

# International financial input-output table for Asia-Pacific region

著者	Hagino Satoru, Kim Jiyoung, Inomata Satoshi
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**International Financial Input-Output  
Table for Asia-Pacific Region**

Satoru HAGINO, Jiyoung KIM\* and  
Satoshi INOMATA\*\*

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**Abstract**

Flow of Funds Accounts (FFA) refer to the statistics describing how funds are transferred and where assets and liabilities exist in or outside a country. This paper tries to produce preliminary global FFA focusing on Asia-Pacific region, which is a type of global FFA, and to identify its uses. We discuss the method of converting countries' FFA into Financial Input-output (FIO) and putting those FIOs, CPIS, CDIS and other international statistics into the framework of global FIO. Then, it discusses the use of global FIO table by applying the methods of input-output analysis.

**Keywords:** Financial Input-Output Table, Flow-of-funds

**JEL classification:** R15, F30

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\*Research Fellow, Global Value Chains Studies Group, Inter-disciplinary Studies Center, IDE (Jiyoung\_Kim@ide.go.jp)

\*\*Chief Senior Researcher, Inter-disciplinary Studies Center, IDE (Satoshi\_Inomata@ide.go.jp)

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**INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO**  
**3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI**  
**CHIBA 261-8545, JAPAN**

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# International Financial Input-Output Table for the Asia-Pacific Region

Satoru Hagino<sup>1</sup>, Jiyoung Kim<sup>2</sup>, Satoshi Inomata<sup>3</sup>

## 1. Introduction

Flow of Funds Accounts (FFAs) are the official statistics describing how funds are transferred and where assets/liabilities exist, within or outside a country. At the international level, global FFAs depict cross-border transfer of funds and the consequent claim/obligation relations among countries. Although the original idea of global FFAs is seen in the pioneering work of FFAs such as Ishida (1993), the worldwide currency and financial crises, especially the 2008 global financial crisis, shed a new light on the importance of global FFAs. “The Financial Crisis and Information Gaps, IMF/FSB Report to the G-20”, or so-called “G20 Data Gap Report”, was published in 2009 to frame a guideline for filling the data gap between existing and necessary statistical assets on the global financial system, and the development of global FFAs was set as its key objective.

The development of global FFAs has been primarily driven by the International Monetary Fund (IMF), which is responsible for monitoring robust functioning of global financial system. For example, in line with Errico (2014)’s global FFAs scheme, the IMF has worked on the improvement of relevant international statistics such as Coordinated Portfolio Investment Survey (CPIS) and Coordinated Direct Investment Survey (CDIS). Global FFAs, however, have not been produced so far, mainly due to the absence of “from-whom-to-whom” FFAs at the national level, which comprise integral segments of global FFAs.<sup>4</sup>

Against this backdrop, the current paper considers the possibility and relevance of compiling global FFAs, and in particular its extension to international financial input-output (FIO) tables, based on the information obtained from a series of dialogues with the experts of the IMF as well as of the Bank of Japan, the Bank of Korea, the U.S. Federal Reserve Board, and Statistics Canada, each of which is responsible for compiling respective country’s FFAs. In the section that follows, we first present a method of transforming national FFAs into a FIO table, and then show how the consequent FIO tables are integrated with CPIS, CDIS and other international statistics within the framework of an international FIO table, with a particular focus on the Asia-Pacific region. In the latter section, we discuss potential uses of an international FIO table in reference to the input-output analysis.

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<sup>1</sup> Professor, Fukuyama University (shagino@fuec.fukuyama-u.ac.jp)

<sup>2</sup> Research Fellow, Global Value Chains Studies Group, Inter-disciplinary Studies Center, Institute of Developing Economies, JETRO (Jiyoung\_Kim@ide.go.jp)

<sup>3</sup> Chief Senior Researcher, Inter-disciplinary Studies Center, Institute of Developing Economies, JETRO (Satoshi\_Inomata@ide.go.jp)

<sup>4</sup> Some countries are expected to produce these tables in near future in compliance with IMF’s Special Data Dissemination Standards plus (SDDS plus).

## 2. The basic framework of FFAs

FFAs present a matrix of financial transactions and assets/liabilities of economic sectors (in columns) and financial instruments (in rows). Economic sectors cover financial institutions (FI), non-financial corporations (NFC), general government (GG), households (HH) and rest-of-the-world (ROW), while financial instruments include deposits, loans, debt securities, shares and insurance/pension reserves. Even though FFAs include stock tables of financial asset/liability along with flow tables of financial transactions as their major components, the compilers of the accounts came to a common usage of the term “flow of funds” following the seminal work of Copeland (1952).<sup>5</sup>

Currently, the compilers of Japan, Korea, the U.S. and Canada submit FFAs data to the Organization for Economic Cooperation and Development (OECD), which publishes these countries’ FFAs data in a standardized form. Table 1 and 2 are examples of financial transaction data and stock data, respectively, each presenting the differences between asset-side and liability-side totals in the bottom rows.

The differences in financial transaction tables represent the amount of financial surplus/deficit of each economic sector. If an increase of assets surpasses that of liabilities, the difference becomes positive and the corresponding sector is considered to run financial surplus. In the opposite case, the difference becomes negative. This indicates the sector’s financial deficit. In the tables, nonfinancial corporations and households in Japan, for example, are shown to run financial surpluses; namely, the nonfinancial corporations are gaining positive returns on investments and the households are earning sufficient income to cover consumption and housing acquisition.

In contrast, the difference in financial stock tables represent a net financial position of a sector. Since financial surplus/deficit is equivalent to net saving, the performance of real economies can be considered in relation to financial surplus/deficit status. For example, when a sector runs into a significantly negative position by accumulating liabilities, its investment is likely to be curbed.

Further to this, the gross values of financial assets/liabilities have an important implication for economic performance of the countries concerned. This is especially true in developed economies whose households have accumulated a large amount of financial assets. The assets diversification, such as investing abroad, has a significant impact on the country’s performability. Likewise, governments are generally prone to accumulate debts, and, at its extremity, their default risks may cause global currency/financial instability. The euro crisis as triggered by the Greek financial problems revealed the vulnerability of such an intertwined financial system.<sup>6</sup>

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<sup>5</sup> In contrast, the System of National Accounts (SNA) refers to financial transactions (= flow tables) as financial accounts and financial asset/liability (= stock tables) as sectoral balance sheet. While it appears that such SNA terminology is commonly used in European countries (and recently even in the U.S. by the Federal Reserve Board), we use the expression “flow of funds” throughout the paper since it covers both aspects of flows and stocks.

<sup>6</sup> As of the end of 2015, financial assets held by Japanese households exceed 15 trillion US dollars, while Japanese government’s debts exceed 10 trillion US dollars, which can be held by investors of the rest-of-the-world.

Table 1. FFAs transaction tables of Japan, Korea, the U.S. and Canada (2015, Billion USD)

Japan transactions	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
deposits	718	1,132	130	0	218	0	118	0	7	59
debt securities	142	122	-2	-46	-185	-27	-13	0	107	0
loans	-25	-83	36	1	-114	-2	-1	69	52	-38
equity and shares	83	174	75	11	61	14	22	0	-41	0
insurance/pension	-17	35	0	-13	0	0	39	0	0	0
derivatives	0	0	0	1	0	0	1	0	0	0
others	429	23	136	83	-76	43	-38	56	56	302
total	1,330	1,402	374	38	-95	29	129	125	180	325
difference		-71		336		-124		4		-145

Korea transactions	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
deposits	37	172	51	0	5	10	95	0	-5	0
debt securities	99	64	16	-9	8	44	7	0	-6	25
loans	190	4	0	68	0	0	0	112	0	7
equity and shares	30	46	-7	19	47	2	15	0	-2	16
insurance/pension	3	86	4	0	0	0	79	0	0	0
derivatives	0	0	0	0	0	0	0	0	0	0
others	57	32	25	21	15	1	0	2	2	44
total	417	403	89	99	75	58	197	114	-12	93
difference		14		-10		18		83		-105

USA transactions	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
deposits	-515	220	103	0	106	0	529	0	-44	-252
debt securities	598	160	-1	408	-4	734	264	-8	407	-31
loans	792	-24	31	412	118	0	-60	411	-108	98
equity and shares	454	574	289	-93	13	0	-91	0	289	474
insurance/pension	280	478	-8	115	0	176	499	2	0	0
derivatives	0	0	0	0	0	0	0	0	0	0
others	-237	-197	1369	890	39	58	10	4	8	-2
total	1,372	1,212	1,783	1,733	273	969	1,150	408	552	287
difference		160		49		-696		742		265

Canada transactions	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
deposits	3	89	-18	0	11	0	53	0	42	2
debt securities	91	100	10	31	31	35	4	0	73	43
loans	170	37	13	95	16	1	0	82	21	5
equity and shares	138	102	25	45	23	0	-48	0	58	49
insurance/pension	15	46	0	5	0	12	48	0	0	0
derivatives	0	0	0	0	0	0	0	0	0	0
others	-8	9	54	-64	6	58	-17	2	4	35
total	409	383	84	112	87	105	40	85	198	133
difference		27		-28		-19		-45		64

Source: authors' tabulation based on the data from OECD.Stat.

