COMPILATION AND APPLICATION OF IDE-JETRO'S INTERNATIONAL INPUT-OUTPUT TABLES

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ABSTRACT

International input-output tables have been considered one of the most useful data sources in economic analyses. Since these tables provide detailed information of international production networks, they have attracted significant attention recently in the research areas of spatial economics, global value chains and trade in value added related issues. IDE-JETRO has more than 40 years of history in the construction and analysis of international input-output tables. This paper gives an easy-to-understand introduction on IDE-JETRO's international projects including the construction of Asian International Input-Output Tables and Transnational Interregional Input-Output Table between China and Japan. In order to help users understand the characteristic features of our tables, this paper also shows some application examples by using these tables.

Keywords: International input-output, Production networks, Economic interdependency

1. INTRODUCTION

Input-output (IO) tables show the flow of goods and services between all the individual sectors of a national economy over a given period of time (normally, one year). They also describe the sale and purchase relationships between producers and consumers within an economy. As such IO tables form the core of the system of national accounts and also have become an important instrument to guarantee and enhance the quality of other statistics. Besides playing the role in descriptive purpose in statistical areas, IO tables have also been widely used for analytical purposes in applied economic research and policy analysis. For example, IO tables can be used for the analysis of production, cost structures and productivity; analysis of prices; analysis of the structure of capital formation, final consumption, exports, etc.; analysis of imports of energy required; impact analysis of new technologies; sensitivity analysis of the effects of changes in tax. If time series of IO tables are available, it is possible to perform structural decomposition analysis of economic growth or to build econometric IO model. Furthermore, IO tables have been a prerequisite for building CGE (Computable General Equilibrium) models.

Due to the importance of IO tables, today there are more than 80 countries around the world that have compiled their own national IO tables and published them officially. However, just using national IO table, it's difficult to illustrate how a target country links or interacts with other countries by the way of international production networks. This is mainly because that national IO tables cannot provide the information about how a country's exports are used by another country as intermediate inputs or how the imported goods are produced in its partner countries. In response to the recent development of spatial economics (New Economic Geography), "New" new trade theory and global value chains related issues, it is increasingly recognized that the international IO table can play an important role in related analysis areas.

The construction of international IO tables is not a simple process of just linking every country's national IO table with international trade statistics together. It's exactly a very artistic practice. When compiling an international IO table, compliers have to face a lot of difficulties and challenges. This is mainly due to the fact that the original national tables are basically compiled by individual national statistical offices with relatively independent or different definitions, sector classifications and compilation methods. Such fact also reflects the difference of original statistical system, economic idiosyncrasies and availability of data across countries. Therefore, the first hard work for compilers is to harmonize every country's national IO table to fulfill the common standards of the compilation of international IO table. In addition, when linking the national IO tables with international trade statistics, there is no guarantee that these two data sources can be consistent well originally. Therefore, a number of adjustment processes have to be done carefully based on some assumptions and supplementary data sources. Furthermore, the quality of compiled international IO tables depends on not only the original data collected, but also the compilation and estimation methodologies used. Finally, compiling international IO tables is not only a time-consuming and money-consuming practice, it also needs a number of experts from both statistical and economic sides to work together and exchange considerable amounts of information, ideas and technical expertise. Therefore, better management of international communication of different member countries is also a very important factor during the construction of international IO tables.

The Institute of Developing Economies (IDE) – JETRO has a long history in the field of construction of international IO tables. Its main products include a series of Asian International Input-Output (AIIO) Tables for the years of 1975, 1985, 1995, 2000, 2005[1], 2008[2], and the recent newly developed Transnational Interregional Input-Output (TIIO) Table between China and Japan for the year of 2000 under the collaboration of China's State Information Center (SIC). The main purpose of this paper is to provide an overall view of IDE's international IO projects. In order to help users understand the characteristic features of IDE's projects well, this paper also shows some analytical application examples by using these tables.

The paper is structured as follows: in section 2 and 3, the details of AIIO and TIIO projects are introduced respectively. Every section includes the project history, background, organizations involved, data source and methodology. In section 4, some application examples are introduced. For the AIIO tables, we mainly show some analysis results of vertical specialization measured by the AIIO tables and transnational employment trade by using the TIIO table.

2. COMPILATION OF THE ASIAN INTERNATIONAL INPUT-OUTPUT TABLES

As a spatial extension of national IO techniques, the international IO table has become a powerful tool for economic analyses. IDE for the last 40 years has been making a lot of efforts to construct various international IO tables in collaboration with statistical offices and research institutions of Asian countries. Now facing the rapid growth of the Chinese economy and the deepening economic interdependency in the Asia-Pacific region, IDE's AIIO Table has been an indispensable apparatus for the analysis of Asian economy from a spatial perspective. This section provides some fundamental information about IDE's AIIO international project.

2.1 History of IDE's Asian International Input-Output projects

The whole history of IDE's AIIO project can be divided into four phases. In the first phase (before 1973), some pioneering works had been done. In 1964, IDE's Watanabe (1966) proposed the idea of using international IO models to analyze the North-South trade problem. Following this idea, in 1965 IDE developed an international IO model covering six regions: North America, Europe, Oceania, Latin America, Asia, and Japan.

[1] A preliminary version of the 2005 AIIO table has been completed in 2011, but not officially published. The official AIIO data for 2005 will be released on March 2012.

[2] In order to response to a special requirement on studying the economic impact of 2008 financial Crisis on Asia-Pacific region, a very preliminary version of the 2008 AIIO table has been complied, but not officially published.

In 1966 and 1971, IDE constructed international IO models for ten Asian countries. Yet the IO tables compiled in these studies were subject to a number of limitations; i.e., estimation techniques were too simple, the industrial sector classification was too crude, and so on.

In the second phase (1973 - 1977), IDE launched development of a comprehensive international IO table to explore the situation of inter-industrial transactions among East Asian countries. In 1973, the Republic of Korea and the five ASEAN countries plus the United States were chosen to be the endogenous member countries, as these countries have close economic relationships with Japan. Had all the countries compiled their national IO tables at the same referential year, the project would not have been so laborious. However, Indonesia, Thailand, and Singapore had not constructed any IO tables by that time. Also, IDE was not sufficiently experienced in compiling a comprehensive IO table. Thus, the project had to begin with two preliminaries: one was to construct national IO tables for these three countries, and the other was to compile bilateral IO tables with the countries for which the national tables were already available. Under this project, three national IO tables (Indonesia for 1971, Singapore for 1973, and Thailand for 1975) and three bilateral IO tables (Korea-Japan for 1970, U.S.A.-Japan for 1970, and Philippines-Japan for 1970) were constructed in collaboration with the national statistical offices and research institutes of the countries concerned.

From 1978, IDE entered its third phase (1978 - 1982) of the IO project, with the aim of constructing the 1975 multilateral IO table among the ASEAN countries, Japan, Korea, and the U.S.A. This project went along with the following three steps: (1) estimation of national IO tables for the countries that did not have 1975 national tables, (2) construction of 1975 bilateral IO tables for the countries that had already compiled national tables by the time, and (3) construction of the 1975 multilateral IO table. First, existing tables had to be updated to the year 1975 for Malaysia, the Philippines, Singapore, and the U.S.A. Next, the 1975 bilateral IO tables for Indonesia-Japan, for Thailand-Japan, and for Korea-Japan were constructed. Finally, these national and bilateral tables were linked together under a single multilateral IO table for 1975, which was completed in 1983. The 1975 multilateral table has been used for various analyses of East Asian industrial structure, and the table became the prototype for the subsequent international IO projects.

After the completion of the 1975 international IO tables, IDE soon launched the construction of the 1985 international IO table, to cover more Asia-Pacific countries. Since China commenced an Open-Door policy as one of its key development strategies it has rapidly increased its external trade with the United States, Japan, and others. China plays an important role in the Asia-Pacific region, not only in providing a gigantic market but also in receiving investment from the neighboring countries. Thus, China and Taiwan were covered in the 1985 multilateral table, making it even more comprehensive than the previous 1975 version. Since then, IDE has successfully completed the multilateral tables every five years, providing powerful analytical tools for dynamic structural changes in the Asia-Pacific region.

2.2 Organizations involved in the AIIO projects

IDE's international IO projects involve many participants (organizations) from different economies. Most of them are the governmental or semi-governmental statistical offices and institutions. For example, more than 70 experts from ten different economies have contributed their efforts directly and indirectly to the compilation of the 2000 AIIO table. The organizations involved in the 2000 AIIO projects are shown below.

China: State Information Center
Indonesia: Statistics Indonesia
Korea: The Bank of Korea
Malaysia: Department of statistics
The Philippines: National Statistics Office
Singapore: Business Research Consultants
Taiwan: Taiwan Research Institute
Thailand: The National Economic and Social Development Board
Japan: Applied Research Institute, Inc.
Japan: IDE-JETRO

In addition, some statistical experts from Gifu Shotoku Gakuen University and the Ministry of Economy, Trade and Industry of Japan also provided their help on this project.

2.3 Compilation procedure and methodology of the AIIO tables

The AIIO table includes ten endogenous economies (see Annex 1) and 76 sectors. Roughly speaking, the compilation process of the AIIO tables goes through three distinctive phases. What follows is a step-by-step illustration of how the AIIO Table is compiled. The first part presents a description of the format adjustment for every constituent national table based on the general survey on national tables, which was conducted by IDE in 2003 and 2004 in order to establish a common rule for the format adjustment of the tables. The second part briefly explains construction of the system of sector concordance, followed by a brief introduction of estimation methods for supplementary data. Finally, the linking procedure is illustrated, with detailed explanations on the manual balancing and reconciliation work.

2.3.1 Adjustment of presentation format

Despite the fact that IO tables constitute the central apparatus of the System of National Accounts, each national table of an individual country exhibits more or less different features and characteristics, reflecting the country's economic idiosyncrasies and availability of data. Such a variety in the form, however, poses a practical difficulty when compiling international IO tables. For even though the international table is composed of the segments taken from each national IO table, the interpretation of the data should be mutually consistent and comparable for any part of the whole. Accordingly, one of the most complicated, nerve-racking tasks of compilation is the adjustment of national tables to conform to a common format. In general, it is the detailed, information-rich table that has to compromise with less-detailed ones, as the other way round would require a costly (yet often unrewarding) effort of obtaining supporting data. Therefore, there always exists a trade-off between the level of uniformity and the level of information, and hence careful and thorough consideration is called for in making adjustment rules.

This section reports on the general survey on the characteristic features of national tables of AIIO member economies. The survey was conducted in the period of 2003-04, in order to construct the basic information reserves for designing the AIIO common format and adjustment rules. To our knowledge, such an extensive and detailed survey on national tables has never been carried out, and we believe that no institution but the IDE, with a history of significant cooperative relationships with IO experts of various Asian economies, would be able to make such a substantial survey possible and successful.

In our survey, a questionnaire was carefully designed so as to capture every important aspect of an IO table. The questions are grouped under seven broad categories, namely: Benchmark-year and recording principles, Availability of national tables and supporting tables, Valuation, Form and coverage, Special treatment, Public or semi-public sectors, Response to the 1993 SNA. Based on the survey results, the major findings can be summarized as follows:

(1) Similarity to the Japanese I-O table

In Figure 1, the degree of similarity to the Japanese IO table is illustrated. The horizontal axis is the level (number) of industrial classification, while vertical axis concerns presentation format, giving the percentage rates of the number of questions in the questionnaire to which the country gave the same answers as Japan's. (The rates are calculated against the sum of valid answers only.) The diagram shows that the most similar table of all is the Korean IO table, as its industrial classification has just one sector difference with that of the Japanese table, and the rate of the same answer is more than 70%.

Then, we can identify the second group, including Indonesia, the Philippines, Thailand and Malaysia. Not to mention about the Korean table, there is no wonder for these tables (except Malaysia) to show high degree of similarity to the Japanese table, since their national IO projects are known to have been initiated and conducted under the advice and support of Japanese IO experts.

The US table is indicated as having some degree of similarity, but in the survey result it is observed that many answers remain to be “unknown”, so that no conclusive evaluation can be made against this table (although it is true that the classification difference is the second smallest after the Korean table.)

