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Deepening Interdependence in East Asia:

Deepening Intra-industry Trade of Japan and its Bilateral FTAs

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Introduction

So far, trade liberalization efforts in a multilateral arena such as in the WTO (World Trade Organization) have not been able to meet the members' needs for quicker and extensive liberalization. Japan naively honored multilateral trade liberalizing frameworks until the late 1990s and has been no exception. After finalizing negotiations with Singapore in early 2002, Japan is now eagerly seeking more bilateral free trade agreements to construct its own *de facto* free trade network. The Japanese government's efforts have further accelerated since the latter half of 2003.

Among several potential bilateral FTAs (free trade agreements) that Japan is now considering, the most influential ones include Japan-Korea, Japan-China and Japan-Mexico FTAs. After five years of preparatory studies, Japan commenced official FTA negotiations with Korea in December 2003. However, in the meantime, the Japan-Mexico FTA has been highlighted more because of Japanese companies' increasing cost disadvantage compared to countries with existing FTAs with Mexico. Also, it should be noted that Mexico, a member of NAFTA (North American Free Trade Agreement), is strategically quite important for Japanese companies because the country may be utilized as an indirect entry point to the U.S. market. The business world is gradually increasing its expectations for the Japan-China FTA, foreseeing rapid expansion of the Chinese market. Compared to these FTAs, the Japan-Korea FTA has not been given much attention. This is due partly to competitive export structures and partly to the fact that Japan has not extensively invested in the Korean market in the past compared to other neighboring markets like China and ASEAN (Association of South-East Asian Nations).

The author would like to show the importance of Japan's "unfinished" FTAs such as the Japan-Korea FTA and the bilateral FTAs with individual ASEAN members based on the interdependence already accomplished so far. As a working indicator for measuring the interdependence, the author adopts the IIT (intra-industry trade) index. The IIT index sounds somewhat old-fashioned, but recent studies reveal that the IIT index represents more profound information such as the trade creation effect associated with foreign direct investments or with the overlap of representative demands between countries.

It is generally considered that the evolution of intra-industry trade brings about a gain of division of labor in disaggregated industrial levels. Also, it is considered that the

evolution of intra-industry trade results in a higher growth of total trade volume and at a rate more rapid than the case where no major intra-industry trade takes place. If this is so, that necessitates a freer trade environment, which is furnished by multilateral liberalization or by bilateral FTAs. Of course, multilateral trade liberalizing frameworks like the WTO ultimately aim to accomplish free trade. But as mentioned, the pace of multilateral negotiations towards worldwide liberalization is only gradual. As a second-best choice, many countries are rushing into forming their own FTA networks. In doing so, the IIT indexes with potential FTA counterparts may be used for determining the priority in forming FTAs.

The rest of the paper is organized as follows. In Chapter I, this paper first explores how much the evolution of intra-industry trade affects bilateral trade volumes using a world trade flow model based on the gravity equation. We then focus on the case of Japan in Chapter II. We discuss how we should set a sequence for FTA negotiations. As a working indicator, the intra-industry trade index is introduced, and the indexes of Japan vis a vis its major trade partners are calculated and shown. Chapter III first summarizes the FTA policies in Northeast Asia. Then, Japan's FTA strategy was tested based on the IIT indexes calculated in the prior Chapter. The Chapter also points out the necessity of cooperation with China, and it looks at Korea's unique role in matchmaking for the Northeast Asian nations. Finally, Chapter IV concludes.

I. Impact of Intra-Industry Trade on World's Trade Flows

I-1. Gravity Equation

In this Chapter, we would like to empirically examine the impact of intra-industry trade on global trade flows. In measuring the effect of intra-industry trade on trade flows, the author adopts the gravity equation which is widely used for estimating the effects of various variables affecting trade flows[1]. Following the famous Newton's law of physics, the simplest version of the gravity equation of international trade consists of the

[1] The gravity equation is often criticized for lacking a firm theoretical background. However, at the same time, widespread use of the equation itself proves its success in clarifying the determinants of trade flows. Recent studies try to relate the gravity equation with existing trade theories. Feenstra et al. (2001) represents such recent efforts for rationalizing the gravity equation.

bilateral trade flow on the left-hand side and the incomes of the exporting and importing countries plus the distance between the two countries involved on the right-hand side. With the accumulation of empirical applications, the gravity equations in recent studies have become more complicated and include additional explanatory variables such as cultural similarity, geographical characteristics, trade patterns and trade policy variables like membership in trade groups.

In an actual application of the equation for example, Feenstra et al. (2001) incorporated such additional variables as common border dummy, common language dummy, common FTA dummy, remoteness from major trading partners, and the weight of energy-related commodity of both exporting and importing countries. Cernat (2001) added GDP (gross domestic products) per capita of the exporting and importing countries, common border and language, and dummies signifying trade within an FTA and trade involving an FTA member[2].

I-2. Specification of Gravity Equation and Adopted Variables

The gravity equation in this Chapter needs to include the IIT indexes because the main purpose of estimating the equation is to detect the impact of the IIT indexes on the trade flows of the world. Also, we need to catch up with the recent tendency to add various kinds of explanatory variables such as geographic, demographic, cultural, FDI(foreign direct investment)-related and trade structure variables to the gravity equation. Hence, our gravity equation is formulated as follows:

$$
\begin{aligned}
\mathrm{Log}(Tij) = {} & \beta 1 + \beta 2 \cdot \mathrm{Log}(GDPi) + \beta 3 \cdot \mathrm{Log}(GDPj) + \beta 4 \cdot \mathrm{Log}(Dij) \\
& + \beta 5 \cdot \mathrm{Log}(PCGDP\_GAPij) + \beta 6 \cdot \mathrm{Log}(POPi \cdot POPj) \\
& + \beta 8 \cdot LOCKi + \beta 9 \cdot LOCKj + \beta 10 \cdot (ISLANDi + ISLANDj) + \beta 11 \cdot ADJij \\
& + \beta 12 \cdot LANGij + \beta 13 \cdot FTAij \\
& + \beta 14 \cdot FDIINi/GDPi + \beta 15 \cdot FDIINj/GDPj \\
& + \beta 16 \cdot FDIOUTi/GDPi + \beta 17 \cdot FDIOUTj/GDPj \\
& + \beta 18 \cdot HK + \beta 19 \cdot CHN + \beta 20 \cdot SGP + \beta 21 \cdot JPN + \beta 22 \cdot KOR \\
& + \beta 23 \cdot Cij + \beta 24 \cdot IITj + \beta 25 \cdot IITi \quad \text{……(Equation. 1)}
\end{aligned}
$$

[2] In the equation adopted by Cernat (2001), to be precise, “trade involving an FTA member” is the case when the importing country is a member of a FTA, but the exporting country does not belong to that FTA.

Table 1. List of Variables : Determinants of World Trade Flows

Variables	Description
Tij	Trade flow, U.S. dollars.
GDPi,GDPj	GDP of exporting and importing countries, respectively, U.S. dollars.
Dij	Distance between capital cities of exporting and importing countries (great circle distance, kilometers).
POPi, POPj	Population of exporting and importing countries, respectively, persons.
PCGDP_GAPij	Gap in per capita GDP (absolute value, U.S. dollars).
LOCKi, LOCKj	Land lock dummy: 1, if exporting or importing country, respectively, is landlocked; 0, otherwise.
ISLANDi, ISLANDj	Island dummy: 1, if exporting or importing country, respectively, is an island state; 0, otherwise.
ADJij	Adjacency dummy: 1, if exporting and importing countries are adjacent; 0, otherwise.
LANGij	Common language dummy: 1, if exporting and importing countries share one or more official languages; 0, otherwise.
FTAij	FTA dummy: 1, if exporting and importing countries belong to the same free trade agreement (or economic partnership agreement); 0, otherwise.
FDIINi/GDPi	Presence of inward foreign direct investment in exporting country (FDIIN: balance of inward foreign direct investment, U.S. dollars).
FDIINj/GDPj	Presence of inward foreign direct investment in importing country (FDIIN: balance of inward foreign direct investment, U.S. dollars).
FDIOUTi/GDPi	Intensity of outward foreign direct investment by exporting country (FDIOUT: balance of outward foreign direct investment, U.S. dollars).
FDIOUTj/GDPj	Intensity of inward foreign direct investment by importing country (FDIOUT: balance of outward foreign direct investment, U.S. dollars).
HK	Hong Kong dummy: 1, if the trade flow involves Hong Kong; 0, otherwise.
CHN	China dummy: 1, if the trade flow involves China; 0, otherwise.
SGP	Singapore dummy: 1, if the trade flow involves Singapore; 0, otherwise.
JPN	Japan dummy: 1, if the trade flow involves Japan; 0, otherwise.
KOR	Korea dummy: 1, if the trade flow involves Korea; 0, otherwise.
Cij	Complementarity index between countries i and j (based on the structure of country i's exports to the world and that of country j's imports from the world).
IITj,IITi	Intra-industry trade index of exporting and importing countries, respectively (Grubel-Lloyd type, based on individual country's export and import structures vis-à-vis the world).
Cij	Complementarity index between countries i and j (based on the structure of country i's exports to the world and that of country j's imports from the world).
IITj,IITi	Intra-industry trade index of exporting and importing countries, respectively (Grubel-Lloyd type, based on individual country's export and import structures vis-à-vis the world).

Source: Author's compilation. See Appendix A for the details about data compilation.

Considering that old samples do not contribute much in drawing meaningful implications, sample years for this study were set to 1996, 1998, 2000 and 2002. The analysis covered all the countries where all the variables in the above equation were available for the sample years. Table 1 gives brief explanations of the variables used in the above equation. For details about the data compilation, refer to Appendix A. In the

above Equation, subscripts i and j denote the variable is about the exporting and importing countries, respectively, and ij denotes that the variable is of bilateral nature.

The first four variables, Tij (bilateral trade flow), GDPi (aggregate income of the exporting country), GDPj (aggregate income of the importing country) [3], and Dij (distance between the two countries) are all fundamental ingredients of the gravity equation, and the GDP variables are expected to have highly significant positive coefficients and Dij a negative coefficient.

PCGDP_GAPij (gap in per capita income) is expected to discern the trade promotion effect due to similar income levels[4]. As a wide gap in per-capita income is expected to impede trade, a negative coefficient is anticipated. POPi and POPj (population) participated in the equation, in order to measure the effect of the demographic features. As the economy's size is already controlled by adding the GDP variables, POPs are supposed to reflect population density per certain unit of income. For a given economic size, it is expected that a densely populated country tends to produce and demand a richer variety of merchandise. Therefore, the anticipated direction of impact is positive[5].

LOCKi and LOCKj (land lock dummies) are expected to have negative coefficients because transportation costs are higher for landlocked countries. On the other hand, island states take advantage of the cost superiority of marine transportation. Therefore, ISLANDi and ISLANDj (island dummies) are expected to have positive coefficients[6].

[3] Past studies often assumed that the coefficients of the exporter's and importer's GDP are identical. However, our test regression revealed that the impacts of those two GDP variables statistically differed. Feenstra et al. (2001) showed that the difference in the coefficients of GDP variables is theoretically meaningful. It suggested that the coefficients of GDPi (home market) tends to be higher (home market effect) if monopolisitic-competition prevails in the field of differentiated products, and free entry and exit prevailed in the field of homogeneous goods. Feenstra et al. showed the existence of the home market effect for the differentiated goods but not for the homogeneous goods.

[4] This is considered to hold true, especially, for the countries in high-income brackets. Linder's representative demand hypothesis suggested that consumers' tastes upgrade along with growth in income level, and it suggested that consumers' tastes resemble in countries with similar income levels. Also, it is generally considered that consumers' "love for variety" intensifies with income growth, and this intensified love for variety leads to differentiation of merchandise (Helpman and Krugman(1985)). In the presence of the monopolistic competition market and the scale economy, as supposed in (Brander and Krugman (1983)), firms try to sell their differentiated products to overseas consumers, but they try to concentrate the production in a limited number of spots. Thus, countries come to exchange differentiated goods within the same industry, that is, intra-industry trade. Our gravity equation incorporates the IIT variables, but these are not of bilateral nature. The income level similarity somewhat conveys the notion of bilateral intra-industry trade and is thus expected to supplement the shortcomings of the IIT variables introduced in our gravity equation.

[5] In the estimation, POPi and POPj were bound together because our test regressions suggested that both POPi and POPj had statistically the same effects.

[6] Lower transportation costs and small size of economies necessitate island states to move toward

ADJij (adjacency dummy) is expected to have a positive coefficient because the adjacency of the two countries means more than closeness conveyed by Dij. Similarly, LANGij (common official language dummy) and FTAij (FTA dummy) are supposed to facilitate bilateral trade flows. Notably, cultural similarity is generally considered to greatly affect the economic interactions, including trade, among countries, but formulating the effects of cultural variables was not easy in actual application. It is considered that the common language dummy in our model represents various cultural variables omitted from the equation.

FDI-related variables were incorporated into our gravity equation in order to measure the trade promotion effects of FDIs. Specifically, our gravity equation incorporates four FDI-related variables FDIINi/GDPi, FDIINj/GDPj (presence of inward FDI), FDIOUTi/GDPi and FDIOUTj/GDPj (intensity of outward FDI). Note that the FDI variables are country-specific ones and not bilateral ones because bilateral FDI stock data were not sufficiently obtained for the sample period. Generally, FDI is considered to enhance trade[7]. If the bilateral FDI stocks (FDIINij, etc.) increase proportionately, the trade promotion effect of a country's aggregated FDI stocks (FDIINi, etc.), which we adopted in this paper, should be estimated to be consistently positive. However, even though fresh FDI is heavily concentrated into certain countries, change in aggregate FDI stock is moderate. In this case, the direction of the estimated coefficient is indeterminate. If the concentrated FDI caused rapid growth of the trade with those investment partners at the cost of the trade with the rest of the world, then the coefficient of the aggregate FDI stocks may be estimated negative. On the other hand, if concentration of FDI rather favorably affects the trade flows with the rest of the world, possibly due to additional gains brought about by the FDI, the coefficient may be estimated positive.

In the case where FDI-related variables were not available, the figures for prior years filled the vacancies.

Country dummies HK, CHN, SGP, JPN and KOR were introduced to the gravity equation to adjust for the country specific effects of major Asian economies. The Hong Kong and Singapore dummies also adjust for their interport function. The direction of

industrial specialization and exportation of the specialized products, which eventually enables them to import a richer variety of goods. Ishido et al. (2003) showed that a lower transportation cost promotes vertical intra-industry trade.

[7] Ishido et al. (2003) showed that a positive change in bilateral FDI tended to cause an increase in the vertical bilateral intra-industry trade.

the impacts of those country dummies differs according to their involvement in international trade.

Cij (complementarity index) was added to measure and control the effect of "vertical match" of trade structures. The value of this bilateral variable becomes higher if export and import structures covering all the tradable items and measured by RCA indexes of the two countries correspond. Cij is expected to affect bilateral trade flows positively.

Table 2 Intra-Industry Trade Indexes of Selected Major Economies (1996, 1998, 2000 and 2002)

Country	ALL Commodities				Manufacture			
	1996	1998	2000	2002	1996	1998	2000	2002
Japan	0.380	0.384	0.400	0.394	0.460	0.446	0.473	0.467
Korea	0.495	0.482	0.517	0.511	0.551	0.516	0.587	0.568
China	0.397	0.409	0.446	0.437	0.403	0.426	0.472	0.456
Philippines	0.474	0.529	0.466	0.473	0.527	0.586	0.506	0.534
Malaysia	0.547	0.591	0.584	*0.610	0.601	0.650	0.615	*0.639
Singapore	0.727	0.736	0.774	0.776	0.761	0.771	0.809	0.797
Thailand	0.422	0.473	0.523	*0.501	0.487	0.525	0.593	*0.577
Indonesia	0.273	0.272	0.317	*0.325	0.274	0.344	0.316	*0.318
USA	0.623	0.623	0.601	0.566	0.681	0.658	0.652	0.608
Mexico	0.575	0.561	0.555	0.585	0.604	0.610	0.607	0.632
Canada	0.603	0.612	0.604	0.648	0.643	0.646	0.644	0.682
UK	0.794	0.784	0.781	0.752	0.838	0.816	0.814	0.777
Germany	0.684	0.704	0.707	0.700	0.718	0.724	0.736	0.723
France	0.760	0.762	0.753	0.760	0.826	0.822	0.822	0.817

Remarks: (1) For formula and the data source, see Appendix A.
(2)* in the above table denotes 2001 figures.
Source: Author's calculation.

Finally, IIT variables adopted in this paper are aggregated ones, like FDI variables, because a large part of the commodity breakdown of the recent bilateral trade flows which is required to calculate bilateral IIT indexes was not available. These country-specific IIT variables are rather convenient to deal with, because the bilateral IIT variables will cause multicollinearity with other explanatory variables such as the FDI-related variables[8]. Our IIT variables carry similar characteristics to the FDI-related variables. The expected sign of the estimated coefficients may be negative or positive depending on how concentrated IITs into certain countries affect those with the rest of the world. If sharp growth of bilateral IITs with certain countries takes place at the cost

[8] Recall that Ishido et al. (2003) pointed out a correlation between bilateral FDI and (vertical) IIT indexes.

of those with other countries, then the coefficients may be estimated negative and vice versa[9]. Table 2 summarizes the aggregated IIT indexes of selected countries[10].

Table 3 Determinants of Bilateral Trade Flows of the World: Regressions using Gravity Equation

Explanatory Variables	Estimated Coefficients			
	1996	1998	2000	2002
Constant	-33.081 ***	-31.318 ***	-31.361 ***	-32.897 ***
Log(GDPi)	1.028 ***	0.920 ***	0.922 ***	0.929 ***
Log(GDPj)	0.806 ***	0.693 ***	0.703 ***	0.735 ***
Log(Dij)	-1.168 ***	-1.145 ***	-1.140 ***	-1.142 ***
Log(PCGDP_GAPij)	-0.028 **	-0.035 ***	-0.027 **	-0.038 ***
Log(POPi*POPj)	-0.019	0.075 ***	0.065 ***	0.085 ***
LOCKi	-0.222 ***	-0.238 ***	-0.247 ***	-0.375 ***
LOCKj	-0.764 ***	-0.667 ***	-0.748 ***	-0.742 ***
ISLANDi+ISLANDj	0.048 *	0.078 ***	0.089 ***	0.326 ***
ADJij	0.844 ***	0.938 ***	1.120 ***	1.039 ***
LANGij	0.727 ***	0.557 ***	0.530 ***	0.508 ***
FTAij	0.119 **	0.238 ***	0.295 ***	0.262 ***
FDIINi/GDPi	-0.063 ***	-0.142 ***	-0.208 ***	-0.077 ***
FDIINj/GDPj	-0.071 ***	-0.085 ***	-0.160 ***	-0.054 ***
FDIOUTi/GDPi	0.580 ***	1.474 ***	0.841 ***	0.805 ***
FDIOUTj/GDPj	0.629 ***	1.153 ***	0.695 ***	0.675 ***
HK	1.602 ***	0.262 *	0.532 ***	0.439 ***
CHN	0.367 ***	0.344 ***	0.630 ***	0.812 ***
SGP	1.790 ***	1.209 ***	1.337 ***	1.018 ***
JPN	0.206 *	0.412 ***	0.213 *	-0.007
KOR	1.223 ***	1.388 ***	0.908 ***	0.986 ***
CIJ	0.269 ***	0.253 ***	0.214 ***	0.200 ***
IITi	0.943 ***	1.475 ***	1.584 ***	1.515 ***
IITj	0.385 ***	0.870 ***	1.064 ***	0.900 ***
Number of Samples	9,860	11,086	11,762	11,793
Adjusted R^2	0.720	0.717	0.719	0.724

Remarks: Asterisks (*) marks attached to each estimated coefficient signify the degree of statistical significance as follows:
*** 1% or less
** 5% or less
* 10% or less
no mark insignificant (10%+)

I-3. Empirical Results

The regression results of the gravity equation (Equation 1) are shown in Table 3. Most

[9] Also, the coefficients for the IIT variables tend to be lower if growth in IIT accompanies a decrease in inter-industry trade.

[10] As discussed in Chapter II, Japan's intra-industry trade with several neighboring economies, notably Korea and the Philippines, expanded throughout the 1990s. However, as shown in Table 1, changes in aggregate IIT indexes has been quite moderate in Korea and the Philippines as well as in Japan. Nevertheless, incorporating the aggregate IIT index into the gravity equation has some significance in that the aggregate IIT indexes, though partially, reflect changes in the bilateral IIT indexes.

of the coefficients were estimated to be significant, and the estimated signs generally matched our expectations.

As anticipated, GDP variables were estimated to have significantly affected the trade flows. The home market effect (coefficient of GDPi) was superior to the importer market effect (coefficient of GDPj) which suggests that differentiated goods dominated world trade[11]. We should also note that differentiated goods are considered to boost intra-industry trade. As expected, the trade promotion effect of the proximity of income level (PCGDP_GAPij) generally held throughout the sample years. Population was shown to have a positive effect for the years after 1998 which suggests that a dense population tended to enhance trade.