Table 2. FFAs stock tables of Japan, Korea, the U.S. and Canada (end of 2015, Billion USD)

Japan	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
stocks										
deposits	4012	14,581	2107	0	667	0	7851	0	82	138
debt securities	9287	2373	219	603	691	8665	324	0	1119	0
loans	10620	3926	467	3562	189	1378	19	2744	1312	996
equity and shares	1966	2666	2362	6841	1595	451	2374	110	1770	0
insurance/pension	258	4355	19	252	0	0	4330	0	0	0
derivatives	591	625	24	38	0	0	9	6	295	249
others	4049	1133	4021	2356	2033	246	385	656	498	6593
total	30,811	29,661	9,218	13,652	5,205	10,756	15,292	3,516	5,093	8,005
difference		1150		-4434		-5551		11776		-2912

Korea	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
stocks										
deposits	595	2,340	440	0	172	45	1162	0	17	0
debt securities	1315	829	55	468	253	594	142	0	207	81
loans	2172	118	0	851	0	13	0	1129	6	67
equity and shares	540	666	599	1608	430	26	542	0	344	154
insurance/pension	13	870	14	0	0	0	843	0	0	0
derivatives	93	102	5	5	1	1	0	0	38	29
others	878	618	900	845	314	90	24	84	325	804
total	5,614	5,546	2,012	3,777	1,169	768	2,714	1,214	939	1,139
difference		68		-1765		401		1500		-200

USA	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
transactions										
deposits	-515	220	103	0	106	0	529	0	-44	-252
debt securities	598	160	-1	408	-4	734	264	-8	407	-31
loans	792	-24	31	412	118	0	-60	411	-108	98
equity and shares	454	574	289	-93	13	0	-91	0	289	474
insurance/pension	280	478	-8	115	0	176	499	2	0	0
derivatives	0	0	0	0	0	0	0	0	0	0
others	-237	-197	1369	890	39	58	10	4	8	-2
total	1,372	1,212	1,783	1,733	273	969	1,150	408	552	287
difference		160		49		-696		742		265

Canada	Financial Institutions		Nonfinancial Corporations		General Government		Households & NPISHs		Rest-of-the-World	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
stocks										
deposits	214	1,636	322	0	78	4	959	0	185	118
debt securities	1705	1007	77	522	241	1185	94	0	884	287
loans	2894	698	236	1141	169	48	3	1406	468	478
equity and shares	3291	3232	817	2068	432	0	1554	0	1020	1815
insurance/pension	116	1537	0	37	0	258	1716	0	0	0
derivatives	0	0	0	0	0	0	0	0	0	0
others	666	654	749	556	179	284	101	38	52	214
total	8,894	8,764	2,201	4,324	1,098	1,779	4,428	1,444	2,609	2,920
difference		130		-2123		-681		2984		-311

Source: authors' tabulation based on the data from OECD.Stat.

### 3. Concept of FIO tables and its compilation method

In considering the impact of currency/financial crises it is important to identify “who has assets/liability with whom” since the impacts propagate across economic sectors through such asset/liability (or claim/obligation) relations within the financial system. The 1993 SNA proposed to augment the conventional FFAs by expanding the information of financial instruments by economic sectors of origins (“detailed” FFAs). For the sake of analytical convenience, however, it is preferable to have the accounts in a symmetric form, presenting economic sectors in both columns and rows and thereby directly elucidating claim/obligation relations among them. The FFAs of this kind are now called “from-whom-to-whom” tables in the major international statistics fora, but the current paper explicitly refers to its original naming of “financial input-output (FIO) tables” in order to emphasize the benefit of analytical reference to the traditional input-output methodology.

In the past, conventional FFAs were transformed into a symmetric matrix by mathematical proration, using the information on each sector’s financial asset/liability composition ratios. In recent years, however, FFAs compilers are also trying to estimate inter-sectoral transactions by directly exploiting “from-whom-to-whom” information in their source data. For example, deposits and loans are by nature associated with the commitment of financial institutions. Insurance/pension reserves and investment trust equity are generally held by households. Financial derivatives are issued mostly by financial institutions, and so on.<sup>7</sup>

What follows summarizes compilation methods of FIO tables of Japan, Korea, the U.S. and Canada.

#### (1) Japan’s FIO table

Table 2-1 presents Japan’s FIO converted from Japan’s FFAs. This shows liabilities of each sector in rows and assets of each sector in columns. As such, when focusing on a specific column, holding of relevant sector’s liabilities can be identified by a sector. For example, among 13,652 billion dollars, the total liabilities of nonfinancial corporations sector, 6,222 billion dollars, are held by financial institutions and 3,859 billion dollars are held by nonfinancial corporations. Using the explanation for industrial IO tables, such data implies how each sector’s financial needs have been satisfied by other and own sectors.

The estimates in Okuma (2013) were used for compiling Japan’s FIO table. Specifically, based on Okuma (2013)’s FIO stock table with the reference to the end of 2011, the ratios of financial assets and liabilities can be identified (the ratios of holding amount by a sector to the total liabilities of a sector). Assuming that domestic assets/liabilities relationship is rather stable, such ratios have been applied to the data of the end of 2015. In contrast, international asset/liability relationship is derived from ratios of foreign asset/liability holding ratios by sector calculated by the net international position.

In this table, the vertical total and horizontal total should match but they do not so in practice. This is because different sources have been used and the net position at the end of 2015 differs that in 2011. Although such discrepancies can be eliminated by convergence calculation of the matrix, they have been absorbed in households’ assets and liabilities by calculating them as residual.

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<sup>7</sup> As for debt securities and shares, the availability of relevant information differs among countries. For example, euro-area European countries have developed comprehensive security-by-security database and hence it is possible to identify issuing and holding sectors of securities.



Table 3-1-1. Japan's FIO table (end of 2015, Billion USD)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	8,321	6,221	8,320	3,091	4,857	0	30,811
Nonfinancial Corporations	3,277	3,858	218	245	1,619	4,434	13,652
General Government	1,613	1,088	966	88	1,451	5551	10,756
Households & NPISHs	14,073	846	240	0	78	0	15,232
Rest-of-the-World	2,377	1,639	1,011	66	0	2,912	8,005
Difference (A>L)	1,150	0	0	11,776	0		
Total	30,811	13,652	10,756	15,292	8,005		

Source: calculated by authors from Japan's FFAs.

Table 3-1-2. Japan's financial asset/liability composition ratios

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	0.27	0.46	0.77	0.20	0.61	0.12	1.00
Nonfinancial Corporations	0.11	0.28	0.02	0.02	0.20	0.27	1.00
General Government	0.05	0.08	0.09	0.01	0.18	0.57	1.00
Households & NPISHs	0.46	0.06	0.02	0.00	0.01	0.00	1.00
Rest-of-the-World	0.08	0.12	0.09	0.00	0.00	0.37	1.00
Difference (A>L)	0.04	0.00	0.00	0.77	0.00		
Total	1.00	1.00	1.00	1.00	1.00		

Source: calculated by authors based on Okuma (2013).

Okuma (2013) classified FFAs data into four categories. The first category refers to instruments whose issuers or holders can be identified by themselves from the definition of financial instruments. It includes currency, deposits and loans. The second category refers to instruments whose holders can be identified by additional sources. For example, foreign deposits held by government can be identified from the Ministry of Finance's data. The third category refers to government bonds of financial investment and loan program bonds whose issuers are financial institutions or general government. In this case, the total liabilities are split into two types of bonds in each holding sector

based on the total amounts of issues. The fourth category refers to instruments for which irrelevant issuing/holding sectors can be eliminated by judgement.

Such categorization and corresponding estimation methods are similar to the summary of FIO table compilation methods as mentioned in the beginning of this section. The peculiarity of Okuma (2013)'s method is to minimize the application of proration as much as possible, and thus, it can improve the accuracy of FIO data. At the same time, Okuma (2013) notes the difficulties in compiling Japan's FIO tables, such as the problem that pension funds' holding assets are regarded as those of entrusted financial institutions in a share-holding sector survey. At any rate, it is expected that the Bank of Japan will overcome such difficulties and come up with qualified Japan's FIO tables which comply with IMF's SDDS plus.

## (2) Korea's FIO table

Lee (2014) estimated Korea's FIO tables with the reference to the end of 2012. It identified partner sectors for 60 percent of the total financial assets. Broken down by sectors, partner sectors were identified for more than 70 percent in financial institutions, general government and households sectors. In contrast, partner sectors were identified for less than 30 percent in nonfinancial corporations and rest-of-the-world sectors, mainly because these sectors use shares, foreign direct investments and trade credits more than other sectors.

Looking at the financial asset/liability composition ratios, the share of financial institutions holdings to the total general government liabilities amounts to 0.44, which is higher than their shares to the total liabilities of other sectors. The shares of same sectors' holdings are more than 0.30 for financial institutions and general government sectors and less than 0.05 for nonfinancial corporations sector.