Figure 1: Similarity to the Japanese I-O table

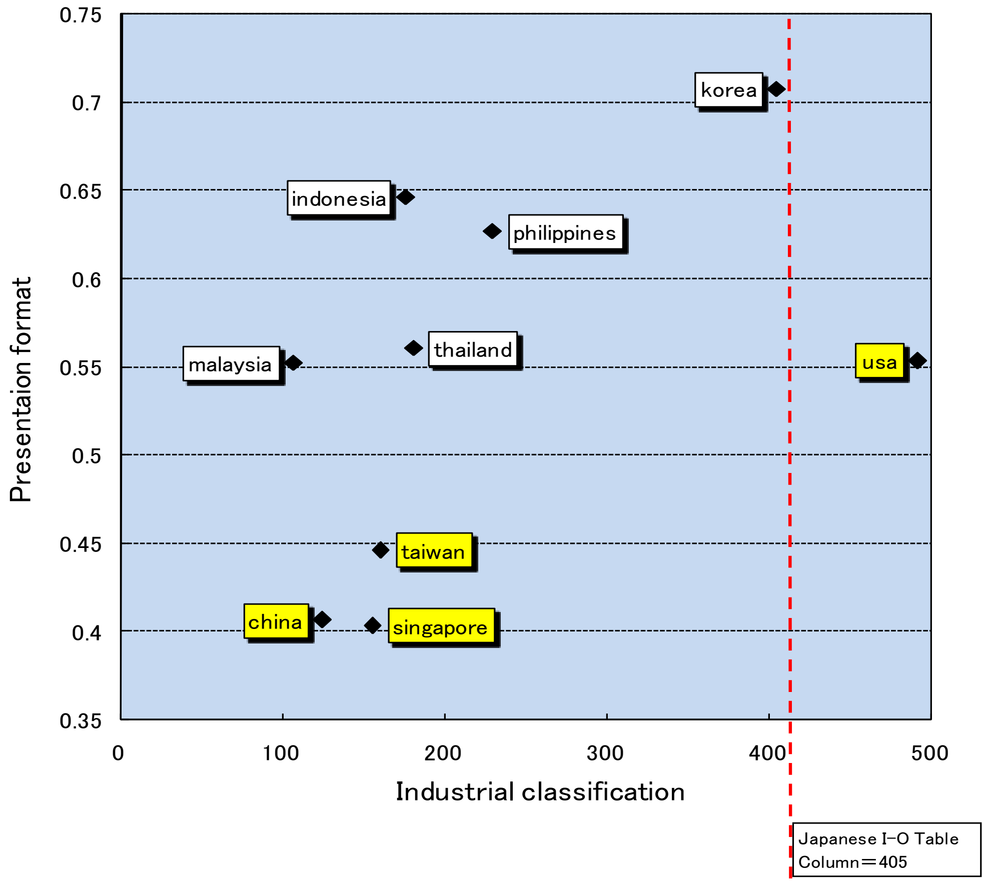


Table 1: Responsiveness to the 1993 SNA

Rank	Country	rate *
1	PHILIPPINES	0.5714
1	USA	0.5714
3	THAILAND	0.5385
4	KOREA	0.5000
4	JAPAN	0.5000
6	SINGAPORE	0.4545
7	INDONESIA	0.4286
7	MALAYSIA	0.4286
9	CHINA	0.3077
10	TAIWAN	0.2143

* The percentage rates of the number of questions in section 7 of the questionnaire to which the country gave the answer that follows the SNA recommendation .

The third group, which is least similar to the Japanese table, includes Taiwan, Singapore and China. In addition to the dissimilarity of the format and of the level of industrial classification, the benchmark years of these national tables differ from that of Japan, i.e., with “0” or “5” in the last digit of the year. So the official tables had to be updated to the year 2000 with the help of some estimation methods like RAS algorithm, and this will further disturb the accuracy of the tables. The same is true for the national table of the United States.

(2) The responsiveness to the 1993 SNA

The System of National Account is a comprehensive guideline for compiling national statistical data. If properly followed, the resulting statistics will be mutually consistent and internationally comparable. The latest version of the SNA, the 1993 SNA, underwent an extensive revision of its predecessor, the 1968 SNA, to bring the statistical notions and methods up to date. IO tables (or more precisely supply and use tables), which constitute a core apparatus of the System, didn’t remain unaffected, and many countries including our project partners have put every effort to make their tables accordant to the new scheme.

The survey result (Table 2) shows that the most “responsive” countries are the Philippines and the United States, yet again one must be careful about the result on the US table as it contains a number of “unknowns”. The Thai IO table comes next, followed by the Korean and Japanese table. Although the Korean table and Japanese table ranked the same, the former can be evaluated higher as it already succeeded in introducing one of the most challenging schemes in the 1993 SNA, i.e., the Financial Intermediary Services Indirectly Measured (FISIM). On the other hand, it is rather surprising to observe that Singapore and Malaysia came to low ranks, as these national tables are known to have followed the previous 1967 SNA schemes quite extensively.

(3) The areas of conflict

Finally, we shall briefly look at the areas of conflict where each country’s treatment is not in line. The most prominent example is the treatment of Scraps and By-products. There are normally four adjustment methods for this problem. Each of them has both advantages and disadvantages, and the member countries employed the various schemes in quite an uncoordinated fashion. In the absence of supplementary information on the generation and use of scraps / by-products, it is not possible to convert from one scheme to another, making it difficult to reach a common agreement on the adjustment method.

The second area of conflict is about the treatment of imputed interest. The previous 1968 SNA recommended that the output of imputed interests (= the difference between the interests receivable and the interests payable) should all go to intermediate transaction, not to final demand. The countries like Japan, Singapore and Malaysia strictly follow this stipulation, while other countries’ tables have output in final demand as well. The introduction of FISIM under the 1993 SNA may provide an integrated guideline for this issue, but so far no member country except Korea is successful in introducing this new scheme.

The last prominent area of conflict is the treatment of inventory. The related question in the questionnaire is: “Suppose that a car industry (demand-side sector) purchased a set of tires (supply-side sector) but did not use them this time. How does this input enter in the table?” Most of the countries answered that the input should be recorded at the intersection between Tire (supply-side) industry and Change in Stocks, but some countries like China, Taiwan and Singapore answered the opposite, i.e., at the intersection with Car (demand-side) industry. Singapore gave an explanatory comment on this. It treated this input as a stock of car since “tires are regarded as a <work-in-progress> of a car.” It is quite surprising to find out that even the very basic economic concept like an “inventory” is in fact yielding to different interpretation among countries.

Table 2: Different features and characteristics of the AIO member economies

	CHINA	INDONESIA	JAPAN	KOREA	MALAYSIA	TAIWAN	PHILIPPINES	SINGAPORE	THAILAND	U.S.A.
1. Conversion of valuation										
1.1 Basic price to producer's price								X		
1.2 Private Consumption Expenditure					X			X		X
1.3 Export vectors					X			X		
1.4 Import matrix/vector			X	X			X		X	X
2. Negative entries				X						
3. Dummy sectors	X		X	X	X			X		X
4. Machine-repair	X		X				X			X
5. Financial intermediaries			X		X			X	X	
6. Special treatment of import/export										
6.1 Water transportation										X
6.2 "Pure import" of gold										X
6.3 Re-export					X					
6.4 Telecommunication				X						
7. Computer software products						X				
8. Producers of government services									X	X

Using the results of general survey on the characteristic features of national tables of AIIO member economies, the main adjustment targets for each national table can be determined (see Table 2).

2.3.2 Preparation of sector-concordance and supplementary data

Before linking every part provided by different member countries, we need to (1) harmonize each national IO table under the common sector classification of the AIIO table; (2) prepare trade related information; (3) utilize the information getting from a special survey on imported commodities. This section gives a brief introduction on each preparation procedure.

(1) Preparation of sector concordance

Each national table has its own industrial classification. In the case of the benchmark tables for the 2000 AIIO table, the number of industrial sectors ranges from 98 for the Malaysian table to 517 (row) for the Japanese table. The weight of the industrial category also differs. The countries with large agro-based economies have relatively detailed classification of agricultural sectors, while industrialized economies give more comprehensive coverage to manufacturing sectors. As such, the sector classification reflects the characteristics of the economy concerned, and a precise conversion system that bridges national codes and AIIO codes is absolutely essential for the compilation of consistent international IO tables.

The system of sector concordance has a treelike image, where AIIO classification (the broadest category) rests on the top, and each AIIO code corresponds to one or several national codes. The national codes are subcategorized into the Harmonized System of Foreign Trade Statistics, which may be further converted to SITC, another classification system for the trade data.

If the concordance system has such a clear-cut tree structure, the aggregation of national tables into AIO classification poses no difficulty. The problem arises when a national code is associated with more than two AIIO codes. For example, Singapore's national code SIO092 "Land transport equipments" corresponds to both AIO055 "Motor vehicles" and AIO056 "Motorcycles." Here, the sector splitting of the national IO table is called for before the aggregation procedure.

(2) Supplementary data

For the compilation of international tables, the following supplementary data should be prepared by each country at AIIO sector classification. (a) Import data by commodity and by 12 economies of origin[3]; (b) Export data by commodity and by 12 economies of destination; (c) Import duties and import commodity taxes by commodity; (d) Domestic trade margins and domestic freight transport costs (TTM) on exported goods by commodity; (e) International freight and insurance by commodity and 10 endogenous economies of origin; (f) Other relevant information.

The import and export data can be directly constructed from the Foreign Trade Statistics, with the help of the HS (or SITC) - national IO - AIIO sector concordance. The data on import duties and import commodity taxes, on the other hand, are independently presented in the original national IO tables in most cases, but if not (as in the case of the U.S. table), they must be also collected from the Foreign Trade Statistics.

[3] 11 economies: project member economies plus Hong Kong, EU, the Rest of the World

The data of TTM on export comes from the supporting tables of the national IO tables. Ideally, those levied on exported goods (for the delivery from factories to ports) should be used, but if they are not available from the table the average figures of the TTM matrices can be used as proxies.

Finally, the data on international freight and insurance are collected from the Foreign Trade Statistics, where available. Yet, because not all countries have these data, we use gravity model to estimate the missing information. In our model, two measures of distance are calculated, i.e., the shipping-route distance and the straight-line distance. The shipping-route distance is taken from the Distance Tables for World Shipping (JSE 1983) in which the distances between major ports are reported. The straight-line distance, which can be regarded as an analogue of the air-flight distance, is calculated between commercial centers of the countries concerned. Of these two measures, the one that better explains variation in international freight and insurance rates is employed.

(3) Getting information from a special survey on the use of imported commodities.

It should be noted, the quality of import matrices plays a critical role in determining the accuracy of the international IO table. In order to increase the accuracy of import matrices, a special survey on imported commodities has been done in the current AIIO project.

The main purposes of the survey include: (a) to identify using industries of the imported commodities by origin country; (b) to determine the value/rate of the international freight and insurance on each imported commodity; (c) to determine the value/rate of import duties and commodity taxes levied on each import commodity.

The respondent of the survey will be the establishments that import the commodities (manufacturers, trading firms, etc.) as they are considered to possess the information on amount imported by country of origin and their distribution amount to domestic industries. The survey is basically carried out as an independent sample survey. Also it may be conducted as a rider survey attached to other official surveys, which is more efficient and comprehensive. (The sample form of the questionnaire in order to collect the information described above is presented in Annex 2).

Carrying out the special survey described above accompanies several problems.

First is the feasibility of the survey. It is difficult for some countries to conduct the survey, owing to the lack of resources (funds, personnel, connections with related authorities and firms, knowledge, etc.). For countries that the survey is infeasible, it will be required to look for some alternative solutions. One possible alternative is to modify the import matrices by referring to other countries' survey results.

Second is the sampling issue. Even if the survey can be carried out, it is not easy to collect the reliable information. For instance, the samples should be selected in order to represent the characteristics of the industry appropriately. However, identifying the typical samples that appropriately reflect the distribution structures is not easy.

Third, it may also be difficult on whether or not the distribution structure can really be determined, even if samples are chosen appropriately. This problem has two different aspects. One aspect is the difficulty to determine the final users of imported commodities by country of origin. As discussed above, the imported commodities are usually delivered to the final users through the wholesale and retail agents. The respondent to the questionnaire, the importing firm, may not have the information on the final users if they sold their imports to the domestic wholesalers or retailers. The other aspect of the problem is that it may be difficult to determine the amount sold of each imported commodities even though the final users can be identified. This may occur if the survey year is distant from the reference year that the respondent cannot trace the transaction records as they may not keep the detailed information.

2.3.3 Linking and balancing

An international IO table is not just a patchwork of the pieces taken from national tables, but it is a product of careful utilization of supplementary data and manual reconciliation or fine-tuning work. This section gives a brief description on the linking and balancing work of the AIIO tables.

(1) Linking of national IO tables

All the pieces of each member country prepared in the previous steps are linked together to the one big table as shown in Annex 1. The basic idea of linking is to replace the export vector by the import matrix of the trading partner. In other words, we first split the import matrix of each country's national IO table to all its partner country and then link these tables row-wise. At this stage, the valuation of imports in each country's national IO table is also converted from the C.I.F. price to the producer's price by using the data of international freight and insurance, and domestic transport costs and trade margins compiled in the previous steps.

(2) Balancing and Reconciliation of the whole table

The final step of compilation is the manual balancing and reconciliation work, following the linking of all the pieces provided so far. The table is balanced with respect to the input composition, but total demand is not necessarily consistent with total supply for each country at this stage. Such an imbalance (discrepancy) stems from various reasons. The first one is the inconsistency between each country's sector classifications. Though each country is required to make its own code concordance from HS code to AIIO sector classification, the possibilities of differences in statistical concept still exists. The second one is because of entrepot trade. This type of trade is always counted in different ways by trade partners. For example, in the case of China, export via Hong Kong to the U.S.A. may be counted by the U.S.A as import from China. In the case of Singapore, where international trade is extremely large compared to the scale of its economy, and there is a large volume of entrepot trade, there are especially large statistical discrepancies in its international trade matrices.