Land lock effect (LOCKi, LOCKj) was estimated correctly with negative and statistically significant coefficients. According to the estimation results, negative impact was greater when a landlocked country is the importer, which implies that the landlocked countries tended to save imports. Also, the great magnitude of the negative land lock effect suggests the severity those economies suffered from high transportation costs and other barriers, and it suggests the importance of getting rid of those obstacles. The trade intensive tendency of the island economies (ISLANDi, ISLANDj) was shown to be generally significant which implies that island economies took advantage of the lower cost of marine transportation.

Geographical adjacency of the trade partners (ADJij) was shown to significantly promote trade, and the effects became stronger over time. Our gravity equation controlled the distance, but geographical adjacency still had some additional meaning to international trade. The existence of a common language among the trade partners (LANGij) was shown to promote trade, with diminishing magnitude. Trade flows within FTAs (FTAij) tended to be higher, and the effects generally became stronger over time.

FDI-related variables were estimated to be statistically highly significant. However, the direction of impacts on trade was mixed. In the case of inward FDI, the coefficients for the aggregate stock (FDIINi/GDPi and FDIINj/GDPj) were estimated to be negative throughout the sample years. This suggests that investment recipients tended to receive FDI intensively from a limited number of investing countries, and that the growth of trade

[11] Feenstra et al. (2001) showed that, at least until 1990, the home market effect overwhelmed world trade of differentiated goods; whereas, the importer market effect dominated homogeneous goods. Our regression result shows the intensity of the home market effect, which, combined with Feenstra's arguments, suggests the dominance of differentiated goods in world trade.

with other countries tended to stagnate. On the other hand, the coefficients for the outward FDI variables were estimated to be positive. Outward FDI tended to accompany trade, not only with investment recipients, but also with the rest of the world.

As for the country dummies, the advent of China was impressive. Consistently increasing coefficients of the China dummy (CHN) suggests the country's increasing involvement in international trade. In contrast, the influence of other major Asian countries generally declined, as the estimated coefficients show. The interport effect of Hong Kong and Singapore are reflected in the coefficients of HK and SGP and fell over time. Japan's country dummy (JPN) also generally fell. This is possibly due to its moderate loss of competitive power and its long lasting recession. The effect of the Korea dummy (KOR) once soared in 1998, and then it faded out thereafter. This reflects Korea's painful effort to offset the damage of the 1997/98 economic crisis by expanding exports and its "V shaped" recovery of domestic expenditures. The trade promoting effect of Cij which may be interpreted as the "vertical" or "inter-industry" match of the trade structures was significantly positive but with diminishing magnitude. This suggests that the importance of inter-industry trade gradually faded out throughout the sample years.

Finally, the regression results about the IIT variables showed that both exporting and importing IIT-intensive countries tended to increase bilateral trade volumes. As for the effect of IIT index on the exporting countries (IITi), higher IIT indexes generally accompanied higher bilateral exports to a great portion of the trade partners. Given the sample means of the IIT indexes (33.04%) and assuming that the increment of total trade volume are all intra-industry trade, a 1 percentage point rise in the IIT index requires a 1.52 percent growth in total trade[12], which roughly coincides with the estimated coefficients of IITi. As for the effect of the IIT index on the importing countries, a higher IIT index somewhat tended to increase bilateral trade volumes, but the increase was not as much as in the case of the exporting countries. The increase in imports associated with enhanced intra-industry trade might take place mainly between just several partners, and this led to the lower estimated coefficient of IITj.

To sum up, the regression of our gravity equation suggested that a country's IIT-

[12] If we assume that the IIT index was originally x percent and the growth in total trade is totally attributable to intra-industry trade, a 1 percentage point increment in the IIT index is equivalent to 100 / (99-x) percent growth in the total trade. Let I be the amount of intra-industry trade and T be the total trade volume. Then, $x = I/T$, and $(x+0.01) = (I+\Delta I) / (T+\Delta I)$. Growth rate in the total trade volume is $\Delta I/T = \{(x+0.01)*T-I\} / T*\{1-(x+0.01)\} = 0.01 / \{1-(x+0.01)\} = \{100 / (99-x)\}$ %.

intensive characteristic tended to boost its bilateral trade flows, and the variables that possibly affect bilateral IIT, such as FDI-related variables and proximity in income levels, also tended to boost bilateral trade flows. In other words, when deepening of IIT is foreseen, total trade volume is anticipated to grow at a high rate even with all the other variables fixed.

Under such a situation, arranging a freer trade environment and opening up domestic markets to the rest of the world is hoped for even more so that we might fully benefit from deepening division of labor. The need for liberalization under intensive IIT is also valid in bilateral relations. Bilateral trade liberalization, most likely furnished by FTAs (or economic partnership agreements=EPAs), is essential if IIT is foreseen to increase between a certain country.

II. Sequence of Bilateral Trade Liberalization and Intra-industry Trade — Case of Japan —

II-1. Trade Liberalization: Overall or Bilateral?

Our regression of the gravity equation on the global bilateral trade flows showed that enhanced intra-industry trade tends to accelerate growth in the bilateral trade flows of the world. The regression results further suggested that trade liberalization, whether overall or bilateral, is imperative if further expansion in IIT is anticipated.

In considering a country's trade liberalization, opening up all items entirely to its trade partners will possibly maximize long-term gain. This is exactly what multilateral trade liberalizing frameworks such as the WTO aim to accomplish. However, the multilateral negotiations in the WTO have been progressing quite slowly because countries remain conservative in liberalizing their "sensitive" items whose penetration into countries are considered to bring about an acute pain to their domestic sectors. In the case of Japan, it has been reluctant to liberalize imports of agricultural items, notably rice. Under the existence of sensitive items in many countries, it is in fact fairly difficult for them to liberalize their market to all of their trade partners, notably to the partners who are specialized in the sensitive items. Today, many countries would like to benefit from liberalization gains as soon as possible, but at the same time they would like to avoid the burden associated with the penetration of the sensitive items. Probably

at this present moment, their best solution would be resorting to bilateral trade liberalization. In fact, the number of regional trade agreements notified to the WTO has steadily increased, and the pace of increase has accelerated since the 1990s. As of October 13, 2003, the WTO has been notified of 137 new agreements[13].

II-2. Sequencing Bilateral Liberalization using Intra-industry Trade Indexes

It is unrealistic to think that a country implements bilateral liberalization measures with all of its trading partners through, for example, FTAs. In practice, bilateral liberalization measures advance gradually, and naturally a sequence is formed as to which counterpart to negotiate with. What determines the sequence?

Economic versus Political Motivation of Bilateral Liberalization

First of all, economic motivation has become more distinct. The prime purpose of bilateral liberalization such as a FTA is to pursue economic gain. Political or diplomatic motivation is also often mentioned, but one of their long-term goals is probably to secure economic interests. Ogita (2004) successfully pointed out that in forming NAFTA (North American Free Trade Agreement) the most important motivation for the United States was to further develop its first and third largest export markets of Canada and Mexico, respectively. Ogita also argued that Japan's positive attitude towards FTAs in recent years accompanies a drastic change in its diplomatic principles; emphasis is now placed on economic gain rather than national security and on political alliance with Asian countries ("Asian orientation") rather than total devotion to its U.S.-Japan relation ("American reduction").

The Ministry of Foreign Affairs (2002) presented five criteria for determining the strategic priority of Japan's FTAs. In that document, "economic criteria" topped the list followed by "geographic", "political/diplomatic", "feasibility", and "time-related criteria". Emphasis on economic gain has become even more distinct in the Ministry of Economy, Trade and Industry (2003). It presented three key points as follows: Benefits to the Japanese economy, contribution to Japan's external policy and circumstances of other countries.

[13] This figure is the total number of agreements under GATT Article 24 (free trade agreements and custom unions), enabling clause for developing economies, and GATS Article 5 (service agreements). For details, refer to a WTO webpage, http://www.wto.org/english/tratop_e/region_e/region_e.htm.

Economic Motivation: Trade Facilitation or FDI Facilitation?

Then, the next question is, "Among various economic variables, what do countries consider most important in determining the counterpart of economic liberalization?" A lot of arguments have been submitted on the determinants of FTA counterparts. Also, as seen in the Japan-Singapore EPA signed in early 2002, recent agreements to secure or enhance various kinds of economic gain became more comprehensive. However, the economic motivation mentioned in various arguments may be reduced to "facilitation of trade and investment." Facilitation of trade is rather easy to understand. It largely consists of (1) tariff reduction or abolition, which is the core and traditional part of FTAs, and (2) improvement in trade-related procedures which is a rather contemporary concept and a major ingredient of EPAs. This trade facilitation argument supports an earlier introduction of FTAs or EPAs when an external surge in trade volume, say, due to deepening of IIT, is foreseen. In other words, trade volume may serve as an indicator for sequencing the potential FTA partners of a country.

What about FDI facilitation? Broadly, FDI facilitation associated with FTAs should be approached from two different sides; investors would like to protect the interests of their foreign affiliates with established FDI, and the investment hosts would like to attract more FDI. In the case of Japan, investors most often raise this kind of interest protection argument about their affiliates in Mexico[14]. When we search for documents on Japan's FTAs, we often come across the phrase "opportunity losses due to not having a FTA[15]," which also falls into the category of investors' affiliate protection argument. In this case, priority for forming FTAs may be given according to the stock of FDI. On the other hand, the host country's desire for attracting FDI may be met by two avenues. One avenue is the convenience in trade associated with FTA so that the affiliates may easily introduce intermediates from the investor's country[16]. The second avenue is if the agreement is of the EPA type and the facilitation part contains more direct measures for improving the investment environment, the host country may want to advertise the FDI-related part of the EPA[17]. In this case, priority may be given to the countries with FDI

[14] See, for example, Japan Foreign Trade Council (2002).
[15] See, for example, Japan Foreign Trade Council (2002).
[16] Institute of Developing Economies and Korea Institute for International Economic Policy (2000) mentioned that tariff reduction due to the launch of the Japan-Korea FTA would attract fresh FDI, which eventually would improve productivity.
[17] The Japan-Singapore EPA regulated investment promotion clause, which resembled an investment pact.

stock smaller than expected[18].

Choice of Indicator on FDI Promotion: Are FDI Stock Figures Appropriate?

At any rate, when discussing FDI promotion using FTAs or EPAs, it is important to measure how much and in what direction the liberalization measures affect the invested entities (the firms or the foreign affiliates created by FDI). FDI stock figures appear to serve as good indicators in determining the sequence of the liberalization. Quite often in the case of the Japan-Mexico relation, business has called for the bilateral FTA to be based on the amount of FDI stock or the number of Japanese firms already in operation in the Mexican market. However, it should be pointed out that we should interpret or compare FDI stock figures with care because the impact of FDI may not be fully described by the monetary amount or the number of cases. FDI stocks merely measure the "population" of the entities that are affected by introducing a new liberalization policy such as a FTA or an EPA. What we need to have is an aggregate proxy variable that comes out swiftly and accurately correlates not only with FDI stock figures which represent the "population" but also with the actual activity level of the invested entities.

Investment Pacts, "Augmented" Part of EPAs, and Traditional FTAs

The activity of invested entities can be broadly divided into two aspects. One is the domestic aspect that covers the activities in the host countries, namely sales, procurement and employment in the host countries. The other is the international aspect that covers their international economic activities, namely exports and imports as international sales and procurement and notably with the investor's countries. FDI promotion through liberalization measures can work on both aspects.

However, each aspect has intrinsically suitable liberalization measures. For the domestic aspect, investment pacts or investment-related clauses in the "augmented" part of EPA will work better. On the other hand, for the international aspect which heavily involves international trade, traditional FTAs and the trade facilitation measures in the augmented part of EPAs will work better.

As is well known, the international aspect occupies a large proportion of the activity of the invested entities. Japan External Trade Organization (2002) showed that 55.1% of

[18] The expected level of inward FDI stock may be measured, for example, by constructing and estimating a model explaining the FDI stock or simply by comparing the performance of other investors with a similar development stage.

the Japanese manufacturing firms located in Asia sold more than half of their products abroad, and 46.0% of them sold more than 70% of their products abroad in 2001. The main destination was Japan. Japan External Trade Organization (2002) also showed that 37.7% of the Japanese manufacturing firms in 2001 procured more than half of their parts and materials from abroad, notably from Japan. A large proportion of the international activities in the invested entities will maintain that the trade liberalization covered by traditional FTAs and trade facilitation measures of EPAs exert a considerably intense stimulus to FDI.

As mentioned, investment pacts and investment-related clauses in EPAs will work better for the domestic aspect of the invested entities' activity. Since the host countries are eager to attract fresh investments from abroad, agreements in this area tend to conclude after a moderate period of negotiations. In recent years, Japan in fact has made extensive use of investment pacts as an "early harvest" of bilateral negotiations. Prior to the conclusion of the Japan-Korea FTA, both countries already signed the investment pact, which went into effect in January 2003. It took only three years to conclude the Japan-Korea investment pact. If bilateral trade liberalization is seen to take many years, splitting the whole negotiation process into two parts and finalizing the investment part first will greatly expedite the whole bilateral negotiation process and realize appropriate gains in a fairly early phase.

IIT indexes: an Appropriate Indicator of Sequencing

In implementing trade liberalization under FTAs and trade facilitation measures under EPAs, to what trade-related indicator should we refer in determining the partners? On a static view point, we had better first refer to the current status of bilateral trade flows. Maybe the total bilateral trade volume serves as a simple reference. According to the compilation of JETRO (Japan External Trade Organization), in 2003, 44.9% of Japan's total exports of 470 billion dollars were destined for East Asia, 27.2% to NAFTA, and 15.3% to EU (European Union). Indeed, East Asian neighbors are important trading partners and appear to be naturally chosen as FTA partners too.

However, the present trade volume does not tell anything about its future development. As for future economic growth, East Asia is anticipated to grow at a high pace (Ministry of Economy, Trade and Industry (2003)). In 2020, East Asia is forecast to grow to 15.9% of the world GDP, which is comparable to 18.5% for the United States,

and 19.4% for Western Europe.

Yet another factor to be examined is the bilateral IIT. Conventionally, IIT is broadly classified into two major categories: horizontal IIT and vertical IIT. Horizontal IIT is not based on countries' factor endowments and is said to accompany product differentiation without a quality gap, notably in the field of consumer goods, and among the advanced economies[19]. Vertical IIT is based on factor endowments, and it is said to take place associated with the international segmentation of production process or product differentiation with a quality gap. This type of IIT may take place among advanced countries as well as between advanced and less developed countries. Ishido et al. (2003) successfully showed that FDI (specifically, sales of foreign affiliates) of the Japanese electrical appliances industry in Asia determined the level of the vertical IIT. An important implication of Ishido's result to our study is that the IIT index is not only a purely trade-related figure, but it also has a correlation with the invested entities' activity level.

Whether the IIT is horizontal or vertical, deepening of the bilateral IIT with a country implies deepening of division of labor with that country in a disaggregated industrial level. Deepening of division of labor, or specialization, naturally brings about an economic gain to the countries involved in the bilateral IIT.

Also, the current depth of a bilateral IIT may serve as a signal about the future possibility of further division of labor between a country and its partner. In other words, IIT may presently be of a self-augmenting nature, and it may attract more bilateral trade and investment in the future.

This self-augmenting nature of bilateral IIT and the trade augmentation effect of IITs derived in Chapter I combine to lead us to conclude that if the current IIT is high enough, the overall bilateral trade volume will probably grow at a higher rate than in the case where inter-industry trade dominates. Under this situation, getting rid of trade-related barriers such as tariffs and cumbersome import/export procedures is imperative even on the developed countries' side in order to maximize the possible gain through division of labor. Naturally, if we confine ourselves mainly to FTA's benefit through trade aspect, considering the above arguments, the IIT index is a convincing indicator in sequencing the FTA partners.

[19] Okuda (2003) showed that throughout 1998-2002, horizontal IIT took place only marginally. Using the threshold approach as suggested by Fontagne and Freudenberg(1997), Okuda showed that the vertical IIT index in 2002 vis-à-vis 11 Asia Pacific countries amounted to merely 3.7%, whereas the corresponding vertical IIT index amounted to 34.1%.

Table 4. IIT Index of Japan: Data Compilation

Source Data	*Trade Statistics* (Ministry of Finance, Japan (2004))
Time Coverage	1988-2003
Country Coverage	All trading partners (228 countries and areas for 2003)
Date of Data Extraction	Feb 10, 2004
Original Classification	HS88 10 digits (1988-1995) HS96 10 digits (1996-2001) HS2002 10 digits (2002-2003)
Working Aggregation Level	HS 6 digits (Basic)
Adopted Presentation Method	・ IIT Index (without distinguishing horizontal or vertical) (1) Grubel-Lloyd Method (GL) $GL_j = \Sigma_h S_h * GL_{jh,}$ Where $GL_{jh} = 1- \|X_{jh}-M_{jh}\| / (X_{jh}+M_{jh})$, $S_h = (X_{jh}+M_{jh})/ \Sigma_h (X_{jh}+M_{jh})$, X_{jh}: exports of commodity h to country j. and M_{jh}: imports of commodity h to country j. (2)Threshold Approach (CEPII*) $CEPII_j = \Sigma_h S_h * CEPII_{jh,}$ Where $CEPII_{jh} = X_{jh}-M_{jh}$, if $Min(X_{jh},M_{jh}) / MAX (X_{jh},M_{jh})>0.1$. $CEPII_{jh} = 0$, otherwise. *CEPII index is similar to Greenaway's index but introduces the threshold TOL (trade overlapping) criteria of 10% to avoid wholly counting the trade flows with very low overlapping into IIT. The name "CEPII" comes from the affiliation of Fontagne et al. who advocated the use of the threshold. ・ Horizontal or Vertical IIT Index (3) Horizontal IIT Index $HIIT_j = \Sigma_h S_h * HIIT_{jh,}$ (4) Vertical IIT Index $VIIT_j = \Sigma_h S_h * VIIT_{jh,}$ Where $HIIT_{jh}=CEPII_{jh}$ and $VIIT_{jh}=0$, if $UV_{jh}<1.25$**, $HIIT_{jh}=0$ and $VIIT_{jh}=CEPII_{jh}$, otherwise, HIIT+VIIT=CEPII, $UV_{jh}=\exp\{\|\log(X_{jh}/QX_{jh})/(M_{jh}/QM_{jh})\|\}$, QX_{jh}: export quantity of commodity h to country j, and QM_{jh}: import quantity of commodity h to country j. ** This price threshold is modified from 1.15 of Fontagne et.al. (1997), considering that Japan is an island state which cannot make use of direct surface transport with adjacent countries like EU members.
CIF/FOB factor	1.09 (assumed from the constant value until 1995, published in IMF's *Direction of Trade Statistics Yearbook*.)
Method of Industry Aggregation	Basic classification (HS 6digit)→ SITC 5digit (Rev.3) (Using HS-SITC correspondence tables, UN (2003a, 2003b, 2003c))

II-3. Intra-Industry Index of Japan: Overall and Horizontal/Vertical IIT Indexes

In what follows, we will take an overview of Japan's bilateral intra-industry trade since the late 1980s. Table 4 summarizes the data compilation process of the IIT index calculation. Charts 1-1 through 1-4 depict Japan's IIT indexes for the years 1988-2003 for all items. The Charts cover Japan's top 50 individual trading partners and 12 major groups including the world total[20].

Overall IIT Indexes (CEPII, GL)

Chart 1-1 clearly shows that Japan's IIT indexes with major trading partners in Asia have risen remarkably over the past 15 years. In terms of the CEPII index, a threshold approach index which is more sensitive to bilateral export/import overlapping, the evolution of the IIT indexes with Korea and Taiwan started with relatively high figures of around 0.3 in 1988, and they went on to attain impressively high figures of around 0.5-0.6 in 2003. These two countries may be regarded as Asia's "front runners" of international division of labor. The second group in Asia includes the Philippines, Singapore, Thailand, Malaysia and China. Japan's division of labor with these countries started from a primitive stage with the CEPII indexes at the 0-0.15 level. Over the past 15 years, economic interactions with these countries advanced greatly, which is probably due greatly to Japan's intensive direct investment[21]. Japan has now attained a high level of division of labor with these countries, and the IIT indexes now reach the 0.4-0.5 levels. The level attained for Asia's second group is now almost comparable with that of Korea and Taiwan[22]. The IIT indexes with Vietnam, Indonesia and India still remain in a low bracket, but we can notice a high rise in the indexes. Especially, the

[20] Appendix B summarizes Japan's IIT indexes in the road vehicles and electrical machinery industries. More detailed IIT indexes are available upon request. Please contact the author.

[21] Ishido et al. (2003) showed that in the case of Japan's electrical appliances industry, the vertical IIT is determined by, among others, distance and activity level of Japanese firms (measured by their sales in the host countries).

[22] In this study, the IIT indexes with Hong Kong remained stagnant. This is due to the property of the Grubel-Lloyd and CEPII indexes that tend to underestimate the trade overlapping in the presence of trade imbalances. The imbalance in Hong Kong trade is as large as about 1:20. In the case of exports, possibly, a large portion of Japan's exports to China via Hong Kong is registered simply as those destined to Hong Kong. On the other hand, in the case of imports, the rule of origin applies, and Japan's imports from China via Hong Kong are not registered as those from Hong Kong unless a certain level of additional value is put on the merchandise. The Aquino Index of intra-industry trade will somewhat mitigate the shortcomings. The 1988-2002 Aquino indexes with Hong Kong is drawn in Okuda (2003), which are comparable with those of Asia's second group countries.

shape of the graph for Vietnam resembles that of China in an early stage.