Based on such information (shadowed parts derived from Lee (2014)), we estimated the entire financial asset/liability composition ratios as shown in Table 3-2-2. Using these ratios and the net international position statistics at the end of 2015 in the same way as Japan's FIO tables, Korea's FIO tables are compiled as shown in Table 3-2-1.

Table 3-2-1. Korea's FIO table (end of 2015, Billion USD)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	1,643	1,445	106	505	320	0	4,019
Nonfinancial Corporations	434	189	8	0	329	1,765	2,725
General Government	594	1,051	72	0	489	0	2,206
Households & NPISHs	2,656	542	22	0	0	0	3,220
Rest-of-the-World	314	550	69	0	0	200	1,133
Difference (A>L)	68	0	401	1,500	0		
Total	5,614	3,777	768	2,714	1,139		

Source: calculated by authors from Korea's FFAs.

Table 3-2-2. Korea's financial asset/liability composition ratios

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	0.30	0.38	0.29	0.42	0.28	0.00	1.00
Nonfinancial Corporations	0.08	0.05	0.02	0.03	0.29	0.47	1.00
General Government	0.11	0.28	0.20	0.00	0.43	0.00	1.00
Households & NPISHs	0.47	0.14	0.06	0.00	0.00	0.00	1.00
Rest-of-the-World	0.06	0.15	0.09	0.00	0.00	0.18	1.00
Difference (A>L)	0.01	0.00	0.34	0.55	0.00		
Total	1.00	1.00	1.00	1.00	1.00		

Source: calculated by authors based on Lee (2014).

The Bank of Korea is working on the compilation of Korea's FIO tables in line with the G20 Data Gap Report. In doing so, the biggest obstacle is to link issuing and holding sectors of securities. Although the Bank of Korea shares security-by-security database with Korea Securities Depository, the database covers only publicly subscribed bonds and does not covers privately placed bonds, which account for approximately 10 percent of total issues. Also, in terms of sectorization, financial institutions are further sub-classified but nonfinancial sector is not separated into general government, nonfinancial corporations and households. The Bank of Korea, in cooperation with Korea Securities Depository, considers improving such aspects. Financial derivatives are based on data sources on a residential basis. In Korea, most derivatives holders/issuers have been financial institutions. Trade credits are based on data sources for balance of payments statistics.

### (3) The U.S. FIO table

As far as the U.S. data is concerned, the IMF has been compiling financial corporations survey based on the U.S. flow of funds accounts. This survey presents financial institutions' claim on the general government and that on the rest-of-the-world, which can be used for financial asset/liabilities ratios between financial institutions and these two sectors, respectively (shadowed parts in table 3-3-2). Also, the U.S. net international investment statistics show nonfinancial corporations' and general government's claims on the rest-of-the-world (parts without shadow in table 3-3-2). Using such information, judging issuing/holding sectors based on characteristics of financial instruments at the same time, and calculating households assets/liabilities as residual, we estimated a U.S. FIO table as shown in table 3-3-1.

The U.S. Federal Reserve Board, the compiler of the U.S. FFAs, plans to compile the U.S. FIO tables to comply with SDDS plus and provides the IMF with financial corporations survey. To compile such surveys, the information on "from-whom-to-whom" of financial corporations' assets/liabilities need to be identified. To realize this, the IMF has asked its member countries to provide financial data in its standardized reporting form, or SRF. The U.S. has not yet complied with IMF's

request. To start such data provision, the U.S. Federal Reserve Board is collecting the information that helps to identify “from-whom-to-whom”. The U.S. FIO tables will be compiled as a result of such work.

Table 3-3-1. The U.S. FIO table (end of 2015, Billion USD)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	12,320	40,487	13,713	8,775	11,197	1879	88,369
Nonfinancial Corporations	2,229	8,289	193	160	3,576	32,998	57,014
General Government	825	0	0	51,909	137	18210	70,943
Households & NPISHs	65,248	0	0	1003	0	0	14,575
Rest-of-the-World	7,747	8,238	7,057	0	0	0	23,043
Difference (A>L)	0	0	0	56,368	5727		
Total	88,369	57,014	23,365	70,943	23,043		

Source: calculated by authors from the U.S. FFAs.

Table 3-3-2. The U.S. financial asset/Liability ratios

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	698	3,034	48	2,984	2,130	0	8,894
Nonfinancial Corporations	2,278	19	817	1,402	527	2,123	4,324
General Government	426	0	241	169	263	681	1,779
Households & NPISHs	4,294	0	94	42	0	0	4,428
Rest-of-the-World	1,070	1,271	579	0	0	311	2,920
Difference (A>L)	130	0	0	2,984	0		
Total	8,894	4,324	1,779	4,428	2,920		

Source: calculated by authors.

#### (4) Canada’s FIO table

For Canada, liabilities by issuing sectors in its net international investment position, from which financial asset/liability composition ratios can be calculated as shown in table 3-4-2, are the only available sector information for FIO tables. Under such situation, Canada’s FIO tables, as shown in table 3-4-1, can be estimated only by a proration method using financial asset/liabilities ratios in Canada’s FFAs as well as a judgement about issuing/holding sectors on characteristics of financial instruments.

Table 3-4-1. Canada's FIO table (end of 2015, Billion USD)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	698	3,034	48	2,984	2,130	0	8,894
Nonfinancial Corporations	2,278	19	817	1,402	527	2,123	4,324
General Government	426	0	241	169	263	681	1,779
Households & NPISHs	4,294	0	94	42	0	0	4,428
Rest-of-the-World	1,070	1,271	579	0		311	2,920
Difference (A>L)	130	0	0	2,984	0		
Total	8,894	4,324	1,779	4,428	2,920		

Source: calculated by authors from Canada's FFAs.

Table 3-4-2. Canada's financial asset/liability composition ratios

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions							
Nonfinancial Corporations							
General Government							
Households & NPISHs							
Rest-of-the-World	0.37	0.44	0.20				
Difference (A>L)							
Total							

Source: calculated by authors.

Statistics Canada, which is the compiler of Canada's FFAs, plans to compile Canada's FIO tables to comply with SDDS plus. Its approach would be to base partner sectors for deposits and loans on survey from financial institutions and to depend on security-by-security database for specifying issuing/holding sectors of securities, though some types of securities can be held only by households. Such database was established originally for the compilation of balance-of-payments related statistics but, according to Jansen (2017), Statistics Canada has started a project to extend this database and consolidate with its own enterprise register. This project is expected to improve the accuracy of specifying issuing/holding sectors of securities.

#### 4. Compilation of international FIO tables

##### (1) Framework of international FIO tables

International FIO tables is the combination of countries' FIO tables compiled from their FFAs. If Japan's and Korea's FIO tables are connected explicitly, the framework of an international FIO tables can be shown as Table 4-1. In Table 4-1, figures represent claims/obligations among domestic sectors. To identify cross-border relationship or claims/obligations between domestic sectors and foreign sectors, rest-of-the-world has to be sub-classified into Japan, Korea and others and then Japan and Korea have to be further sub-divided into domestic sectors as partner.

As a result, cells in the upper-right represents claims of Japan's domestic sectors on Korea's domestic sectors, or obligations of Korea's domestic sectors to Japan's domestic sector, and cells in the lower-left represents obligations of Japan's domestic sectors to Korea's domestic sector or claims of Korea's domestic sectors on Japan's domestic sectors. More specifically, (a) in the Table 4-1 represents claims of Japanese financial institutions on Korea's financial institutions, (b) represents claims of Japanese financial institutions on Korea's general government, (c) represents obligations of Japanese financial institutions to Korea's financial institutions and (d) represents obligations of Japan's general government to Korea's financial institutions. In this table, "other" correspond partner counties other than Japan and Korea.

Table 4-1. Japan's and Korea's FIO matrices in the international FIO framework (end of 2015, Billion USD)

(Liabilities) (Assets)		Japan				Korea				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
Japan	Financial Institutions	8,321	6,221	8,320	3,091	(a)		(b)		
	Nonfinancial Corporations	3,277	3,858	218	245					
	General Government	1,613	1,088	966	88					
	Households & NPISHs	14,073	846	240	0					
Korea	Financial Institutions	©		(d)		1,643	1,445	106	505	
	Nonfinancial Corporations					434	189	8	0	
	General Government					594	1,051	72	0	
	Households & NPISHs					2,656	542	22	0	
Others										

##### (2) Source data for cross-border claims/obligations

To demonstrate cross-border claims/obligations as shown in table 4, source data specifying "from-whom-to-whom" sectors in such claim/obligation relations are necessary. For this purpose, net international positions and related statistics are useful.

Net international positions refer to statistics that represent cross-border claims/obligations of a country or a region. While balance of payments statistics record cross-border transactions and describe flows, net international positions describe stocks and correspond to balance sheets. In terms of its relationship with FFAs, cross-border claims/obligations represented in net international positions

corresponds to the rest-of-the world. While FFAs describe cross-border claims/obligations from the standpoint of nonresidents, net international positions describe claims/obligations from the standpoint of residents of a country. Since residents' claims correspond to nonresidents' liabilities and residents' liabilities correspond to residents' claims, figures in net international positions figures are mirror images of those in FFAs.