Figure 2: Procedure of balancing and reconciliation

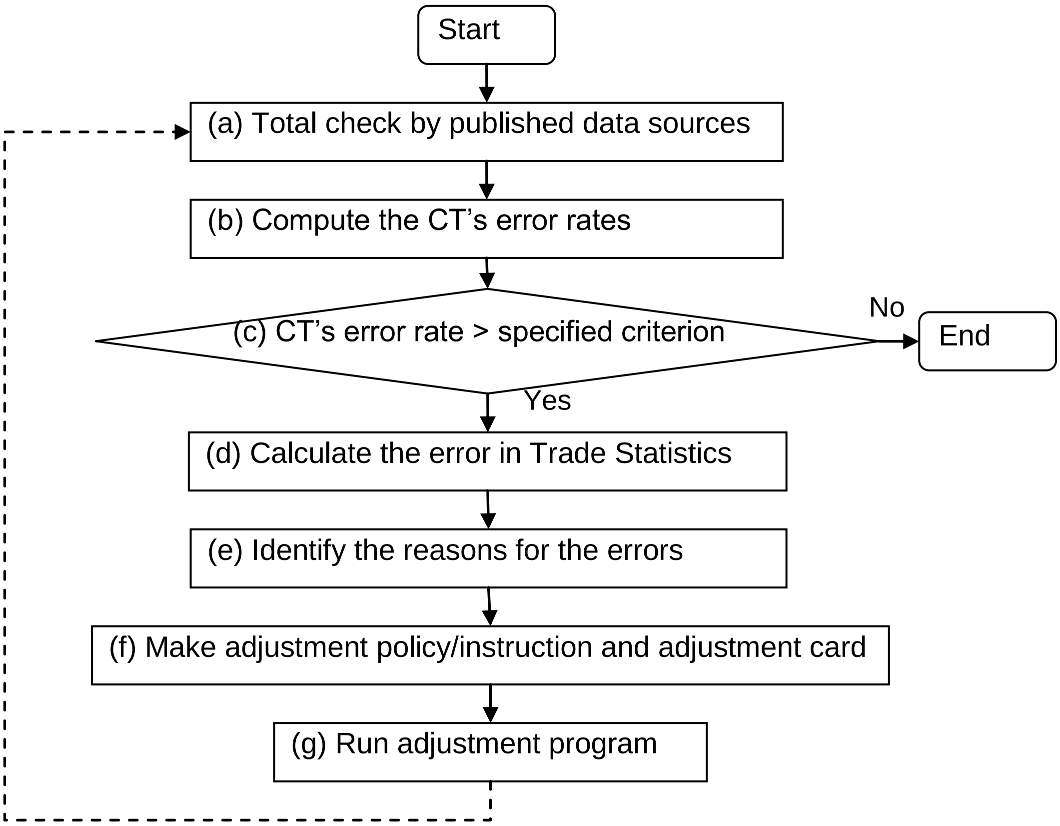
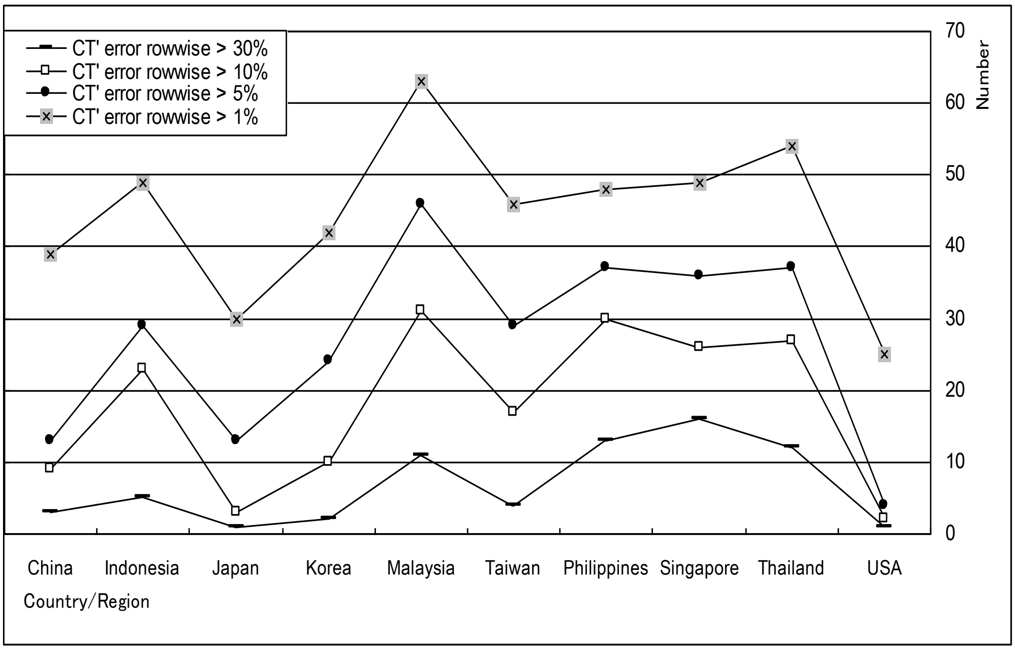


Figure 3: Distribution pattern of CT error



In order to rationally and efficiently decrease the discrepancies generated through the linking process, the procedure shown below (see Figure 2) is employed in final reconciliation of the AIIO table.

(a) Initially, we use the linking results to summarize the transactions among the industries of all countries and compile an AIIO table that there is only one sector per country. Then it becomes easy to check whether or not the present data in the AIIO table at the national level are consistent with the published data sources, such as the GDP statistics published by each country or the IMF statistics. Through the above checking, we can have the overall information on the preliminary linking results.

(b) In order to determine the size of the final adjustment in detail, we calculate the error rates of CT row-wise by sector for each country. Figure 3 shows the distribution pattern of the absolute rate of CT error at different levels for the 2000 AIIO table. The vertical axis represents the number of sectors in which CT's errors are larger than the specified levels. Obviously, China, Japan, and the U.S.A. have relatively smaller numbers that are counted at each level. On the other hand, Indonesia, Malaysia, the Philippines, Singapore, and Thailand have relatively larger numbers. Korea and Taiwan show the similar pattern. The distribution pattern shown in Figure 3 not only depends on the economic scale but also relates to the statistic system of each country. Considering the large scale of the AIIO table and the distribution pattern of error rates, any sector with relatively large rate of CT error (5%) is determined as the target for our adjustment.

(c) Though 5% is determined as the criterion for the preliminary adjustment, considering that positive errors and negative errors may offset each other row-wise, we have to investigate the structure of the errors in detail. As stated in the previous section, the AIIO table is mainly based on the import matrices of each country’s national IO table. However, there is no guarantee that a country’s import statistic can be completely consistent to its partner’s export statistics. In order to discuss the structure of the error in detail, we calculate the difference between a target country’s imports and its partner country’s export for every commodity. When looking at this information, the structure of a target country's CT error row-wise becomes easy to understand. This also offers us information about which sectors and which countries should be the main targets for adjustment.

(d) According to the analysis of bilateral trade information obtained from preliminary linking results and careful investigation of the HS-AIO code concordance, the majority of errors can be identified. Then the adjustment policy will be determined. Based on detailed discussion on the adjustment policy among related member staffs who are in charge of different target country, an adjustment card can be produced.

(e) The adjustment cards are used as input file in our adjustment program. Basically, the adjustment is merely executed on the import matrices, and it vertically moves the same figure from one sector to other sectors. This means that the CT balance can be maintained column-wise.

The above procedures (a) - (e) will be repeated until the results satisfy the specified criteria. Additionally, spot-check is conducted at the end of the adjustment. This is to "spot out" any unnatural entries in the table that might have been brought in during the process of the adjustment. For example, the output of electricity, gas & water supply or some other service sectors is not supposed to have any cells along Fixed Capital Formation or Change in Stocks. Any of such mis-tabulation should be adjusted properly.

2.4 Challenge towards the future project of international IO tables

Given the increasing economic interdependence across countries caused by the extension of globalization and regional integration, international IO tables have been considered a very useful data source for the analyses of production networks, international fragmentation production, global value chains and so on. In response to the increasing attentions and requirements from many policy makers and researchers, there are a lot of challenges reminded towards the future project.

The first challenge is about the time lag of publication. IDE compiles the AIIO tables every five years. However, there is always more than five-year time lag between the benchmark year and reference year. Since most countries construct their national IO table per five years, and also the benchmark year across countries are different, this makes it difficult to speed up the process of linking every countries' parts together in time. If the statistic system in much more Asian countries can switch to or follow the SUT (Supply and Use Table), annual national IO table can be easily estimated. This will help the compilation of international IO table become speedy.

The second challenge is about how to minimize the discrepancy arising from the linking process. As mentioned in the previous sections, the most important reasons causing the discrepancy are (1) the inconsistency of export/import figures between national IO table and international trade statistics; (2) the mirror problem in bilateral trade statistics caused by the treatment re-export and re-import; (3) the different treatment of valuation between export statistics (F.O.B) and import statistics (C.I.F). One of the possible solutions on the above problems is to apply the recent UN's BEC (Broad Economic Categories) classification to the current trade statistics[4]. Under this classification, trade data can be grouped into different end-use categories, like intermediate goods, final consumption goods, capital goods and so on. This can improve the precision of allocation of bilateral trade data when linking the national IO tables. In addition, according to the new recommendations for IMTS (International Merchandise Trade Statistics) proposed by UNSD, imports on the F.O.B basis in addition to the standard C.I.F valuation is expected to be published in the near future. This may help us make much more consistent bilateral trade data. Finally, the re-export statistics by country of origin and destination should be an important source in the solution of the mirror problem happened in trade statistics.

[4] For the recent information on end-use and industry based trade data, one can refer to the OECD s work (see Zhu,Yamano and Cimper 2011)

The third challenge is about the valuation. The AIIO tables are at producer's prices. It is no doubt that the most preferable valuation concerning the requirement of economic analysis is basic price. However, even at present, most of our member countries construct their national IO tables at producer's price. Fortunately, in recent years, much more Asian economies have been considering to establish or improve their SUT system under an international joint project supported by ADB[5]. If the SUT data for more Asian countries can be available, the national IO table at basic prices can be easily estimated.

3. COMPILATION OF THE TRANSNATIONAL INTERREGIONAL INPUT-OUTPUT TABLE BETWEEN CHINA AND JAPAN

Triggered by the commencement of 'Open-Door Policy' in 1978 and the entry into the WTO in 2001, an increasing presence of China has brought a significant change in the industrial network between China and Japan. Given the continuous reduction of international trade cost, the economic interdependence and integration between China and Japan experienced great development in recent years. At the same time, the cross-border economic interaction between the two countries by the way of production networks also spreads to each country's domestic economies at regional level. Since both China and Japan have relatively large economic scales, the economic size of their domestic province sometimes is larger than a middle-size country. This fact attracts us to considering the possibility to provide some information which can be used to measure the transnational interregional economic impacts between China and Japan. On this account, IDE-JETRO, with its 40 years of experience in compiling the international input-output tables, launched a new international joint project in 2006 on the compilation of the first-ever Transnational Interregional Input-Output (TIIO) Table between China and Japan, namely linking the individual interregional IO tables of the two countries. This section provides some fundamental information about the TIIO international project

3.1 Overview of the TIIO table

The 2000 TIIO table between China and Japan is designed to depict the transnational, interregional and inter-industrial network extended over the following nineteen regions, namely, seven domestic regions of China, eight domestic regions of Japan, five ASEAN5 countries (Indonesia, Malaysia, the Philippines, Singapore and Thailand), two economies of East Asia (Korea and Taiwan) and the United States. The domestic regions of China and Japan are from the aggregations of their domestic provinces. Annex 3 shows the detailed information of regions.

Due to the time and budget limitation, the TIIO project was designed to be completed within one-year. For the simplicity and because of the data availability, relatively rough industrial classification (ten sectors) is used in this project. Considering the recent evolution of production technologies and the features of production networks, instead of

5 See Hashiguchi (2011) for detailed survey based information on ADB's technical assistance for adopting the Supply-Use framework in Asian economies.

using the traditional classification, such as light industry, heavy industry, the following ten sectors are employed in the TIIO table.

001 Agriculture, livestock, forestry and fishery
002 Mining and quarrying
003 Household consumption products (Life-related manufacturing products)
004 Basic industrial materials (Primary makers's manufacturing products)
005 Processing and assembling (Secondary makers's manufacturing products)
006 Electricity, gas and water supply
007 Construction
008 Trade
009 Transportation
010 Services

The layout of the 2000 TIIO table is shown in Annex 4, which is similar to the AIIO table as shown in Annex 1. It is easy to see that this table provides detailed transnational, interregional and inter-industrial information on the input composition and output distribution of each domestic industry vis-à-vis home as well as foreign countries' industries.

3.2 Organizations involved in the TIIO project

The original idea of compiling the TIIO table is from Nobuhiro Okamoto, a previous research fellow of IDE. Based on his idea, in 2006, IDE launched the TIIO international project. This project is mainly based on the collaboration of the following institutions.

China: State Information Center (SIC)
Japan: Applied Research Institute, Inc. (ARI)
Japan: IDE-JETRO (project manager)

In addition, some experts from National Institute for Land and Infrastructure Management (NILIM), Ministry of Land, Infrastructure and Transport of Japan, Pacific Consultants Co,. LTD. also involved in this project as consultants and advisors.

3.3 Compilation procedure and methodology of the TIIO table

Roughly speaking, the compilation process of the TIIO table is very similar to the AIIO tables. There are mainly three steps. The first step is to adjust the format of different data source provided by China and Japan sides. The second step is to prepare the transnational and interregional trade data and split the import matrix of China and Japan's domestic interregional IO table by origins of the nineteen regions. Finally, the third step is to link China and Japan's parts completed in the second step and make the balancing and reconciliation work.

3.3.1 Data collection and estimation

The main data source used in the TIIO project is shown below:
(1) The 1997 interregional IO table of China
(2) The 2000 interregional IO table of Japan
(3) The 2000 Asian international IO table
(4) The 2000 commodity flow data by port between China and Japan
(5) Other supplementary data

The 2000 AIIO table is used as the control total data in the project. The SIC and ARI are in charge of the compilation of China's part and Japan's part respectively. Both parts are the interregional IO tables with separate import matrix by nineteen origins (endogenous regions). In order to making these parts, both institutions use the information of commodity flow by port between China and Japan to split the import matrix of their interregional IO tables. The commodity flow data by port is estimated by our consultants coming from the NILIM.

