

Part II

Compilation of the 2016 Japan-Taiwan International Input-Output Table

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The Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO) has compiled international input-output tables since the 1970s, and many international tables have been available so far. Among those, the Asian international input-output tables (AIO) are the representative table and are available for 1975 (Taiwan and China are excluded), 1985, 1990, 1995, 2000, and 2005. The 2016 Japan-Taiwan International Input-Output Table (JNIO) is compiled on the same framework as the AIO to allow comparison to the table of the previous ones.

This project provides extended the international I-O table by splitting transactions of manufacturing sectors into exporting and non-exporting firms to attempt explicitly introduce some kinds of firm heterogeneity into input-output table.

This chapter explains how the JNIO is constructed according to three phases of compilation introduced in Inomata, Tokoyama, Kuwamori, and Meng [2006]. First, the adjustment of the presentation format of the 2016 JNIO is described, followed by an explanation of the preparation of sector concordance and supplementary data. Section three explains the method of linking the national I-O table. The last part of this chapter introduces the extension of the 2016 JNIO by exporting and non-exporting firms, and the data for splitting the I-O table used in this project is explained.

1. Adjustment of presentation format

The input-output tables published by individual countries have some differences among the tables, reflecting the industrial structure and availability of data in each country. When compiling international input-output tables, adjusting, and conforming these differences into a unified format is essential.

Inomata *et al.* [2006] point out eight adjustment targets to make each national I-O table a unified format. Adjustments of financial intermediaries, computer software, and producers of government service are dropped from the adjustment targets since treatment for those items is not necessarily in this project. Instead, a new item, updating the table, is added to the list of adjustments. As a result, six items are to be adjusted, as shown in Table 1. This section explains each adjustment made to the national I-O tables

by country. Note that the adjustment policy for this project follows the one that was used when the 2000 AIO table was compiled.

Table 1. List of adjustment target for JNIO

	Japan	Taiwan
1. Updating the table	✓	
2. Negative entry	✓	
3. Dummy sectors	✓	
4. Machine repair	✓	✓
5. Conversion of valuation	✓	
6. Special treatment of import/export		✓

(Source) Prepared by the author with reference to Inomata *et al.* [2006]

1.1 Japan

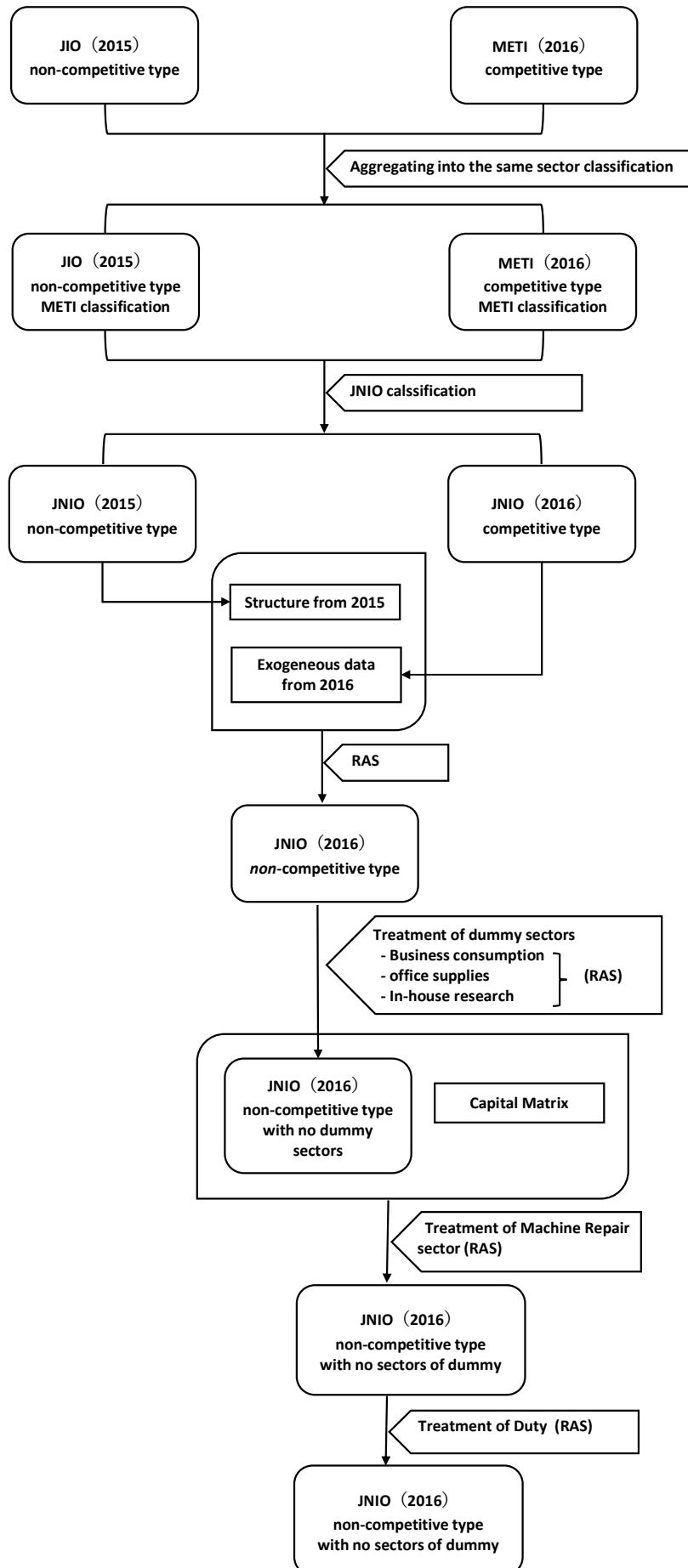
Figure 1 shows the procedure of constructing the 2016 Japan I-O table with non-competitive import type under JNIO classification. Each step is explained in the following subsection.

1.1.1 Updating the Table

The target year for the JNIO is 2016, while the benchmark year for the Japan I-O Table (Ministry of Internal Affairs and Communications: MIC [2019]) is 2015. Since Japan's benchmark year differs from the JNIO's target year, Japan's table needs to update from 2015 to 2016. Also, as the project requires a non-competitive import type I-O table, the updated table should be a non-competitive import type I-O table.

The updated 2016 Japan I-O table is available from the Ministry of Economy, Trade, and Industry (METI) (METI table) [2020]. However, it cannot be used as it is a competitive import type I-O table. This project uses the 2016 METI table as the data source for gross output, value-added, and trade data and independently estimates the 2016 updated table using the structure of the 2015 Japan I-O table.

Figure 1. Procedure of constructing the 2016 Japan I-O table



(Source) Prepared by the author.