Detailed analysis by industry revealed that chemicals (SITC 5), manufactured goods chiefly classified by material (SITC 6), general industrial machinery (SITC 74), office machines, etc. (SITC 75), telecommunications apparatus (SITC 76), electrical machinery (SITC 77), furniture, stuffed furnishings (SITC 82) and miscellaneous manufactured articles (SITC 89) showed high IIT indexes for Korea. The IIT with Korea may be characterized by its wide extent of commodities and depth. For China, the IIT in machinery and transport equipment (SITC 7) has already achieved a level comparable with the region's relatively advanced economies of Korea, Taiwan as well as the Philippines. Specifically, the IIT with China has advanced in the fields of general industrial machinery and equipment (SITC 74), office machines, etc. (SITC 75), telecommunications apparatus (SITC 76), electrical machinery (SITC 77), other transport equipment (SITC 79), scientific instruments (SITC 87), optical goods and watches (SITC 88).

Other impressive items include machineries for industries (SITC 72, Vietnam, Malaysia, and Israel), metal working machinery (SITC 73, Singapore), general industrial machinery (SITC 74, Vietnam and Thailand), office machines, etc. (SITC 75, all major East Asian economies including Indonesia), telecommunications apparatus (SITC 76, Taiwan, Vietnam, Thailand, Singapore, Malaysia, Philippines and Israel), electrical machinery (SITC 77, Taiwan, Thailand, Singapore, Malaysia, Philippines, Indonesia, and Israel), road vehicles (SITC 78, Thailand and Indonesia), furniture and stuffed furnishings （SITC 82, Hong Kong, Singapore, Pakistan and Israel）, travel goods (SITC 83, Taiwan, Hong Kong and Malaysia), apparel and clothing (SITC 84, Taiwan, Hong Kong and Singapore), footwear （SITC 85, Taiwan, Hong Kong and Singapore）, scientific apparatus (SITC 87, Taiwan, Vietnam, Thailand, Singapore, Malaysia, Philippines, Indonesia, Pakistan and Israel), and optical goods and watches (SITC 88, Vietnam, Malaysia, Philippines and Indonesia).

Chart 1-2 depicts Japan's IIT with European countries. Although the gap in income level is not very wide between Japan and Europe in comparison with Asia, Japan's IIT did not really advance in the past 15 years, except for United Kingdom and Germany. With the two countries, Japan attained an IIT index of 0.5, which is comparable with those attained with major Asian partners. However, for the other European countries, IIT was not deepened. In many countries, the indexes showed stagnant or even

downward trends over time. With this regard, the distance between Japan and Europe seems to impede extensive economic interaction. Also, differences in consumer tastes may be contributing to the low profiles of intra-industry trade with Europe. In IIT with Germany, machinery for industry (SITC 72), metal working machinery (SITC 73), general industrial machinery (SITC 74), road vehicles (SITC 78), other transport equipment (SITC 79), scientific instruments (SITC 87), optical goods and watches (SITC 88) and miscellaneous goods (SITC 89) had relative strength above other items.

Chart 1-3 depicts Japan's IIT with Americas, Africa, Oceania and other areas. Firstly, the overwhelming depth and extent of IIT with the United States draw attention. Also, the IIT with Mexico, as a member of NAFTA, grew rapidly after the late 1990s. In fact, this surge in IIT with Mexico substantiates Japan's eagerness for the bilateral FTA with Mexico. Though not as striking as the United States or Mexico, the IIT with South Africa which is mainly driven by the exchange of automobiles also draws attention.[23]

Japan's IIT index with the United States was higher in chemicals (SITC 5), manufactured goods classified chiefly by materials (SITC 6), machinery for industry (SITC 72), general industrial machinery (SITC 74), office machines, etc. (SITC 75), electrical machinery (SITC 77), other transport equipment (SITC 79), furniture and stuffed furnishings (SITC 82), scientific instruments (SITC 87) and optical goods and watches (SITC 88). The aggregate IIT index with the United States once soared around 1996, and then it stagnated thereafter. This is mainly driven by the sharp rise and decline of IIT in the area of road vehicles. As for Mexico, general industrial machinery (SITC 74), office machines, etc. (SITC 75), electrical machinery (SITC 77), road vehicles (SITC 78), furniture and stuffed furnishings (SITC 82), and scientific instruments (SITC 87) had relative strength in the bilateral IIT.

Chart 1-4 enables us to compare Japan's IIT across the regions of the world. The IIT with the world increased in earlier stages depicted on the chart, but it stagnated thereafter. Until the mid 1990s, the surge in IIT synchronized globally, but after that the downward trend of IIT with NAFTA which is caused by the fluctuation that took place in the road vehicle industry of the United States cancelled out the steady advance of IIT with Asia. In the trade with South America, Africa and Oceania, whose trade relations with Japan are highly vertical, IIT played only a limited role.

[23] The deeply fluctuated IIT indexes were calculated for Liberia. This is due to the discrete characteristics of ship sales and the peculiar structure of Japan-Liberia trade that ships occupy an overwhelming portion.

Chart 1-1. IIT Indexes of Japan 1988-2003

(Asia, All Items)

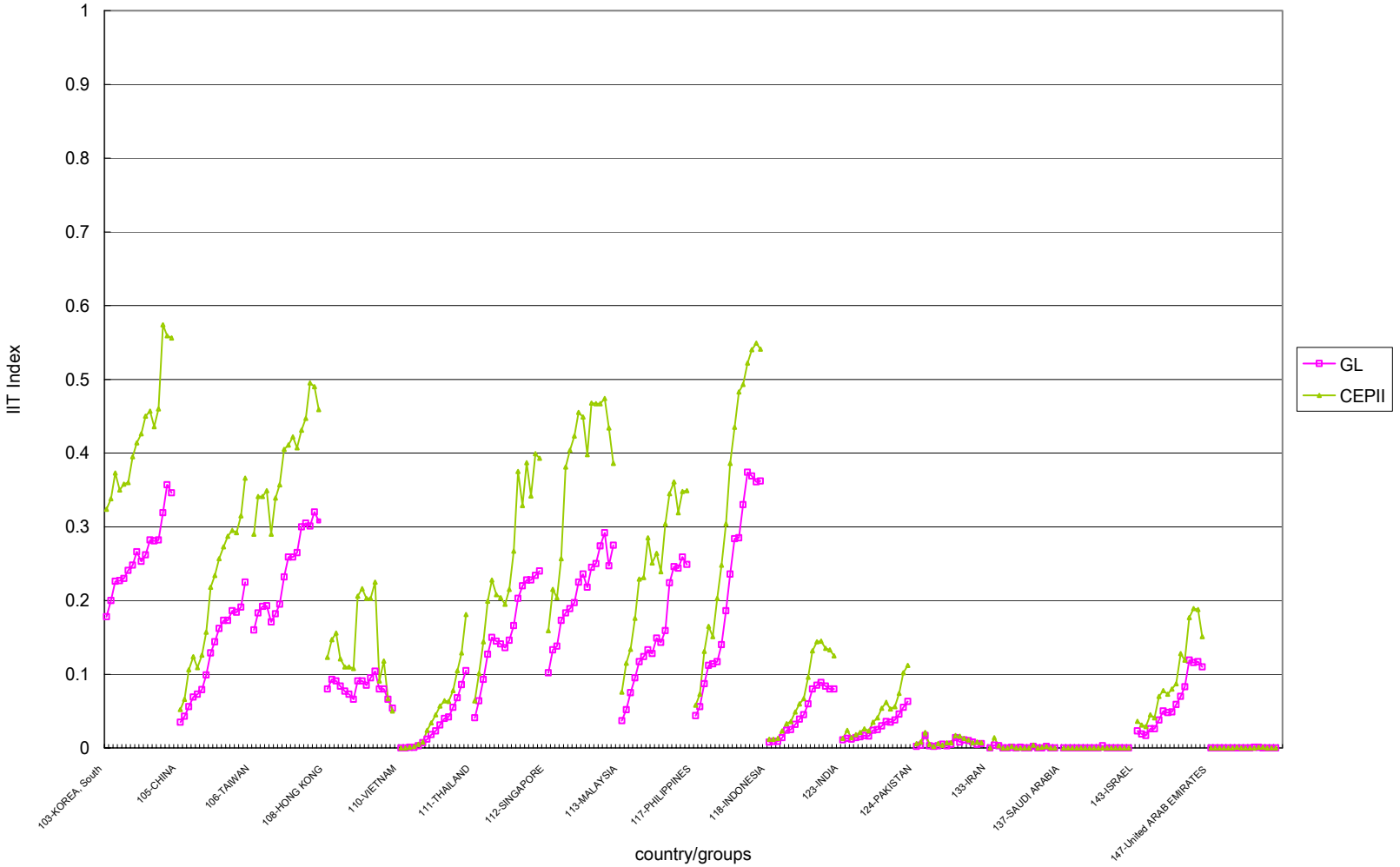


Chart 1-2. IIT Indexes of Japan 1988-2003

(Europe, All Items)

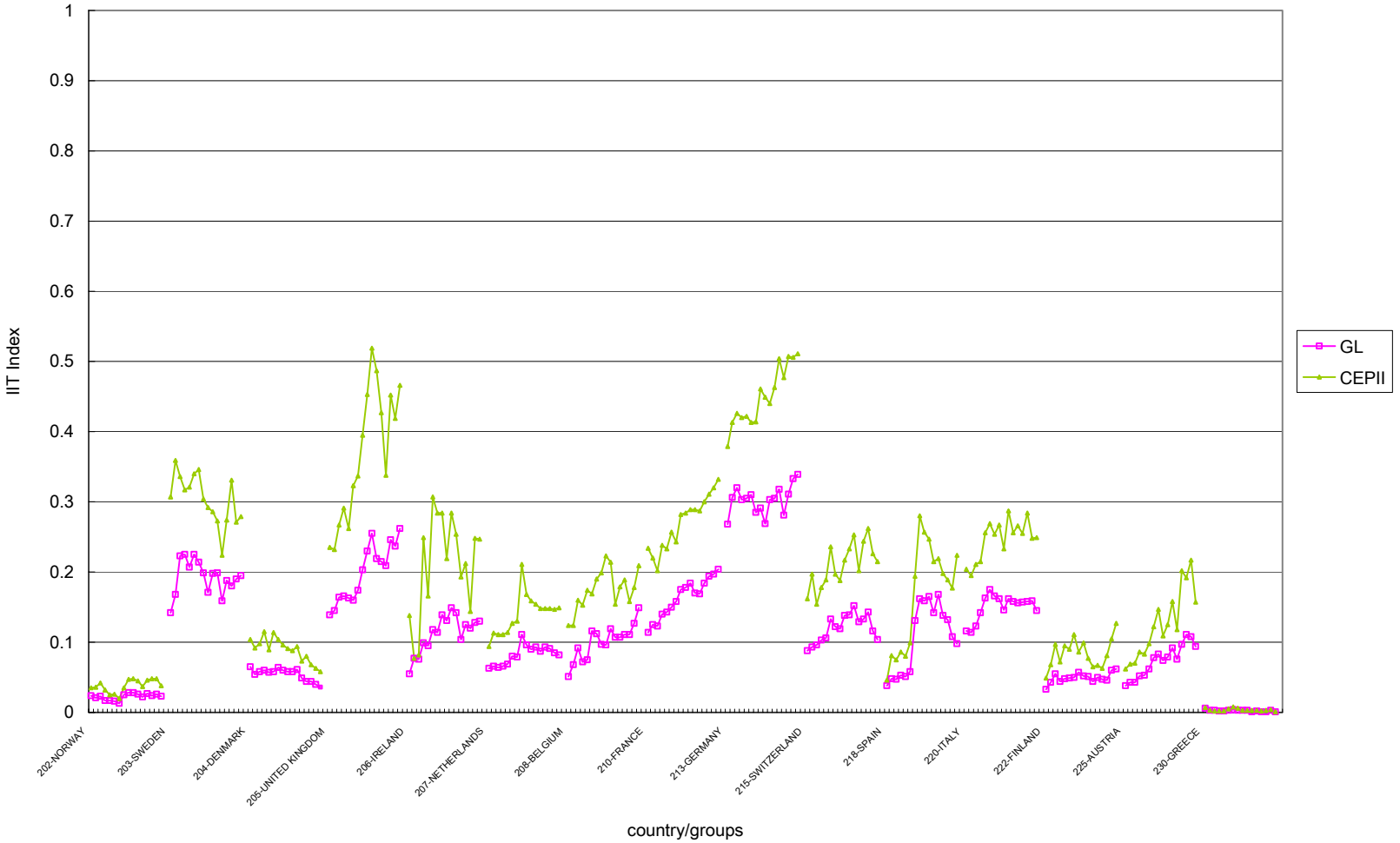


Chart 1-3. IIT Indexes of Japan 1988-2003

(Americas and Others, All Items)

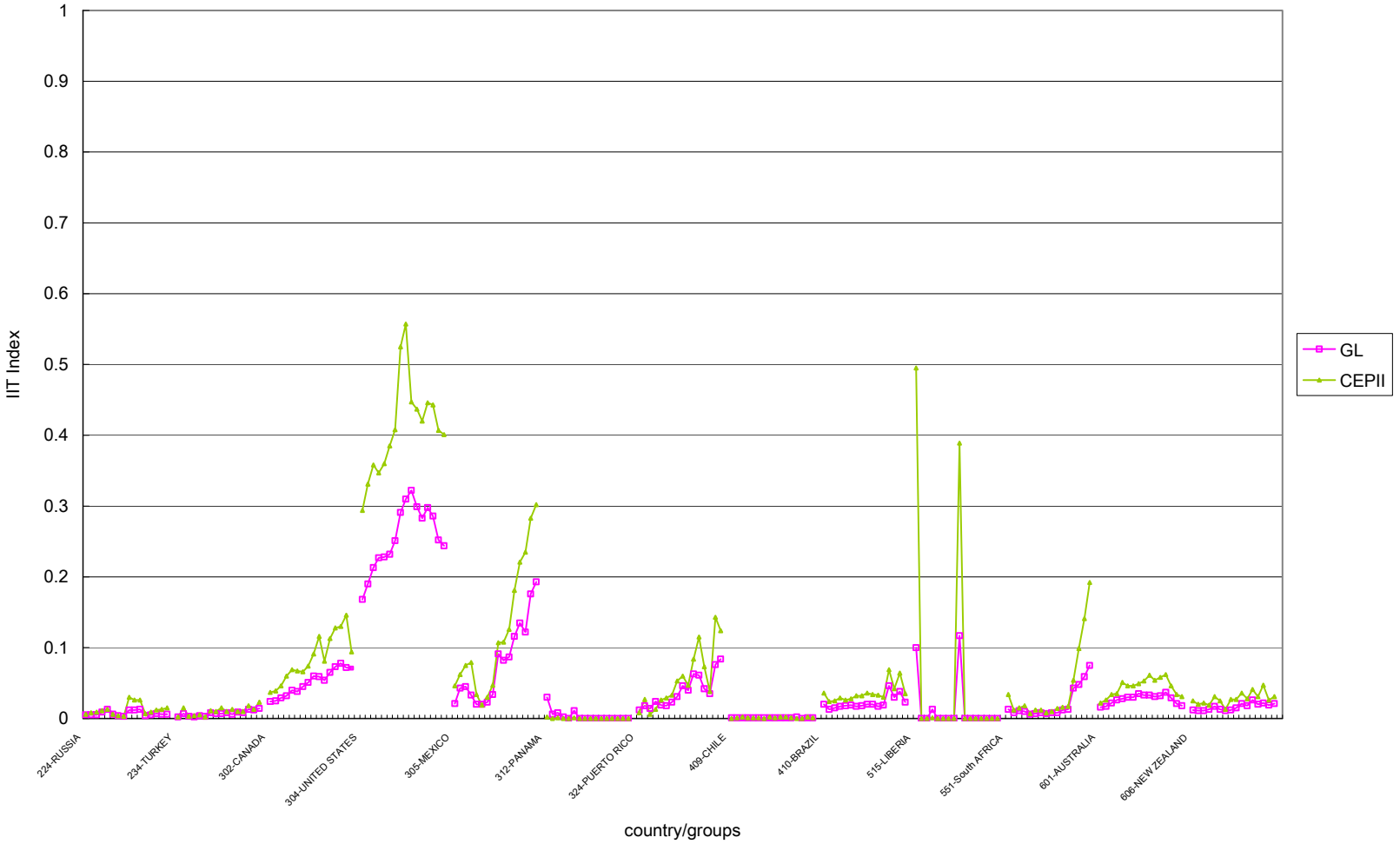


Chart 1-4. IIT Indexes of Japan 1988-2003

(Major Groups, All Items)

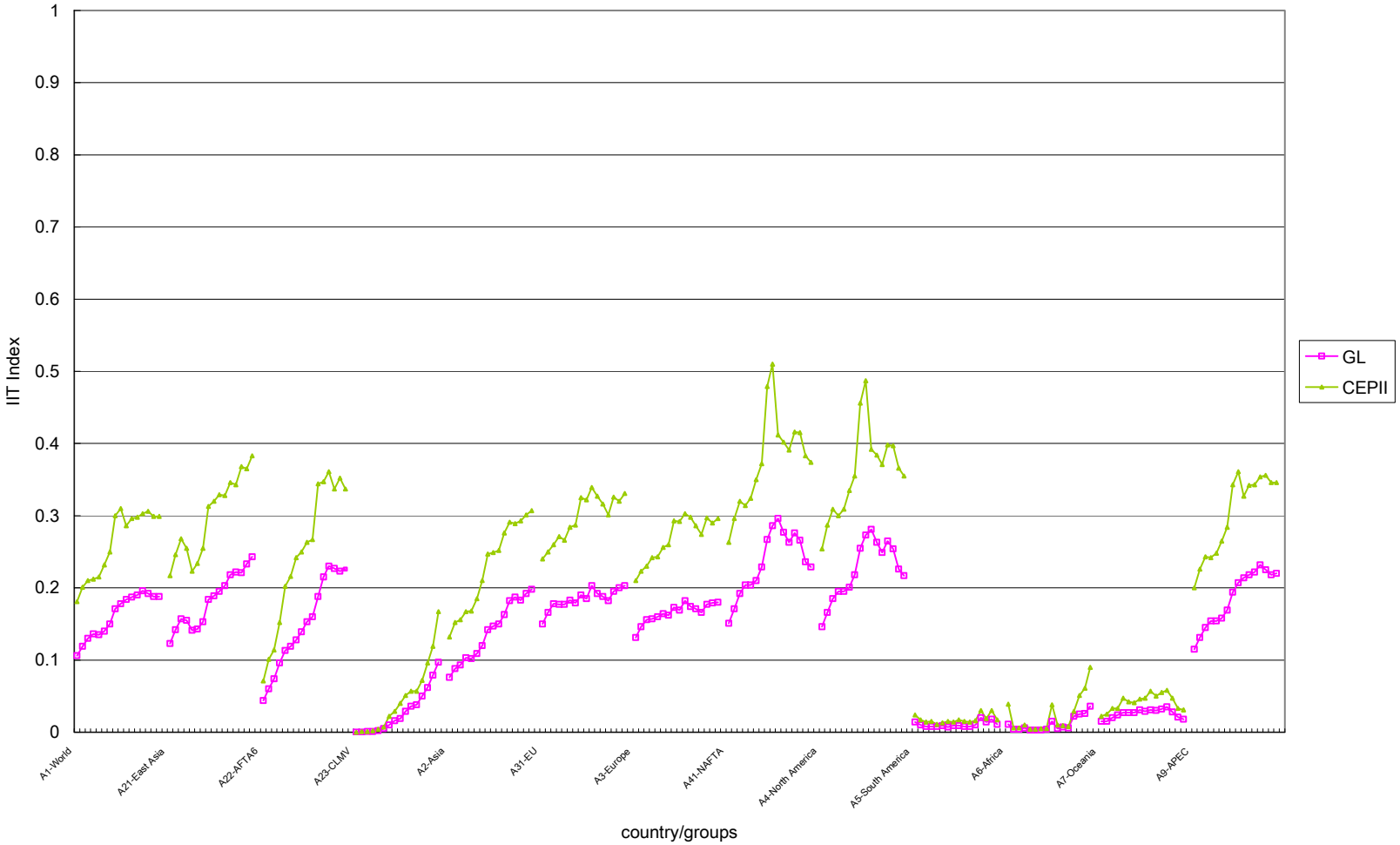


Chart 2-1. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Asia, All Items)