3.3.2 Compilation methodology

The 2000 TIIO table between China and Japan is compiled from the 2000 AIIO table and interregional IO tables of both China and Japan. Since there are not enough survey data for us to estimate the detailed transnational and interregional commodity flow, some relative strict assumptions are used. The main compilation method is based on the following principle.

Suppose that there is an international (bilateral) IO table between country R and country S and an interregional IO table between region p and region q for country R, the part of country R in the international IO table is divided into two regions (p and q) by using information obtained from the interregional IO table and transnational commodity flow data by port.

In order to divide the row-wise transactions of country R into regions, the regional ratio of interregional IO table is applied to the domestic transaction and the regional export ratio is used for dividing the export matrix to country S. Thus, the output structure of region p in country R can be estimated as follows:

$\frac{z_{ij}^{pp}}{(z_{ij}^{pp}+z_{ij}^{pq}+z_{ij}^{qp}+z_{ij}^{qq})} z_{ij}^{RR}$: intermediate output of region *p* in country *R*

$\frac{f_{il}^{pp}}{(f_{il}^{pp}+f_{il}^{pq}+f_{il}^{qp}+f_{il}^{qq})} f_{il}^{RR}$: final demand of region *p* in country *R*

$\frac{e_{i}^{pS}}{(e_{i}^{pS}+e_{i}^{qS})} z_{ij}^{RS}$: exports from region *p* in country *R* to intermediate sectors in country *S*

$\frac{e_{i}^{pS}}{(e_{i}^{pS}+e_{i}^{qS})} f_{il}^{RS}$: exports from region *p* in country *R* to final demand sectors in country *S*

$\frac{x_i^p}{(x_i^p + x_i^q)} x_i^{RR}$: gross output of region *p* in country *R*

where, e represents exports. Region q in country R is also estimated in the same manner. After splitting the row vector of country R into regions, the column-wise division is done in the same way as described above. The input structure of region p in country R is estimated as follows:

$\frac{m_i^{Sp}}{(m_i^{Sp} + m_i^{Sq})} z_{ij}^{SR}$: imports of region *p* in country *R* from country *S*

$\frac{m_i^{Wp}}{(m_i^{Wp} + m_i^{Wq})} z_{ij}^{WR}$: imports of region *p* in country *R* from the rest of the world (*W*)

$\frac{v_{kj}^p}{(v_{kj}^p + v_{kj}^q)} v_{kj}^R$: value added of region *p* in country *R*

$\frac{x_j^p}{(x_j^p + x_j^q)} x_j^R$: gross input of region *p* in country *R*

where, m indicates imports. Finally, region p's import matrix from country S is divided by region of origin in country S. Let the region of country S be y, then we have

$\frac{e_i^{yR}}{\sum_y e_i^{yR}} \frac{m_i^{Sp}}{(m_i^{Sp} + m_i^{Sq})} z_{ij}^{SR}$: imports of region *p* in country *R* from region *y* in country *S*

The imbalances arise in both rows and columns. The adjustment based on the RAS method and the specialists' opinions are performed to eliminate the discrepancies.

3.4 Some new movements towards the next joint TIIO projects

After the Great East Japan Earthquake happened on March 11 2011, transnational economic impacts focusing on specific domestic regions have attracted a lot of attention for regional governments. Given the deepening economic interdependence and the increasing transnational spillover impact at domestic regional level among East-Asian economies, IDE is planning to launch a new international project of 2005 TIIO table involving the three East Asian countries, Japan, China and Korea from Japan's fiscal year of 2012. This will be also the first-ever joint project that links the domestic interregional/multiregional IO table together for the three East-Asian countries.

The good news is that the 2005 interregional IO tables for Japan and Korea have been available for us; the SIC of China is on the process of compiling the 2002 and 2007 interregional IO tables which are expected to be officially published soon. This section provides some new information about the on-going compilation process of China's multi-regional IO table and some related employment data.

3.4.1 Compilation of China's multi-regional IO tables

SIC and IDE jointly compiled 1997 China 8-region, 30-industry multi-regional IO (CMRIO) model (see IDE 2003), which was widely used internationally. However, since 1997, as China's interregional trade and economic linkage strengthens, it's more urgent to update and develop 2002 and 2007 CMRIO model according to the compiling year of IO table in China.

Based on summarizing the experience on our 1997 CMRIO model development, SIC further study and improve the development methods and procedures on CMRIO model, then 2002 and 2007 MRIO model are successively developed based on more normative method.

In construction of 2002 and 2007 CMRIO models, we adopt the industrial classification used by the National Bureau of Statistics (NBS). We aggregate some of the service industries, so that the models are classified at 29-industry level. This industrial classification methodology is basically comparable to that used for the CMRIO model for 1997, allowing for the establishment of a series of CMRIO models. The regional division for the 2002 and 2007 models is identical to that for the 1997 model. All research and development work for the 2002 and 2007 CMRIO models, however, is based on separate information on 30 provinces (municipalities, autonomous regions[6]), allowing for different combinations in regional division and thus the establishment of CMRIO models for different regions.

There are several characteristics in our 2002 and 2007 CMRIO model development: first, the entire development is based on 30 provinces, various regional versions of CMRIO model can be made after aggregating different province groups, according to needs of regional plan and policy design; second, in CMRIO core work - estimating interregional trade coefficient, we propose specific models and estimation methods, based on entropy maximizing and gravity models; third, in cooperation with NBS, we modify interregional transaction matrix, adopting the basic survey data reflecting inter-province inflow and outflow in "National Input-Output Survey 2007"; fourth, when conducting balance adjustment, each province's table are fully used in total control that the sum of all provinces' parts equals national table.

During the compilation of the 2002 and 2007 CMRIO tables, the following difficulties and challenges have been our main targets for adjustment.

(a) Inconsistence between the trade data in national IO table and customs trade data

Although the IO tables for provinces are improving continuously in term of the details of trade data, they still need to be further divided and be converted to import-inflow non-competitive input-output tables. During the adjustment of two-column trade data

[6] Due to IO table of Tibet province is not compiled, Tibet is not included in provinces described in this paper. Also, economic structure of Tibet is not considered in the development of CMRIO model.

tables[7], the Customs trade data for individual provinces are used to produce data for the "import" and "export" columns, and the "inflow + import" and "outflow + export" columns of provincial tables are used to generate the "inflow" and "outflow" columns. However, it is noted in the actual calculation process that the values in the "inflow" and "outflow" columns for some industries may be negative after the deduction of import or export data, which means the Customs trade data do not match the input-output trade data.

When looking for solution to this problem, we retained the data provided in the provincial input-output tables wherever possible. Namely, we deducted the import and export data calculated using Customs trade data from the "inflow + import" and "outflow + export" columns of two-column tables for individual provinces to generate the "inflow" and "outflow" columns. When the "inflow" or "outflow" values are negative, we adjust the corresponding import figures to make them equal to "inflow + import" or the export figures to make them equal to "outflow + export", and set the corresponding "inflow" or "outflow" values as zero. We use this method also because two-column tables are mainly compiled by inland provinces, where the shares of inflows and outflows are relatively small.

(b) Adjustment to provincial processing trade and "re-export" data

When estimating data for provincial non-competitive input-output tables, we found that if import and inflow data are respectively deducted from the intermediate and final demands, some elements of the intermediate or final demand matrix or even the sum of the intermediate demand or final demand for some industries may be negative. This means that even if all products used in a province are imported or inflow products, it is impossible to use up all the products, and this is obviously inconsistent with the facts.

To solve this problem, we need Customs processing trade data and "re-export" trade data classified by province and product as well as data on "re-export" trade between domestic provinces. As we have little or even no such statistics, we use the following method and achieve good results. No negative value occurs again concerning the intermediate use and final use in any industry. Our method is based on the assumption that part of the imports and inflows is used for exports and outflows and is thus deducted. The share of this part of imports and inflows is the ratio of exports and outflows to intermediate use and final use.

[7] According to the completeness of included data on the trade with other provinces and countries, we divided provincial tables into three categories: four-column tables, two-column tables and one-column tables. Four-column tables have four trade data columns – "inflow", "outflow"(refer to the domestic trade between the province and other provinces), "import" and "export". Two-column tables have only two trade data columns – "inflow + import" and "outflow + export". One-column tables have only one column – "net outflow" (outflow + export – inflow - import) or "net inflow" (inflow + import – outflow - export).

(c) Balance adjustment

We apply RAS method to conduct balance adjustment to preliminary estimates, with the national table being used as the control. In addition, we need to revise the interregional intermediate and final use flow matrix inferred from trade coefficients against the results of inflows and outflows between provinces available from the "National Input-Output Survey 2007".

As CMRIO model incorporates a huge amount of data including national input-output data, provincial input-output data, Customs data and transportation data, errors are unavoidable. Errors are primarily from the following sources: (1) the processes of converting provincial tables to "four-column" tables and estimating data for import-inflow non-competitive tables; (2) the calculation of control totals of industries of provinces; (3) when we use the national input-output table as the control, the total inputs are calculated by adding together the intermediate inputs and the primary inputs (value added), so discrepancies with the intermediate uses and the final uses are unavoidable; (4) original errors in provincial input-output tables. After passing through all the steps in the development of the model, all these errors are finally reflected in the error term. Therefore, it is a very important and technically challenging job to find the appropriate method to consider the various balance relations in the CMRIO models, to calculate various control data, and to minimize errors during the development of models. We carefully consider and repeatedly try a lot of methods during the development of the model and have brought errors under effective control. As a result, we have made only minor adjustment to the error term using the expertise, and complete the development of CMRIO models.

3.4.2 Compilation of China's regional employment matrix

In order to analyze effects of trade linkages between China and Japan on each region's employment in China by using TIIO model, 4-category, 7-region and 10- industry employment matrix in 2000 of China is compiled. Four categories of labors are defined as follows: First, agricultural labors, who are engaged in agriculture; Second, rural non-agricultural labors, who hold rural residential status and engage in activities in the secondary industry and services in rural areas; Third, urban lowly educated labors in the secondary industry and services, who hold residential status and work in unskilled occupations in urban industries, and their education levels include no schooling, elementary, junior middle and senior middle school; Fourth, urban highly educated labors in the secondary industry and services, who hold residential status and work in skilled occupations in urban industries, and their education levels include college, university, graduate and over.

Primary data used include: employment of three industries (agriculture, secondary industry and service), 97-industry employment in urban units, 7-industry employment in whole nation and urban private enterprises and self-employed individuals, total urban employment, which are from China Statistical Yearbook; 31-province, 97-industry employment in urban units, urban employment structures of 19 industries in whole nation and each province classified by education levels, which is from China Population

& Employment Statistics Yearbook; 31-province, 6-industry employment in township enterprises which are from China Agriculture Yearbook.

(a) Agricultural employment

There is agricultural employment data of 31 provinces in China Statistical Yearbook, however, the sum of all provinces' employment is smaller than the whole country. Agricultural employment of each province is scaled to that the sum of 31 province's employment equals the employment of the whole country, according to above provincial employment structure.

(b) Rural non-agricultural employment

Rural non-agricultural employment includes employment in township enterprises and employment of private enterprises and self-employed individuals outside of towns and cities. Total rural non-agricultural employment of secondary industry and services is obtained by subtracting urban lowly and highly educated employment from total employment of corresponding industries in China Statistical Yearbook. 31-province, 6-industry (manufacturing, Construction, Transportation, Wholesale and retail trades, Hotels and catering service, Social service) employment of township enterprises is obtained from China Agriculture Yearbook. Thus rural non-agricultural employment of each industry in each province can be obtained by scaling 6-industry employment of township enterprises in China Agriculture Yearbook, and by 7-industry employment of rural private enterprises and self-employed individuals from China Statistical Yearbook.

(c) Employment of urban lowly and highly educated labors in secondary industry and services

Urban employment of all industries in each province can be reclassified into lowly educated and highly educated employment, according to education level structures of each industry's employment from China Population & Employment Statistics Yearbook. Urban employment of lowly and highly educated labor of each industry in each province, except for agriculture, can be obtained by scaling employment of urban units to that the sum of which equals total urban employment in China Statistical Yearbook.

After the above estimations, the data is aggregated to 4-category, 7-region, 10-industry employment matrix, according to the mapping from 10 industries in 2000 TIIO model to 97 industries in China Statistical Yearbook. Based on compensation of employees in TIIO model, each industry's per capita labor income is calculated, then the accuracy of each industry's employment can be tested by comparing with average compensation of employees of corresponding industry in urban units in China Statistical Yearbook.

4. APPLICATION EXAMPLES OF IDE-JETRO'S INTERNATIONAL INPUT-OUTPUT TABLES

4.1 Vertical specialization measurements based on the AIIO tables

The recent increasing importance of vertical specialization (VS) trade has been considered one of the most outstanding features of the rapid economic globalization and regional integration. Notably, more intermediate parts and components are produced in sequential stages or processed across different countries, and then exported to other countries for further production. In an attempt to understand countries' depth of participation in global production chains, many Input-Output based VS indicators have been developed.

Here, we utilize both demand-driven and supply-driven I-O model to show how the vertical specialization trade has evolved in the Asia-pacific region during 1990 and 2008. Alternative measures proposed here provide different views of vertical specialization which can add supplementary information to the existing indicators.