(Note) METI (2016) refers to the updated Japan I-O table published by METI.

The 2015 table needs to be processed to match the concept of the 2016 METI table. First, the 2015 Japan I-O table to be processed is selected from the two kinds of 2015 Japan I-O tables; one has a private transport sector, and the other does not. As the 2016 METI table has no private transport sector, 2015 without a private transport sector is selected. After choosing the table, consumption of fixed capital (social fixed capital), which is 9321000 in code number of the 2015 Japan I-O table, is deleted from the table to align the concepts of the 2016 METI table, which has no consumption of fixed capital (social fixed capital). Then, the 2015 Japan I-O table and the 2016 METI table are unified under the same sector classification to match the sector classification of the 2016 METI table. Those I-O tables are further converted to JNIO classification. Using the 2016 METI table under JNIO classification as a data source, the 2015 Japan I-O under JNIO is updated to the 2016 Japan I-O table, which has a non-competitive import type structure.

1.1.2 Negative entries

The general principle of the AIO: there should be no negative entries except rising from the generation of waste and by-products in intermediate transactions. (Inomata et al. [2006] p. 25)

As the Japan I-O tables employ the Stone method for the treatment of waste and by-product, there are negative entries in intermediate transactions. Those negative values in the Japan I-O table remain unchanged in the table per principle.

1.1.3 Dummy sectors

The general principle of the AIO is that there should not be a dummy sector in the table. (Inomata et al. [2006]p. 26)

The Japan I-O table has four standalone dummy sectors: business consumption, office supply, In-house research, and scrap. In what follows, the methods of how to delete dummy sectors are introduced. Note that the final values of the table will vary depending on the order in which the dummy sectors are deleted. For the compilation of the 2016 JNIO, the order of processing dummy sector is 1. scrap, 2. business consumption, 3. office supply, and 4. in-house research.

When preparing the AIO table, dummy sectors were allocated using a kind of proportional allocation method. This project, for preparation of the JNIO, the Resource Allocation System (RAS) method is used to allocate dummy sectors to the transactions table. The RAS method reduces and converges the error by repeating the process while distributing the error to the rows and columns respectively. The proportional allocation method, on the other hand, determines the error in either rows or columns in a single process. Therefore, the RAS method is employed to minimize errors which occurs due to the treatment of dummy sector.

1.1.3.1 Scrap

The code in the Japan I-O table:

- 1631021P (Used paper: Row)
- 2612011P (Iron scraps: Row)
- 2712011P (Nonferrous metal: Row)

There are three scrap sectors in the Japan I-O table, such as used paper, iron scrap, and nonferrous metal scrap. These scrap sectors are merged into sectors with similar uses and physical attributes of the principal products. Specifically, 1631021P (Used paper) is integrated into 1631011 (Pulp), 2612011P (Iron scraps) into 2611041 (Crude steel: electric furnace), and 2712011P (Nonferrous metal) into 2711099 (Other nonferrous metals). Treatment of dummy sectors is done on the tables which is already converted to JNIO, whereas treatment of scrap is done on the 2015 JNIO and METI tables.

1.1.3.2 Business consumption sector

The code in the Japan I-O table:

- 7111000 (Total business consumption: Row)
- 7111001 (Daily allowance and accommodation: Row)
- 7111002 (Social expense: Row)
- 7111003 (Welfare expense: Row)
- 71110 (Business consumption: Col)

The business consumption sector has values in intermediate transactions and gross output (control totals: CT) parts, but no values in final demand and value-added. Values in intermediate transactions and CT are distributed in the transaction table using the RAS method whose initial values are the 2016 updated Japan I-O table. The allocation of business consumption to endogenous sectors may increase the CT of the allocated sector. In such cases, the increase in CT is offset by a decrease in value-added and consequently, CT remains unchanged. These processes eliminate the values in the business consumption sector so that the resulting business consumption can be eliminated from the table.

1.1.3.3 Office supply sector

The code in the Japan I-O table: 6811000 (Row), 681100 (Col)

The office supply sector has values in intermediate transactions and CT parts, while no values in value-added and final demand parts. The location of each value of the office supply sector is similar to the location of the business consumption sector. So that, the way of adjusting is also done in similar manner. The RAS method is employed to distribute the values in the office supply sector, and the initial value for the RAS is the transaction table. As explained in the business consumption sector, the CT is unchanged even though the intermediate transaction values increase.

1.1.3.4 In-house research sector

The code in Japan I-O table: 6322011 (Row), 632201(Col)

In-house research sector has value-added part since the 1990 Japan I-O table. Other than in-house research sector, there is no dummy sector which has value-added. Therefore, the treatment of in-house research sector is different from other dummy sectors. In-house research sector has values not only in intermediate transaction, value-added, and CT, but also in the gross fixed capital formation of final demand. The values of intermediate transaction, value-added, and CT are distributed in the table by the RAS method whose initial value is transaction table. In contrast, the value in the gross fixed capital formation of final demand is distributed proportionally within the gross fixed capital formation. As a result of the treatment, CTs of each sector has changed.

1.1.4 Machine-repair

General principal of the AIO table is no standalone machine-repair sector should exist in the table. (Inomata et al. [2006] p. 37)

There are five standalone machine-repair sectors in the Japan I-O table: repair of ships, repair of rolling stocks, repair of aircraft, repair of motor vehicles, and repair of machines.

The code in the Japan I-O table:

3541101(Repair of ships: Row), 354110 (Col)

3591101(Repair of rolling stock: Row), 359110 (Col)

3592101(Repair of aircraft: Row), 359211(Col)

6631101(Repair of motor vehicles: Row), 663110 (Col)

6632101(Machine-repair: Row), 663210 (Col)

Each repair of the transport equipment sector is merged with the relevant sector for transport equipment. For example, the repair of motor vehicles (6632101) is put in the JNIO 057 in 87 sectors classification, motor vehicles, while the repair of ships is put in the JNIO059 in 87 sector classification, shipbuilding.

The machine-repair sector differs from the repair of transport equipment sectors in that the sectors to be repaired need to be identified. The sectors listed under the machine-repair sector in the Japanese Standard Industrial Classification are assumed to be the sectors repaired in this project. The capital matrix, a supplementary table to the I-O table, is reconstituted into a matrix comprising only the sectors that receive repairs. Using this matrix as the initial value, the RAS allocates the machine repair sector in the I-O table. As a result of the treatment, CTs of some sectors have increased.

