labor among the regional economies (Ito and Umemoto 2004; James and Ramstetter 2005). For strong growth in regional trade to be sustained in the future, policy makers need to fight vested interests and redouble their efforts at dismantling visible and invisible trade barriers across a wider spectrum of industries.

6. Conclusion

This paper has studied manufacturing IIT in East Asia and factors behind its dynamics. According to existing studies, growing IIT in East Asia reflects market-driven integration of the regional economies, a tendency often presumed to continue into the future. Our analysis shows, however, that East Asia's IIT is concentrated in a relatively narrow range of electronic products whose producers are known to be highly footloose geographically. During the 1980s and much of the 1990s, roaring demand for ICT hardware from industrial countries and the formation of cross-border production networks in Southeast Asia played a key role in the rapid expansion of regional manufacturing trade and the share of IIT therein.

Nevertheless, this trend of spreading regional production networks turned out to be relatively short-lived. As the last century came to a close, the growth of the advanced-country ICT equipment market started to slow down markedly while China emerged quickly as a new global electronics powerhouse. The manufacturing of ICT hardware, which had previously been segmented into multiple stages and spread across many countries, is increasingly re-integrated within China, although the country still lacks the capacity to produce key semiconductor devices that constitute the core of these products. During the last few years, China's exports of end-user ICT goods have skyrocketed while its imports of advanced ICs have also grown at a hitherto unprecedented pace. The increasingly lopsided structure of China's electronics trade is currently putting significant pressure on both the existing structure of regional production sharing and the ratio of IIT to total regional manufacturing trade.

To the extent that this trend continues into the near future, the manufacturing GL index for East Asia may well begin falling unless IIT in non-electronics industries expands sufficiently quickly and robustly. As shown in Sections 3 and 5, however, the past expansion of IIT in the non-electronics sectors has been modest, with their GL indices still remaining at much lower levels than in North America and

Europe. Although this implies that East Asia still has ample room for expanding two-way trade, whether this will occur or not depends on the resolve of policy-makers to remove remaining trade barriers and to create a truly liberal and integrated market in the region.

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Appendix Table A. CEPII industry/product categories

Code	Sector	Description
BA	6	Cement & related products
BB	6	Ceramics
BC	6	Glass & glassware
CA	6	Iron & steel
CB	6	Tubes
CC	6	Non-ferrous metals
DA	5	Yarns & fabrics
DB	5	Clothing
DC	5	Knitwear
DD	5	Carpets
DE	5	Leather
EA	6	Wood articles
EB	6	Furniture
EC	6	Paper and pulp
ED		Printing & pnblishing
EE	6	Miscellaneous manufactnred articles
FA	6	Metal structures
FB	6	Miscellaneous hardware
FC	3	Engines, turbines & pumps
FD	3	Agricultural equipment
FE	3	Machine tools
FF	3	Construction equipment
FG	3	Specialized machines
FH		Arms & weaponry
FI	1	Precision instruments
FJ	1	Clocks and watches
FK	1	Optical equipment
FL	1	Active compouents
FM	1	Consumer electrouics
FN	1	Telecommunications equipment
FO	1	Computer & office equipment
FP	1	Domestic electrical appliances
FQ	1	Heavy electrical equipment
FR	1	Other components and devices
FS	2	Vehicle components
FT	2	Passenger cars & motorcycles
FU	2	Commercial vehicles
FV	2	Ships
FW	2	Aircraft
GA	4	Basic inorganic chemicals
GB	4	Fertilizers
GC	4	Basic organic chemicals
GD	4	Paints & intermediate chemical products
GE	4	Toiletries & perfumes
GF	4	Pharmaceuticals
GG	4	Plastics, fibers & synthetic resins
GH	4	Plastic articles
GI	4	Rubber articles (incl. tires)
HA		Iron ores
HB		Non-ferrous ores
HC		Unprocessed minerals n.e.s.
IA		Coals
IB		Crnde oil
IC		Natural gas
IG		Coke
IH		Refined petroleum products
II		Electricity
JA		Cereals
JB		Other edible agricultural products
JC		Non-edible agricultural products
KA		Cereal products
KB		Fats
KC		Meat
KD	6	Preserved meat & fish products
KE	6	Preserved fruit & vegetable products
KF	6	Sugar products (incl. chocolate)
KG	6	Animal food
KH	6	Beverages
KI	6	Manufactured tohaccos
NA	6	Jewelry & works of art
NB		Non-monetary gold
NV		Products n.e.s.

(Notes) Product codes are CEPII's original 2-digit codes. Sector code refers to each of the six broad manufacturing sectors defined in Section 3. Industries marked by shading are excluded from analysis.
(Source) CEPII homepage (http://www.cepii.fr/anglaisgraph/bdd/chelem/internatrade/71catsitc.htm).