We first define four VS related indicators based on traditional IO models:

$$VS0^{r}_{imd} = M^{or}_{imd}\ (I\text{-}A^{rr})\text{-}1\ EX^{ro}_{imd} \ /\ EX^{ro} \qquad (1)$$

where, the subscript r and o represent country r and the rest of the world. M^{or}_{imd} is country r's import (imported intermediate goods) coefficient vector (1*n), I the identity matrix, A^{rr} country r's domestic input coefficient matrix (n*n), $(I\text{-}A^{rr})^{-1}$ the Leontief inverse matrix, EX^{ro}_{imd} the vector of country r's exports of intermediate goods (n*1), EX^{ro} the total value (scalar) of country r's exports. As shown in Figure 1, $VS0^{r}_{imd}$ represents the directly and indirectly induced imports of intermediate goods by exports of intermediate goods, which can also be explained as the value of imported intermediates embodied in country r's exports of intermediate goods. In this meaning, the VS0 reflects country r's degree of participation in international production networks from the view of the import demander (country r).

On the other hand, if the vector of imported intermediates by country of origin is available, the following alternative measurement (VA1) proposed by Yi (2003) can also be estimated.

$$VS1^{r}_{imd} = \Sigma_{s}(M^{rs}_{imd}\ (I\text{-}A^{ss})\text{-}1\ EX^{so}_{imd}) \ /\ EX^{ro} \qquad (2)$$

the VS1 captures the embodied value of country r's exports used as intermediate inputs used to produce exports of intermediate goods in other countries. Comparing with the VS0, the VS1 also reflects country r's degree of participation in international production networks, but it is from the viewpoint of a supplier (country r) of intermediate goods. Therefore this indicator is an alternative measure of countries' participation degree in global value chains, particularly for countries specializing in the first stages of the vertical chain.

If the demand-driven I-O model is well accepted in the fields of national account and regional economics, the supply-driven model always faces on both critical and supporting comments. Despite there is a restrictive assumption in the supply-driven model, namely each commodity is sold to each sector in fixed proportions, it has been proved that the model can be interpreted as a price I-O model (Dietzenbacher, 1997). In this meaning, these two models may be considered as two sides of one coin, which reflect dual relationship of demand and supply within the same economic system.

As mentioned above, the VS0 indicator based on demand-driven I-O model captures the "import contents of export", which shows how many imports are directly and indirectly necessary for producing exports. It should be noted that the VS0 is based on the Leontief inverse, which represents the backward linkage in interindustrial production chain. On the other hand, in supply-driven I-O model, the forward linkage in interindustrial production chain can be defined by the Ghosh inverse. Therefore, using the Ghosh inverse, we can easily show how many imports are re-exported or how many exports are induced by the supply of imported intermediates. Here, we introduce an alternative measurement of vertical specialization, and call it "export contents of import", which can be given as follows:

$$VS0^{r*}_{imd} = IM^{or}_{imd}\ (I\text{-}G^{rr})\text{-}1\ E^{ro}_{imd}\ /\ IM^{or} \qquad (3)$$

Where, IM^{or}_{imd} is the vector (1*n) of imported intermediates of country r, G^{rr} the domestic allocation coefficient matrix (n*n), $(I\text{-}G^{rr})\text{-}1$ the Ghosh inverse matrix, E^{ro}_{imd} country r's export coefficient vector (n*1) in terms of intermediate goods, IM^{or} the total value (scalar) of country r's imports.

If the vector of exports by country of destination is available, following the relationship between the VS0 and VS1, the VS1* can be written as the form below:

$$VS1^{r*}_{imd} = \Sigma_s(IM^{os}_{imd}\ (I\text{-}G^{ss})\text{-}1\ E^{sr}_{imd})\ /\ IM_{or} \qquad (4)$$

For investigating the evolvement of vertical specialization in the Asia-Pacific region during 1990 and 2008, we plot vicarious VS measures introduced above in Figure 4. In the upper left of the figure, the movement of two demand-driven type VS ($VS0_{imd}$ and $VS1_{imd}$) measures for all economies over 1990 and 2000 are illustrated. It is easy to see that 1) the vertical specialization in the Asia-Pacific region had developed rapidly during the period, since both $VS0_{imd}$ and VS1imd grew up for almost all economies. 2) The $VS1_{imd}$ grew much faster than $VS0_{imd}$ for the developed economies like the United States and Japan. This implies that these two economies joined in the vertical production chain by mainly providing more intermediate goods to other economies rather than import more intermediates from outside. This is not difficult to be understood since during 1990 and 2000 the outsourcing and FDI flows from developed countries to developing countries experienced much boosted development. As a result, the United States and Japan tended to provide more intermediates to their outsourcing or FDI target countries. 3) Both $VS0_{imd}$ and $VS1_{imd}$ increased rapidly for other Asian economies, with the exception of China. This clearly reflects that the production networks inside the region have become more complex since the Asian economies tended to not only import more intermediates from outside but also provide more intermediates to other economies. 4) The $VS0_{imd}$ for China shows little increasing tendency, but its $VS1_{imd}$ remained stagnant. This means that China had not completely involved in the vertical production network of the Asia-Pacific region until 2000. There are various reasons to explain this, but the most important one is that China was not WTO member over the period.

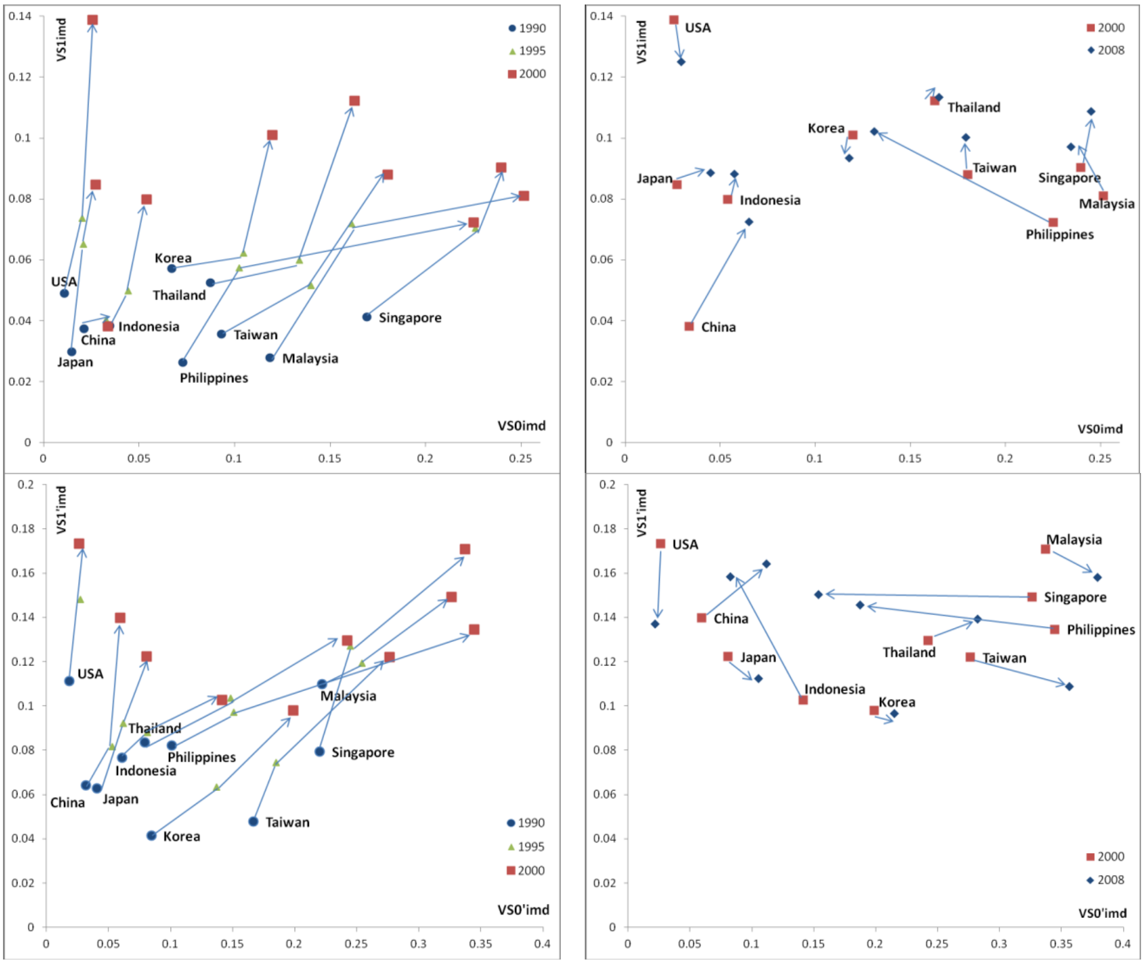
In the upper right of Figure 4, the movement of $VS0_{imd}$ and $VS1_{imd}$ for all economies over 2000 and 2008 are illustrated. The main features can be summarized as follows: 1) comparing with the upper left of the figure, there are not distinct changes for all economies except the Philippines and China. The Philippines's $VS0_{imd}$ declined sharply. It can be considered a kind of "regression" or "readjustment" since the same measure for the Philippines during 1990 and 2000 experienced extremely fast increase. On the other hand, both $VS0_{imd}$ and $VS1_{imd}$ for China grew up very rapidly. This implies that after the participant of WTO, China has certainly involved in the vertical supply chain of the region and began to play more important role not only as a demander of imported intermediates but also as a provider of intermediate goods. 2) Even if the impact of the Crisis, the $VS1_{imd}$ measures for most economies (except the United States and Korea) still increased to some extent. This reflects the continuously deepening production network within the region since more economies tend to enhance their participation share in the vertical supply chain as a provider of intermediate goods.

$VS0^*_{imd}$ and $VS1^*_{imd}$ are based on supply-driven I-O model, which can provide different views of vertical specialization. It is because that the $VS0^*_{imd}$ can captures the "export contents of import" of intermediate goods, and the $VS1^*_{imd}$ shows how many imported intermediates of a country are from other countries' imported intermediates. From the lower left of Figure 4, it is easy to see that 1) the vertical supply chains of the Asia-Pacific region had experienced very quick development during 1990 and 2000, since both $VS0^*_{imd}$ and $VS1^*_{imd}$ grew up for all economies in the region. 2) The $VS1^*_{imd}$ grew much faster than $VS0^*_{imd}$ for the three largest economies, namely the United States, Japan and China. This implies that the length of vertical supply chains related to these three economies had increased rapidly since much more imported intermediates of these economies are from other economies' imports. However, their imported intermediates were mainly used for domestic demands since their $VS0^*_{imd}$ were relatively lower. 3) Much more imported intermediates were used to produce exports of intermediate goods in all Asian economies, since their $VS0^*_{imd}$ grew very fast during the period. At the same time, their $VS1^*_{imd}$ measures also show increasing tendency. This implies that the length of vertical supply chains related to these economies had also increased.

When looking at the lower right of Figure 4, very dynamic movement can be confirmed: 1) China and Thailand still enhanced their participation levels of vertical supply chain over 2000 and 2008. 2) Japan, Korea, Taiwan and Malaysia show similar movements, namely their $VS1^*_{imd}$ declined to some extent, but $VS0^*_{imd}$ continuously increased, especially for Malaysia and Taiwan. 3) The $VS1^*_{imd}$ for the United States dropped sharply. Since the 2005 or 2007 I-O tables for most economies are not available at present, it is difficult to identify the impact of the Crisis on vertical specialization.

However, it is clear that the rapid rise of Chinese economy after its WTO accession caused a great structural change of production networks in the Asia-Pacific region.

Figure 4: Evolvement of vertical specialization (%)



4.2 Transnational impacts of final demand change on employment between China and Japan measured by the TIIO table[8].

China and Japan are both important economy and trade partners of each other, and economy and trade linkages between them play critical roles in both their economic development. From bilateral trade, before 2003 Japan had long been China's largest trade partner, and in 1990s China was Japan's second largest trade partner, just behind USA.

[8] Thanks to Miss. An Peng, Central University of Finance and Economics, China, for her diligent assistance.

Rapid development of economy and trade linkages between China and Japan benefit employment in both countries significantly. As reported, "foreign trade facilitates China's modernization and makes China an open economy, and foreign trade directly drives over 80 million employment, in which over 60% are from rural areas and their income and living are improved." Rising demand in one industry in China and Japan trade will not only directly drive employment in the industry, but also indirectly employment in correlated industries through interrelation of industrial structures. On the other hand, driving effects of trade linkages on different regions and industries in both countries are different, and effects on different occupations are also not identical. Meanwhile, driving effects on different occupations of each industry in China and Japan are not only correlated with their demand structures, but also with industrial structures, employment structures and income distribution structures.

China is a country with large employment and large trade power, so there are important practical significance in studying the effect of foreign trade on its employment and income distribution. However, there is little research on effects of foreign trade between China and its main trade partners on employment, especially employment in different regions and different industries. One of the reasons is lacking of detailed employment data in China and no employment matrix is compiled in China's IO table, and the other reason is lack of international IO model which can be used for correlated analysis.

TIIO model between China and Japan 2000, compiled by SIC and IDE, provides instruments in analyzing effects of trade between Japan and China on employment in different regions and different industries.