1.1.5 Conversion of Valuation: duties and import commodity taxes

The general principle of the 2016 AIO table is as follows: import matrix should be valued at CIF, not including duties and import commodity taxes. (Inomata et al. [2006] p. 23)

The import matrix of Japan is valued at CIF with duties and import commodity taxes. The column vector of import duty and commodity tax is distributed to the import matrix by taking the import matrix as the initial value with the RAS method. An import duty and import commodity matrix can be obtained by subtracting the value of the original import matrix from the new import matrix obtained by the RAS. The matrix is aggregated column-wise and is inserted under the import matrix.

1.2 Taiwan

1.2.1 Machine-repair

The general principles of machine-repair are the same as in the Japanese case as set out in 1.1.4.

The code in the Taiwan I-O table:

10710 (Repair of industrial machinery and equipment: Row), 107 (Col)

10720 (Repair of Transportation: Row), 107 (Col)

16110 (Maintenance and repair of motor vehicles: Row), 161 (Col)

16210 (Repair of computers, communication equipment and electronic products: Row), 162 (Col)

16220 (Maintenance and repair of motorcycles: Row), 162 (Col)

16290 (Maintenance and repair of other personal and household goods not elsewhere classified: Row), 162 (Col)

There are six standalone machine-repair sectors in the 2016 Taiwan table. These machine-repair sectors are merged into the sectors to be repaired, as it is clear which sector repairs which machines from the sector name. For example, Repair of industrial machinery and equipment (10710) is merged into JNIO 045 in 87 sectors classification, general machinery. See concordance in Part 1 for where the repair sector is integrated.

1.2.2 Special treatment of export

The general principle of the 2016 AIO table is: Reexport should not be counted either as export or as import. (Inomata et al. [2006]p.43)

The 2016 Taiwan table has positive values in the export vector of import matrix. Those are the re-export and deleted from the table, as the JNIO does not treat re-export and re-import in the table. Total value of the re-export is 440,908 million NT dollar and this corresponds to four percent of total exports of goods and service for Taiwan.

1.2.3 Adjustment Item

The adjustment item appears as one of the value-added items in the 2016 Taiwan table. The adjustment item means “abnormal cost” in 2016, for example, the back-end operating costs of Taiwan Taipower Corporation’s nuclear power generation. Also, compensation is paid by the city water and real estate companies to the government. There are three places with values in the intersection with the adjustment item:

The code in the Taiwan I-O table:

P5(Adjustment item: Row), 108 (Electricity and steam: Col)

P5(Adjustment item: Row), 110 (City water: Col)

P5(Adjustment item: Row), 140 (Real estate: Col)

Total value of those three items is 31,860 million NT dollar and this corresponds to 0.2% of the total value-added. Adjustment items are integrated with value-added for this project.

2. Preparation of sector concordance and supplementary data

2.1 Sector concordance

The published table has seven sector classifications for this project, but compilation work before linking the parts has been done on 87 sector classifications³. The 87 sector classifications are shown in chapter 1: sector classification.

³ The project uses the RAS method to make the necessary adjustments in the tabulation work. The RAS method only converges if all the target values in the matrix are positive. Thus, the usual RAS method cannot be applied to the Japan tables because it has multiple negative values. In the project, the RAS was applied with fixed negative values in the table, but the results may

A feature of the 87 sector classifications used in the compilation work is that the manufacturing sector is more detailed than the 2005 AIO sector classification. The number of the manufacturing industry is 49 in the 2005 AIO, while that is 54 in the 2016 JNIO. Among manufacturing industries, the number of high-tech industries increases. The newly setting sectors of high-tech industries are three, such as semiconductor manufacturing equipment, office machinery, and aircraft. The semiconductor sector was separated from the specialized machinery sector, and office machinery was segregated from other electronics and electronic products. Also, the aircraft sector is set up by dividing other transport equipment in the 2005 AIO classification into three: rolling stock, aircraft, and other transport equipment.

The number of industrial sectors in the Japan I-O table is 502 for the row and 384 for the column, while that in the Taiwan I-O table is 487 for the row and 164 for the column. The number of sectors of the Japan and Taiwan table is large compared to the other countries involved in AIO. Even then, the 2016 JNIO classification requires the national tables to be split up to conform to the unified sector. The division of the sectors is based on the proportion of each sector's CTs.

All the sectors of Japan and Taiwan national I-O table are shown in the table: concordance between national I-O classification and Japan-Taiwan I-O classification in Part I. Among those, the divided sectors are with the alphabet after the sector number.

2.2 Trade and transport margin

Trade and transport margins for Japanese and Taiwanese exports are derived from the difference between the export part of each country's I-O table valued at the producer and purchaser prices. One ratio per sector column-wise is applied when subtracting TTM from the import matrix. It should be noted that, for example, to deduct TTM from Japan's imports from Taiwan and change the imports to producer prices, the Taiwanese export TTM is applied. The ratio used in this project is shown in the table 2. The services sector is excluded from Table 2 because only trade in goods is subject to TTM deductions.

Table 2. TTM ratio for Japan and Taiwan under JNIO 7 sector classification

need to be more stable. It was thus decided to publish the results in a 7-sector classification.

Sector	Japan	Taiwan
001	0.2	0.357
002	0.225	0.139
003	0.15	0.061
004	0.088	0.098

(Source)Prepared by the author.

2.3 International freight and insurance data

International freight and insurance data were collected from the Foreign Trade Statistics when compiling the AIO table, where available. For this project, international freight and insurance of Japan and Taiwan cannot be obtained from the Foreign Trade Statistics. Therefore, the data is collected from the International Transport and Insurance Cost of Merchandise Trade (ITIC) dataset of the Organization for Economic Co-operation and Development (OECD).⁴

The OECD ITIC dataset provides information on CIF-FOB margins for more than 190 reporter countries and 240 partner countries, covering 1200 products (HS2007 at 4 digits level) and the period from 1995 to 2020. CIF-FOB margins are obtained through Foreign Trade Statistics directly, but some are built using the gravity model (See Miao and Wegner [2022]).

The OECD ITIC dataset provides the international freight and insurance ratio at HS 2007 at 4 digits level, while trade data used in this project is at HS 2012 at 6 digits level. In order to fill the difference in these two data, the international freight and insurance ratio of HS 2007 at 4 digits level should be converted to that of HS 2012 at 6 digits level. The conversion is carried out as follows.

- (1) Collect import data from the Foreign Trade Statistics at 6 digits level of HS 2012 from Global Trade Atlas⁵
- (2) Converting the HS 2012 at 6 digits data (obtained in (1)) to HS 2007 at 4 digits level using concordance between HS 2012 and HS 2007. The

⁴ OECD. International Transport and Insurance Costs of Merchandise Trade (ITIC), OECD.Stat. https://stats.oecd.org/Index.aspx?DataSetCode=CIF_FOB_ITIC (2023.3.10)

⁵ Global Trade Atlas. <https://www.gtis.com/gta/> (2022. 12.14)

concordance is obtained from the United Nations website⁶.