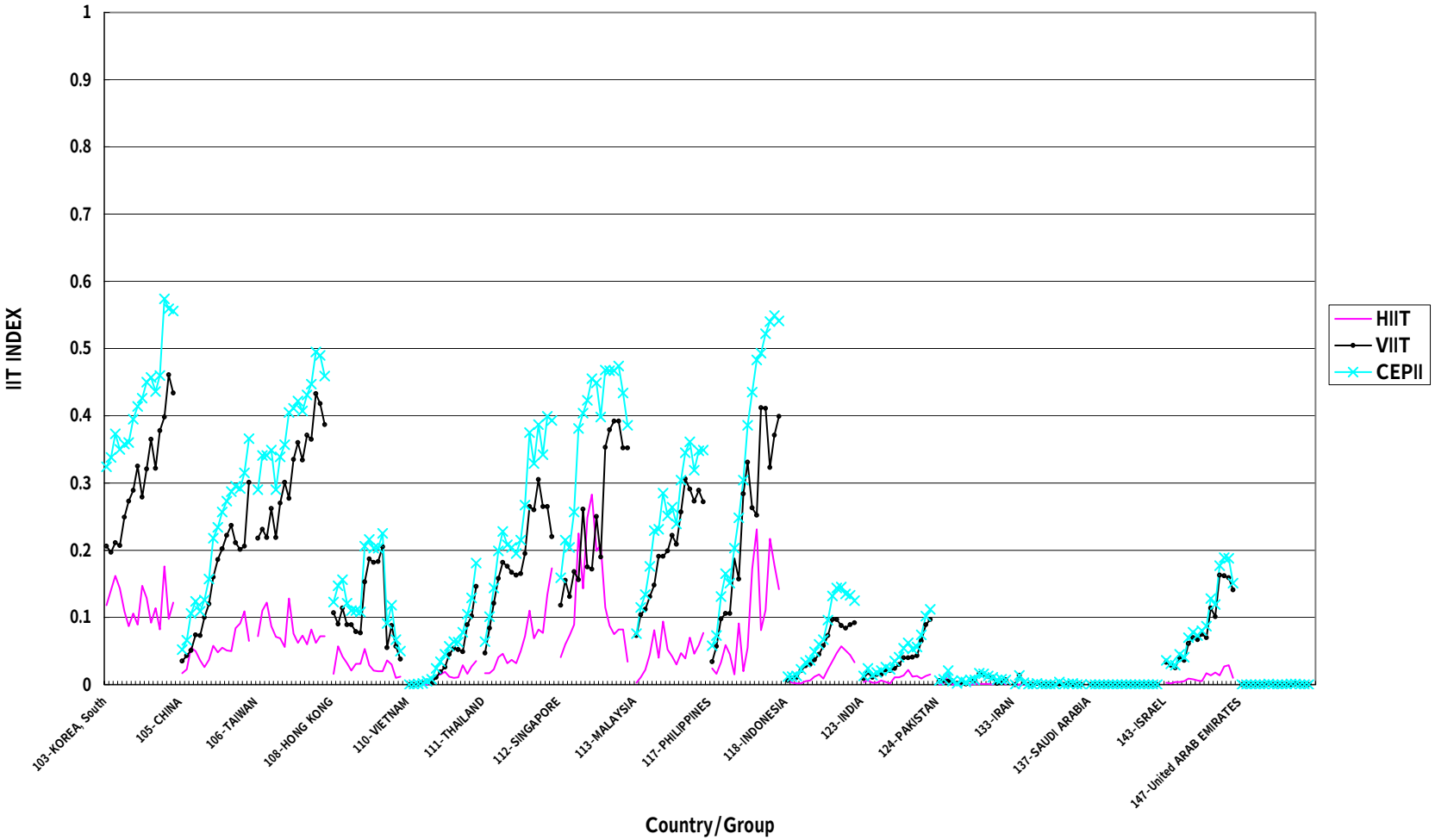


Chart 2-2. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Europe, All Items)

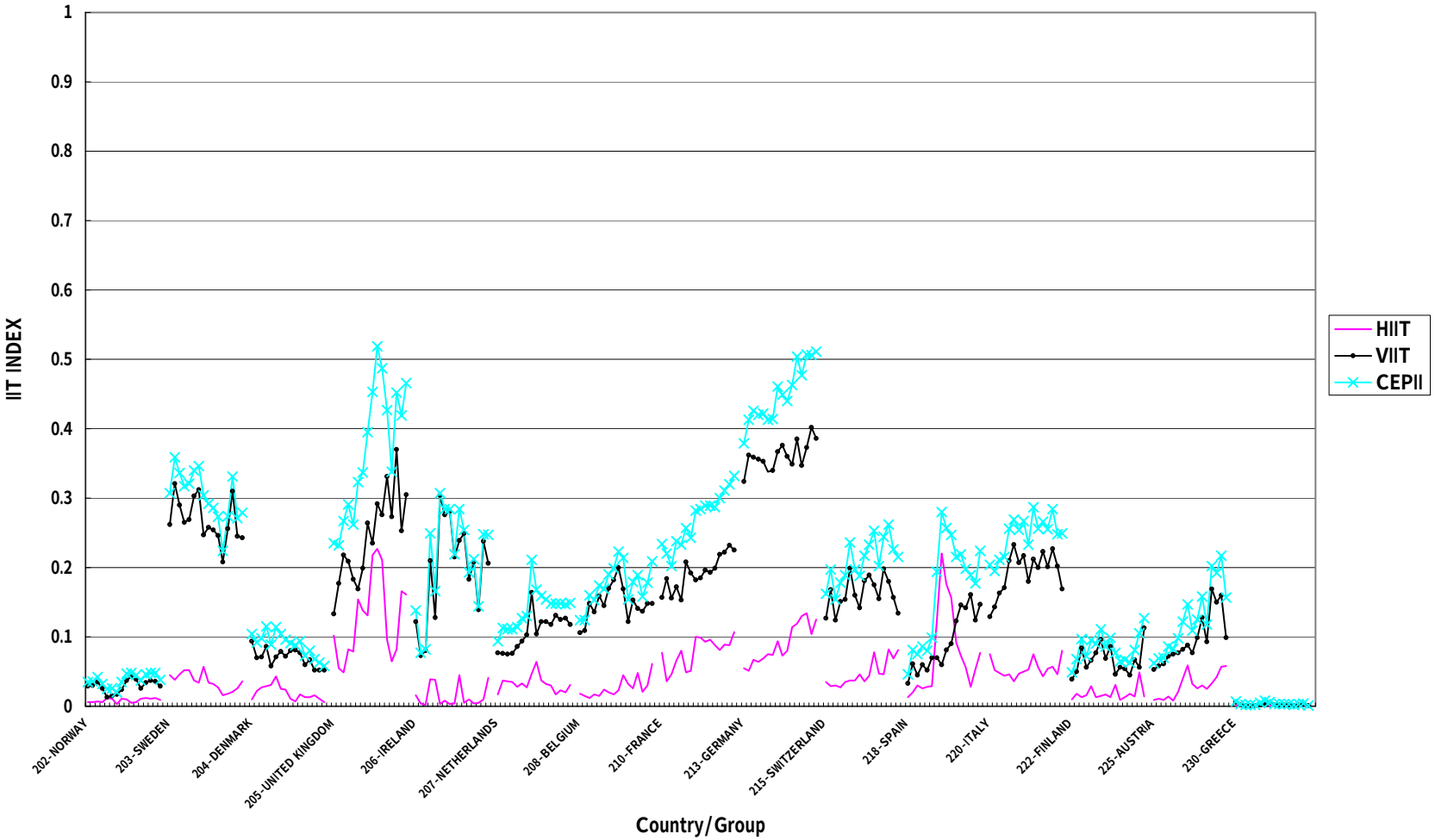


Chart 2-3. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Americas, others, All Items)

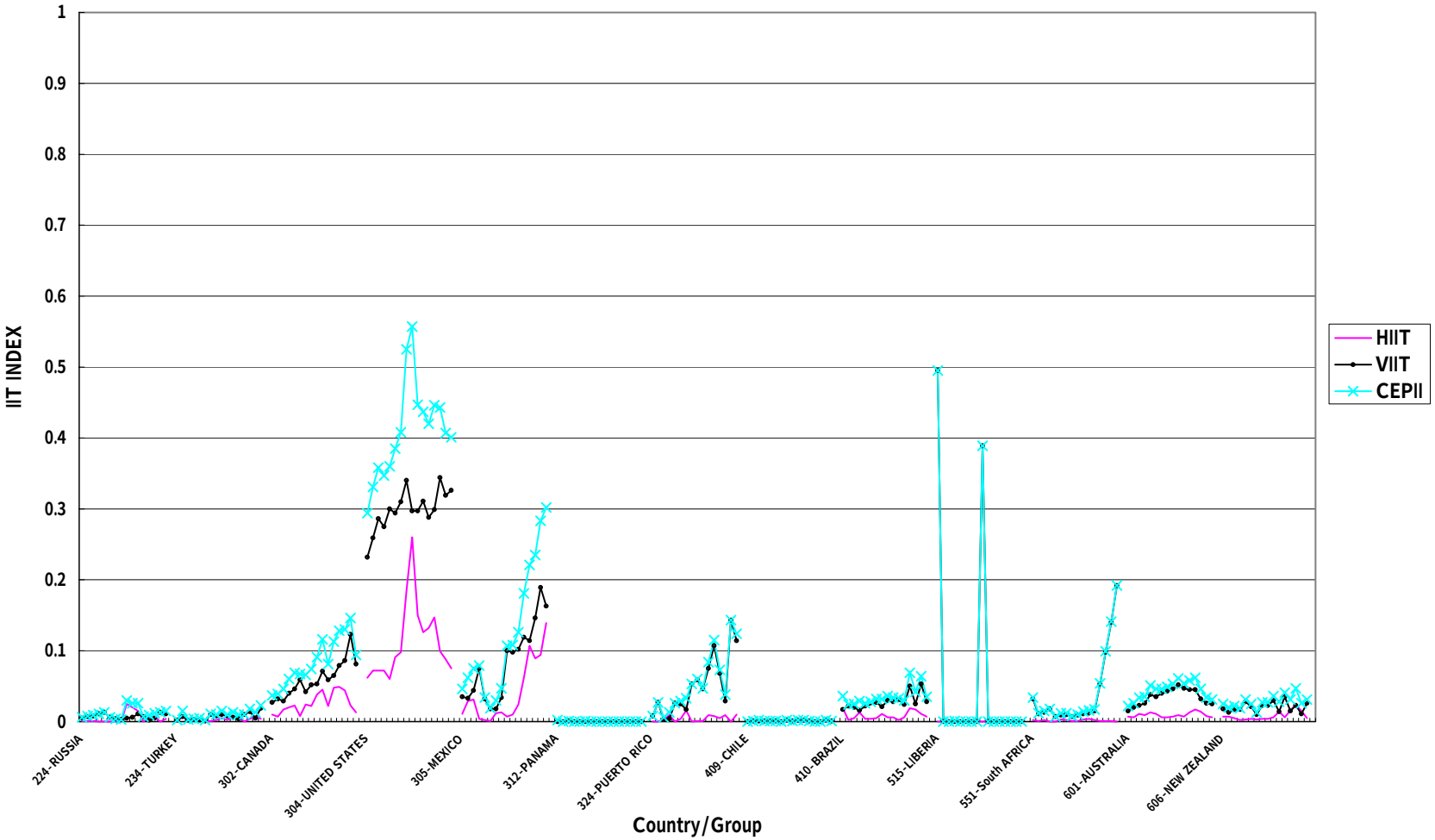
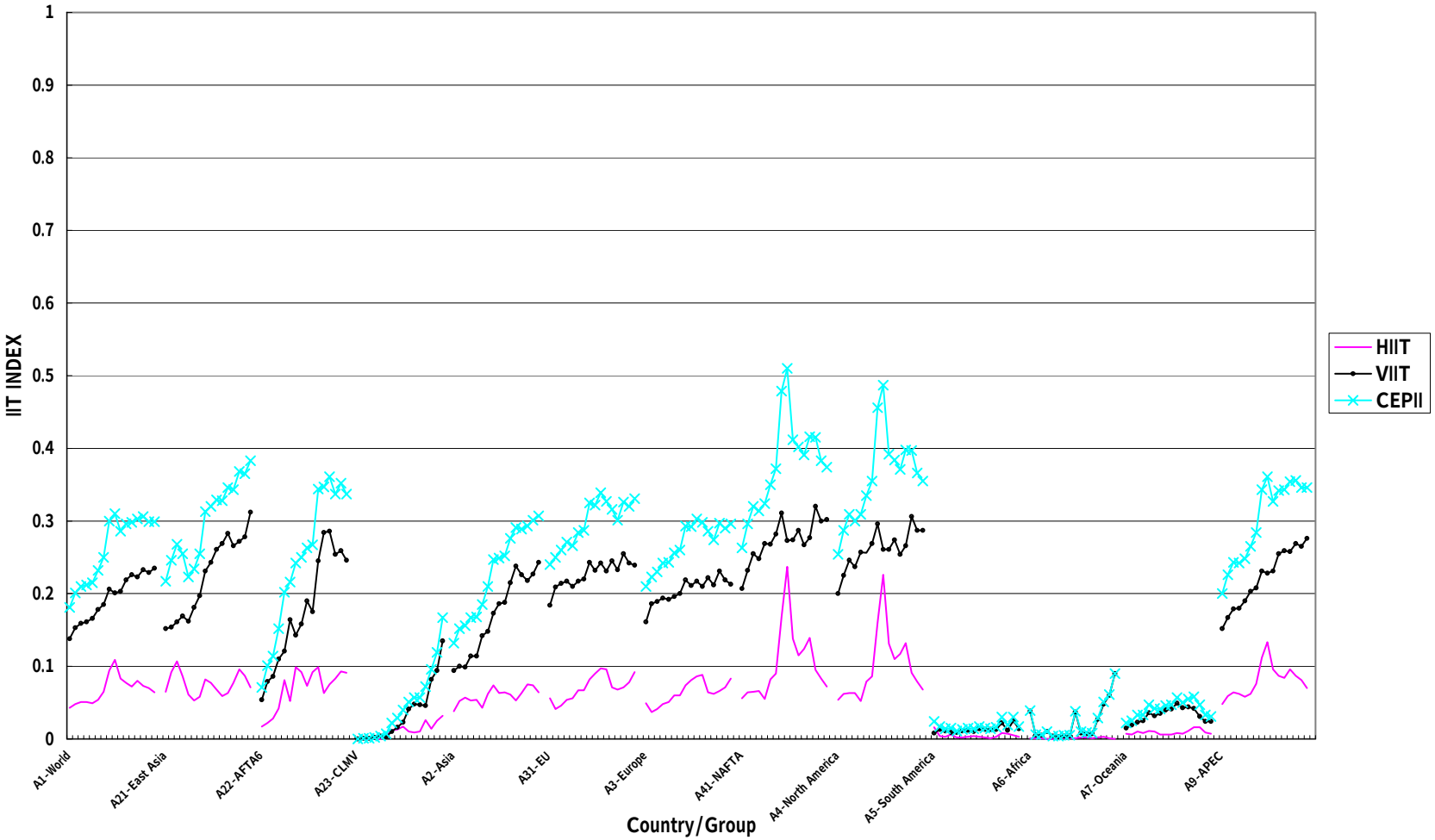


Chart 2-4. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Major groups, All Items)



Charts 2-1 through 2-4 illustrate Japan's CEPII-type horizontal IIT indexes and vertical IIT indexes with its major trading partners as well as major regions in the world. Unlike the case of the EU where development of IIT has been propelled by expansion of the horizontal IIT, major development in horizontal IIT did not take place for Japan at the aggregate level. The world average of Japan's horizontal IIT indexes generally recorded below 10% for the past 15 years. As Chart 2-4 illustrates, in the case of Japan, the growth in the IIT indexes were chiefly led by the vertical IIT, which is considered to take place based on the difference in factor endowments.

Nevertheless, at the disaggregated level, we can find several interesting changes in horizontal IIT indexes. Horizontal IIT indexes of road vehicles (SITC 78) soared in the Philippines, United Kingdom, France, Spain, Mexico and the United States. For the case of the developed counterparts, notably world famous car makers of France and the United States, the surge may be caused by the exchange of finished cars, just as the theory assumes. For the case of the developing counterparts like the Philippines the horizontal IIT may involve processing on commission by, say, firms in export processing zones. In the case of the horizontal IIT indexes of electrical machinery (SITC 77), although the indexes showed wide ranges of fluctuation, a trend toward growth was seen for the Asian countries such as China, Thailand and the Philippines. A large extent of change also occurred in horizontal IIT with the United States. The horizontal IIT index of electrical machinery surged in the mid 1990s, and it fell quickly thereafter. The overall level of IIT (CEPII index) showed no major change. The category of electrical machinery includes semiconductors, which very often suffer from price fluctuations. This price fluctuation probably affected the level of the horizontal IIT and the fluctuation of the indexes.

III. Interdependence in Northeast Asia and FTA in the Region

III-1. Large Presence of East Asia

Northeast Asia, which consists of Japan, Korea and China, is the third largest regional group in the world in terms of GDP size and trade volume, and it is the largest in terms of population. These three countries have not yet formed an official economic integration body or agreement, but the impact of the integration in the region would be

enormous (See Table 5).

The intra-regional trade in Northeast Asia has not been very active compared with the EU and NAFTA. In 2002, the share of intra-regional trade in Northeast Asia was 19.0% of total trade, which contrasts with 61.0% and 56.0% for the EU and NAFTA, respectively. The small weight of intra-regional trade is common to other small regional groups like AFTA (See Table 5).

Table 5. Main Economic Indicators of Regional Groups, 2002

Groups	Number of Members	Intra-regional Trade ($billion)	Total Trade ($billion)	Share of intra-regional Trade (%)	World Share (trade,%)	GDP ($billion)	World Share (GDP,%)	Population (Million Persons)	World Share (Population,%)
AFTA	10	92	411	22.4	6.5	1,064	3.3	535	8.6
ANDEAN	5	5	53	9.6	0.8	265	0.8	117	1.9
CEFTA	7	18	147	12.1	2.3	428	1.3	97	1.6
EU	15	1,474	2,419	61.0	38.1	8,563	26.5	379	6.1
MERCOSUR	4	17	95	17.5	1.5	572	1.8	223	3.6
NAFTA	3	613	1,095	56.0	17.2	11,770	36.5	424	6.8
Northeast Asia	*3*	*171*	*904*	*19.0*	*14.2*	*5,693*	*17.7*	*1,470*	*23.7*
WORLD		2,390	6,356	37.6	100.0	32,253	100.0	6,201	100.0

Remarks: Trade data are export figures. For GDP, current figures in national currencies were converted into current dollar figures using the average exchange rate.

Data Sources: [Trade] International Monetary Fund(2003a); [GDP and population] International Monetary Fund(2003b)

However, Northeast Asia is different from other regional groups because of its further commitment to intra-regional trade. Among major regional groups, only NAFTA and Northeast Asia increased the share of intra-regional trade from 1996 to 2002 (Table 6).

In NAFTA, deepening interdependence was achieved mainly because of the economic growth during the period (+35.5% nominal dollar terms); notably, the United States enjoyed the IT boom. On the other hand, in Northeast Asia, economic growth did not deepen the interdependence in the region. The total economic size of Northeast Asia as a whole shrank for the period 1996-2002 mainly due to Japan's long lasting recession and the depreciation of the yen. However, China's increasing commitment to external trade during the period more than offset the negative factors derived from Japan. As a result, Northeast Asia deepened its regional interdependence as well as enlarged its presence in world trade. Our regression of the gravity equation in

Chapter I demonstrated that China's commitment to external trade, as expressed by the coefficient to the China dummy, incessantly rose during the sample period.

Table 6. Deepening Interdependence in Regional Groups

Groups	Number of Members	Intra-regional Trade ($billion)		Total Trade ($billion)		Share of Intra-regional Trade (%)		World Share (trade,%)	
		1996	2002	1996	2002	1996	2002	1996	2002
AFTA	10	84	92	342	411	24.5	22.4	6.5	6.5
ANDEAN	5	5	5	49	53	9.7	9.6	0.9	0.8
CEFTA	7	13	18	89	147	14.4	12.1	1.7	2.3
EU	15	1,349	1,474	2,075	2,419	65.0	61.0	39.1	38.1
MERCOSUR	4	17	17	75	95	22.6	17.5	1.4	1.5
NAFTA	3	438	613	919	1,095	47.6	56.0	17.3	17.2
Northeast Asia	*3*	*117*	*171*	*700*	*904*	*16.7*	*19.0*	*13.2*	*14.2*
WORLD		2,022	2,390	5,301	6,356	38.1	37.6	100.0	100.0

Remarks and Data Sources: See Table 5.

III-2. FTA Policies of Japan, Korea and China and Preparatory Contacts toward Northeast Asian Economic Integration

Today, enthusiasm for bilateral or regional FTAs surrounds the world. Northeast Asia is no exception to that trend. Traditionally, the northeast Asian countries of Japan, Korea and China were quite reluctant to adopt free trade agreements or other economic integration measures. They thought these measures to be discriminative or departures from multilateral frameworks. However, as the inefficiency of the WTO became distinct and as other countries became inclined to develop bilateral or regional FTAs, the three countries began to transform their external economic policies into "multi-layered" policies. One layer adheres to multilateral liberalization frameworks, and the other pursues flexibility and promptness by adopting bilateral or regional FTAs.

In the Northeast Asian region, Japan and Korea made the first step of economic integration. The leaders of the two countries first mentioned the Japan-Korea FTA in the joint summit declaration released in October 1998(See Table 7). Since then the three governments of the region continue to fund extensive efforts toward forming FTAs. For Japan, the Japan-Singapore Economic Partnership Agreement (JSEPA) was signed in January 2001 and came into effect at the end of November 2003. This agreement is the

first established FTA in the region. Finalized in October 2002, the second established FTA is the Korea-Chile FTA, and the Korean Diet eventually approved it in the middle of February 2004. On the other hand, China signed the China-Hong Kong Closer Economic Partnership Agreement (CEPA) in June 2003 and the Agreement went into effect in January 2004. Japan also finalized official negotiations for the Japan-Mexico FTA in the middle of February 2004.