The TIIO model between China and Japan can be written as following matrix form,

$$\begin{bmatrix} X^{C1} \\ \vdots \\ X^{C7} \\ X^{J1} \\ \vdots \\ X^{J8} \end{bmatrix} = \begin{bmatrix} B^{C1C1} & \cdots & B^{C1C7} & B^{C1J1} & \cdots & B^{C1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{C7C1} & \cdots & B^{C7C7} & B^{C7J1} & \cdots & B^{C7C8} \\ B^{J1C1} & \cdots & B^{J1C7} & B^{J1J1} & \cdots & B^{J1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{J8C1} & \cdots & B^{J8C7} & B^{J8J1} & \cdots & B^{J8J8} \end{bmatrix} \cdot \begin{bmatrix} F^{C1C1} + \cdots + F^{C1C7} + F^{C1J1} + \cdots + F^{C1J8} + L^{C1W} \\ \vdots \\ F^{C7C1} + \cdots + F^{C7C7} + F^{C7J1} + \cdots + F^{C7J7} + L^{C7W} \\ F^{J1C1} + \cdots + F^{J1C7} + F^{J1J1} + \cdots + F^{J1J8} + L^{J1W} \\ \vdots \\ F^{J8C1} + \cdots + F^{J8C7} + F^{J8J1} + \cdots + F^{J8J8} + L^{J8W} \end{bmatrix} \quad (5)$$

Where *B* is the Leontief inverse matrix for each region of China and Japan; *X, F* and *L* are their total outputs, final demands and exports to other economies.

We define the employment matrix as,

$$E = \begin{bmatrix} E^{C1} \\ \vdots \\ E^{C7} \\ E^{J1} \\ \vdots \\ E^{J8} \end{bmatrix} \qquad (6)$$

Where E^{Ci} and E^{Ji} are China and Japan region i employment matrix. We define $l_i^{Cr} = \frac{e_i^{Cr}}{X_i^{Cr}}, l_i^{Jr} = \frac{e_i^{Jr}}{X_i^{Jr}}$ representing employment and output rations for China and Japan region r and industry i. Thus the labor input coefficient matrix can be written as,

$$L = \begin{bmatrix} L^{C} \\ \vdots \\ L^{C} \\ L^{J} \\ \vdots \\ L^{J} \end{bmatrix} = \begin{bmatrix} E^{C1} / X^{C1} \\ \vdots \\ E^{C7} / X^{C7} \\ E^{J1} / X^{J1} \\ \vdots \\ E^{J8} / X^{J8} \end{bmatrix} \qquad (7)$$

So we can have,

$$\begin{bmatrix} E^{C1} \\ \vdots \\ E^{C7} \\ E^{J1} \\ \vdots \\ E^{J8} \end{bmatrix} = \begin{bmatrix} \hat{L}^{C1} & & & & & \\ & \ddots & & & & \\ & & \hat{L}^{C7} & & & \\ & & & \hat{L}^{J1} & & \\ & & & & \ddots & \\ & & & & & \hat{L}^{J8} \end{bmatrix} \cdot \begin{bmatrix} B^{C1C1} & \cdots & B^{C1C7} & B^{C1J1} & \cdots & B^{C1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{C7C1} & \cdots & B^{C7C7} & B^{C7J1} & \cdots & B^{C7C8} \\ B^{J1C1} & \cdots & B^{J1C7} & B^{J1J1} & \cdots & B^{J1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{J8C1} & \cdots & B^{J8C7} & B^{J8J1} & \cdots & B^{J8J8} \end{bmatrix} \cdot$$

$$\begin{bmatrix} F^{C1C1} + \cdots + F^{C1C7} + F^{C1J1} + \cdots + F^{C1J8} + L^{C1W} \\ \vdots \\ F^{C7C1} + \cdots + F^{C7C7} + F^{C7J1} + \cdots + F^{C7J7} + L^{C7W} \\ F^{J1C1} + \cdots + F^{J1C7} + F^{J1J1} + \cdots + F^{J1J8} + L^{J1W} \\ \vdots \\ F^{J8C1} + \cdots + F^{J8C7} + F^{J8J1} + \cdots + F^{J8J8} + L^{J8W} \end{bmatrix} \qquad (8)$$

Where $\hat{L}$ is the diagonal matrix of labor input coefficient matrix L. Then we can have,

$$
= \begin{bmatrix} \hat{L}^{C1} & & & & & \\ & \ddots & & & & \\ & & \hat{L}^{C7} & & & \\ & & & \hat{L}^{J1} & & \\ & & & & \ddots & \\ & & & & & \hat{L}^{J8} \end{bmatrix} \cdot \begin{bmatrix} B^{C1C1} & \cdots & B^{C1C7} & B^{C1J1} & \cdots & B^{C1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{C7C1} & \cdots & B^{C7C7} & B^{C7J1} & \cdots & B^{C7J8} \\ B^{J1C1} & \cdots & B^{J1C7} & B^{J1J1} & \cdots & B^{J1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{J8C1} & \cdots & B^{J8C7} & B^{J8J1} & \cdots & B^{J8J8} \end{bmatrix}
$$

$$
= \begin{bmatrix} \hat{L}^{C1} B^{C1C1} & \cdots & \hat{L}^{C1} B^{C1C7} & \hat{L}^{C1} B^{C1J1} & \cdots & \hat{L}^{C1} B^{C1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \hat{L}^{C7} B^{C7C1} & \cdots & \hat{L}^{C7} B^{C7C7} & \hat{L}^{C7} B^{C7J1} & \cdots & \hat{L}^{C7} B^{C7J8} \\ \hat{L}^{J1} B^{J1C1} & \cdots & \hat{L}^{J1} B^{J1C7} & \hat{L}^{J1} B^{J1J1} & \cdots & \hat{L}^{J1} B^{J1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \hat{L}^{J8} B^{J8C1} & \cdots & \hat{L}^{J8} B^{J8C7} & \hat{L}^{J8} B^{J8J1} & \cdots & \hat{L}^{J8} B^{J8J8} \end{bmatrix} \quad (9)
$$

The column sun of $\hat{L}^{C1} B^{C1C1}$ is the employment increase of each industry in region *C1* induced by its final demand. Thus the domestic intra-regional employment multiplier of China region *C1* can be written as $(L^{C1})^T B^{C1C1}$, where $(L^{C1})^T$ is the row-wise labor input coefficients. So we can write the intra-regional employment multiplier as follows,

China intra-regional employment multiplier : $(L^{Cr})^T B^{CrCr}, r = 1,2,\cdots,7$

Japan intra-regional employment multiplier : $(L^{Js})^T B^{JsJs}, s = 1,2,\cdots,8$

Similarly we can have,

China interregional employment multiplier: $(L^{Ck})^T B^{CkCl}, k,l = 1,2,\cdots,7; k \neq l$

Japan interregional employment multiplier: $(L^{Jk})^T B^{JkJl}, k,l = 1,2,\cdots,8; k \neq l$

Japan induced China regional employment multiplier:

$$(L^{Ck})^T B^{CkJl}, k = 1,2,\cdots,7; l = 1,2,\cdots,8$$

China induced Japan regional employment multiplier:

$$(L^{Jk})^T B^{JkCl}, k = 1,2,\cdots,8; l = 1,2,\cdots,7$$

With aggregating the final demand of each region, equation (6) can be re-written as,

$$\begin{bmatrix} \hat{L}^{C1} & & & & & \\ & \ddots & & & & \\ & & \hat{L}^{C7} & & & \\ & & & \hat{L}^{J1} & & \\ & & & & \ddots & \\ & & & & & \hat{L}^{J8} \end{bmatrix} \cdot \begin{bmatrix} B^{C1C1} & \cdots & B^{C1C7} & B^{C1J1} & \cdots & B^{C1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{C7C1} & \cdots & B^{C7C7} & B^{C7J1} & \cdots & B^{C7J8} \\ B^{J1C1} & \cdots & B^{J1C7} & B^{J1J1} & \cdots & B^{J1J8} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ B^{J8C1} & \cdots & B^{J8C7} & B^{J8J1} & \cdots & B^{J8J8} \end{bmatrix} \cdot \begin{bmatrix} F^{CC1} + F^{CJ1} \\ \vdots \\ F^{CC7} + F^{CJ7} \\ F^{JC1} + F^{JJ1} \\ \vdots \\ F^{JC8} + F^{JJ8} \end{bmatrix} =$$

$$\begin{bmatrix} \hat{L}^{C1} B^{C1C1}(F^{CC1} + F^{CJ1}) + \cdots + \hat{L}^{C1} B^{C1C7}(F^{CC7} + F^{CJ7}) + \hat{L}^{C1} B^{C1J1}(F^{JC1} + F^{JJ1}) + \cdots + \hat{L}^{C1} B^{C1J8}(F^{JC8} + F^{JJ8}) \\ \vdots \\ \hat{L}^{C7} B^{C7C1}(F^{CC1} + F^{CJ1}) + \cdots + \hat{L}^{C7} B^{C7C7}(F^{CC7} + F^{CJ7}) + \hat{L}^{C7} B^{C7J1}(F^{JC1} + F^{JJ1}) + \cdots + \hat{L}^{C7} B^{C7J8}(F^{JC8} + F^{JJ8}) \\ \hat{L}^{J1} B^{J1C1}(F^{CC1} + F^{CJ1}) + \cdots + \hat{L}^{J1} B^{J1C7}(F^{CC7} + F^{CJ7}) + \hat{L}^{J1} B^{J1J1}(F^{JC1} + F^{JJ1}) + \cdots + \hat{L}^{J1} B^{J1J8}(F^{JC8} + F^{JJ8}) \\ \vdots \\ \hat{L}^{J1} B^{J1C1}(F^{CC1} + F^{CJ1}) + \cdots + \hat{L}^{J1} B^{J1C7}(F^{CC7} + F^{CJ7}) + \hat{L}^{J1} B^{J1J1}(F^{JC1} + F^{JJ1}) + \cdots + \hat{L}^{J1} B^{J1J8}(F^{JC8} + F^{JJ8}) \end{bmatrix} \quad (10)$$

China domestic final demand induced employment of China region *Cr* can be written as follows,

$$\hat{L}^{Cr}(B^{CrC1} F^{CC1} + \cdots + B^{CrC7} F^{CC7}), r = 1,2,\cdots,7$$

Japan demand induced China employment of China region *Cr* can be written as follows,

$$\hat{L}^{Cr}(B^{CrC1}F^{CJ1}+\cdots+B^{CrC7}F^{CJ7})+\hat{L}^{Cr}(B^{CrJ1}F^{JJ1}+\cdots+B^{CrJ8}F^{JJ8})+\hat{L}^{Cr}(B^{CrJ1}F^{JC1}+\cdots+B^{CrJ8}F^{JC8}) \quad r$$

$= 1,2,\ldots,7.$

The geographical locations for each China regions are shown in Figure 5. DongBei (northeast) is a traditional manufacturing base, while HuaBei (north coast), HuaDong (east coast) and HuaNan (south coast) are the developed regions since China opening and reform policy was taken since 1978. XiBei (northwest) and Xinan (southwest) are inland western regions whose incomes are relatively low. In 2000, according to the statistics, the economic size of HuaBei and HuaDong are the 2 biggest regions in terms of GDP, while the biggest employment is from HuanZhong (middle China), which accounts for 26.8 per cents of the total employment. The three coastal regions and DongBei covers most of the exports in 2000. 41.9% Japan import from China is from HuaDong .

Figure 5: Locations for each regions in China

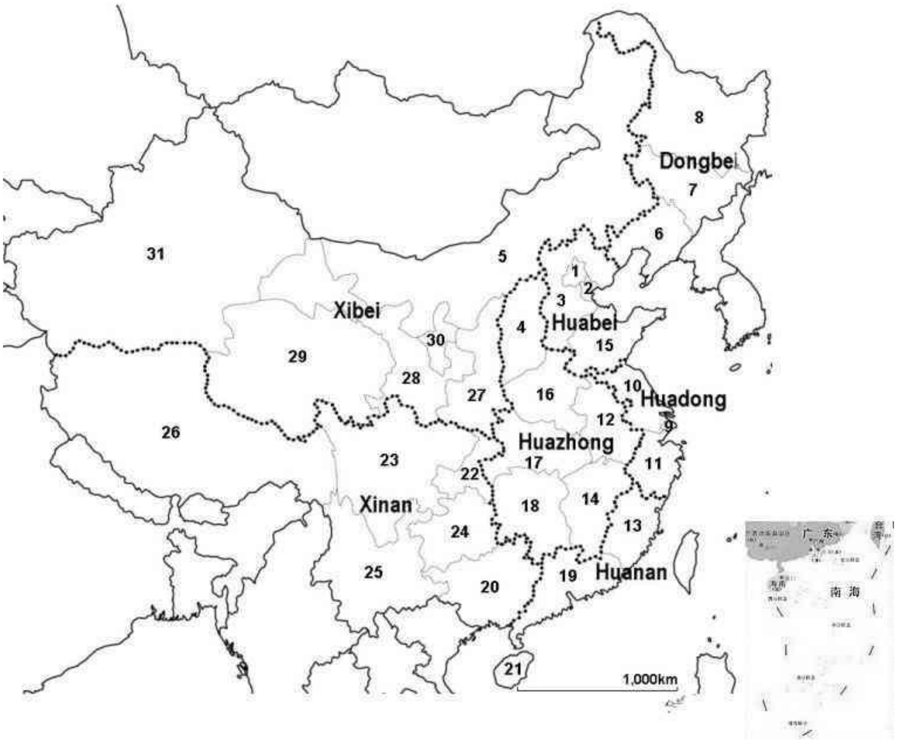


Table 4: China's Regional Development in 2000

	GDP(million USD)	GDP (%)	Employment (1000 persons)	Employ-ment (%)	Japan import from China (million USD)	Japan import from China (%)
DongBei	109800.8	9.8	53537.2	7.5	5291.5	11.8
HuaBei	234745.3	21.0	109479.4	15.4	10081.9	22.5
HuaDong	231927.8	20.8	82247.6	11.6	18790.4	41.9
HuaNan	163893.2	14.7	75468.8	10.6	10247.6	22.8
HuaZhong	171754.8	15.4	190915.3	26.8	28.9	0.1
XiBei	76363.6	6.8	63447.4	8.9	251.5	0.6
XiNan	127031.0	11.4	136404.4	19.2	198.2	0.4
Total	1115516.5	100.0	711500.0	100.0	44890.0	100.0

Data source: 2000 TIIO for China and Japan.