- (3) Estimate the international freight and insurance data value at the 4 digits level of HS 2007 using ITIC data multiplied by Import data at 4 digits level of HS2007 (obtained in (2)).
- (4) Convert international freight and insurance value at 4 digits level of HS 2007 (obtained in (3)) into HS 2012 at 6 digits level.
- (5) Convert both international freight and insurance value (obtained in (4)) and import data at 6 digits level of HS 2012 into JNIO classification
- (6) Calculate international freight and insurance rate at JNIO classification using the value of international freight and insurance and import data.

International freight and insurance obtained above method is shown in table 3.

Table 3. International freight and insurance under 7 sectors for Japan and Taiwan

Sector	Japan	Taiwan
001	0.096	0.091
002	0.062	0.060
003	0.052	0.050
004	0.034	0.040

(Source) Prepared by the author.

The services sector is excluded from Table 3 because only trade in goods is subject to the international freight and insurance deductions. The method subtracting the international freight and insurance ratio is the same as the TTM.

3. Linking of the table

The compilation procedure of the 2016 Japan-Taiwan Input-Output table follows the procedure of compiling the AIO table, except that no import goods demand destination survey was conducted when the import table was split by country. Since

⁶ United Nations. Statistics Division. <https://unstats.un.org/unsd/classifications/Econ> (2023.03.11)

existing literature, for example, Inomata *et al.* [2006] and Kuwamori, Tamamura, and Sano [2017], have already explained in detail how to link each table to compile AIO, in this section, each step of linking the tables is not explained. Instead, the way of splitting the import matrix using the 5th edition of the Broad Economic Category (BEC) classification provided by the United Nations [2018] is discussed.

Preparing the split of the import matrix by country is an essential task in compiling the international I-O table. IDE-JETRO has constructed the import matrix, which allows for differences in the demand structure in different countries by conducting surveys of demand destinations for imported goods rather than using only the share of trade statistics. The project does not conduct a destination survey of imports and planned to use the BEC classification of trade statistics, but this time only the import share was used.

The imported goods at 6 digits of HS 2012 were divided into intermediate inputs, final consumption, and fixed capital formation using the BEC classification. Furthermore, those are aggregated into the JNIO classification by country. The items obtained here conform to the corresponding part of the input-output table. Thus, a new import matrix is constructed using the RAS method, with the initial values as an import matrix. This method is feasible when final consumption moves between government and private consumption and when the capital stock is used as an adjustment term. As the table is compiled under seven sector classifications in which the final demand is just one sector from the link process, the trade data for BEC cannot be utilized.

In this project, the import vector was split using the import shares by country and by commodity obtained from Foreign Trade Statistics. Then, the RAS method compiles an import matrix for each country. The initial value for the RAS is an import matrix without the country split. The entire import matrix, including imports of services sectors, was used as the initial value for the RAS so that imports of services (codes 005 and 007) were allocated to each country. After the import matrix was built, the amounts in sector 005 were moved to sector 007.

Table 4 shows the correlation between the row totals of intermediate transactions of the import matrix prepared the way shown above and the values of intermediate goods based on the BEC classification. The correlation coefficients shown in “World” at the bottom of the table show the correlation between the sum of the rows in the original import matrix and the trade statistics based on the BEC classification. Taiwan shows a strong correlation between the row totals in the original import tables and the FTS compiled by the BEC, but Japan is not. The country-specific correlation

coefficients show the correlation between the row totals of the import tables split by country using the share of trade statistics and the country-specific intermediate goods imports obtained based on the BEC. Taiwan's BEC based trade statistics and import matrix show strong correlations for all countries except Hong Kong. Japan offers a less strong correlation in some countries, and overall, Japan has a lower correlation between trade statistics and import tables than Taiwan. The results of the estimates suggest that devising the use of the BEC classifications is essential if the BEC classification is utilized to prepare an import matrix. The “devising the use of the BEC classification” is to find a category highly correlated with the original import matrix by changing the split ratio of the BEC end-use category, which contains two items such as “intermediate/consumption.”

Table 4. Correlation between import matrix and FTS by BEC

	JPN	TWN
JPN	-	0.938
TWN	0.769	-
IDN	0.974	0.968
MLY	0.703	0.967
PHL	0.957	0.994
SIN	0.983	0.977
THL	0.96	0.994
CHN	0.964	0.995
KOR	0.96	0.964
USA	0.969	0.964
HKG	0.87	0.390
IND	0.983	0.999
EU28	0.999	0.827
ROW	0.635	0.903
WLD	0.489	0.968

(Source) Prepared by the author.

The trade statistics of Japan and Taiwan based on BEC under JNIO classification (7 sectors) is attached as an appendix.

Once the domestic tables, divided import and export matrix, and supplementary data are in place, the components that are local currency denominated are converted to US dollars. The exchange rates used for the conversion are shown in Table 5.

Table 5. Local Currency to US dollar exchange rate

Country	Currency	Exchange rate	Concept
Japan	Yen	108.79	Period Average
Taiwan	NT\$	32.32	Period Average

(Source) International Monetary Fund, International Financial Statistics⁷
Asian Development Bank, Key Indicators⁸

Now that each part is in dollars, the bilateral international input-output table is created by fitting each part where it belongs.

4. Splitting the 2016JNIO table by firm type

Several attempts have been made to construct extended national input-output tables incorporating information on firm heterogeneity. The extensions can be classified into three types: by firm size, by firm ownership, and by trade type. Ahmad et al. [2013] extended the Turkey IO table by firm, by size, and by ownership Turkey. Ma, Wang, and Zhu [2014] extended the China I-O table by mode of trade (processing trade, exports, and domestic), while Hagino, Tahara, and Tokoyama [2017] and Ito, Deseatnicov, and Fukao [2020] made similar extensions for Japan. Fetzer and Strassner [2015] also extend by ownership of firms for the US I-O table.

Regarding the extension of multiregional tables, Piacentini and Fortanier [2015] followed the method of Ahmad et al. [2013] and construct an extended international I-O table by firm size and firm ownership for 29 countries. In 2018, the OECD also published an extended table by ownership of firm covering 59 countries and 34 sectors from 2005 to 2016. The accumulation of studies on the extension of multiregional tables has been growing rapidly in recent years.

The history of compiling the Japan I-O tables by firm size is relatively old, with the Small and Medium Enterprise Agency (SMEA) having produced the Japan I-O table by firm size for 35 years, from the 1973 table to the 2005 table. Only the 2005 table is currently available on its website.⁹

⁷ IMF Data access to macroeconomic & financial data, <https://data.imf.org/> (2023.02.01)

⁸ ADB. Key Indicators Database, <https://kidb.adb.org/>(2023.02.01)

⁹ SMEA 2012. "The Japan I-O table by firm size," SMEA.