### (3) International statistics development by international organizations

Major countries in the world have published net international positions by sectors and they are strong source data for international FIO tables. However, the details of such data vary in particular in terms of sector breakdowns of issuers/holders. This makes it difficult to incorporate such data in international FIO tables.

In contrast, the IMF has developed internationally harmonized statistics for portfolio and direct investments, respectively, and it has published Coordinated Portfolio Investment Survey (CPIS) and Coordinated Direct Investment Survey (CDIS). This paper has made use of such surveys as their harmonized frameworks are very useful. Incidentally, the IMF has collected data on foreign reserve assets held by monetary authority (central governments and/or central banks) and has published Securities Held as Foreign Exchange Reserves (SEFER). The results of SEFER are incorporated in CPIS.

Given that international FIO tables combine FIO tables with sectors in row and sectors in column, identifying partner countries is not sufficient and it is necessary to identify sectors in both home and partner countries. In this respect, the IMF has tried to develop data classified by home sectors and partner countries and data cross-classified by them in its enhanced CPIS. However, only a few countries have provided data classified by sectors in partner countries. Also, CDIS does not contain data classified by sectors. Therefore, for the time being, assumptions have to be made in terms of sector breakdowns. For example, this paper regarded all cross-border direct investment positions as those among nonfinancial corporations.

In terms of deposits and loans, the Bank for International Settlements (BIS) has published cross-border positions by residence in its International Banking Statistics (IBS). Thus, such data are useful for identifying partner countries in compiling international FIO tables. However, as BIS data are not further broken down by sectors, this paper regarded all cross-border deposit/loan positions as those among financial institutions.

### (4) Trial estimation of a Japan-Korea international FIO table

Both Japan's and Korea's CPISs contain sector breakdowns in home countries but do not contain such breakdowns in partner countries. Thus, assets of a home country sector were allocated to partner country sectors based on ratios of the entire liability amounts by sector in partner countries. Then, Japan's and Korea's CPISs can be incorporated in an international FIO table as shown in Table 4-2.

Since both Japan's and Korea's CDIS do not contain sector breakdowns for home and partner countries, direct investments were added regarding all as those among nonfinancial corporations. In addition, Korea's CDIS does not identify direct investments to Japan. Thus, this paper used Japan's inward and outward data to cover such absence in Korea's CDIS. Such data are shown as positions among nonfinancial corporations between two countries in Table 4-3. As for deposit/loan positions

between two countries, data are available in Japan's and Korea's IBSs. Such data are shown as positions among financial institutions between two countries as shown in Table 4-3.

Table 4-2. Incorporating CPIS of Japan and Korea into the international FIO framework (end of 2015, Billion USD)

(Liabilities) (Assets)		Japan				Korea				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
Japan	Financial Institutions					11	20	3	0	
	Nonfinancial Corporations					5	9	1	0	
	General Government					0	0	0	0	
	Households & NPISHs					0	0	0	0	
Korea	Financial Institutions	3	2	1	0					
	Nonfinancial Corporations	13	9	5	0					
	General Government	17	0	0	0					
	Households & NPISHs	0	0	0	0					
Others										

Table 4-3. Incorporating CDIS of Japan, IBS of Japan and Korea into the international FIO framework (end of 2015, Billion USD)

(Liabilities) (Assets)		Japan				Korea				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
Japan	Financial Institutions					4				
	Nonfinancial Corporations						31			
	General Government									
	Households & NPISHs									
Korea	Financial Institutions	3								
	Nonfinancial Corporations		4							
	General Government									
	Households & NPISHs									
Others										

If these sources are combined in a matrix, a Japan-Korea international FIO table is estimated as shown in Table 4-4.



Table 4-4. Japan-Korea international FIO table (end of 2015, Billion USD)

(Liabilities) (Assets)		Japan				Korea				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
Japan	Financial Institutions	8,321	6,221	8,320	3,091	16	20	3	0	4819
	Nonfinancial Corporations	3,277	3,858	218	245	5	41	1	0	1572
	General Government	1,613	1,088	966	88	0	0	0	0	1450
	Households & NPISHs	14,073	846	240	0	0	0	0	0	78
Korea	Financial Institutions	3	2	1	0	1,643	1,445	106	505	310
	Nonfinancial Corporations	13	12	5	0	434	189	8	0	298
	General Government	17	0	0	0	594	1,051	72	0	473
	Households & NPISHs	0	0	0	0	2,656	542	22	0	0
Others		2,341	1,625	1,004	65	304	571	67	0	

(5) Trial estimate of the U.S.-Canada International FIO tables

In the same way as the compilation process of the Japan-Korea international FIO table, if the US and Canada's FIO tables are connected explicitly, the framework of the U.S.-Canada international FIO tables can be shown as Table 4-5.

Table 4-5. The U.S. and Canada's FIO transaction matrices in the international FIO framework (end of 2015, Billion USD)

(Liabilities) (Assets)		U.S.				Canada				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
U.S.	Financial Institutions	12,320	40,487	13,713	8,775					
	Nonfinancial Corporations	2,229	8,289	193	160					
	General Government	825	0	0	51,909					
	Households & NPISHs	65,248	0	0	1,003					
Canada	Financial Institutions					698	3,034	48	2,984	
	Nonfinancial Corporations					2,278	19	817	1,402	
	General Government					426	0	241	0	
	Households & NPISHs					4,294	0	94	0	
Others										

The U.S. CPIS contains breakdowns of sectors in Canada, partner country, as well as those in the U.S. Using such breakdowns in CPIS, a large part of sectoral claims/liabilities between the U.S. and Canada can be identified (cells with light shadow in Table 4-6). It is to be noted that foreign assets held by the U.S. general government are recorded as zero (cells with dark shadow in Table 4-6). As a result, its claims on the rest-of-the-world in Table 3-3-1 cannot be allocated to sectors in Canada.

Canada's CPIS identifies claims/obligations with the U.S. but does not contain sector breakdowns in both Canada, home country, and the U.S., partner country. Thus, sectoral claims/obligations need be estimated based on the proration method multiplying Canada's foreign asset ratios in terms of investing sectors by U.S. foreign liability ratios in terms of investee sectors.

Table 4-6. Incorporating CPIS of the U.S. and Canada into the international FIO framework (end of 2015, Billion USD)

(Liabilities) (Assets)		the U.S.				Canada				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
the U.S.	Financial Institutions					177	344	54	0	
	Nonfinancial Corporations					45	74	12	0	
	General Government					0	0	0	0	
	Households & NPISHs					0	0	0	0	
Canada	Financial Institutions	212	252	115	0					
	Nonfinancial Corporations	52	62	28	0					
	General Government	14	16	7	0					
	Households & NPISHs	0	0	0	0					
Others										

Since both the U.S. and Canada's CDIS do not contain sector breakdowns for home and partner countries, direct investments were added regarding all as those among nonfinancial corporations. In addition, as there are discrepancies between the U.S. data on Canada and Canada's data on the U.S., this paper used U.S. inward and outward data with Canada for the sake of convenience. Such data are shown as positions among nonfinancial corporations of two countries in Table 4-7. Deposit/loan positions between two countries are available in the U.S. and Canada's IBSs and they are shown as positions among financial institutions of two countries in Table 4-7.

If these sources are combined in a matrix, U.S.-Canada international FIO tables can be estimated as shown in Table 4-8. Both Japan-Korea International FIO tables and U.S.-Canada International FIO tables show that claims of smaller economies (Korea and Canada) on larger economies (Japan and U.S.) are more important than otherwise. This implies the gravitation of money by the weight of economies. In contrast, comparing the amounts shown in two FIO tables, financial interconnectedness between the U.S. and Canada appears to be more important than that between Japan and Korea. Having these aspects in mind, authors crossed the Pacific Ocean and combines two FIO tables. Table 4-9 presents a Japan-Korea-the U.S.-Canada international FIO table.