The domestic demand contributes 646.2 million employments which accounts for 90.8% of the 2000 total employment in China. It means that the external demand induced 9.2% or 65.3 million employments for China in 2000. Japanese demand induced 2.25% or 16.03 million employments in China.

The characteristics of China domestic employment multiplier and Japan induced employment multiplier differ. HuaZhong, XiNan and XiBei have the 3 biggest regional domestic employment multipliers. The agriculture sector possesses the larger domestic employment multiplier for each region. Basic industrial materials, transportation and services industries in some regions have stronger domestic employment multiplier effect. In contrast, the coastal regions of HuaBei, HuaDong, HuaNan and DongBei have the bigger Japan demand induced employment multiplier. Agriculture, basic industrial materials, household consumption products and mining and quarrying industries in most of the coastal regions possess the larger Japan induced employment multipliers. The Japan induced employment multipliers in almost all industries in coastal regions are bigger than that in the inland regions.

Although the inland regions hold the larger domestic employment multipliers, the induced employments in HuaZhong, XiNan and HuaBei ranks top three among that of the 7 regions, which is due to the large total employments in these regions. But Japan induced China employment multiplier and employment is both strong in coastal regions. Agriculture, basic industrial materials and household consumption products have bigger effects in those regions, while for domestic effects, except for agriculture, basic industrial materials, transportation and services industries multipliers and induced employments are bigger.

Japan induced China employment multiplier and employment are much bigger for agricultural, rural non-agricultural and urban lowly educated employments, while the multiplier of urban highly educated employment is only 0.0030 and the induced employment is 422.2 thousand, which accounts for only 2.63% of the total induced employment by Japan. It indicates that China exports to Japan are mainly the lowly educated labor intensive products. Except for HuaDong and HuaNan, the induced urban highly educated employment show smaller shares comparing with the domestic induced employment. Same as the effects for different regions, Japan induced employment also tends to have stronger impacts on coastal regions different categories of labor.

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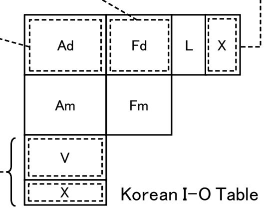
Annex 1: The layout of Asian International Input-Output Table

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



<STEP 1>

So far, all the parts except the highlighted segments have been prepared and are ready for linking. The remaining parts are in fact directly transplanted from the corresponding parts of national tables, after due aggregation into AIO classification. The diagram shows an example of Korea's case, with arrows indicating the parts-correspondance between the AIO table and the Korean I-O table.

The same treatment should be done for all the other member countries.

<STEP 2>

After linking, all the rowwise statistical discrepancies due to the difference in data source are dumped into a single column vector, QX. (Note that the export vectors to the member countries are NOT used in the end, to avoid double-counting with the corresponding import matrices.)

Annex 2: The Sample format of questionnaire on the special survey of imported commodity

Commodity		Code of Origin Country	C.I.F. Import Value (Unit: Pesos)	Duties & Import Comm. Taxes (Unit : Pesos)	Int'l Freight & Insurance (Unit : Pesos)	Distribution of the C.I.F. Import Value (Using Sector / Destination)		
Description	SITC Code					I-O Code	Value (Unit: Pesos)	Share (%)
rice	042	1	26	5	7	022	1	3.85
						023	2	7.69
						HH	23	88.46
meat, dried, salted or smoked	012	1	203,991	1,563	5,893	019	94,737	46.44
						020	3,586	1.76
						021	5,881	2.88
						063	3,712	1.82
						HH	84,262	42.29
						OH	9,813	4.81

The total of distribution values should be the same as for the amount imported.

The total of the percentage share should be 100%.

Source: Kuwamori (2008)

Annex 3: The Classification of region used in the TIIO table

Code	Region	Description (countries or domestic provinces included)
AA00	**ASEAN5**	Indonesia, Malaysia, the Philippines, Singapore and Thailand
AC01	**China: Dongbei**	Liaoning(6), Jilin(7), Heilongjiang(8)
AC02	**China: Huabei**	Beijing(1), Tianjin(2), Hebei(3), Shandong(15)
AC03	**China: Huadong**	Shanghai(9), Jiangsu(10), Zhejiang(11)
AC04	**China: Huanan**	Fujian(13), Guangdong(19), Hainan(21)
AC05	**China: Huazhong**	Shanxi(4), Anhui(12), Jiangxi(14), Henan(16), Hubei(17), Hunan(18)
AC06	**China: Xibei**	Inner Mongolia(5), Shaanxi,(27), Gansu(28), Qinghai(29), Ningxia(30), Xinjiang(31)
AC07	**China: Xinan**	Guangxi(20), Chongqing(22), Sichuan(23), Guizhou(24), Yunnan(25), Tibet(26)
AE00	**East Asia**	Korea and Taiwan
AJ01	**Japan: Hokkaido**	Hokkaido(1)
AJ02	**Japan: Tohoku**	Aomori(2), Iwate(3), Miyagi(4), Akita(5), Yamagata(6), Fukushima(7)
AJ03	**Japan: Kanto**	Ibaraki(8), Tochigi(9), Gunma(10), Saitama(11), Chiba(12), Tokyo(13), Kanagawa(14), Niigata(15), Yamanashi(19), Nagano(20), Shizuoka(22)
AJ04	**Japan: Chubu**	Toyama(16), Ishikawa(17), Gifu(21), Aichi(23), Mie(24)
AJ05	**Japan: Kinki**	Fukui(18), Shiga(25), Kyoto(26), Osaka(27), Hyogo(28), Nara(29), Wakayama(30)
AJ06	**Japan: Chugoku**	Tottori(31), Shimane(32), Okayama(33), Hiroshima(34), Yamaguchi(35)
AJ07	**Japan: Shikoku**	Tokushima(36), Kagawa(37), Ehime(38), Kochi(39)
AJ08	**Japan: Kyushu & Okinawa**	Fukuoka(40), Saga(41), Nagasaki(42), Kumamoto(43), Oita(44), Miyazaki(45), Kagoshima(46), Okinawa(47)
AU00	**U.S.A.**	the United States

Annex 4: The layout of the Transnational Interregional Input-Output Table between China and Japan

		Intermediate Demand (A)									Final Demand (F)											
		ASEAN5	China-region 1	China-region n	China-region 7	Japan-region 1	Japan-region n	Japan-region 8	East Asia	United States	ASEAN5	China-region 1	China-region n	China-region 7	Japan-region 1	Japan-region n	Japan-region 8	East Asia	United States	Export to ROW	Discrepancies	Total Output
	code	(AA00)	(AC01)	(AC0n)	(AC07)	(AJ01)	(AJ0n)	(AJ08)	(AE00)	(AU00)	(FA00)	(FC01)	(FC0n)	(FC07)	(FJ01)	(FJ0n)	(FJ08)	(FE00)	(FU00)	(LW)	(QX)	(XX)
ASEAN5	(AA00)	A^{A00A0}	A^{A00C01}	A^{A00C0n}	A^{A00C07}	A^{A00J01}	A^{A00J0n}	A^{A00J08}	A^{A00E00}	A^{A00U00}	F^{A00A00}	F^{A00C01}	F^{A00C0n}	F^{A00C07}	F^{A00J01}	F^{A00J0n}	F^{A00J08}	F^{A00E00}	F^{A00U00}	L^{A00W}	Q^{A00}	X^{A00}
China-region 1	(AC01)	A^{C01A0}	A^{C01C01}	A^{C01C0n}	A^{C01C07}	A^{C01J01}	A^{C01J0n}	A^{C01J08}	A^{C01E00}	A^{C01U00}	F^{C01A00}	F^{C01C01}	F^{C01C0n}	F^{C01C07}	F^{C01J01}	F^{C01J0n}	F^{C01J08}	F^{C01E00}	F^{C01U00}	L^{C01W}	Q^{C01}	X^{C01}
China-region n	(AC0n)	A^{C0nA0}	A^{C0nC01}	A^{C0nC0n}	A^{C0nC07}	A^{C0nJ01}	A^{C0nJ0n}	A^{C0nJ08}	A^{C0nE00}	A^{C0nU00}	F^{C0nA00}	F^{C0nC01}	F^{C0nC0n}	F^{C0nC07}	F^{C0nJ01}	F^{C0nJ0n}	F^{C0nJ08}	F^{C0nE00}	F^{C0nU00}	L^{C0nW}	Q^{C0n}	X^{C0n}
China-region 7	(AC07)	A^{C07A0}	A^{C07C01}	A^{C07C0n}	A^{C07C07}	A^{C07J01}	A^{C07J0n}	A^{C07J08}	A^{C07E00}	A^{C07U00}	F^{C07A00}	F^{C07C01}	F^{C07C0n}	F^{C07C07}	F^{C07J01}	F^{C07J0n}	F^{C07J08}	F^{C07E00}	F^{C07U00}	L^{C07W}	Q^{C07}	X^{C07}
Japan-region 1	(AJ01)	A^{J01A00}	A^{J01C01}	A^{J01C0n}	A^{J01C07}	A^{J01J01}	A^{J01J0n}	A^{J01J08}	A^{J01E00}	A^{J01U00}	F^{J01A00}	F^{J01C01}	F^{J01C0n}	F^{J01C07}	F^{J01J01}	F^{J01J0n}	F^{J01J08}	F^{J01E00}	F^{J01U00}	L^{J01W}	Q^{J01}	X^{J01}
Japan-region n	(AJ0n)	A^{J0nA00}	A^{J0nC01}	A^{J0nC0n}	A^{J0nC07}	A^{J0nJ01}	A^{J0nJ0n}	A^{J0nJ08}	A^{J0nE00}	A^{J0nU00}	F^{J0nA00}	F^{J0nC01}	F^{J0nC0n}	F^{J0nC07}	F^{J0nJ01}	F^{J0nJ0n}	F^{J0nJ08}	F^{J0nE00}	F^{J0nU00}	L^{J0nW}	Q^{J0n}	X^{J0n}
Japan-region 8	(AJ08)	A^{J08A00}	A^{J08C01}	A^{J08C0n}	A^{J08C07}	A^{J08J01}	A^{J08J0n}	A^{J08J08}	A^{J08E00}	A^{J08U00}	F^{J08A00}	F^{J08C01}	F^{J08C0n}	F^{J08C07}	F^{J08J01}	F^{J08J0n}	F^{J08J08}	F^{J08E00}	F^{J08U00}	L^{J08W}	Q^{J08}	X^{J08}
East Asia	(AE00)	A^{E00A0}	A^{E00C01}	A^{E00C0n}	A^{E00C07}	A^{E00J01}	A^{E00J0n}	A^{E00J08}	A^{E00E00}	A^{E00U00}	F^{E00A00}	F^{E00C01}	F^{E00C0n}	F^{E00C07}	F^{E00J01}	F^{E00J0n}	F^{E00J08}	F^{E00E00}	F^{E00U00}	L^{E00W}	Q^{E00}	X^{E00}
United States	(AU00)	A^{U00A0}	A^{U00C01}	A^{U00C0n}	A^{U00C07}	A^{U00J01}	A^{U00J0n}	A^{U00J08}	A^{U00E00}	A^{U00U00}	F^{U00A00}	F^{U00C01}	F^{U00C0n}	F^{U00C07}	F^{U00J01}	F^{U00J0n}	F^{U00J08}	F^{U00E00}	F^{U00U00}	L^{U00W}	Q^{U00}	X^{U00}
International Freight and Insurance	(BF)	BA^{A00}	BA^{C01}	BA^{C0n}	BA^{C07}	BA^{J01}	BA^{J0n}	BA^{J08}	BA^{E00}	BA^{U00}	BF^{A00}	BF^{C01}	BF^{C0n}	BF^{C07}	BF^{J01}	BF^{J0n}	BF^{J08}	BF^{E00}	BF^{U00}			
Import from ROW	(CW)	A^{WA00}	A^{WC01}	A^{WC0n}	A^{WC07}	A^{WJ01}	A^{WJ0n}	A^{WJ08}	A^{WE00}	A^{WU00}	F^{WA00}	F^{WC01}	F^{WC0n}	F^{WC07}	F^{WJ01}	F^{WJ0n}	F^{WJ08}	F^{WE00}	F^{WU00}			
Duties and Import Tax	(DT)	DA^{A00}	DA^{C01}	DA^{C0n}	DA^{C07}	DA^{J01}	DA^{J0n}	DA^{J08}	DA^{E00}	DA^{U00}	DF^{A00}	DF^{C01}	DF^{C0n}	DF^{C07}	DF^{J01}	DF^{J0n}	DF^{J08}	DF^{E00}	DF^{U00}			
Value Added	(VV)	V^{A00}	V^{C01}	V^{C0n}	V^{C07}	V^{J01}	V^{J0n}	V^{J08}	V^{E00}	V^{U00}												
Total Input	(XX)	X^{A00}	X^{C01}	X^{C0n}	X^{C07}	X^{J01}	X^{J0n}	X^{J08}	X^{E00}	X^{U00}												

Notes: (1) n=2,…,6 for China-region. (2) n=2,…,7 for Japan-region.