This project divides the Japan -Taiwan international I-O table by exporting and non-exporting firm to attempt to explicitly introduce some kinds of firm heterogeneity into the international input-output tables. The definitions that distinguish whether a firm is an exporting or non-exporting firm are as follows. A firm is defined as exporting if it exports even a small amount of the goods it produces, while a non-exporting firm does not export at all.

In order to split the input-output table by exporting and non-exporting firms, it is necessary to collect data on which firms export which items from the census individual data. The following sub-section introduces the data collected for this project for Japan and Taiwan.

4.1 Japan

The division of the Japan I-O table by CT is made possible by constructing a make matrix (by industry commodity) using individual data on business activities collected from the 2016 Economic Census. The idea of constructing make matrix to split national I-O table is from Applied Research Institute [2010] and Shimoda [2012], which show how to compile the national I-O table by firm size. To introduce the concept of size, which is closely related to the concept of an economic entity into the I-O tables, the concept of size and commodity can be connected through make matrix was devised (ARI[2010] p. 2).

The project followed the ARI method of data aggregation, and aggregated value of shipments by commodity and by exporting and non-exporting firms. The criterion for determining exporting/non-exporting firms is the proportion of direct exports, with firms whose proportion of direct exports is more significant than zero being considered exporting firms. The information by these firms is then aggregated by industry. This yields a table by industry, exporting and non-exporting firms, and by six-digit commodity item. As there is no corresponding table for commodity items and Japan I-O classification, the make matrix is obtained by industry, by the firm, and by Japan I-O classification, assuming that the first two digits of the commodity item correspond to the Japan I-O classification.

Individual data from the Economic Census Survey for the year 2016 were used for this project. As the division of sectors in this project only covered the manufacturing

<https://www.chusho.meti.go.jp/koukai/chousa/renkan/index.htm> (2023.01.30)

sector, data from the manufacturing sector was collected. Some establishments did not have information on the names of the firms, resulting in 103,204 commodity data that could be aggregated. These data were disaggregated by the firm, resulting in 5,970 exporting firms out of 45,346 total firms, which is 13.17% of the total number of firms. Aggregating this information by the JNIO classification, as shown in table 4.

Table 6. The share of shipment value by exporting and non-exporting firms: Japan

Sector	Non-exporting firm	Exporting firm
002	0.879	0.121
003	0.539	0.461
004	0.444	0.556

(Source) Prepared by the author.

Note that the year covered by the Census (2015) and the target year of the I-O table (2016) are different. In this project, 2016 data could not be collected, so 2015 data was used to split the table.

4.2 Taiwan

The information on splitting the Taiwan I-O table is also obtained from the manufacturing industry survey of the 2016 industry and service census database. The Directorate General of Budget, Accounting, and Statistics (DGBAS) of Executive Yuan, R.O.C, handles census and surveys every five years. The number of business and production units in the 2016 manufacturing industry survey is 161,334 and 167,470. For this project, operating revenue is aggregated by the firm. The aggregate data under the JNIO classification is in table 7.

Table 7. The share of shipment value by exporting and non-exporting firms: Taiwan

Sector	Non-exporting firm	Exporting firm
002	0.286	0.714
003	0.181	0.819
004	0.057	0.943

(Source) Prepared by the author.

4.3 Splitting the 2016 JNIO

In this project, an extension table was developed by dividing the CTs of each industry by the percentage of shipments by the firm for Japan and operating revenues by the firm for Taiwan. In this project, the division between the rows and the division between the columns are done in the same proportion due to lack of data.

Future directions for expansion could include,

- (1) incorporating differences in the share of imported inputs between exporting and non-exporting firms,
- (2) Assigning different values to row and column divisions, and
- (3) Incorporating information on foreign and domestic firms and dividing exports and non-exports by foreign and domestic firms.

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Appendix A. Import data of Japan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
TWN	001	8,195,229	0	12,353,035	20,548,264
TWN	002	50,470,159	3,740,340	73,552,785	127,763,000
TWN	003	415,849,000	23,241,519	75,825,282	514,915,000
TWN	004	1,014,870,000	459,192,000	147,177,000	1,621,240,000
TWN	005	0	0	0	0
TWN	006	0	0	0	0
TWN	007	2,674,925	1,749,204	5,145,375	9,569,504
CHN	001	148,474,000	0	113,023,000	261,497,000
CHN	002	1,264,200,000	147,528,000	2,780,270,000	4,191,990,000
CHN	003	2,008,510,000	136,051,000	727,292,000	2,871,850,000
CHN	004	3,385,530,000	3,181,900,000	2,942,120,000	9,509,560,000
CHN	005	0	0	0	0
CHN	006	0	0	0	0
CHN	007	409,959	348,204	1,279,015	2,037,178
IDN	001	590,804,000	0	273,349,000	864,153,000
IDN	002	205,282,000	10,764,371	204,103,000	420,149,000
IDN	003	277,083,000	5,523,740	104,305,000	386,912,000
IDN	004	147,824,000	89,399,583	65,844,519	303,068,000
IDN	005	0	0	0	0
IDN	006	0	0	0	0
IDN	007	205	205	818	1,227
PHL	001	64,384,717	0	38,031,008	102,416,000
PHL	002	109,315,000	4,892,734	107,852,000	222,060,000
PHL	003	97,040,548	3,678,721	29,524,242	130,244,000
PHL	004	268,688,000	167,158,000	65,478,032	501,324,000
PHL	005	0	0	0	0
PHL	006	0	0	0	0
PHL	007	3,477	1,836	4,060	9,372
USA	001	557,414,000	3,352,066	219,113,000	779,879,000
USA	002	411,550,000	18,457,687	655,483,000	1,085,490,000
USA	003	1,350,960,000	88,550,226	356,550,000	1,796,060,000
USA	004	1,460,520,000	1,507,310,000	525,046,000	3,492,880,000
USA	005	0	0	0	0
USA	006	0	0	0	0
USA	007	4,600,989	2,872,020	8,030,141	15,503,150
KOR	001	28,269,250	0	44,817,405	73,086,655
KOR	002	99,134,412	6,172,862	144,679,000	249,986,000
KOR	003	898,527,000	15,838,067	302,309,000	1,216,670,000
KOR	004	541,473,000	355,714,000	153,086,000	1,050,270,000
KOR	005	0	0	0	0
KOR	006	0	0	0	0
KOR	007	1,659,110	1,101,357	3,289,923	6,050,390
THL	001	37,144,787	0	16,469,731	53,614,519
THL	002	195,684,000	6,134,481	372,960,000	574,779,000
THL	003	361,155,000	13,251,607	119,217,000	493,624,000
THL	004	437,401,000	323,289,000	269,841,000	1,030,530,000
THL	005	0	0	0	0
THL	006	0	0	0	0
THL	007	28,731	28,731	114,922	172,383
SIN	001	2,300,724	5,508	6,596,805	8,903,038
SIN	002	32,871,518	3,899,089	39,839,874	76,610,481
SIN	003	213,132,000	29,449,572	67,389,575	309,972,000
SIN	004	135,998,000	172,648,000	43,470,020	352,116,000
SIN	005	0	0	0	0
SIN	006	0	0	0	0
SIN	007	664,213	648,937	2,565,195	3,878,344