Table 4-7. Incorporating CDIS of the U.S., IBS of the U.S. and Canada into the international FIO framework

(Liabilities) (Assets)		U.S.				Canada				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
U.S.	Financial Institutions					185				
	Nonfinancial Corporations		269				353			
	General Government									
	Households & NPISHs									
Canada	Financial Institutions	185								
	Nonfinancial Corporations									
	General Government									
	Households & NPISHs									
Others										

Table 4-8. The U.S.-Canada international FIO table (end of 2015, Billion USD)

(Liabilities) (Assets)		U.S.				Canada				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
U.S.	Financial Institutions	12,320	40,487	13,713	8,775	362	344	54	0	10,437
	Nonfinancial Corporations	2,229	8,289	193	160	45	343	12	0	3,175
	General Government	825	0	0	51,909	0	0	0	0	137
	Households & NPISHs	65,248	0	0	1,003	0	0	0	0	0
Canada	Financial Institutions	212	252	115	0	698	3,034	48	2,984	1,351
	Nonfinancial Corporations	52	62	28	0	2,278	19	817	1,402	60
	General Government	14	16	7	0	426	0	241	0	226
	Households & NPISHs	0	0	0	0	4,294	0	94	0	0
Others		1,899	985	861	66	-3	550	27	0	

Table 4-9. Japan-Korea-the U.S.-Canada international FIO table (end of 2015, Billion USD)

(Liabilities) (Assets)		Japan				Korea				U.S.				Canada				Others
		Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	
Japan	Financial Institutions	8,321	6,221	8,320	3,091	16	20	3	0	1,024	640	548	0	44	35	16	0	28,504
	Nonfinancial Corporations	3,277	3,858	218	245	5	41	1	0	89	508	81	0	2	2	1	0	936
	General Government	1,613	1,088	966	88	0	0	0	0	111	118	101	0	28	33	15	0	1,043
	Households & NPISHs	14,073	846	240	0	0	0	0	0	0	0	0	0	0	0	0	0	78
Korea	Financial Institutions	7	2	1	0	1,643	1,445	106	505	46	41	35	0	2	1	1	0	184
	Nonfinancial Corporations	13	12	5	0	434	189	8	0	20	22	19	0	0	0	0	0	237
	General Government	17	0	0	0	594	1,051	72	0	0	0	0	0	0	0	0	0	473
	Households & NPISHs	0	0	0	0	2,656	542	22	0	0	0	0	0	0	0	0	0	0
U.S.	Financial Institutions	599	318	196	13	91	128	16	0	12,320	40,487	13,713	8,775	177	344	54	0	9,262
	Nonfinancial Corporations	104	180	44	3	11	20	2	0	2,229	8,289	193	160	230	427	12	0	2,542
	General Government	0	0	0	0	0	0	0	0	825	0	0	51,909	0	0	0	0	137
	Households & NPISHs	0	0	0	0	0	0	0	0	65,248	0	0	1,003	0	0	0	0	0
Canada	Financial Institutions	283	167	103	7	44	75	9	0	212	252	115	0	698	3,034	48	2,984	862
	Nonfinancial Corporations	11	14	5	0	2	4	0	0	52	331	28	0	2,278	19	817	1,402	78
	General Government	3	2	1	0	1	1	0	0	14	16	7	0	426	0	241	0	218
	Households & NPISHs	0	0	0	0	0	0	0	0	0	0	0	0	4,293	0	94	0	0
Others		1,340	943	655	43	144	261	37	0	6,179	6,310	6,123	0	587	428	480	0	

## 5. Expansion of FIO tables

Some previous researches have examined international flow of funds analyses. For examples, Tsujimura and Tsujimura (2008) constructed financial transactions tables between multiple countries. Zhang (2005, 2009, 2015) built a model of the global flow of funds which is composed of financial instruments of major countries and estimated several multiple-equation models. However, compilation of the international flow of funds table which consists of multiple countries' institutional sectors has not been tried yet because of lack of data availability.

In this respect, we constructed the international FIO tables table using FFAs data provided by the OECD in section 3 and 4. Since it has a standardized form of FFAs data, we could compile the international FIO tables for multiple countries. The table consists of 5 institutional sectors, i.e., financial institutions, non-financial corporations, general government, households and rest-of-the-world. However, individual countries' national FFAs have more institutional sectors. For example, the FFAs of Korea in 1993 Systems of National Accounts (SNA) have 18 institutional sectors, and it is possible to break down into 22 institutional sectors. However, it is not easy to construct international FIO tables using individual countries' own FFAs. Each country has its own financial system and laws. Furthermore, the form of FFAs is not unified, since individual countries have their own standards. That is the reason why we adopted FFAs data provided by the OECD in the former section.

In this section, we verify reliability of the international FIO tables calculated by integrated FFAs data and original data. First, we create FIO table with national FFAs data which has more specific institutional sectors and financial items, and then compare it with FIO table of section 3 to examine its confidence. Second, we rearrange institutional sectors of two countries' FIO tables to derive an expanded international FIO table.

### (1) Expanded FFAs and FIO of Korea

In this subsection, we adopt Korean case as an example. Table 5-1-1 demonstrates institutional sectors of FFAs of Korea in 2008 SNA. Sectoral classification of the original FFAs compiled by the Bank of Korea (BOK) provides data of 21 sectors without the information of S4 (other banks), S7 (other non-banks) and S13 (co-operative society). However, we can break down into 24 sectors as follows: S4 is obtained by subtracting S2 (domestically licensed banks) and S3 (specialized banks) from total banks, S7 by subtracting S5 (collectively managed trusts) and S6 (small loan financial companies for households & small businesses) from total non-banks depository corporations, and S13 by subtracting S10 (life insurance companies), S11 (non-life insurance companies) and S12 (reinsurance companies) from total insurance corporations. On the other hand, Table 5-1-2 presents 46 financial instruments of FFAs in 2008 SNA. We decide to exclude Gold & SDRs in this study to consider only financial transactions. Short-term government bonds and short-term local government securities recorded zero in 2015 FFAs data. Thus, these three instruments are removed from the table. Finally, we obtain 2015 FFAs data in 2008 SNA which is composed of 24 institutional sectors and 43 financial instruments.

First of all, FFAs gives us the information of partner directly for creating "from-whom-to-whom" tables. 10 financial instruments which have only one holder or issuer are listed in Table 5-1-3. For example, the BOK is the sole issuer of currency, deposits with BOK and government deposits with BOK. Thus, it enables us to distinguish particular partner. 8 financial instruments are listed in Table 3 which are provided by the sole issuer. Especially, government deposits with BOK has only one pair of holder and issuer, i.e., general government and the BOK. For another example, government bonds and

local government securities are only issued by general government. Thus, it gives us information of funds-flow to general government from its several partners. In the same manner, 3 items have the only single holder. For instances, captive financial institutions and money lender is the unique holder of short-term and long-term asset-backed securities. However, remaining 33 instruments do not provide us “from-whom-to-whom” partner information. For remaining items, we use financial asset/liability composition ratios in an institutional sector and sector holding ratios of a financial asset/liability instrument. Finally, we obtained Table 5-1-4 as Korea’s expanded FIO table which is composed of 24 sectors. To compare with Korea’s FIO table of section 3, i.e., Table 3-2-1 and Table 3-2-2, sectors of Table 5-1-4 are integrated into 5 sectors in Table 5-1-5. Thereafter, Table 5-1-6 shows transactions converted billion Korean Won into billion US dollars and Table 5-1-7 into a percentage. Since 2015 FFAs announced by the BOK is based on 2008 SNA, but FFAs published by OECD follows 1993 SNA, sectoral classification can be different. Approximatively, total of financial assets/liabilities of 5 institutional sectors in Table 5-1-6 are similar to the values in Table 1 and Table 3-2-1.

Previous challenge in Lee (2014) reported that intra-sectoral exposures (shadowed part in Table 5-1-6) are estimated around 30% for financial institutions, 5% for non-financial corporations and 40% for general government which adopted 2012 FFAs data. However, Table 5-1-6 displays 33% for financial institutions, 27% for non-financial corporations and 12% for general government. Though financial corporations sector shows similar shares, the other two sectors have significant gaps between 2012 and 2015. Lee (2014) used the BOK internal FFAs data, which is not opened to the public and has more specific partner information. However, changes in asset/liability portfolio can be one reason of these differentials.

Lee (2014) pointed out that general government sector has heavy weight of intra-sectoral exposures. For example, it has huge intra-sectoral transactions among general government subsectors, such as local government borrows central government loans. However, the proportion of general government’s intra-sectoral transactions is lower in 2015 than 2012. Figure 5-1 shows trend of government loans, government bonds and local government securities. It is separated into general government and the other sectors. i.e., sum of financial institutions, non-financial corporations, Households & NPISHs and Rest-of-the-World. First, government loans borrowed by general government decreased in 2015. Second, government bonds and local government securities held by non-government sector rose drastically. These phenomena can reduce the proportion of general government’s intra-sectoral exposures, since transactions between government and non-government sectors increased.

In the same manner, significant changes in asset/liability portfolios of non-financial corporations are founded. Short-term and long-term commercial paper, short-term and long-term corporate bonds, shares & other equities issued by residents and trade credits are employed for inter-sectoral transactions of non-financial corporations. Among 6 financial items, short-term and long-term corporate bonds are only issued by non-financial corporations. And more than 80% of shares & other equities issued by residents and trade credits are provided by non-financial corporations. Table 5-1-9 demonstrates these 6 financial instruments held by non-financial corporations and the other sectors in 2012 and 2015. Compared with 2012, shares of non-financial corporations increased in 2015. Especially, huge changes of short-term corporate bonds and long-term commercial paper are found. Only 0.7% of short-term corporate bonds are held by non-financial corporations in 2012. However, it increased to 12.9% in 2015. Since corporate bonds is only issued by non-financial corporations, it augments intra-

sectoral transactions directly. Moreover, share of long-term commercial paper of non-financial corporations marked 1.5%, but rose to 48.4% in 2015. It also can be an incremental factor of inter-sectoral transactions.