At this current moment, the scope of the FTA policies of the three countries of Northeast Asia has greatly expanded. The following area established FTAs or preparations toward establishing FTAs in Northeast Asia:

Japan: Singapore (EPA in effect, 11/30/2003), Mexico (official negotiations completed, 3/15/2004), Korea (official negotiation, 12/22/2003～) , Malaysia (official negotiation, 1/13/2004～), the Philippines (official negotiation, 2/4/2004～), Thailand (official negotiation, 2/16/2004 ～), Indonesia (preparatory government-level consultation, 09/2003～), Australia (Japan-Australia Trade and Economic Framework, agreed upon launch of joint consultation committee to deal with future bilateral FTA, 7/16/2003) and Brazil (agreed upon private research, 3/2003), Japan-ASEAN (Japan-ASEAN leaders' declaration, agreed upon establishing FTA in 10 years, 11/2002), Japan-Korea-China (Chinese Premier Zhu Rongji's proposition, 11/2002), plus Taiwan, Canada, New Zealand, South Africa, EFTA and Israel are interested in forming FTAs with Japan.

Korea: Chile (approval by Diet, 2/16/2004), Japan (official negotiation, 12/22/2003 ～), Singapore (official negotiation, 1/27/2004～), Mexico (preparatory research discontinued, 11/16/2003), China (China proposed a joint research, 11/2002), Japan-Korea-China (Chinese Premier Zhu Rongji's proposition, 11/2002), New Zealand (joint research finished, 08/2001), Thailand (joint research finished, 3/2001).

China: Hong Kong (CEPA in effect, 1/1/2003), Macau (signed CEPA, 10/2003), ASEAN (agreed upon comprehensive economic cooperation framework, 11/2002), Japan-Korea-China (Chinese Premier Zhu Rongji's proposition, 11/2002), Korea (China proposed a joint research, 11/2002), Thailand ("early harvest" abolition of tariffs on agricultural products in effect, 10/1/2003), Australia (agreed upon economic cooperation framework, 10/2003), Singapore (agreed upon start of bilateral FTA after China-ASEAN FTA is formed), India (agreed upon launch of joint study, 06/2003), plus

New Zealand and South Africa are under domestic review whether or not to start joint researches.

Except for the Japan-Korea FTA, the Northeast Asian countries have not been very aggressive in forming intra-regional FTAs, either region-wide or bilateral; although, as mentioned, Northeast Asia is the third largest regional group in the world in terms of economic size. Table 7 shows preparatory contacts made so far by the three countries toward forming intra-regional FTAs.

Table 7: Chronology of Northeast Asian Economic Integration

Countries	Date	Contacts
JK	October 1998	The Japan-Korea joint summit declaration mentioned "Strengthening the economic cooperation."
JK	December1998	Academic joint research (IDE-JETRO and KIEP) started.
JK	May 2000	IDE and KIEP released the final report of academic joint research. The report foresaw long-term gains to both countries.
JK	September 2000	Both countries agreed to launch the Japan-Korea Business Forum （co-chaired by Jiro Ushio, Representative, Ushio Group, and Yong-sung Park, Chairman, Korea Chamber of Commerce and Industry）.
JK	January 2002	The Japan-Korea Business Forum released the final joint declaration. The declaration recommended an early formation of a comprehensive Japan-Korea FTA.
JK	March 2002	Both leaders agreed to launch "tripartite" joint research represented by business, government and academia.
JK	January 2003	The Japan-Korea Investment Pact went into effect.
JK	October 2003	The tripartite joint research group released its final report. The report again recommended an early formation of a comprehensive Japan-Korea FTA.
JK	October 2003	Both leaders agreed (1) to start official negotiation within 2003, and (2) to practically finish the negotiation within 2005.
JK	December 2003	1st official FTA negotiation was held.
JK	February 2004	2nd official FTA negotiation was held.
JK	February 2004	The Japan-Korea Social Security Agreement was signed.
JKC	November 1999	Three leaders agreed to launch an academic joint research on strengthening economic cooperation among Japan, Korea and China. (NIRA, DRC, KIEP)
JKC	October 2002	Chinese Premier Zhu Rongji proposed a feasible study on Japan-Korea-China FTA.
JKC	October 2003	Final report on strengthening economic cooperation among Japan, Korea and China was released.
JKC	March 2004	Unofficial meeting on exploring a Japan-Korea-China investment pact.
KC	October 2002	China unofficially proposed joint research on a Korea-China FTA.

Remarks: JK refers to Japan and Korea; JKC to Japan, Korea and China; and KC to Korea and China
Sources:
JK: Homepage of Ministry of Foreign Affairs, Japan (http://www.mofa.go.jp/mofaj/gaiko/fta/j_korea/genjo.html)
JKC: Homepage of MOFA, Japan (http://www.mofa.go.jp/region/asia-paci/asean/pmv0211/trilateral.html, http://www.mofa.go.jp/mofaj/gaiko/investment/jck_kaigo_01.html), NIRA Home page (http://www.nira.go.jp/newse/paper/joint3/esummary.html)
KC: Bank of Korea (2003)

Looking at Table 7, one can easily notice that high-level contacts, such as official negotiations, are all confined between Japan and Korea. Also, there has been no direct dialogue, even unofficial, between Japan and China. For the Japan-Korea FTA, both countries have indeed achieved high-level negotiation, but we should note that more than five years have passed since the first contact took place. This is due partly to resistance on the Korean side[24]. In the bilateral FTA between China and Japan, the Japanese government officially expresses that it will wait and see how China fulfills its WTO accession commitments. However, for Japan and Korea, their common sensitive industry, agriculture, is acting as the stumbling block. However, the views of the private sectors seem to be somewhat different from those of the governments. In Japan, many people hope to have a bilateral FTA with China. A recent poll held by the Ministry of Foreign Affairs of Japan was released in February 2004, and China was selected to be the most favorable FTA partner. The poll indicated that 35.4% of the respondents replied that Japan should have a FTA with China, followed by the United States (30.8%), Korea (20.7%), ASEAN countries (17.3%) and European countries (16.6%)[25]. Also, extensive support exits for the Korea-China FTA notably among academia[26]. As for the region-wide Japan-Korea-China FTA, China once positively proposed it in 2002. But the reaction of Japan and Korea was ambiguous or even a bit reluctant, just like they would behave in the bilateral FTAs between China. Now that the advocate of the tripartite FTA, the Chinese Premier Zhu Rongji, is gone, the enthusiasm on the China side seems to be missing.

III-3. What should Japan do with Northeast Asian FTAs?

What should Japan do with FTAs within the Northeast Asian region? The government's FTA priority seems to be placed primarily on FTAs with ASEAN, Korea and Mexico as

[24] We should remember that due to the harsh protests of farmers the Korea-Chile FTA was barely approved in February 2004, and this was more than one year after the finalization of the negotiation in October 2002. In the process of the Japan-Korea FTA negotiations, many worry that the situation of the Korea-Chile FTA will be repeated in the last stage. Reportedly, government, academia, press, and industrial associations in Korea generally support or at least are ready to cope with the bilateral FTA with Japan. However, as the FTA gradually becomes a reality, protests of the competitive industries such as machinery, road vehicles and electrical appliances are gradually coming out.

[25] See Ministry of Foreign Affairs of Japan, "Poll on Economic Diplomacy (WTO, FTA)", February 2004, available at http://www.mofa.go.jp/mofaj/gaiko/wto/2003ec.html (Japanese).

[26] In Korea there is a widespread belief that the Japan-Korea FTA should result in a considerable amount of FDI flows or technology transfer to Korea. The final report of IDE-KIEP joint research released in May 2000 pointed out the feasibility of the "win-win" nature of the bilateral FTA, but the proposition is based on the assumption of new FDI flow from Japan to Korea caused by the FTA. Recently, one of the government-affiliated researchers even urged that Korea should prioritize the Korea-China FTA over the Japan-Korea FTA if a drastic increase in technology transfer from Japan is not foreseen. See Kim (2004).

Ministry of Foreign Affairs (2002) and Ministry of Economy, Trade and Industry (2003) indicated. The FTAs with ASEAN and Korea constitute a major part of "the East Asia FTA", or the two-storied "ASEAN+3 FTA", with the base story being a FTA network among ASEAN members, and the second story being a FTA network in the Northeast Asian region.

As discussed in Chapter II, we recommended making use of IIT indexes, as more "augmented" indicators that carry information on future gains to the FDI investors and the FDI hosts, as well as the current level of gain due to division of labor. The IIT indexes we calculated generally support the strategy of the Japanese government to form FTAs first with ASEAN, Korea and Mexico; Chart 1-1 clearly depicts a sharp rise in Japan's IIT indexes with the country mentioned above. Chart 1-3 also shows that the IIT index with Mexico has been rising. Charts 1-1 through 1-4 also show that the IIT indexes with some of the other countries mentioned as those interested in FTAs with Japan has been rising. For example, the IIT indexes with Taiwan, Israel, Canada and South Africa all showed a steep upward trend. Although FTA formation with Taiwan as well as Israel may be politically controversial, economic gain due to enhanced division of labor with those countries should be fully considered.

As for the FTAs with ASEAN, Ministry of Economy, Trade and Industry (2003) argued that Japan should have FTAs not only with individual ASEAN members but also with ASEAN as a whole. Suppose for example that Japan and each ASEAN member have a bilateral FTA, but no Japan-ASEAN FTA exists as a whole. In this case, if a Japanese firm orders a partial processing to an affiliate in an ASEAN country (country A) and simply brings back the finished products to Japan, the firm would fully benefit from the bilateral FTA between the ASEAN country and Japan. However, if the firm wishes to do further processing in another ASEAN country (country B), the exports from A to B are usually not tariff-free, as the AFTA rule of origin (40% value added or more, which is quite high) prevents the trade flow from providing tariff-cut benefits.

Creation of the FTA with China is necessitated by the already deepened IIT, along with a fever among Japanese companies for a FTA with China. However, in practice, political variables such as leadership rivalries in the ASEAN+3 FTA and mutual distrust are working as obstacles. In this situation, Korea may be able to play a very unique role in matchmaking the two large economies which may lead to form a *de facto* Northeast Asian FTA. Since the inauguration in February 2003, Korea's Roh Moo-hyun

administration has advocated the “Northeast Asia Central Nation” doctrine which defines his country as the hub of the Northeast Asian region. To materialize the doctrine, the Presidential Committee on Northeast Asian Business Hub was established on April 7, 2003, though major results have not come about yet. If Korea forms a FTA with Japan and China and sets a moderate rule of origin criteria (lower than the 40% criteria of AFTA) then Japanese firms may choose Korea as a transit processing site because exports from Japan to Korea are subject to the Japan-Korea FTA, and re-exports from Korea to China may be subject to the Korea-China FTA. If this occurs Japanese firms would in fact benefit from a *quasi* Northeast Asian FTA, which is relayed by Korea.

Finally, the Japanese government may be changing its attitude toward the bilateral FTA with China or the Northeast Asian FTA as a whole. The three countries held the first unofficial meeting on the Japan-Korea-China investment pact on March 8-9, 2004 in Tokyo. This may also be Japan’s first step toward promoting the Northeast Asian FTA. Recall that the preparation contacts about the Japan-Korea FTA were expedited after the Japan-Korea investment pact went into effect in early 2003. As mentioned in Chapter II, if a negotiation on EPA is split into the FTA-intensive part and the investment pact, then the explanatory power of IIT indexes in sequencing the FTA partners is considered to increase. Again, the Japan-China cooperation will be highlighted by the growing trend of the bilateral IIT indexes. Ideally, the Northeast Asian FTA or the ASEAN+3 FTA would exhibit their full strength if they were formed from the beginning with as many countries as possible involved rather than gathering bilateral FTAs. This is partly because bilateral FTAs between large economies, say China and Japan, may exert a large trade conversion effect that hits other smaller economies. But as a second-best choice, until the Northeast Asian FTA is formed, Japan and Korea should collaborate in forming and maintaining a *de facto* Northeast Asian FTA.

IV. Conclusion

In the first Chapter, using the gravity equation, we have seen that in recent years a great portion of the growth in world trade may be attributable to increases in intra-industry trade. Also, we pointed out an increasing necessity to liberalize international trade when a surge in IIT is foreseen.

In Chapter II, we discussed how we should set a sequence in determining with what

country to negotiate bilateral FTA. In considering the sequence, Japan's FDI balance was found to have a mixed effect; affiliates' domestic activity in the host country is affected by the change in the host country's FDI attraction policy, which is supplemented by an EPA. However, the domestic FDI policy may also be covered by an investment pact; thereby, the governments negotiating a FTA may concentrate on the time-consuming part of trade-related issues. Also, Chapter II pointed out the 'perpetual' characteristics of the IIT index; it may work as a sign that signifies the future possibility of performing finer division of labor, and moreover, thereby, attracting more FDI. The IIT indexes of Japan with its major trading partners were calculated and shown.

Chapter III first pointed out the importance of the Northeast Asian region in terms of economic size and the lack of core FTA like NAFTA and EU in North America and Europe. Except for developed counterparts, whose trade and investment have been highly liberalized and therefore bilateral FTAs are thought to bring little gain, it was verified that Japan's FTA strategy on sequencing the FTA partners is generally justifiable based on the levels the IIT indexes achieved between potential partners. Finally, Korea's possible unique role in the region is recommended. If Japan and China cannot form a FTA instantly, Korea should form bilateral FTAs with both Japan and China. In that case, Korea should set a moderate rule of origin, so that it may be able to enjoy a gain as the regional hub. Finally, we touched upon the possibility of Japan's change in attitude towards forming the Northeast Asian FTA associated with the launch of unofficial meetings on a Japan-Korea-China investment pact. Even though Japan is ready to form a bilateral FTA with other large economies like China, Japan should be careful about the trade conversion effect that the bilateral FTA may exert on other small economies. Also, until a region-wide FTA is achieved, whether it's Northeast Asia or ASEAN+3, if a *de facto* Northeast Asian FTA is working, then both countries should collaborate in maintaining it.

This study still leaves several important aspects remaining to be studied. Those include comparing IIT indexes and FDI and rigorously relating the gravity equation with IIT-related variables, etc. All those unfinished problems are left as future tasks.

Appendix A: Details of Data Compilation for the Gravity Equation

Tij (trade flows): Nominal export figures denominated in U.S. dollars come from International Monetary Fund (2003a). The IMF-DOT CD-ROM contains an application that generates a global trade matrix for a specified year. For this study, the author obtained export matrixes for the sample years (1996, 1998, 2000 and 2002) using the above mentioned application. In the process of generating a global matrix, the application fills in missing export data if the information is available from the importing country. The trade flow data for the gravity equation were extracted by breaking down the global trade matrix.

GDP: Nominal GDP figures in U.S. dollars were calculated by dividing nominal GDP figures in local currency by average exchange rates. For most of the sample countries, International Monetary Fund (2003b) gives the nominal GDP figures in local currencies (mainly code 99b.c) and average exchange rates (code rf, local currency vs. U.S. dollar) for the sample years. For the countries not covered by International Monetary Fund (2003b), the author filled in the missing values using the global geographic coordination table supplied by Central Intelligence Agency (2003).

Dij (distance between capital cities): Distance between the capital cities of the exporting and importing countries (in kilometers) are calculated according to the following formula.

$$Dij = r * \arccos[\sin(Lat1)*\sin(Lat2) + \cos(Lat1)*\cos(Lat2)*\cos(abs(Lon1-Lon2))],$$

assuming that the earth is a complete sphere with radius r = 6371 kilometers, the capital city of the exporting country is at latitude Lat1 and longitude Lon1, and that the capital city of the importing country is at latitude Lat2 and longitude Lon2. Lat's and Lon's are in degrees, and in applying the above formula south latitudes and west longitudes are treated as negative angles. The latitudes and longitudes of 221 capital cities can be downloaded from the following site.

http://www.wcrl.ars.usda.gov/cec/java/capitals.htm.

POP (population): The data, in persons, mainly came from International Monetary Fund (2003b), and it was again supplemented by the global population table in Central Intelligence Agency (2003).

PCGDP_GAPij (gap in per capita GDP): This is the absolute difference in the per capita GDP between the exporting and importing countries in nominal U.S. dollar terms. GDP per capita can be derived by dividing GDP by population. The data descriptions about GDP and population are given above.

LOCK (land lock dummy), ISLAND (island dummy): In determining the values of those dummy variables, first we need to obtain the length of the coastline and the land border of each country. The global tables of coastlines and land boundaries in Central Intelligence Agency (2003) provide sufficient information. A country is defined as landlocked and the land lock dummy is set to 1 if the length of the coastline is zero. Similarly, a country is defined as an island state and the island dummy is set to 1 if the length of the country's land boundary is zero.

ADJij (adjacency dummy): The global land boundary table in Central Intelligence Agency (2003) lists the countries that share common boundaries; for example, in the row for the United States, Mexico and Canada are listed as border countries. If the exporting and importing countries are determined to share a common border using the above mentioned global land boundary table, then the adjacency dummy is set to 1.

LANGij (common language dummy): This dummy variable takes the value of unity if both the exporting and importing countries share one or more languages as the official languages. For example, for the country pair of United States and Canada, the dummy variable is set to one because they have the common official language of English. For France and Canada, the dummy is set to unity because of the common official language of French. However, the dummy is set to zero for the country pair of Canada and Mexico because they share no common official languages. The official languages of the countries are provided in SIL International (2004), which is available at the following address: http://www.ethnologue.com/country_index.asp. For the countries not covered by this, the global language table in Central Intelligence Agency (2003) lists the major

languages used in those countries. The author picked out the official languages of those countries from the list.

FTAij (FTA dummy): World Trade Organization (2003b) is the complete list of the regional trade agreements notified to the World Trade Organization (WTO) as of October 13, 2003. To be precise, the coverage of the agreements listed inhere is not limited to free trade agreements. Among the agreements in the above list, we picked out the following types of agreements: customs unions, free trade agreements and preferential arrangements. The list does not always identify all the members of each agreement. Another WTO web page (http://www.wto.org/english/ tratop_e/region_e/region_area group_e.htm) lists the members of the agreements that several countries participate (For example AFTA, EU, or NAFTA). The dummy is set to unity if both the exporting and importing countries belong to an identical regional trade agreement.

FDIIN, FDIOUT (inward and outward foreign direct investment stock): Printed version data on foreign direct investment stocks in U.S. dollars are available from United Nations Conference on Trade and Development (2003). However, this only gives data for selected years. UNCTAD also provides a continuous series of foreign direct investment stocks in "World Investment Directory", available at http://r0.unctad.org/en/subsites/dite/fdistats_files/WID.htm. For the countries that did not report the investment stocks in 2002, the figures for 2001 or 2000 were used instead.

Cij (complementarity index): Cij is defined as the inner product of the revealed comparative advantage index vector (by commodity) of the exporting country (RCAx) and the revealed comparative disadvantage index vector (by commodity) of the importing country (RCAm) weighted by the world trade share of each commodity. The world average of Cij is unity, so Cij greater than unity implies that the export structure of the exporter and the import structure of the importer are more complementary.
More specifically,

$C_{ij} = \Sigma_h [(RCA_{xih})*(RCA_{mjh})*(W_h/W)]$…….(Equation 2),
where

C_{ij} : complementarity index based on the exporter's export structure and the importer's import structure,

RCA_{xih}: the exporter's revealed comparative advantage index on commodity h,

RCA_{mjh}: the importer's revealed comparative disadvantage index on commodity h,

W_h: the world trade volume of commodity h,

W: the total world trade volume.

The definition of revealed comparative advantage is as follows:

$RCA_{xih} = (X_{ih}/X_i) / (W_h/W)$, where

X_{ih} : exports of commodity h from the exporter to the rest of the world,

X_i : the exporter's total exports.

RCA_{mih} is also defined in a similar manner.

However, it should be noted that Cij is not based on any actual bilateral trade flows, as shown in Equation 2. Therefore, Cij implies a "virtual match" between two countries, derived from their comparative advantage structure. It should also be noted that Cij tends to be greater when the comparative advantage structure of two economies are "vertically matching." Suppose country i intensively exports high-technology commodities, and its trading partner country j imports a large amount of high-technology commodities. Then, Cij in this case would show quite a high number.

The total country-wide and global exports and imports by commodity came from United Nations Conference on Trade and Development (2003a), and they are based on 3 digit SITC-R2 classification for the years 1996 and 2002. For the years 1997-2001, the data shown in International Trade Center (2003) based on 3 digit SITC-R3 classification were used instead. For the countries that the Cij's for 2002 could not be derived due to the lack of trade data, the author instead adopted Cij's available in prior years (2001 or 2000).