Appendix A. Import data of Japan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
MLY	001	192,902,000	0	461,414,000	654,316,000
MLY	002	121,620,000	3,913,823	77,869,582	203,404,000
MLY	003	203,758,000	5,591,430	85,374,468	294,724,000
MLY	004	242,405,000	239,855,000	156,431,000	638,691,000
MLY	005	0	0	0	0
MLY	006	0	0	0	0
MLY	007	38,430	37,805	149,971	226,206
IND	001	27,026,685	0	7,116,193	34,142,878
IND	002	45,064,630	2,577,023	81,109,912	128,752,000
IND	003	157,738,000	2,476,394	75,396,643	235,611,000
IND	004	58,899,270	22,808,785	25,893,527	107,602,000
IND	005	0	0	0	0
IND	006	0	0	0	0
IND	007	2,110	2,110	8,441	12,662
HKG	001	4,531,026	0	10,936,074	15,467,100
HKG	002	1,449,815	379,945	4,109,953	5,939,713
HKG	003	17,083,157	183,866	5,798,480	23,065,503
HKG	004	15,525,608	7,417,169	11,018,684	33,961,461
HKG	005	0	0	0	0
HKG	006	0	0	0	0
HKG	007	165,987	165,885	663,338	995,210
EUA	001	36,278,568	1,421,228	32,129,666	69,829,461
EUA	002	529,144,000	68,905,681	994,636,000	1,592,690,000
EUA	003	2,124,360,000	288,250,000	509,158,000	2,921,770,000
EUA	004	962,892,000	1,295,920,000	1,200,530,000	3,459,350,000
EUA	005	0	0	0	0
EUA	006	0	0	0	0
EUA	007	1,984,178	1,864,081	7,216,129	11,064,388
ROW	001	9,524,750,000	382,714	2,141,480,000	11,666,600,000
ROW	002	1,174,190,000	35,350,917	1,950,060,000	3,159,600,000
ROW	003	1,875,350,000	100,667,000	1,095,160,000	3,071,170,000
ROW	004	673,565,000	582,667,000	514,627,000	1,770,860,000
ROW	005	0	0	0	0
ROW	006	0	0	0	0
ROW	007	732,297	731,708	2,925,656	4,389,661
WLD	001	11,222,500,000	5,161,515	3,376,830,000	14,604,500,000
WLD	002	4,239,970,000	312,717,000	7,486,520,000	12,039,200,000
WLD	003	10,000,500,000	712,752,000	3,553,300,000	14,266,600,000
WLD	004	0	0	0	0
WLD	005	0	0	0	0
WLD	006	9,345,600,000	8,405,290,000	6,120,570,000	23,871,500,000
WLD	007	12,964,610	9,552,082	31,392,983	53,909,675

Appendix B. Export data of Japan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
TWN	001	34,154,688	21,338,827	40,055	55,533,571
TWN	002	441,460,718	331,113,138	1,558,164	774,132,020
TWN	003	2,498,339,848	397,193,487	74,672,069	2,970,205,404
TWN	004	113,158,377	43,209,239	77,776,869	234,144,485
TWN	005	0	0	0	0
TWN	006	0	0	0	0
TWN	007	2,328,334	0	770,407	3,098,741
CHN	001	90,520,651	24,713,188	41,404	115,275,243
CHN	002	1,386,437,022	1,071,481,536	4,480,114	2,462,398,672
CHN	003	6,335,593,806	1,540,895,794	324,184,141	8,200,673,741
CHN	004	325,368,502	221,704,302	370,184,512	917,257,316
CHN	005	0	0	0	0
CHN	006	0	0	0	0
CHN	007	4,884,477	40,559	1,631,950	6,556,986
IDN	001	9,312,984	2,966,763	0	12,279,746
IDN	002	173,114,259	156,358,473	434,600	329,907,332
IDN	003	614,229,345	121,343,348	14,776,150	750,348,842
IDN	004	28,413,001	18,797,964	40,765,566	87,976,531
IDN	005	0	0	0	0
IDN	006	0	0	0	0
IDN	007	1,828,725	3,995,454	1,275,367	7,099,545
PHL	001	6,974,496	2,557,943	0	9,532,439
PHL	002	85,384,960	93,571,111	324,297	179,280,368
PHL	003	575,878,268	166,963,489	20,632,933	763,474,690
PHL	004	37,832,538	20,125,341	29,283,149	87,241,028
PHL	005	0	0	0	0
PHL	006	0	0	0	0
PHL	007	154,459	0	51,486	205,945
USA	001	47,259,415	32,609,541	19,473	79,888,428
USA	002	673,390,120	1,009,262,220	1,781,790	1,684,434,130
USA	003	8,010,158,574	2,198,417,399	481,708,211	10,690,284,184
USA	004	397,004,588	188,277,727	391,710,764	976,993,079
USA	005	0	0	0	0
USA	006	0	0	0	0
USA	007	12,883,019	4,538,367	5,043,661	22,465,047
KOR	001	43,173,644	13,947,438	345,570	57,466,652
KOR	002	678,662,689	557,698,248	1,252,148	1,237,613,085
KOR	003	2,509,141,999	396,136,907	120,149,923	3,025,428,829
KOR	004	150,320,495	65,167,115	146,650,566	362,138,177
KOR	005	0	0	0	0
KOR	006	0	0	0	0
KOR	007	5,858,533	273,627	1,996,812	8,128,972
THL	001	16,646,085	6,255,469	6,072	22,907,627
THL	002	414,229,093	389,295,746	858,998	804,383,837
THL	003	1,419,377,197	313,760,726	45,730,657	1,778,868,580
THL	004	72,752,249	35,969,366	100,031,984	208,753,598
THL	005	0	0	0	0
THL	006	0	0	0	0
THL	007	2,006,679	386,809	733,361	3,126,849
SIN	001	13,008,801	6,193,142	375	19,202,318
SIN	002	143,450,493	204,474,318	295,931	348,220,742
SIN	003	943,071,577	230,519,486	40,047,281	1,213,638,344
SIN	004	76,488,261	49,459,046	56,575,615	182,522,921