Table 5-1-1. Institutional sectors of FFAs in Korea (in 2008 SNA)

S1	The Bank of Korea
S2	Domestically Licensed Banks
S3	Specialized Banks
S4	Other Banks
S5	Collectively Managed Trusts
S6	Small Loan Financial Companies for Households & Small Businesses
S7	Other Non-Banks Depository Corporations
S8	MMFs
S9	Non-MMFs
S10	Life Insurance Companies
S11	Non-life Insurance Companies
S12	Reinsurance Companies
S13	Co-operative Society
S14	Pension Funds
S15	Securities Institutions
S16	Credit-specialized Financial Institutions
S17	Public Financial Institutions
S18	Financial Auxiliaries
S19	Captive Financial Institutions and Money Lenders
S20	General Government
S21	Public Nonfinancial Corporations
S22	Private Nonfinancial Enterprises
S23	Households & NPISHs
S24	Rest-of-the-World
D	Difference
T	Total

Table 5-1-2. Financial Instruments of FFAs in Korea (in 2008 SNA)

1. Gold & SDRs
2. Currency & Deposits
1) Currency
2) Transferable Deposits
(1) Depository Corporation Transferable Deposits
(2) Deposits with BOK
(3) Government Deposits with BOK
3) Nontransferable Deposits
(1) Depository Corporation Short-term Deposits
(2) Depository Corporation Long-term Savings Deposits
(3) Cover Bills
(4) Negotiable Certificates of Deposit (CDs)
(5) Repurchase Agreements (RPs)
(6) Money in Trust
(7) Other Deposits
3. Insurance & Pension Reserves
4. Securities other than Shares
1) Short-term
(1) Government Bonds
(2) General Financial Debentures
(3) Commercial Paper
(4) Local government securities
(5) Corporate Bonds
(6) Asset-Backed Securities
(7) External Securities
2) Long-term
(1) Government Bonds
(2) General Financial Debentures
(3) Commercial Paper
(4) Local government securities
(5) Corporate Bonds
(6) Asset-Backed Securities
(7) External Securities



3) Derivatives-Linked Securities
5. Loans
1) Short-term
(1) BOK Loans
(2) Depository Corporation Loans
(3) Ins. Co. & Pension Fund Loans
(4) Financial Intermediary Loans
(5) Call loans and money
(6) Other Loans
2) Long-term
(1) Depository Corporation Loans
(2) Ins. Co. & Pension Fund Loans
(3) Financial Intermediary Loans
(4) Other Loans
6. Government Loans
7. Equity and Investment Fund Shares
1) Shares & Other Equities Issued by Residents
2) Shares Issued by Non-Residents
3) Investment Fund Shares
8. Financial Derivatives
9. Trade Credits
10. Foreign Direct Investment
11. Other Foreign Claims and Debts
12. Miscellaneous
Difference
Total

Table 5-1-3. Financial Instruments which have Particular Counterpart Sector (in 2008 SNA)

Financial Instrument	Counterpart Sector (Issuer or Holder)
2. 1) Currency	The Bank of Korea (Issuer)
2. 2) (2) Deposits with BOK	The Bank of Korea (Issuer)
2. 2) (3) Government Deposits with BOK	The Bank of Korea (Issuer), General Government (Holder)
2. 3) (6) Money in Trust	Collectively Managed Trusts (Issuer)
4. 1) (6) Asset-Backed Securities (Short-term)	Captive Financial Institutions and Money Lenders (Issuer)
4. 2) Government Bonds (Long-term)	General Government (Issuer)
4. 2) (4) Local government securities (Long-term)	General Government (Issuer)
4. 2) (6) Asset-Backed Securities (Long-term)	Captive Financial Institutions and Money Lenders (Issuer)
5. 1) (1) BOK Loans	The Bank of Korea (Holder)
6. Government Loans	General Government (Holder)
7. 2) Shares Issued by Non-Residents	Rest-of-the-World (Issuer)

Table 5-1-4. The FIO table in Korea (Billion KRW, the end of 2015, in 2008 SNA, 24 institutional sectors)

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	D	T
S1	310	21,538	16,379	37,886	1,395	384	4,836	4	114	282	139	37	37	44	1,622	2,068	44	146	142	20,862	1,501	22,678	144	298,189	1,905	432,689
S2	68,944	33,964	34,633	20,321	7,972	6,894	3,961	3,453	13,187	2,521	1,132	207	576	318	21,451	17,275	475	1,108	34,147	72,508	19,802	421,439	486,941	74,861	0	1,348,088
S3	28,551	14,912	14,785	9,131	2,784	3,289	1,818	2,844	10,118	1,564	917	104	360	100	7,686	6,728	213	423	15,362	31,460	16,093	241,835	255,208	37,927	0	704,213
S4	10,480	18,950	15,056	34,185	7,468	2,903	3,204	22	696	2,518	970	192	196	288	9,528	4,874	296	830	1,295	20,370	11,050	34,016	18,608	49,522	9,829	257,344
S5	7,929	39,110	17,341	9,456	14,811	17,366	4,223	315	3,346	2,780	1,329	369	548	449	28,141	9,371	1,057	1,870	38,644	19,515	20,583	43,410	6,470	15,648	39,137	343,216
S6	3,699	13,741	6,559	4,110	5,747	5,041	747	1,066	4,098	1,052	492	141	234	174	46,272	4,248	189	82,324	2,142	36,610	8,850	164,749	175,383	13,564	0	581,233
S7	2,157	7,101	5,126	1,857	16,496	1,922	1,604	2,046	7,038	343	206	32	96	32	1,228	2,998	210	135	7,747	3,757	7,799	42,704	35,260	11,084	0	158,978
S8	13,740	11,136	20,501	972	208	2,329	1,698	82	615	20	24	1	74	1	7,766	3,471	255	543	15,179	3,165	2,087	9,479	3	729	335	94,414
S9	14,315	21,646	21,983	8,919	5,271	4,324	3,945	258	1,378	2,784	1,648	203	322	175	7,316	11,387	493	1,645	9,183	32,896	25,634	88,851	6,475	49,698	13,018	333,769
S10	18,458	28,972	28,344	2,862	5,113	7,219	8,237	12,136	41,497	1,941	1,194	138	226	166	4,197	15,387	631	1,434	32,457	196,046	77,979	152,826	69,349	28,444	1,275	736,530
S11	4,574	7,486	6,956	1,429	3,798	2,621	2,184	3,926	13,511	3,619	1,061	100	329	684	1,335	4,103	194	566	6,190	25,066	18,354	40,784	30,013	5,289	17,127	201,299
S12	206	801	458	226	405	273	86	250	878	1,226	318	22	107	243	137	222	16	43	74	1,706	1,000	1,417	91	141	1,226	11,574
S13	1,574	7,214	4,071	684	5,519	2,947	638	3,564	12,151	439	233	33	52	48	643	1,128	53	300	1,016	2,445	4,010	15,821	7,438	1,503	0	73,525
S14	2,461	32,903	11,592	1,501	1,979	16,695	2,809	2,886	9,938	5,147	1,314	78	447	1,025	2,147	1,928	71	683	2,945	7,414	5,996	9,589	5,549	249	9,409	136,753
S15	28,823	44,751	41,350	6,510	9,505	13,382	5,128	5,020	17,510	1,232	718	104	153	120	18,064	15,809	441	16,691	21,638	55,144	16,079	39,576	23,967	8,275	0	389,990
S16	352	2,983	1,504	693	3,928	1,050	178	368	1,327	427	189	31	48	60	8,229	732	38	1,004	2,159	1,212	1,540	45,117	106,818	354	389	180,728
S17	68	842	373	251	204	310	56	3	25	46	23	6	6	7	81	106	7	22	2,946	520	230	5,134	5,458	728	0	17,450
S18	9,625	12,035	11,857	755	3,261	2,976	1,547	4,016	13,694	321	233	26	39	28	2,559	7,398	156	2,695	18,439	28,716	19,852	28,685	6,344	2,277	0	177,534
S19	151	11,588	4,983	638	45,668	5,825	860	199	751	2,351	1,773	123	322	26	2,495	3,422	182	495	7,136	2,521	28,172	193,186	90,837	341	0	404,046
S20	93,759	108,635	71,081	16,865	28,714	34,744	11,466	20,395	70,239	8,034	5,111	618	1,001	478	10,305	19,783	1,636	3,112	42,299	165,406	107,967	312,040	55,635	181,371	0	1,370,694
S21	652	15,806	6,258	3,761	12,042	5,864	938	30	449	2,190	1,006	172	219	146	2,731	2,125	213	804	3,412	4,518	8,356	66,024	1,760	15,670	455,230	610,374
S22	24,739	249,473	96,260	30,233	96,038	94,126	13,070	5,719	22,016	31,967	12,827	1,438	2,958	2,947	35,958	17,115	1,662	6,854	45,700	35,056	90,149	1,051,902	34,649	200,343	1,615,321	3,818,520
S23	85,951	593,195	211,814	20,716	64,173	318,785	54,226	25,475	87,979	651,145	162,877	6,892	55,604	129,156	61,491	14,770	896	48,720	45,379	55,932	65,309	402,474	211	9,864	0	3,173,033
S24	11,171	47,415	44,405	43,383	717	7,230	25,525	339	1,213	12,583	5,563	506	886	39	15,396	14,279	1,574	4,277	20,152	78,077	51,980	384,784	457	325,266	234,118	1,331,336
D	0	1,887	10,543	0	0	22,731	5,997	0	0	0	0	0	8,686	0	93,213	0	6,447	813	28,264	469,773	0	0	1,749,964	0		
T	432,689	1,348,088	704,213	257,344	343,216	581,233	158,978	94,414	333,769	736,530	201,299	11,574	73,525	136,753	389,990	180,728	17,450	177,534	404,046	1,370,694	610,374	3,818,520	3,173,033	1,331,336		