IIT (intra-industry trade index): The IIT indexes added in the gravity equation cover all the commodities, are of Grubel-Lloyd type, are country-wide, and they are based on the trade of the countries in question with the rest of the world. A major counterpart to Grubel-Lloyd type index is "threshold type" index, which counts all the trade volume of an item as intra-industry trade if the trade overlapping ratio (TOL ratio: min[exports, imports] / max[exports, imports]) exceeds a certain threshold (usually 10%, as in

Fongatne et al. (1997)). In the threshold approach, once the trade of an item is classified as intra-industry trade, further deepening of intra-industry trade in that item does not contribute at all to increase the index. Considering the discontinuous property of the threshold approach and the widespread use of Grubel-Lloyd indexes, we adopted the latter in favor of the former for our estimation of the gravity equation. Bilateral IIT indexes were not adopted because bilateral trade flow data for several sample years, notably for 2002, were not readily available from a widely used database like PC-TAS, which is a trade data retrieval system released by the United Nations. The formula for the IIT indexes used for the estimation of the gravity equation is as follows:

$IITi = \sum_h s_{ih} * IIT_{ih}$ (IIT, all commodity), where

$s_{ih} = (X_{ih} + M_{ih}) / \sum_h (X_{ih} + M_{ih})$,

$IIT_{ih} = 1 - |X_{ih} – M_{ih}| / (X_{ih} + M_{ih})$, (IIT, by commodity)

X_{ih} and M_{ih} are country i's exports and imports of commodity h with the rest of the world, respectively.

Trade data for 1996 and 2002 came from United Nations Conference for Trade and Development (2003a), and they are based on 3 digit SITC-R2 classification. Figures for 1998 and 2000 are calculated from the data in International Trade Center (2003), and they are based on 3 digit SITC-R3 classification. IIT indexes for individual disaggregated industrial levels (IIT_{ih}'s) are first calculated, and then we averaged them weighted by the trade volume (exports plus imports) of individual industries. Like Cij, in the case where IIT indexes for 2002 were not calculated due to a lack of trade data, IIT indexes for prior years (2001 or 2000) were adopted.

Appendix B: IIT Indexes of Japan 1988-2003 (Road Vehicles and Electrical Machinery)

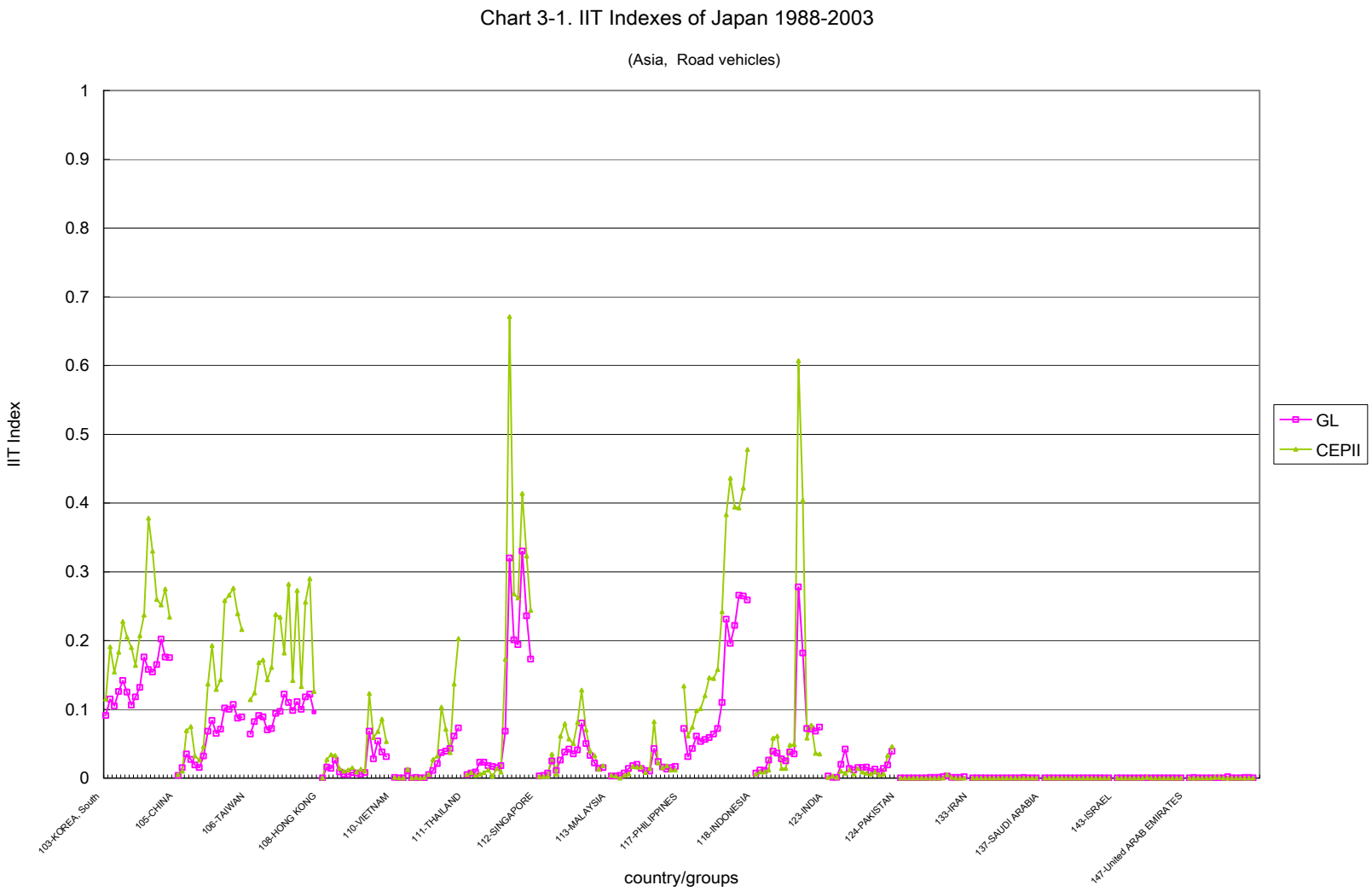


Chart 3-2. IIT Indexes of Japan 1988-2003

(Europe, Road vehicles)

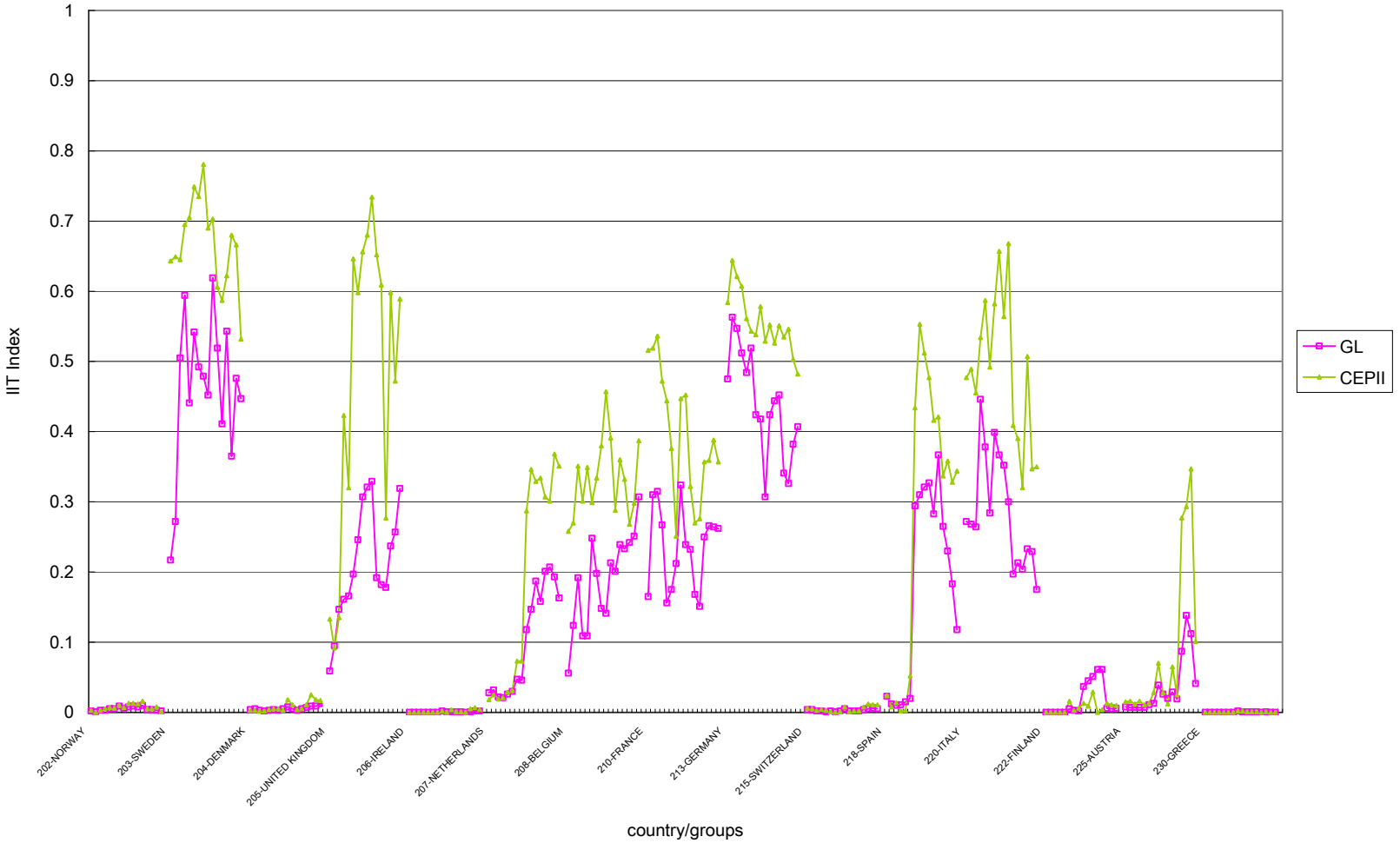


Chart 3-3. IIT Indexes of Japan 1988-2003

(Americas and Others, Road vehicles)

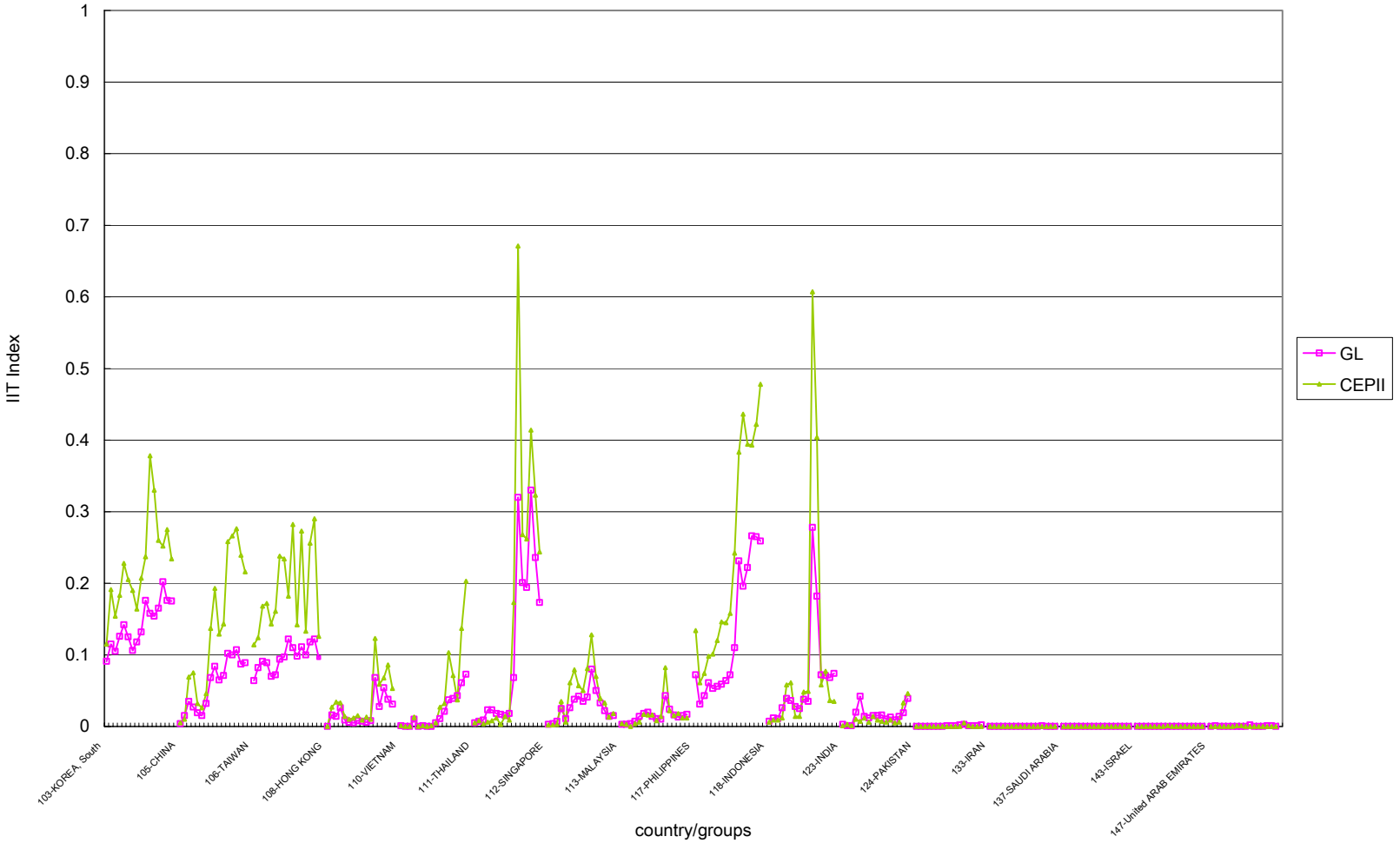


Chart 3-4. IIT Indexes of Japan 1988-2003

(Major Groups, Road vehicles)

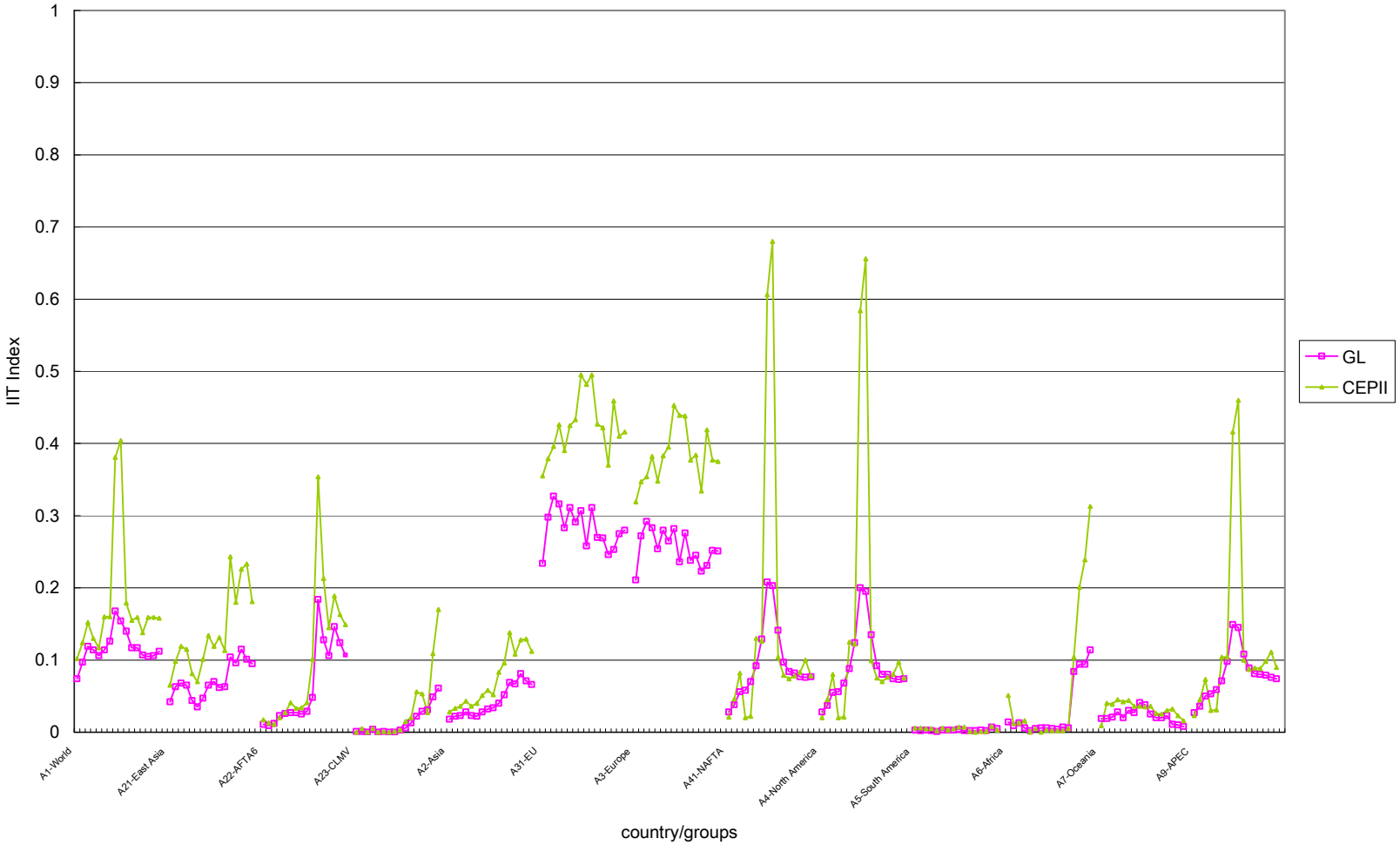


Chart 4-1. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Asia, Road vehicles)

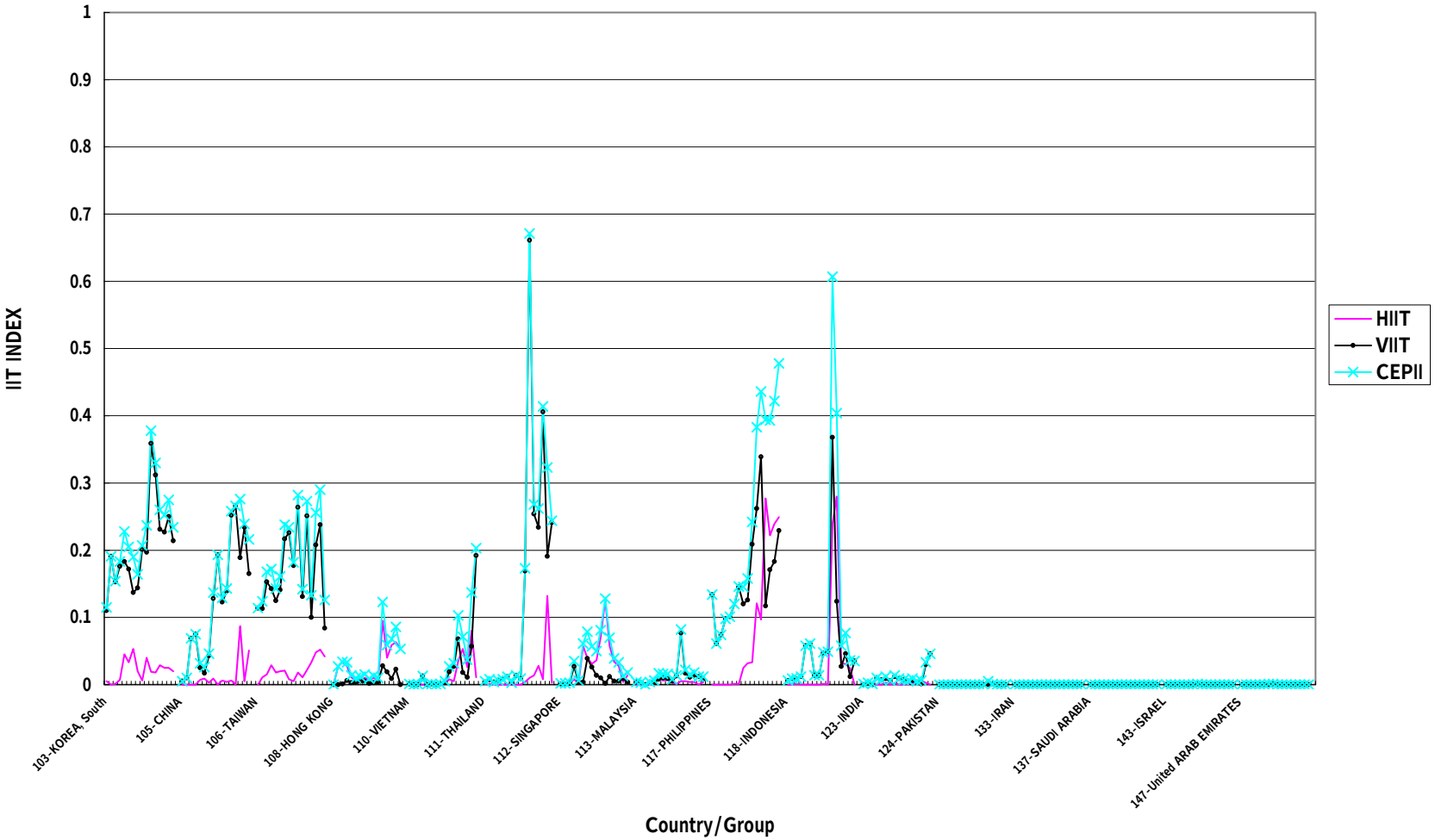


Chart 4-2. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Europe, Road vehicles)