Appendix B. Export data of Japan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
SIN	005	0	0	0	0
SIN	006	0	0	0	0
SIN	007	613,726	395,901	270,559	1,280,186
MLY	001	6,727,203	2,101,349	0	8,828,552
MLY	002	131,344,600	123,923,028	186,197	255,453,825
MLY	003	651,836,542	140,330,100	11,966,468	804,133,110
MLY	004	84,935,614	31,132,908	34,945,938	151,014,460
MLY	005	0	0	0	0
MLY	006	0	0	0	0
MLY	007	3,773,099	9,761,131	2,884,555	16,418,785
IND	001	12,864,571	2,495,121	0	15,359,692
IND	002	117,250,640	107,878,169	78,792	225,207,601
IND	003	438,669,123	84,062,097	11,990,293	534,721,513
IND	004	29,550,093	18,822,757	29,069,187	77,442,036
IND	005	0	0	0	0
IND	006	0	0	0	0
IND	007	588,501	2,697	192,515	783,713
HKG	001	40,679,053	52,979,125	5,985	93,664,162
HKG	002	209,373,933	191,519,565	2,184,184	403,077,682
HKG	003	1,675,341,433	462,609,062	68,493,538	2,206,444,033
HKG	004	99,477,105	70,958,510	112,401,547	282,837,162
HKG	005	0	0	0	0
HKG	006	0	0	0	0
HKG	007	367,024	0	117,899	484,923
EUA	001	31,303,623	10,826,203	130,592	42,260,418
EUA	002	392,525,572	578,965,171	2,372,834	973,863,577
EUA	003	4,262,747,308	1,127,848,220	209,039,519	5,599,635,048
EUA	004	350,846,425	224,016,789	254,705,003	829,568,216
EUA	005	0	0	0	0
EUA	006	0	0	0	0
EUA	007	6,602,243	539,289	2,271,915	9,413,447
ROW	001	39,838,730	21,843,135	3,567	61,685,432
ROW	002	894,868,961	978,572,015	3,352,390	1,876,793,367
ROW	003	6,733,933,941	1,752,794,815	143,966,101	8,630,694,857
ROW	004	583,618,385	547,588,188	463,689,991	1,594,896,564
ROW	005	0	0	0	0
ROW	006	0	0	0	0
ROW	007	6,347,613	10,141,035	3,795,125	20,283,773
WLD	001	392,463,935	200,827,242	593,093	593,884,269
WLD	002	5,741,493,070	5,794,112,739	19,160,440	11,554,766,250
WLD	003	36,668,318,827	8,932,874,838	1,567,357,320	47,168,550,985
WLD	004	2,349,765,676	1,535,229,344	2,107,790,667	5,992,785,687
WLD	005	0	0	0	0
WLD	006	0	0	0	0
WLD	007	48,236,428	30,074,875	21,035,613	99,346,916

Appendix C. Import data of Taiwan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
JPN	001	113,343	100,796	0	214,139
JPN	002	678,701	717,214	82,788	1,478,702
JPN	003	11,603,567	2,296,303	480,761	14,380,631
JPN	004	10,706,655	3,538,302	9,898,423	24,143,381
JPN	005	877	85	0	962
JPN	006	0	0	0	0
JPN	007	67,322	50,003	30,774	148,099
CHN	001	486,191	55,405	0	541,596
CHN	002	1,185,762	1,719,400	192,211	3,097,373
CHN	003	8,691,596	1,635,059	453,104	10,779,759
CHN	004	14,088,614	4,828,413	9,825,952	28,742,979
CHN	005	2,508	13	0	2,521
CHN	006	0	0	0	0
CHN	007	9,234	15,797	5,711	30,743
IDN	001	1,615,441	694,329	0	2,309,770
IDN	002	350,407	285,143	28,568	664,118
IDN	003	677,052	224,867	4,225	906,144
IDN	004	148,288	65,812	208,719	422,819
IDN	005	0	0	0	0
IDN	006	0	0	0	0
IDN	007	8	31	8	46
PHL	001	17,691	6,718	0	24,408
PHL	002	37,285	54,008	2,995	94,287
PHL	003	299,442	162,927	4,101	466,470
PHL	004	941,922	65,034	596,322	1,603,279
PHL	005	0	0	0	0
PHL	006	0	0	0	0
PHL	007	0	2	0	3
USA	001	1,187,205	586,963	313	1,774,482
USA	002	926,879	1,134,363	67,848	2,129,089
USA	003	4,643,372	1,197,671	359,364	6,200,407
USA	004	7,156,668	1,599,421	6,636,954	15,393,043
USA	005	44	1	0	45
USA	006	0	0	0	0
USA	007	32,341	30,463	15,857	78,661
KOR	001	12,979	28,176	0	41,155
KOR	002	192,843	164,118	23,687	380,648
KOR	003	4,084,758	1,736,096	67,324	5,888,178
KOR	004	5,382,687	414,878	2,391,682	8,189,247
KOR	005	6	2	0	8
KOR	006	0	0	0	0
KOR	007	28,573	3,423	10,095	42,091
THL	001	65,402	46,223	0	111,625
THL	002	288,289	309,622	14,340	612,251
THL	003	738,192	178,355	11,600	928,148
THL	004	1,050,851	358,369	728,207	2,137,427
THL	005	0	0	0	0
THL	006	0	0	0	0
THL	007	62	242	61	365
SIN	001	366	173	0	539
SIN	002	40,159	61,754	3,393	105,306
SIN	003	928,461	534,696	32,783	1,495,940
SIN	004	2,945,430	390,150	2,514,270	5,849,850
SIN	005	78	0	0	78
SIN	006	0	0	0	0
SIN	007	3,818	15,230	3,811	22,859
MLY	001	290,669	727,842	0	1,018,512