Table 5-1-5. The FIO table in Korea (Billion KRW, the end of 2015, in 2008 SNA, integrated into 5 institutional sectors)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	2,110,706	1,887,908	561,932	1,330,358	598,822	0	6,489,726
Nonfinancial Corporations	849,916	1,216,431	39,574	36,409	216,013	2,070,551	4,428,893
General Government	548,275	420,007	165,406	55,635	181,371	0	1,370,694
Households & NPISHs	2,639,244	467,783	55,932	211	9,864	0	3,173,033
Rest-of-the-World	256,653	436,764	78,077	457	325,266	234,118	1,331,336
Difference (A>L)	84,932	0	469,773	1,749,964	0		
Total	6,489,726	4,428,893	1,370,694	3,173,033	1,331,336		

Table 5-1-6. The FIO table in Korea (Billion USD, the end of 2015, in 2008 SNA, integrated into 5 institutional sectors)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	1,801	1,611	479	1,135	511	0	5,537
Nonfinancial Corporations	725	1,038	34	31	184	1,767	3,779
General Government	468	358	141	47	155	0	1,169
Households & NPISHs	2,252	399	48	0	8	0	2,707
Rest-of-the-World	219	373	67	0	278	200	1,137
Difference (A>L)	72	0	401	1,493	0		
Total	5,537	3,779	1,170	2,707	1,136		

Table 5-1-7. The FIO table in Korea (percentages in liabilities, the end of 2015, in 2008 SNA, integrated into 5 institutional sectors)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World
Financial Institutions	0.33	0.43	0.41	0.42	0.45
Nonfinancial Corporations	0.13	0.27	0.03	0.01	0.16
General Government	0.08	0.09	0.12	0.02	0.14
Households & NPISHs	0.41	0.11	0.04	0.00	0.01
Rest-of-the-World	0.04	0.10	0.06	0.00	0.24
Difference (A>L)	0.01	0.00	0.34	0.55	0.00
Total	1.00	1.00	1.00	1.00	1.00

Table 5-1-8. The FIO table in Korea (percentages in assets, the end of 2015, in 2008 SNA, integrated into 5 institutional sectors)

	Financial Institutions	Nonfinancial Corporations	General Government	Households & NPISHs	Rest-of-the-World	Difference (L>A)	Total
Financial Institutions	0.33	0.29	0.09	0.20	0.09	0.00	1.00
Nonfinancial Corporations	0.19	0.27	0.01	0.01	0.05	0.47	1.00
General Government	0.40	0.31	0.12	0.04	0.13	0.00	1.00
Households & NPISHs	0.83	0.15	0.02	0.00	0.00	0.00	1.00
Rest-of-the-World	0.19	0.33	0.06	0.00	0.24	0.18	1.00

Figure 5-1. Government Bonds and Loans (Billion KRW)

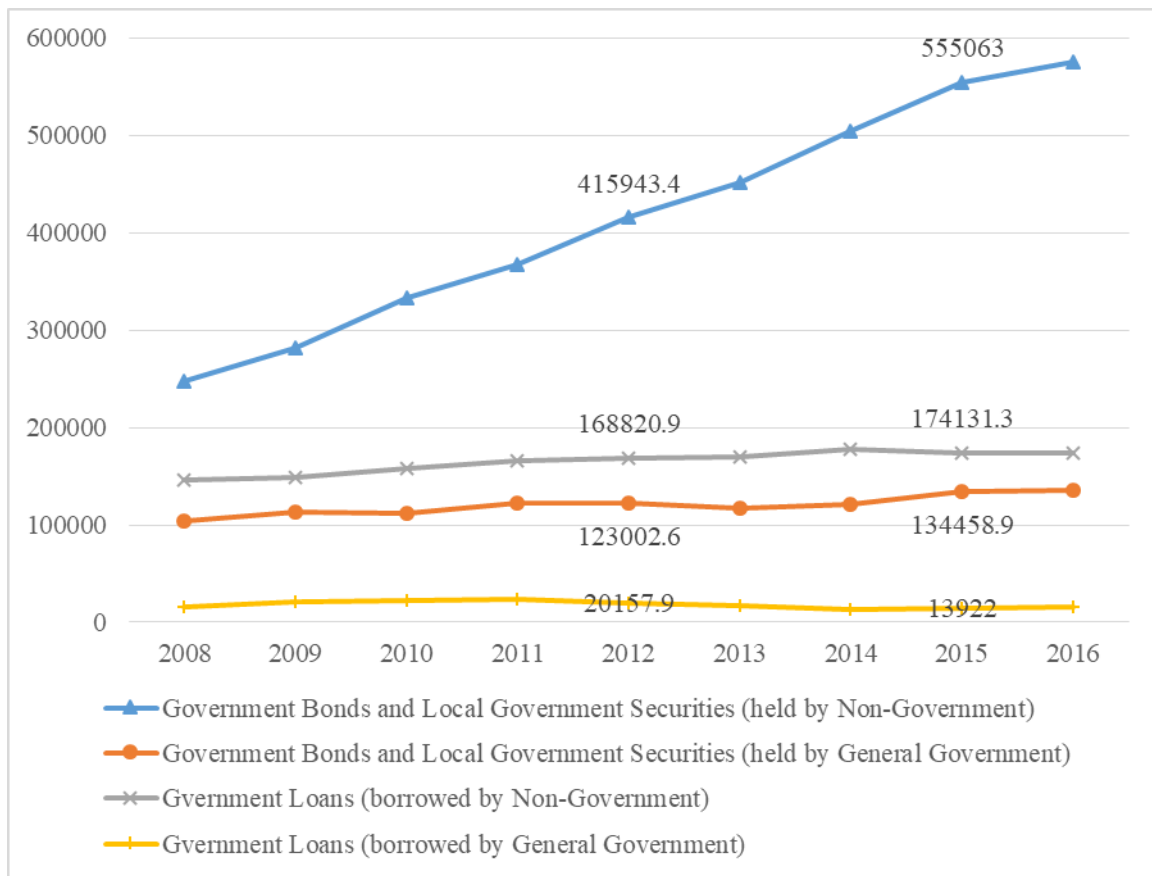


Table 5-1-9. Financial Instruments held by Non-financial Corporations (Billion KRW)

	Holder (2012)		Holder (2015)	
	Nonfinancial Corporations	The Other Sectors	Nonfinancial Corporations	The Other Sectors
Short-term Commercial Paper	464.5	1,022,876.30	12,284.40	1,088,841.70
(in percentages)	0.00%	100.00%	1.10%	98.90%
Short-term Corporate Bonds	49.5	6996.3	2384.5	16120.4
(in percentages)	0.70%	99.30%	12.90%	87.10%
Long-term Commercial Paper	706.9	46207.5	10954.9	11681
(in percentages)	1.50%	98.50%	48.40%	51.60%
Long-term Corporate Bonds	9864.7	424154.6	7517.2	452632.8
(in percentages)	2.30%	97.70%	1.60%	98.40%
Shares & Other Equities Issued by Residents	590719.3	1485642.1	673167.1	1610610.8
(in percentages)	28.40%	71.60%	29.50%	70.50%
Trade Credits	543269.1	24078.5	571263	10746.4
(in percentages)	95.80%	4.20%	98.20%	1.80%

## (2) Future Plan for Japan-Korea International FIO

In this subsection, we suggest the way how to enlarge number of sectors in international FIO tables which is compiled in section 4. Especially, Japan and Korea have similar form and standard of FFAs tables, we focus on these two countries. First, sectoral classification is required to be rearranged since they have different standards. Table 5-2-1 demonstrates correspondence of classification which is condensed into 13 sectors. It has 8 financial sectors, two non-financial corporations, general government, households & NPISHs and foreign sector. The FFAs data of Japan's 2007 fiscal year is selected as an example. Since Japan's fiscal year ends in March, correspondingly first quarter of 2008 FFAs data of Korea is adopted. Table 5-2-2 shows Korea's FIO table, whereas Table 5-2-3 presents Japan's FIO. These tables need to be converted into USD since individual FFAs data is expressed in local currency. Table 5-2-4 suggests the prototype of expanded Japan-Korea international FIO table. Compilation of empty part in this table remains a work in progress.