Annex 5: China Regional Employment Multiplier

Unit: person/1000US$

		DongBei	HuaBei	HuaDong	HuaNan	HuaZhong	XiBei	XiNan	Total
Domestic multiplier	Agriculture	1.3616	1.7150	0.7426	1.3171	4.5971	2.2529	3.8566	15.8429
	Mining and quarrying	0.2289	0.2709	0.3219	0.1175	0.4943	0.3474	0.3164	2.0974
	Household consumption products	0.1667	0.2516	0.2632	0.2673	0.4621	0.2096	0.1957	1.8163
	Basic industrial materials	0.4161	0.6478	0.5433	0.2836	1.0662	0.4649	0.5737	3.9955
	Processing and assembling	0.1504	0.2443	0.2184	0.1603	0.3978	0.2133	0.1904	1.5750
	Electricity, gas and water supply	0.1137	0.0993	0.0479	0.0482	0.1603	0.1592	0.1542	0.7828
	Construction	0.0959	0.1064	0.0921	0.0752	0.2211	0.1404	0.2156	0.9466
	Trade	0.1788	0.1687	0.1069	0.1137	0.4353	0.1972	0.2304	1.4311
	Transportation	0.7004	0.8148	0.4496	0.4294	1.0670	0.9073	1.3411	5.7095
	Services	0.3837	0.4383	0.2774	0.3117	0.7957	0.7405	0.8071	3.7545
	Total	3.7962	4.7570	3.0634	3.1241	9.6971	5.6327	7.8812	37.9516
Japan induced multiplier	Agriculture	0.0062	0.0148	0.0059	0.0062	0.0047	0.0009	0.0016	0.0403
	Mining and quarrying	0.0022	0.0024	0.0033	0.0006	0.0009	0.0004	0.0004	0.0102
	Household consumption products	0.0008	0.0027	0.0054	0.0022	0.0006	0.0001	0.0001	0.0119
	Basic industrial materials	0.0027	0.0062	0.0056	0.0031	0.0019	0.0004	0.0006	0.0207
	Processing and assembling	0.0005	0.0010	0.0014	0.0013	0.0004	0.0001	0.0001	0.0048
	Electricity, gas and water supply	0.0003	0.0003	0.0002	0.0001	0.0002	0.0001	0.0001	0.0012
	Construction	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002
	Trade	0.0006	0.0010	0.0011	0.0007	0.0004	0.0001	0.0001	0.0040
	Transportation	0.0014	0.0025	0.0019	0.0012	0.0007	0.0002	0.0003	0.0083
	Services	0.0007	0.0014	0.0012	0.0010	0.0006	0.0002	0.0003	0.0054
	Total	0.0155	0.0323	0.0261	0.0165	0.0105	0.0024	0.0035	0.1068

Annex 6: China Regional Employment Multiplier by Labor Categories

Unit: person/1000US$

		DongBei	HuaBei	HuaDong	HuaNan	HuaZhong	XiBei	XiNan	Total
Domestic multiplier	**Agricultural employment**	1.3616	1.7150	0.7426	1.3171	4.5971	2.2529	3.8566	15.8429
	rural non-agricultural employment	0.9855	1.4621	1.2794	0.8570	2.4629	1.3964	1.9616	10.4048
	urban lowly educated employment	1.2752	1.3894	0.9186	0.8253	2.3068	1.6919	1.7601	10.1673
	urban highly educated employment	0.1738	0.1905	0.1228	0.1247	0.3304	0.2915	0.3030	1.5367
	Total	3.7962	4.7570	3.0634	3.1241	9.6971	5.6327	7.8812	37.9516
Japan induced multiplier	**Agricultural employment**	0.0062	0.0148	0.0059	0.0062	0.0047	0.0009	0.0016	0.0403
	rural non-agricultural employment	0.0031	0.0085	0.0121	0.0052	0.0028	0.0005	0.0009	0.0331
	urban lowly educated employment	0.0057	0.0082	0.0074	0.0047	0.0027	0.0009	0.0010	0.0304
	urban highly educated employment	0.0005	0.0008	0.0007	0.0005	0.0003	0.0001	0.0001	0.0030
	Total	0.0155	0.0323	0.0261	0.0165	0.0105	0.0024	0.0035	0.1068

Annex 7: China Regional Employment Induced

Unit: 1000 persons

		DongBei	HuaBei	HuaDong	HuaNan	HuaZhong	XiBei	XiNan	Total
Induced by Domestic demands	Agriculture	18366.9	30926.8	13629.5	24771.9	142241.5	22976.9	89314.5	342228.1
	Mining and quarrying	1184.0	2101.7	632.6	372.1	4777.1	1301.6	1350.4	11719.6
	Household consumption products	2497.0	4910.5	5331.4	4283.3	13408.1	1664.1	3402.7	35497.1
	Basic industrial materials	4143.9	10299.9	9151.2	3093.6	19538.1	3558.3	6692.9	56478.0
	Processing and assembling	1613.6	4568.7	5474.4	2226.0	7376.7	1261.9	2279.9	24801.1
	Electricity, gas and water supply	549.0	762.9	426.8	324.5	1722.2	568.8	807.4	5161.5
	Construction	2060.3	5353.1	4682.6	2523.0	10191.7	2553.2	5555.1	32919.1
	Trade	1423.1	1996.5	1264.8	714.0	5595.2	1056.5	1730.5	13780.6
	Transportation	3141.5	5872.6	2755.4	2585.2	10738.8	3465.0	5712.4	34270.9
	Services	7827.7	13817.1	8617.2	7041.7	25301.7	10510.5	16265.3	89381.3
	Total	42807.1	80609.9	51965.9	47935.3	240891.3	48916.8	133110.9	646237.2
Induced by Japanese demands	Agriculture	835.5	2230.5	1112.3	866.2	975.8	167.3	240.6	6428.2
	Mining and quarrying	101.3	130.8	122.2	27.7	101.9	26.8	23.3	533.9
	Household consumption products	241.4	787.1	1759.1	662.4	133.4	29.0	20.5	3632.9
	Basic industrial materials	218.8	517.1	626.0	258.9	270.5	46.5	65.8	2003.6
	Processing and assembling	83.2	156.3	303.6	316.6	62.4	8.8	10.3	941.1
	Electricity, gas and water supply	21.8	31.1	26.3	14.9	24.8	5.9	5.6	130.4
	Construction	0.5	7.2	8.1	5.0	2.9	0.5	1.5	25.8
	Trade	97.3	164.7	203.2	123.7	63.7	13.7	17.8	684.1
	Transportation	132.1	238.5	205.6	135.0	104.9	24.2	38.3	878.5
	Services	78.3	175.8	216.2	156.8	86.9	21.3	31.8	767.2
	Total	1810.2	4439.1	4582.4	2567.1	1827.1	344.1	455.5	16025.6

Annex 8: China Regional Employment Induced by Labor Categories

Unit: 1000 persons

		DongBei	HuaBei	HuaDong	HuaNan	HuaZhong	XiBei	XiNan	Total
Induced by Domestic demands	Agricultural employment	18366.9	30926.8	13629.5	24771.9	142241.5	22976.9	89314.5	342228.1
	rural non-agricultural employment	8076.4	20702.8	17467.5	8715.2	43700.5	8791.7	16985.6	124439.7
	urban lowly educated employment	13639.2	24205.1	17693.7	12038.9	46190.3	13725.6	21661.4	149154.1
	urban highly educated employment	2724.6	4775.2	3175.2	2409.3	8759.0	3422.6	5149.5	30415.3
	Total	42807.1	80609.9	51965.9	47935.3	240891.3	48916.8	133110.9	646237.2
Induced by Japanese demands	Agricultural employment	835.5	2230.5	1112.3	866.2	975.8	167.3	240.6	6428.2
	rural non-agricultural employment	384.2	1107.7	1966.8	749.0	425.1	69.6	100.7	4803.0
	urban lowly educated employment	541.7	1004.3	1377.5	868.8	382.8	96.3	100.8	4372.1
	urban highly educated employment	48.8	96.7	125.9	83.1	43.4	10.9	13.4	422.2
	Total	1810.2	4439.1	4582.4	2567.1	1827.1	344.1	455.5	16025.6

Annex 9: Sector classification of the Asian International Input-Output Table

7 Sector Classification		24 Sector Classification		76 Sector Classification		78 Sector Classification (1995)	
Code	**Description**	**Code**	**Description**	**Code**	**Description**	**Code**	**Description**
					INTERMEDIATE SECTORS		
001	Agriculture, livestock, forestry and fishery	001	Paddy	001	Paddy	001	Paddy
		002	Other agricultural products	002	Other grain	007A	Other grain
				003	Food crops	002	Cassava
						004	Sugar cane and beet
						005	Oil parm and coconuts
						007B	Other food crops
				004	Non-food crops	003	Natural rubber
						006	Fiber crops
						008	Other commercial crops
		003	Livestock and poultry	005	Livestock and poultry	009	Livestock and poultry
		004	Forestry	006	Forestry	010	Forestry
		005	Fishery	007	Fishery	011	Fishery
002	Mining and quarrying	006	Crude petroleum and natural gas	008	Crude petroleum and natural gas	012	Crude petroleum and natural gas
		007	Other mining	009	Iron ore	015A	Iron ore
				010	Other metallic ore	013	Copper ore
						014	Tin ore
						015B	Other metallic ore
				011	Non-metallic ore and quarrying	016	Non-metallic ore and quarrying
003	Manufacturing	008	Food, beverage and tobacco	012	Milled grain and flour	018	Milled rice
						019	Other milled grain and flour
				013	Fish products	021A	Fish products
				014	Slaughtering, meat products and dairy products	021B	Slaughtering and meat products
				015	Other food products	017	Oil and fats
						020	Sugar
						021C	Other food products
				016	Beverage	022A	Beverage
				017	Tobacco	022B	Tobacco
		009	Textile, leather, and the products thereof	018	Spinning	023	Spinning
				019	Weaving and dyeing	024	Weaving and dyeing
				020	Knitting	025	Knitting
				021	Wearing apparel	026	Wearing apparel
				022	Other made-up textile products	027	Other made-up textile products
				023	Leather and leather products	028	Leather and leather products
		010	Timber and wooden products	024	Timber	029	Timber
				025	Wooden furniture	030A	Furniture
				026	Other wooden products	030B	Other wooden products
		011	Pulp, paper and printing	027	Pulp and paper	031	Pulp and paper
				028	Printing and publishing	032	Printing and publishing
		012	Chemical products	029	Synthetic resins and fiber	033A	Synthetic resins and fiber
				030	Basic industrial chemicals	033B	Other basic industrial chemicals
				031	Chemical fertilizers and pesticides	034	Chemical fertilizers and pesticides
				032	Drugs and medicine	035A	Drugs and medicine
				033	Other chemical products	035B	Other chemical products
		013	Petroleum and petro products	034	Refined petroleum and its products	036	Refined petroleum and its products
		019	Other manufacturing products	035	Plastic products	050A	Plastic products
		014	Rubber products	036	Tires and tubes	037	Tires and tubes
				037	Other rubber products	038	Other rubber products
		015	Non-metallic mineral products	038	Cement and cement products	039	Cement and cement products
				039	Glass and glass products	040	Glass and glass products
				040	Other non-metallic mineral products	041	Other non-metallic mineral products
		016	Metal products	041	Iron and steel	042	Iron and steel
				042	Non-ferrous metal	043	Non-ferrous metal
				043	Metal products	044	Metal products
		017	Machinery	044	Boilers, Engines and turbines	045E	Engines and turbines
				045	General machinery	045C-2	Ordinary industrial machinery
				046	Metal working machinery	045B-1	Specialized industrial machinery
						045C-2	Ordinary industrial machinery
				047	Specialaized machinery	045A	Agricultural machinery
						045B-2	Specialized industrial machinery
				048	Heavy Electrical equipment	045D	Heavy Electric machinery
				049	Television sets, radios,audios and communicatio	046A	Electronics and electronic products
				050	Electronic computing equipment		
				051	Semiconductors and integrated circuits		
				052	Other electronics and electronic products		
				053	Household electrical equipment	046B	Other electric machinery and appliance
				054	Lighting fixtures, batteries, wiring and others		
		018	Transport equipment	055	Motor vehicles	047A	Motor vehicles
				056	Motor cycles	047B-1	Motor cycles and bicycles (Motor cycles)
				057	Shipbuilding	048B	Shipbuilding
				058	Other transport equipment	047B-2	Motor cycles and bicycles (Bicycles)
						048A	Aircrafts
						048C	Other transport equipment
		019	Other manufacturing products	059	Precision machines	049	Precision machines
				060	Other manufacturing products	050B	Other manufacturing products
004	Electricity, gas and water supply	020	Electricity, gas, and water supply	061	Electricity and gas	051	Electricity, gas and water supply
				062	Water supply		
005	Construction	021	Construction	063	Building construction	052A	Building construction
				064	Other construction	052B	Other construction
006	Trade and transport	022	Trade and transport	065	Wholesale and retail trade	053A	Wholesale and retail trade
				066	Transportation	053B	Transportation
007	Services	023	Services	067	Telephone and telecommunication	054A	Telephone and telecommunication
				068	Finance and insurance	054B	Finance and insurance
				069	Real estate	054D-1	Other services
				070	Education and research	054C	Education and research
				071	Medical and health service	054D-2	Other services
				072	Restraunts	054D-3	Other services
				073	Hotel	054D-4	Other services
				074	Other services	054D-5	Other services
				076	Unclassified	056	Unclassified
		024	Public administration	075	Public administration	055	Public administration