Appendix C. Import data of Taiwan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
MLY	002	311,552	221,689	5,860	539,102
MLY	003	774,662	411,055	34,498	1,220,215
MLY	004	1,929,129	189,176	1,336,795	3,455,100
MLY	005	0	0	0	0
MLY	006	0	0	0	0
MLY	007	687	2,495	645	3,827
IND	001	74,668	17,377	0	92,044
IND	002	91,224	107,428	2,748	201,401
IND	003	905,691	778,084	7,600	1,691,375
IND	004	99,466	42,330	44,395	186,192
IND	005	0	0	0	0
IND	006	0	0	0	0
IND	007	9	36	9	54
HKG	001	694	835	0	1,530
HKG	002	10,630	26,704	1,871	39,205
HKG	003	552,167	201,206	7,429	760,802
HKG	004	142,336	110,029	85,978	338,343
HKG	005	1	0	0	2
HKG	006	0	0	0	0
HKG	007	6,185	24,643	6,169	36,997
EUA	001	58,174	49,419	5	107,597
EUA	002	970,325	1,728,682	135,191	2,834,199
EUA	003	4,746,827	1,177,425	421,572	6,345,824
EUA	004	4,593,867	3,165,644	6,573,983	14,333,494
EUA	005	136	1	0	137
EUA	006	0	0	0	0
EUA	007	25,397	100,844	25,273	151,514
ROW	001	20,178,369	3,020,777	2,005	23,201,150
ROW	002	2,060,376	2,147,577	44,411	4,252,364
ROW	003	7,876,063	4,389,305	135,930	12,401,298
ROW	004	5,650,468	986,091	3,368,688	10,005,247
ROW	005	448	0	0	448
ROW	006	0	0	0	0
ROW	007	5,148	7,850	3,024	16,022
WLD	001	24,101,191	5,335,034	2,323	29,438,548
WLD	002	7,144,433	8,677,701	605,911	16,428,044
WLD	003	46,521,850	14,923,049	2,020,293	63,465,191
WLD	004	54,836,381	15,753,650	44,210,368	114,800,399
WLD	005	4,097	102	0	4,199
WLD	006	0	0	0	0
WLD	007	178,783	251,060	101,438	531,281

Appdedix D. Export data of Taiwan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
JPN	001	72,566	96,139	0	168,705
JPN	002	450,866	591,535	30,673	1,073,074
JPN	003	3,520,048	662,083	247,889	4,430,021
JPN	004	6,576,740	1,197,001	3,000,343	10,774,083
JPN	005	467	5	0	472
JPN	006	0	0		0
JPN	007	14,161	26,060	9,064	49,284
CHN	001	68,134	110,011	0	178,145
CHN	002	1,736,915	934,831	57,547	2,729,293
CHN	003	16,535,503	2,032,200	290,126	18,857,829
CHN	004	27,006,118	2,557,197	15,229,987	44,793,302
CHN	005	7	2	0	9
CHN	006	0	0	0	0
CHN	007	24,121	29,035	12,879	66,036
IDN	001	5,477	321	0	5,799
IDN	002	456,071	201,830	7,019	664,920
IDN	003	930,990	184,917	27,134	1,143,041
IDN	004	341,927	117,747	366,460	826,135
IDN	005	18	1	0	19
IDN	006	0	0		0
IDN	007	17	70	17	105
PHL	001	1,596	324	0	1,921
PHL	002	221,426	117,545	11,074	350,045
PHL	003	1,437,469	2,092,893	22,444	3,552,806
PHL	004	2,120,979	142,103	923,749	3,186,831
PHL	005	1,466	487	0	1,953
PHL	006	0	0		0
PHL	007	452	1,707	435	2,594
USA	001	62,610	8,233	0	70,843
USA	002	775,760	875,061	71,441	1,722,262
USA	003	6,362,775	1,793,649	940,957	9,097,381
USA	004	9,050,181	4,416,638	7,219,209	20,686,028
USA	005	42	0	0	42
USA	006	0	0		0
USA	007	2,632	2,226	1,248	6,106
KOR	001	14,873	4,468	0	19,341
KOR	002	166,696	117,366	9,843	293,904
KOR	003	1,757,297	410,053	58,740	2,226,090
KOR	004	6,157,411	394,008	2,438,732	8,990,151
KOR	005	19	0	0	19
KOR	006	0	0		0
KOR	007	4,356	1,036	1,625	7,016
THL	001	5,627	467	0	6,094
THL	002	337,072	240,729	9,300	587,101
THL	003	1,730,663	215,217	56,903	2,002,783
THL	004	1,500,090	230,263	815,305	2,545,658
THL	005	315	105	0	420
THL	006	0	0		0
THL	007	137	545	137	819
SIN	001	4,461	4,089	0	8,550
SIN	002	80,771	72,989	6,286	160,046
SIN	003	1,223,980	1,473,895	30,735	2,728,610
SIN	004	8,722,643	167,417	3,177,646	12,067,707
SIN	005	345	115	0	460
SIN	006	0	0		0
SIN	007	16,972	682	5,771	23,425
MLY	001	5,911	1,275	0	7,186

Appdedix D. Export data of Taiwan by JNIO and BEC classification

Unit: \$1,000

Country	Sector	Intermediate	Consumption	Capital	Total
MLY	002	166,818	93,080	19,764	279,662
MLY	003	1,655,964	400,026	43,390	2,099,380
MLY	004	3,473,831	231,559	1,335,382	5,040,772
MLY	005	336	111	0	447
MLY	006	0	0		0
MLY	007	2,502	456	910	3,868
IND	001	3,790	1,284	0	5,074
IND	002	141,205	38,962	9,894	190,062
IND	003	1,329,175	104,583	22,269	1,456,027
IND	004	418,424	148,079	438,417	1,004,920
IND	005	71	24	0	95
IND	006	0	0		0
IND	007	49	151	41	241
HKG	001	13,875	27,749	63	41,687
HKG	002	668,521	412,266	24,258	1,105,045
HKG	003	2,377,780	634,572	51,310	3,063,662
HKG	004	20,910,505	853,536	7,886,064	29,650,106
HKG	005	59	19	0	79
HKG	006	0	0		0
HKG	007	3,906	12,610	3,404	19,920
EUA	001	28,084	1,621	0	29,704
EUA	002	360,262	303,065	25,080	688,407
EUA	003	4,426,950	1,159,093	647,367	6,233,410
EUA	004	7,525,437	3,050,910	5,372,862	15,949,209
EUA	005	2	0	0	2
EUA	006	0	0		0
EUA	007	884	2,021	632	3,537
ROW	001	55,639	8,058	534	64,231
ROW	002	3,510,598	1,739,818	76,575	5,326,990
ROW	003	10,376,804	2,387,606	428,465	13,192,874
ROW	004	5,892,516	2,745,113	4,604,758	13,242,387
ROW	005	3,929	1,308	0	5,237
ROW	006	0	0		0
ROW	007	1,020	3,785	971	5,777
WLD	001	342,644	264,039	597	607,280
WLD	002	9,072,981	5,739,075	358,755	15,170,812
WLD	003	53,665,400	13,550,786	2,867,730	70,083,917
WLD	004	99,696,811	16,251,573	52,808,916	168,757,301
WLD	005	7,075	2,179	0	9,254
WLD	006	0	0		0
WLD	007	71,210	80,385	37,134	188,729