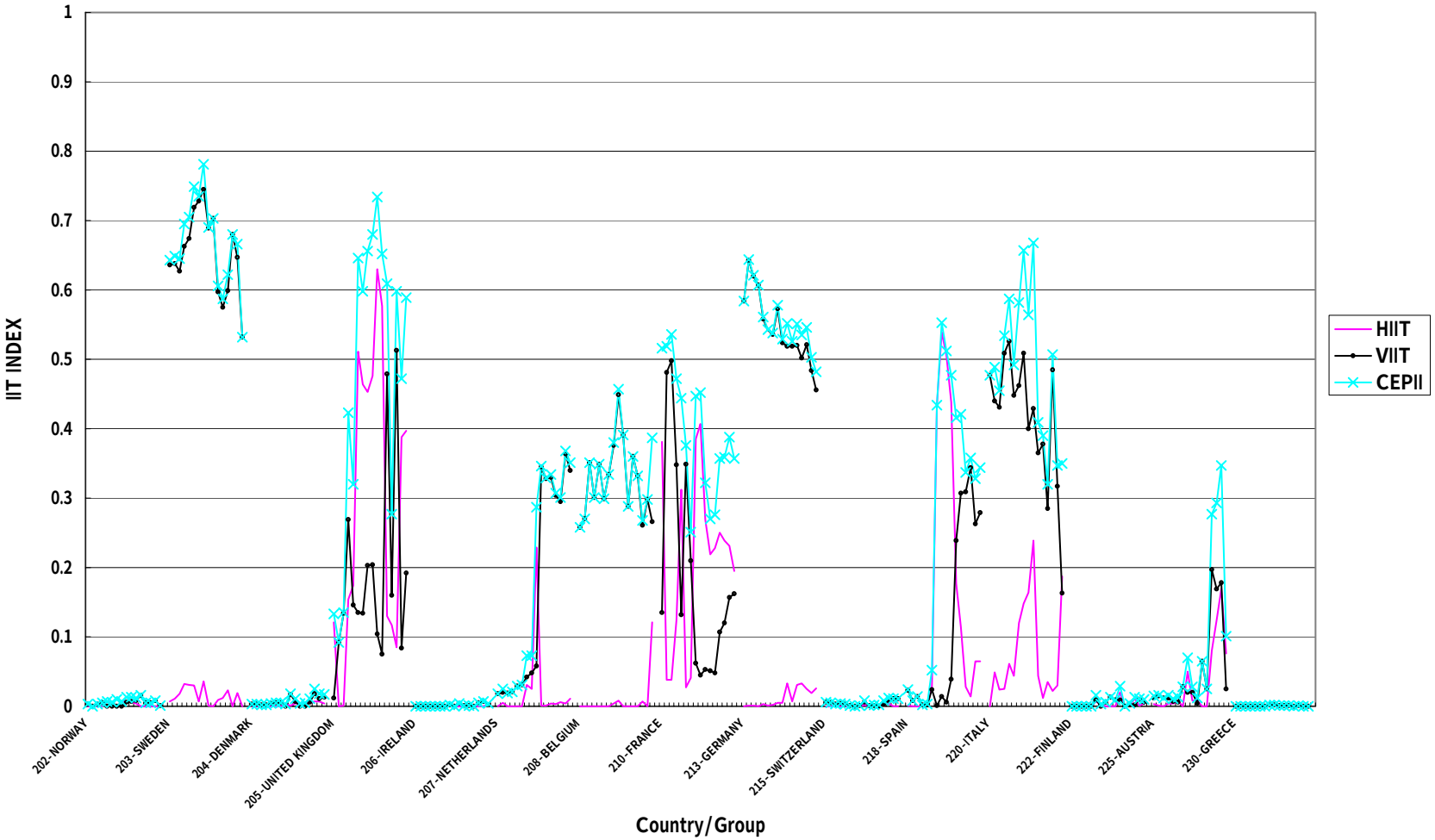


Chart 4-3. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Americas, others, Road vehicles)

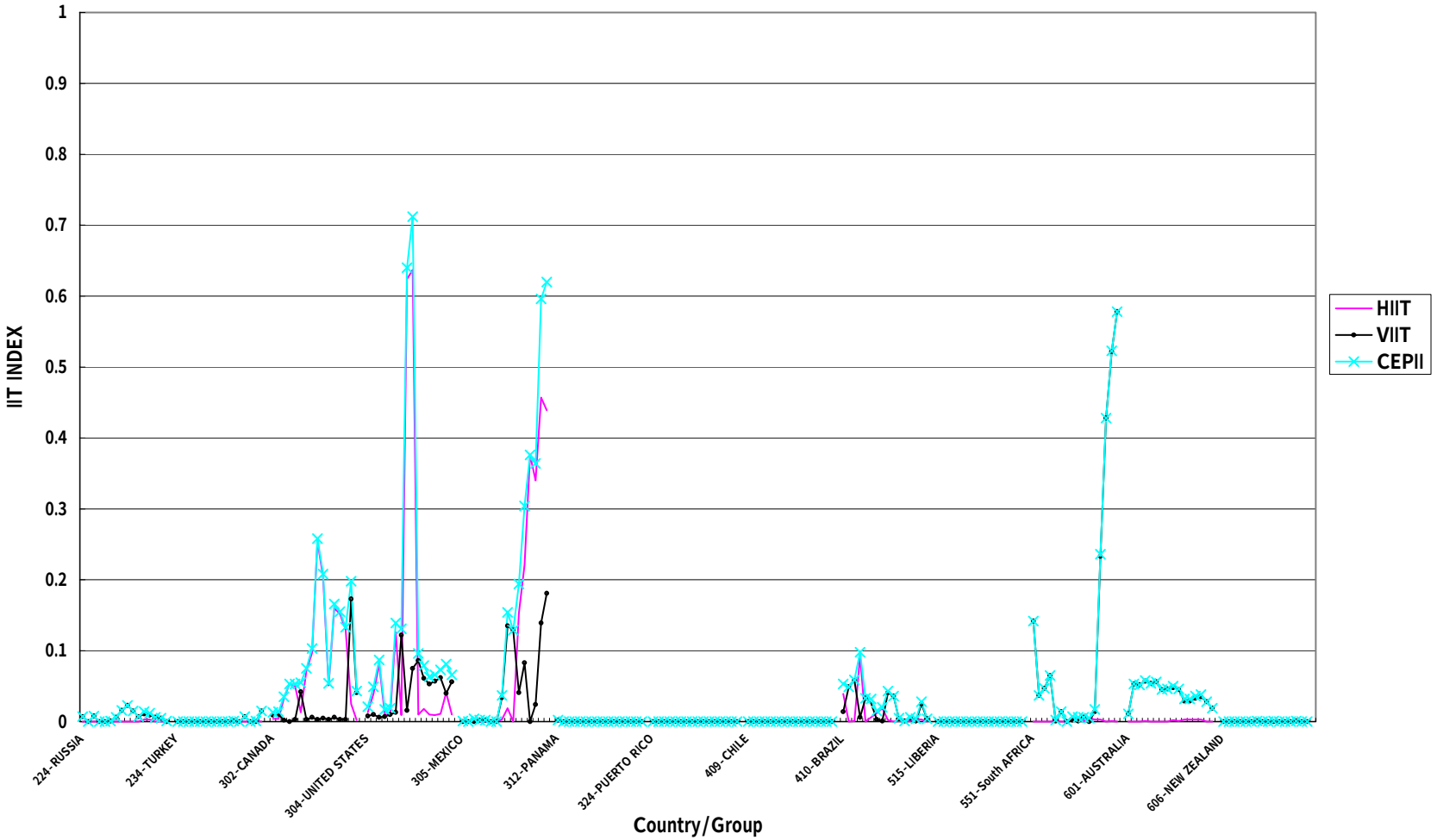


Chart 4-4. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Major groups, Road vehicles)

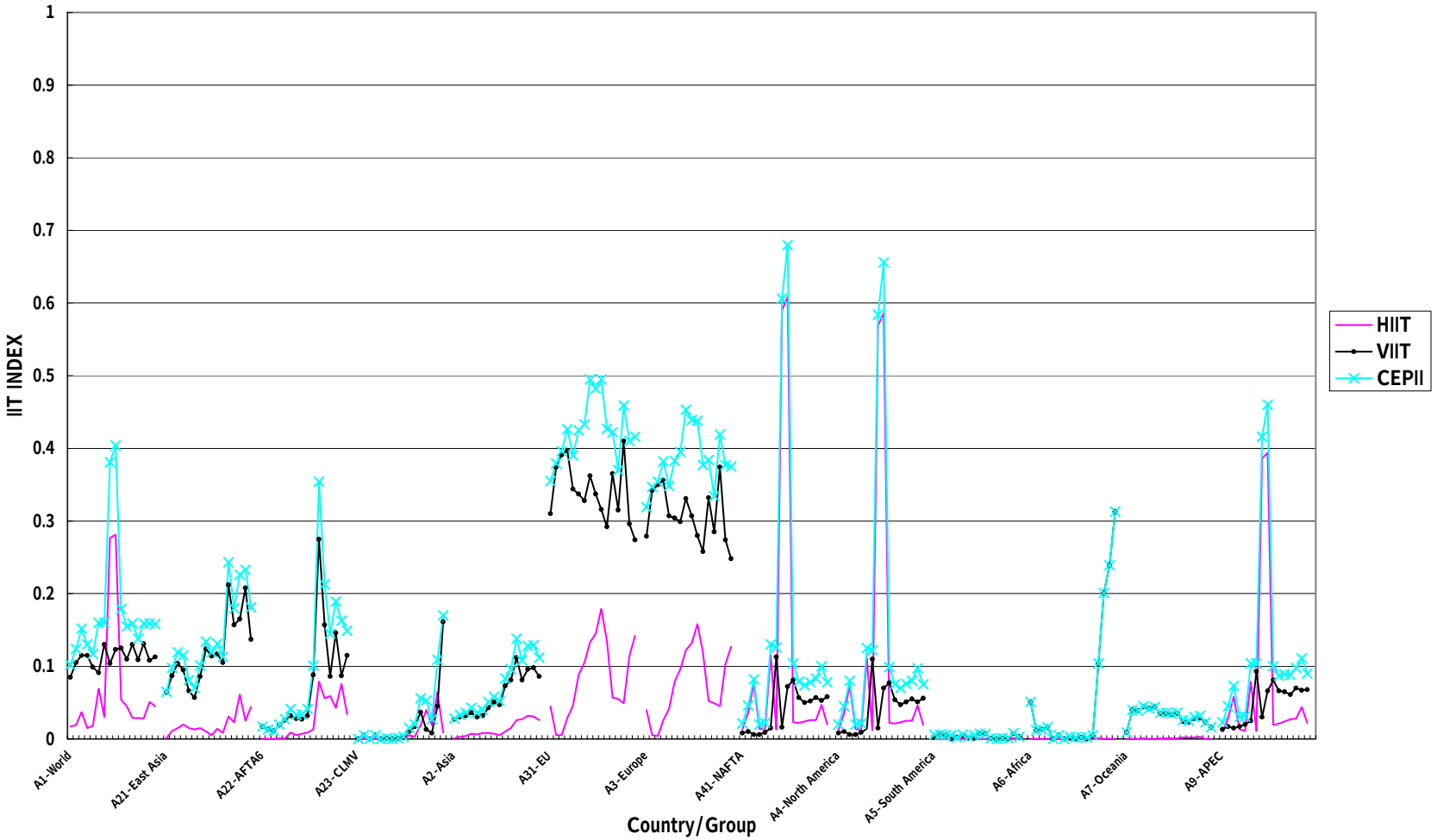


Chart 5-1. IIT Indexes of Japan 1988-2003

(Asia, Electrical machinery)

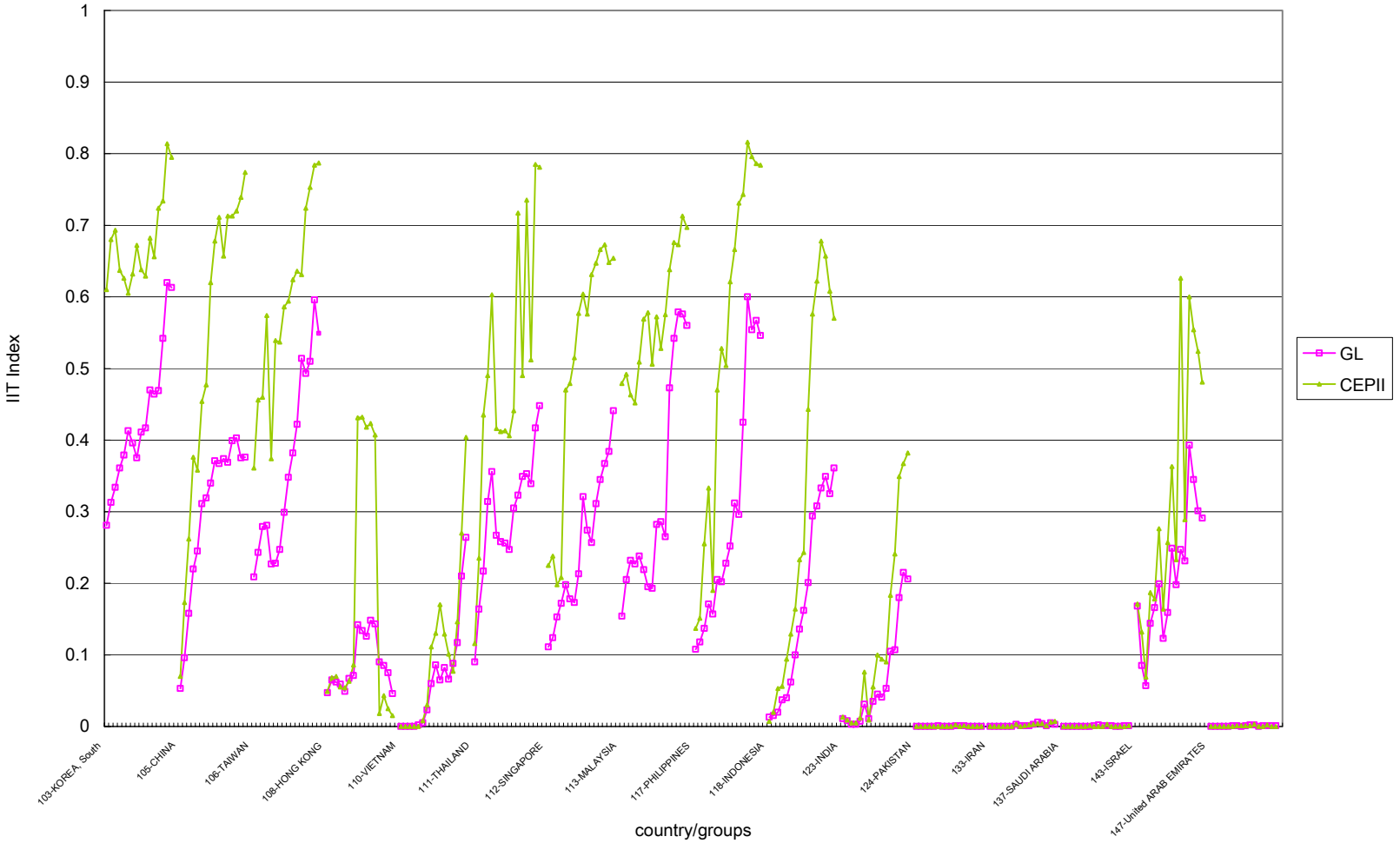


Chart 5-2. IIT Indexes of Japan 1988-2003

(Europe, Electrical machinery)

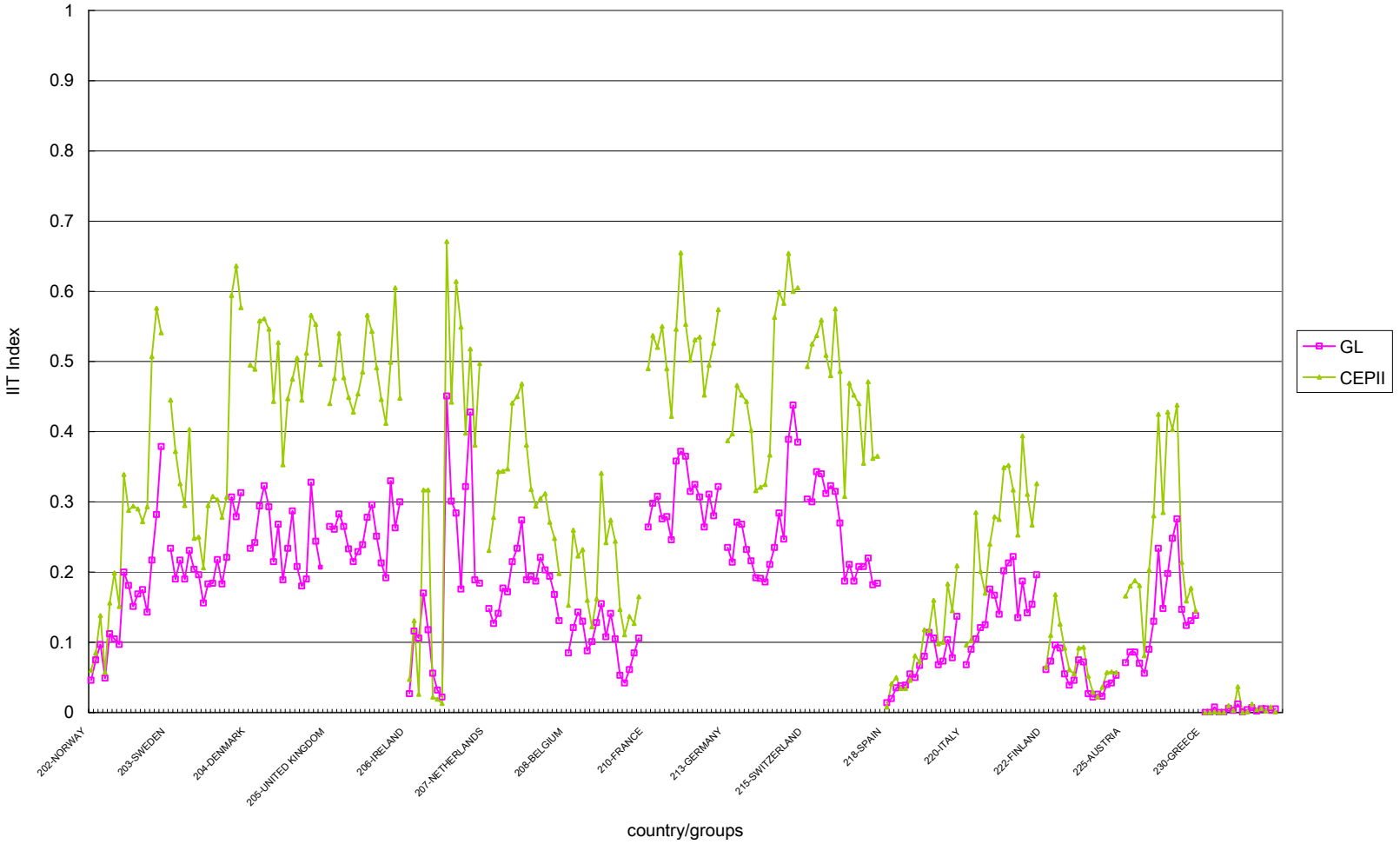


Chart 5-3. IIT Indexes of Japan 1988-2003

(Americas and Others, Electrical machinery)

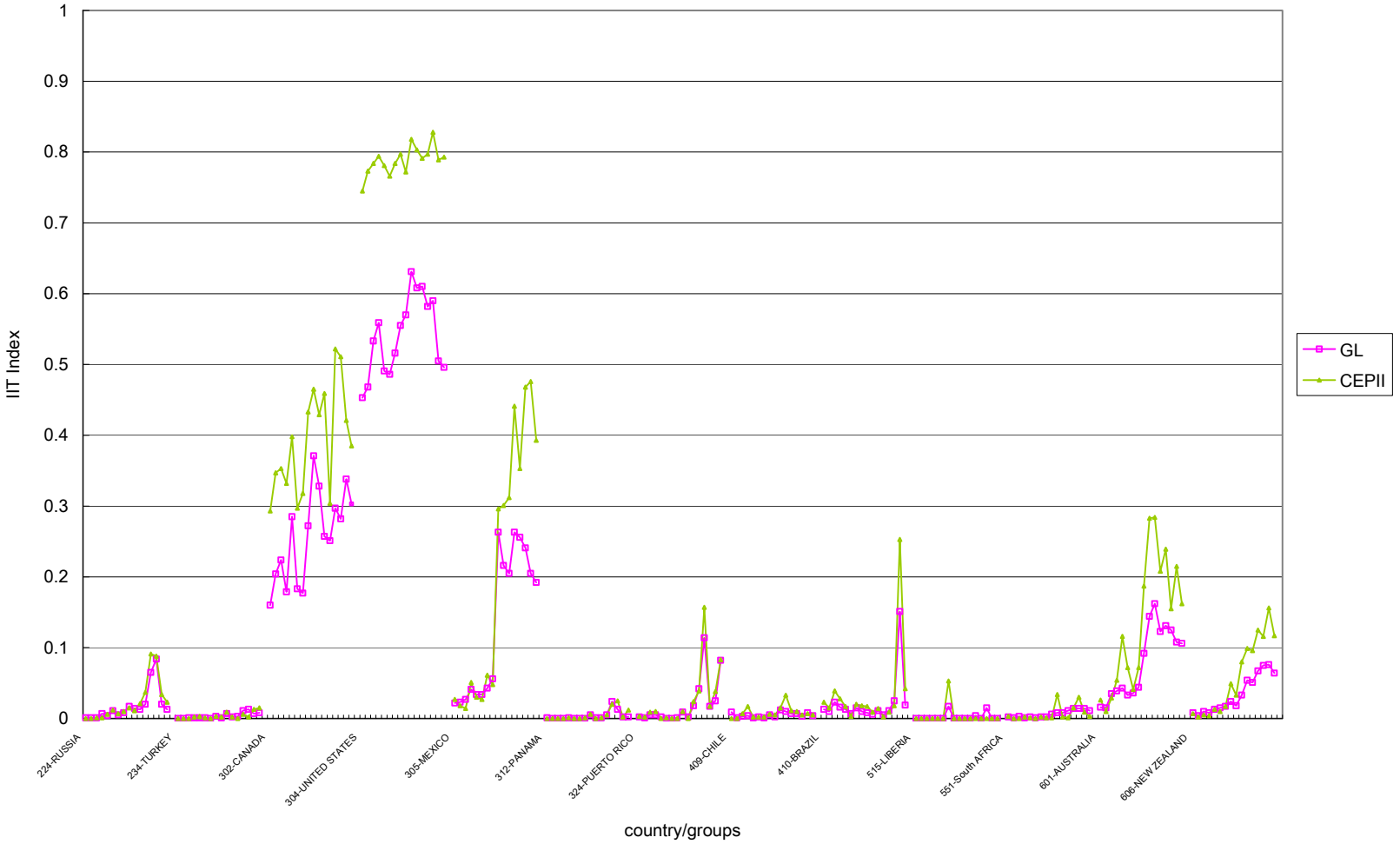


Chart 5-4. IIT Indexes of Japan 1988-2003

(Major Groups, Electrical machinery)

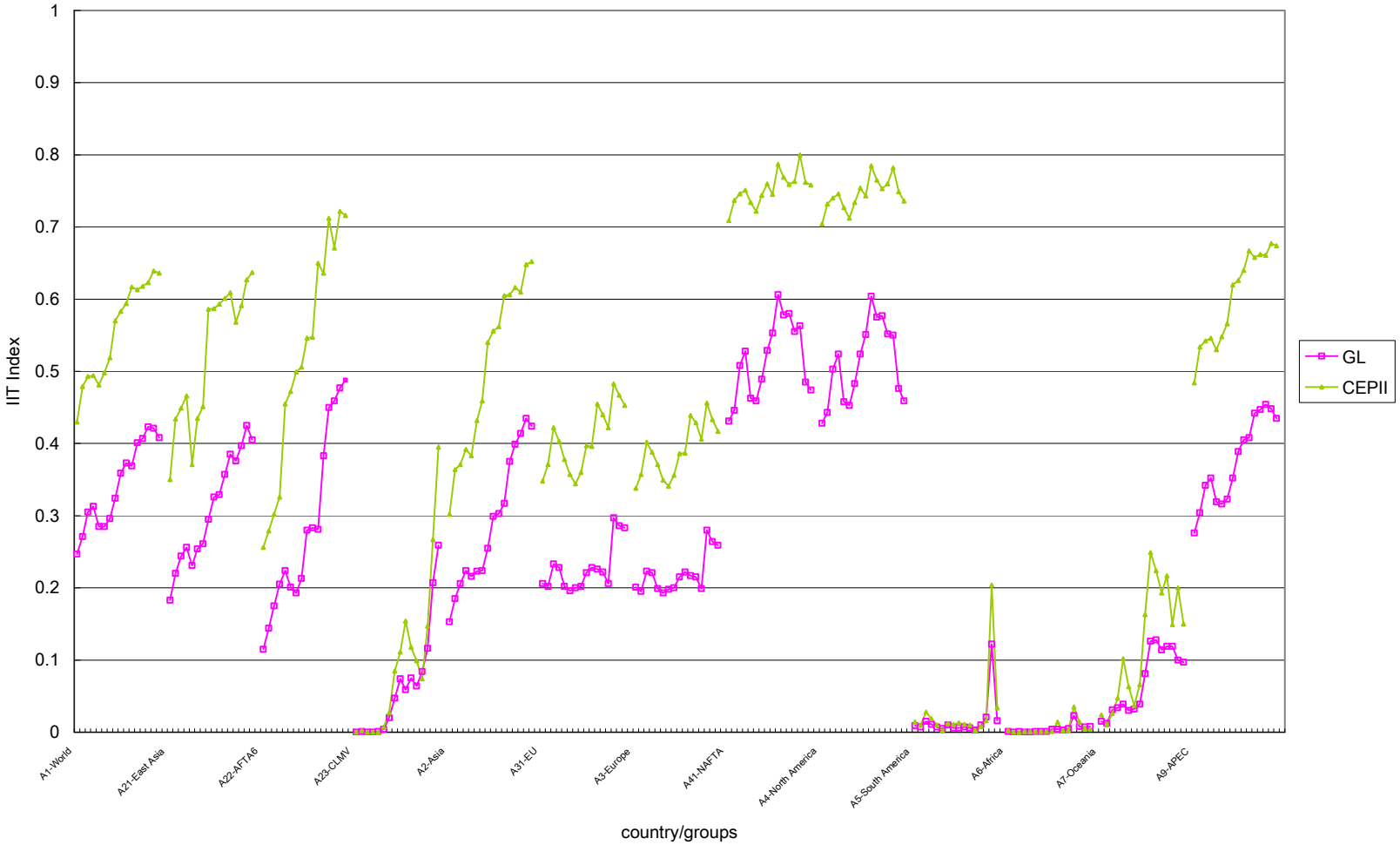


Chart 6-1. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Asia, Electrical machinery)

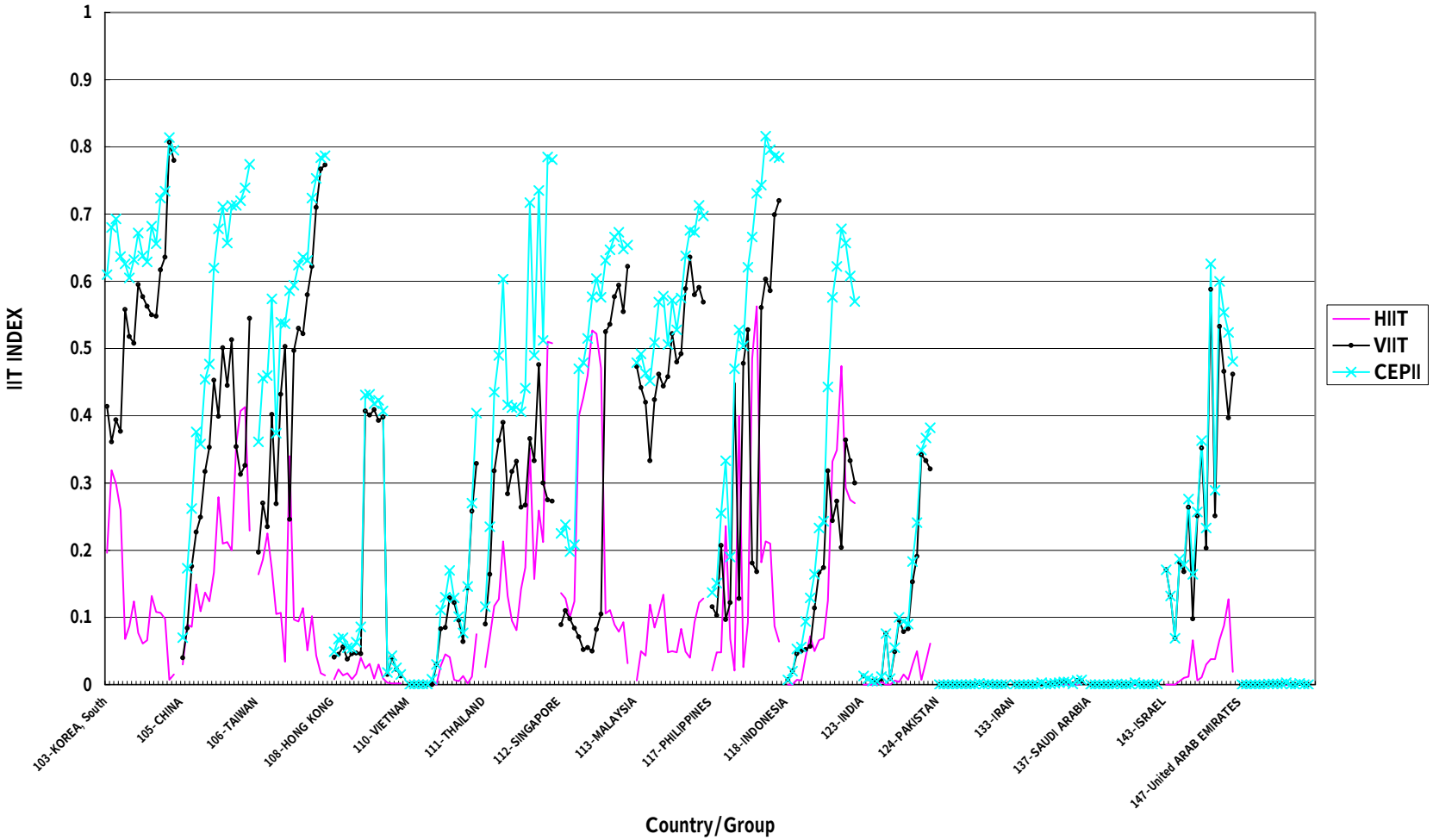


Chart 6-2. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Europe, Electrical machinery)

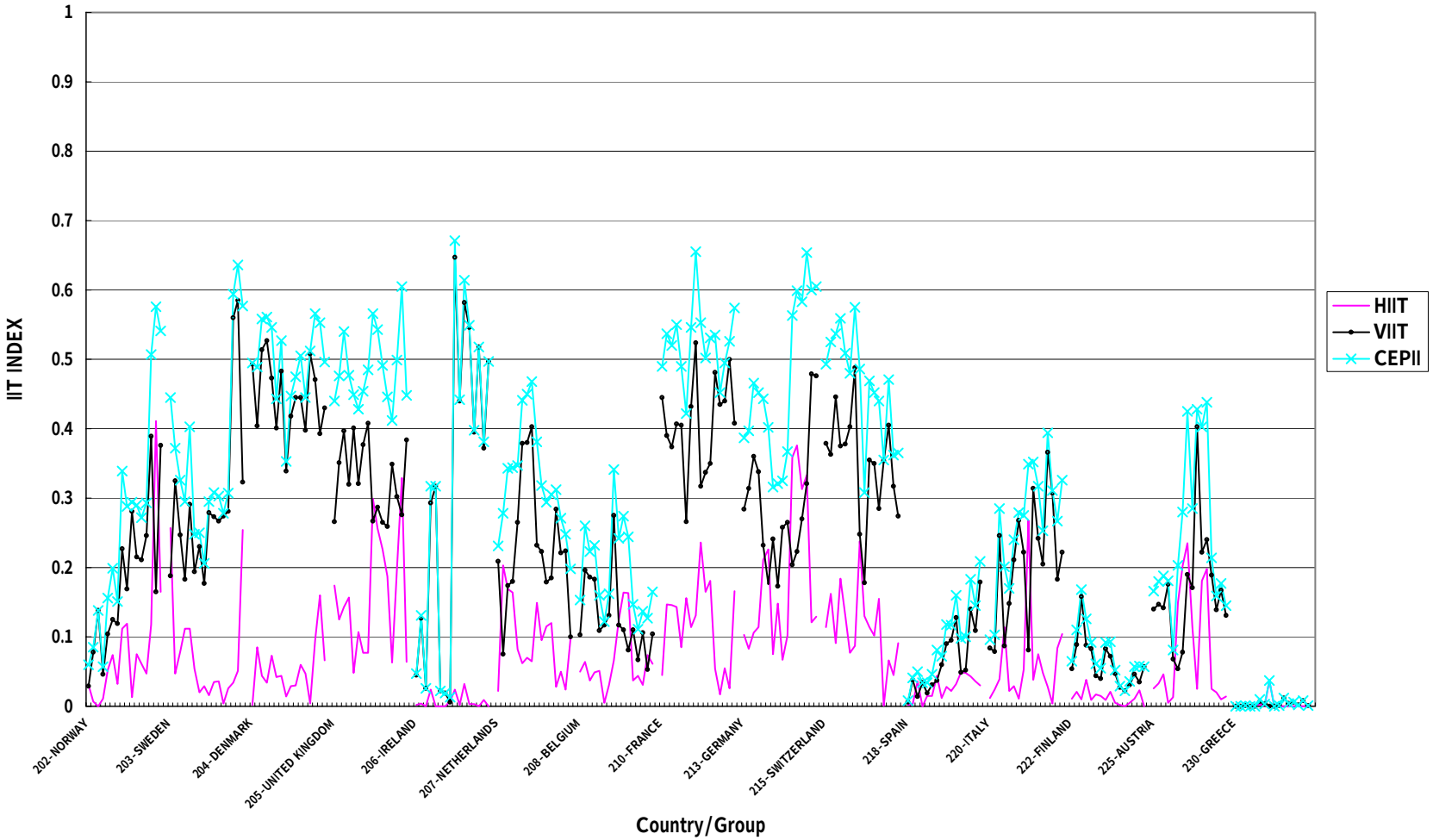


Chart 6-3. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Americas, others, Electrical machinery)

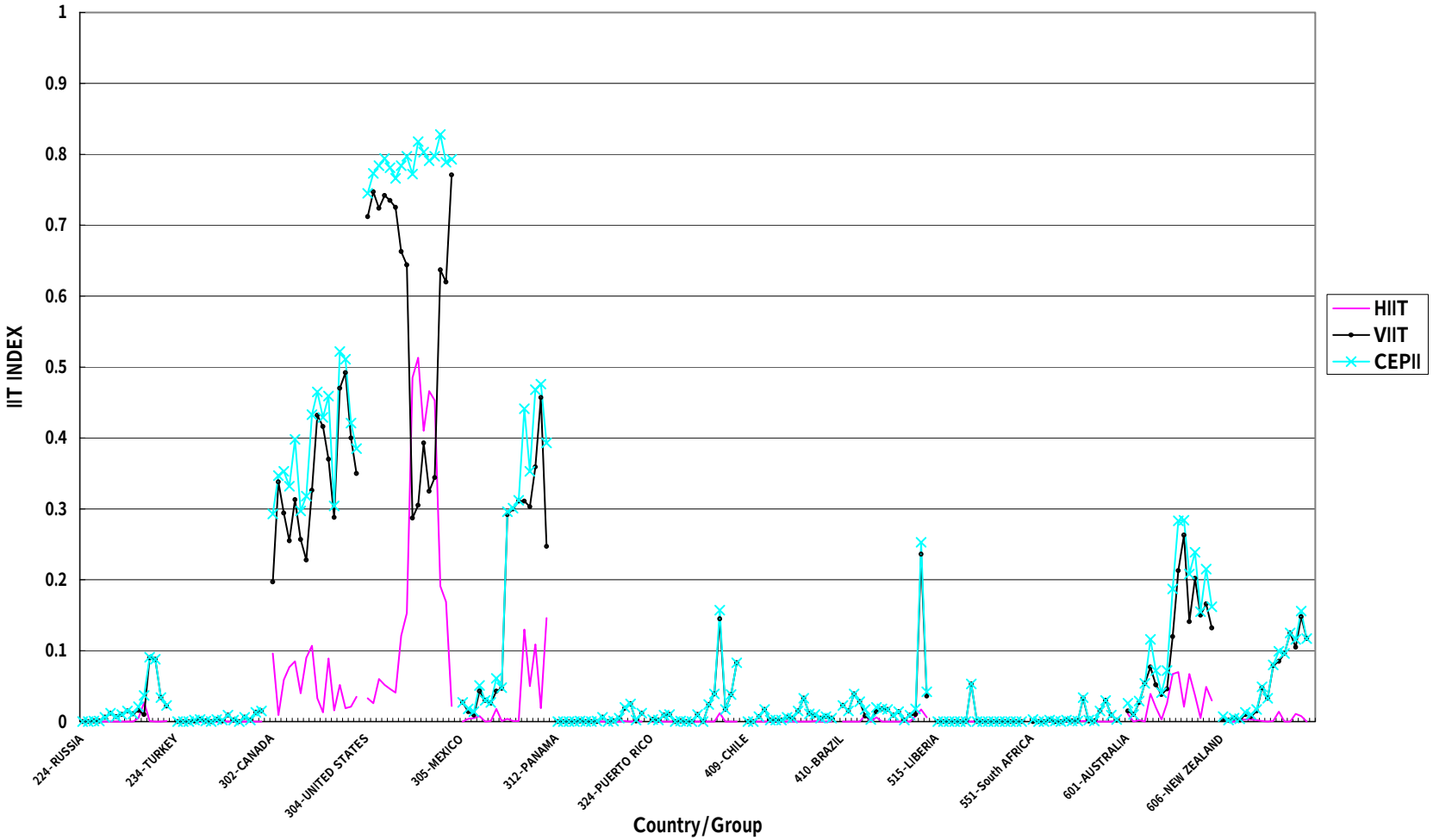
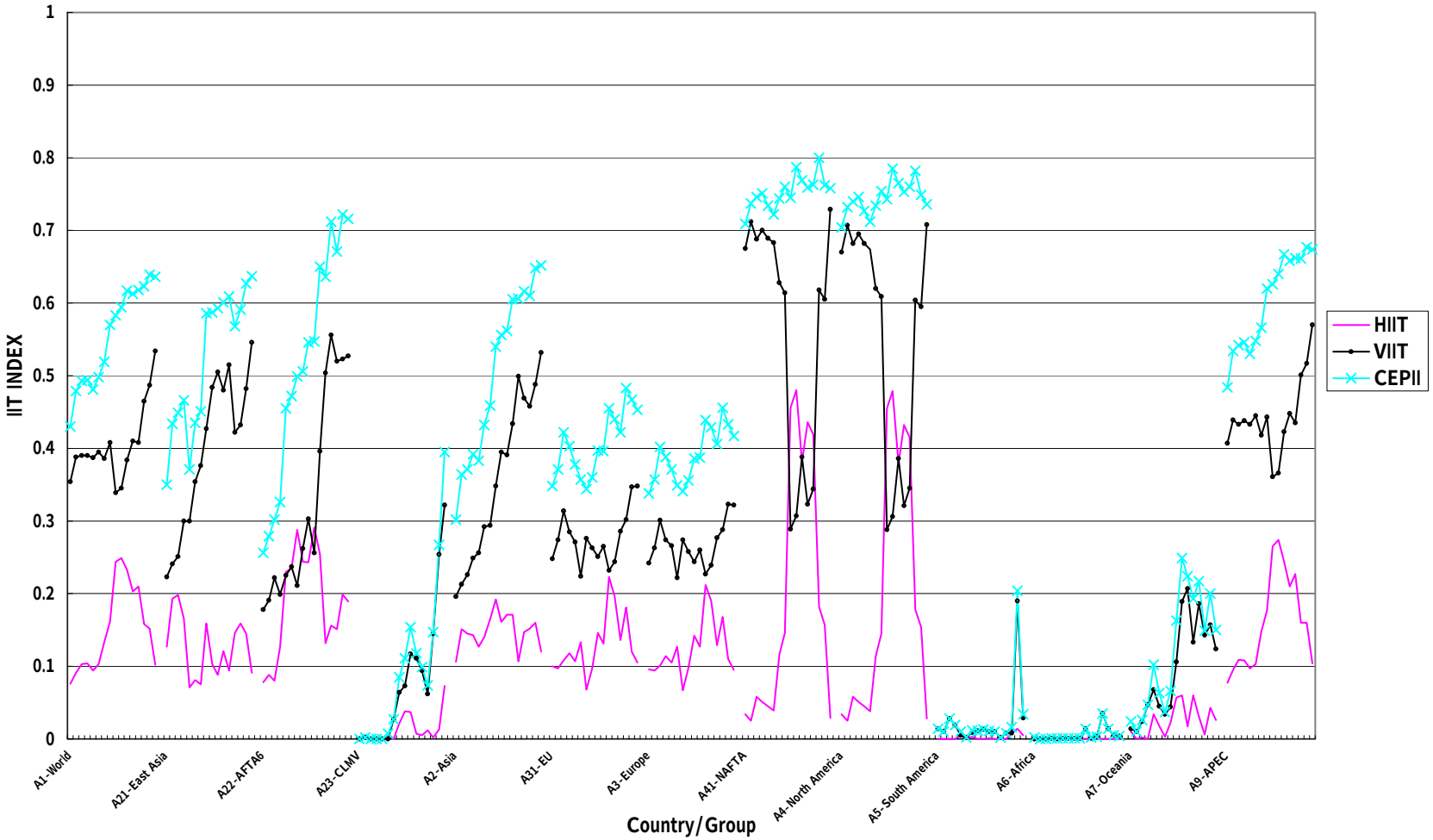


Chart 6-4. Horizontal and Vertical IIT Indexes of Japan 1988-2003

(Major groups, Electrical machinery)



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