Table 5-2-1. Integrated Institutional sectors of Japan-Korea International FIO table (in 1993 SNA)

	Integrated Sectors	Korea	Japan
IS1	Central Bank	The Bank of Korea	The Bank of Japan
IS2	Banks	Domestically Licensed Banks, Other Banks (Foreign Banks in Korea, Bank Holding Companies)	Domestically Licensed Banks, Foreign Banks in Japan
IS3	Specialized Financial Institutions	Specialized Banks, Other Non-Banks Depository Corporations, Small Loan Financial Companies for Households & Small Businesses	Financial Institutions for Agriculture, Forestry and Fisheries, Financial Institutions for Small Businesses
IS4	Collectively Managed Trusts	Collectively Managed Trusts	Collectively Managed Trusts
IS5	Investment Institutions	Investment Institutions	Securities Investment Trusts
IS6	Insurance and Co-operative Society	Life Insurance Companies, Non-life Insurance Companies, Co-operative Society	Life Insurance, Non-life Insurance, Mutual Aid Insurance
IS7	Other Financial Institutions	Credit-specialized financial institutions, Securities Institutions, Mutual Fund and Other Financial Institutions	Finance Companies, Financial Dealers and Brokers (of which: Securities Companies), Non-Bank (Structured-Financing Special Purpose Companies and Trusts)
IS8	Public Financial Institutions and Financial Auxiliaries	Public Financial Institutions, Financial Auxiliaries	Public Financial Institutions, Financial Auxiliaries
IS9	General Government	General Government, Pension Funds	General Government, Pension Funds (Other Pension)
IS10	Public Nonfinancial Corporations	Public Nonfinancial Corporations	Public Nonfinancial Corporations
IS11	Private Nonfinancial Enterprises	Private Nonfinancial Enterprises	Private Nonfinancial Enterprises
IS12	Households & NPISHs	Households & NPISHs	Households, Private Nonprofit Institutions Serving Households
IS13	Rest-of-the-World	Rest-of-the-World	Overseas
D	Difference		
T	Total		



Table 5-2-2. The FIO table in Korea (Billion KRW, 2008 March, in 1993 SNA, integrated into 13 institutional sectors)

IS1	IS2	IS3	IS4	IS5	IS6	IS7	IS8	IS9	IS10	IS11	IS12	IS13	D	T
617	13,904	5,368	2,212	4,597	503	1,599	866	10,781	4,432	9,349	308	263,528	29,872	347,933
67,568	156,431	59,041	9,161	20,310	3,698	45,833	17,258	49,545	39,045	455,595	332,946	30,110	0	1,286,540
23,504	80,432	38,544	6,852	27,592	1,947	25,478	17,240	17,746	36,041	308,415	237,292	12,990	0	834,074
4,532	33,902	18,016	3,000	5,864	716	12,208	3,688	4,133	6,342	38,921	7,511	5,788	0	144,621
20,231	81,126	37,846	1,362	11,270	2,637	30,720	3,380	11,285	13,283	146,212	4,926	35,768	0	400,047
13,564	37,377	23,182	3,140	30,419	1,123	18,625	20,017	60,966	24,624	91,143	63,221	11,648	5,587	404,637
16,477	49,922	24,997	3,545	10,279	1,027	28,941	5,347	7,064	6,714	75,696	75,566	6,171	14,389	326,134
2,574	16,388	9,484	1,230	5,732	609	3,975	1,001	2,948	25,372	30,545	29,222	645	29,103	158,828
138,975	77,426	81,724	11,990	21,324	2,793	20,123	76,354	74,227	88,569	105,953	10,479	13,998	0	723,932
1,113	21,962	7,460	4,646	3,632	1,667	4,900	1,372	1,417	5,619	64,079	3,122	2,491	199,432	322,911
19,202	207,179	113,099	59,407	56,660	9,004	46,372	4,725	6,342	30,542	490,502	35,825	39,598	1,304,773	2,423,229
28,255	359,853	341,478	35,395	174,955	371,856	51,468	6,272	38,615	27,573	277,441	101	5,832	0	1,719,093
11,323	145,509	40,261	1,121	1,611	7,056	35,893	1,309	30,580	14,757	329,377	8,768	151,776	0	779,342
0	5,129	33,574	1,562	25,800	0	0	0	408,283	0	0	909,806	199,001		
347,934	1,286,540	834,074	144,621	400,047	404,637	326,134	158,829	723,932	322,911	2,423,229	1,719,093	779,342		

Table 5-2-3. The FIO table in Japan (Billion JPY, 2008 March, in 1993 SNA, integrated into 13 institutional sectors)

	IS1	IS2	IS3	IS4	IS5	IS6	IS7	IS8	IS9	IS10	IS11	IS12	IS13	D	T
IS1	593	12,006	771	3	17	392	24,650	13,385	55,934	162	4,285	555	6,201	0	118,952
IS2	15,548	67,366	17,557	802	5,280	4,541	85,044	19,830	121,654	13,383	231,513	166,876	92,096	35,299	876,790
IS3	8,439	68,092	74,468	490	4,192	1,068	20,824	69,174	195,806	5,794	66,038	55,480	45,834	0	615,700
IS4	1,291	7,845	2,976	1,854	5,316	402	3,903	5,585	19,840	489	19,869	2,047	23,438	0	94,855
IS5	64	6,830	1,528	27	669	3,002	5,212	2,888	9,922	496	25,631	1,290	47,447	60	105,065
IS6	540	16,652	5,743	618	13,697	2,547	21,523	46,947	148,153	8,134	71,294	11,323	56,298	0	403,469
IS7	8,067	35,302	6,074	259	550	5,716	67,293	6,416	30,414	3,050	53,994	40,910	18,892	21,609	298,547
IS8	527	6,674	22,035	73	53	808	5,200	68,849	149,322	34,247	39,617	56,362	17,119	0	400,888
IS9	4,270	48,237	16,553	395	1,718	9,017	12,851	87,693	103,008	11,919	88,030	3,878	122,091	452,815	962,473
IS10	388	6,173	5,928	9	287	1,493	636	827	1,726	1,266	10,315	469	506	82,615	112,637
IS11	27,683	147,070	70,377	3,414	7,894	10,589	25,038	11,770	15,816	20,428	400,616	55,620	125,863	340,599	1,262,777
IS12	42,725	392,233	376,476	84,071	64,575	338,547	7,631	16,478	56,115	10,311	126,207	3,501	22,564	0	1,541,433
IS13	1,325	62,309	2,147	64	818	5,414	18,743	17,736	54,763	2,959	125,369	7,491	39,057	279,211	617,405
D	7,493	0	13,067	2,775	0	19,932	0	33,310	0	0	0	1,135,631	0		
T	118,952	876,790	615,700	94,855	105,065	403,469	298,547	400,888	962,473	112,637	1,262,777	1,541,433	617,405		

Table 5-2-4. Prototype of Expanded Japan-Korea International FIO (Billion USD, 2008 March, in 1993 SNA, integrated into 13 institutional sectors)

	Japan												Korea												ROW
	IS1	IS2	IS3	IS4	IS5	IS6	IS7	IS8	IS9	IS10	IS11	IS12	IS1	IS2	IS3	IS4	IS5	IS6	IS7	IS8	IS9	IS10	IS11	IS12	
IS1	6	121	8	0	0	4	249	135	564	2	43	6	0	0	0	0	0	0	0	0	0	0	0	0	
IS2	157	679	177	8	53	46	858	200	1,227	135	2,335	1,683												0	
IS3	85	687	751	5	42	11	210	698	1,975	58	666	560												0	
IS4	13	79	30	19	54	4	39	56	200	5	200	21												0	
IS5	1	69	15	0	7	30	53	29	100	5	259	13												0	
IS6	5	168	58	6	138	26	217	473	1,494	82	719	114												0	
IS7	81	356	61	3	6	58	679	65	307	31	545	413												0	
IS8	5	67	222	1	1	8	52	694	1,506	345	400	568												0	
IS9	43	487	167	4	17	91	130	884	1,039	120	888	39	0	0	0	0	0	0	0	0	0	0	0	0	
IS10	4	62	60	0	3	15	6	8	17	13	104	5												0	
IS11	279	1,483	710	34	80	107	253	119	160	206	4,041	561												0	
IS12	431	3,956	3,797	848	651	3,414	77	166	566	104	1,273	35	0	0	0	0	0	0	0	0	0	0	0	0	
IS1	0	0	0	0	0	0	0	0	0	0	0	0	1	14	5	2	5	1	2	1	11	4	9	0	
IS2												0	68	158	60	9	20	4	46	17	50	39	459	336	
IS3												0	24	81	39	7	28	2	26	17	18	36	311	239	
IS4												0	5	34	18	3	6	1	12	4	4	6	39	8	
IS5												0	20	82	38	1	11	3	31	3	11	13	147	5	
IS6												0	14	38	23	3	31	1	19	20	61	25	92	64	
IS7												0	17	50	25	4	10	1	29	5	7	7	76	76	
IS8												0	3	17	10	1	6	1	4	1	3	26	31	29	
IS9									0	0	0	0	140	78	82	12	22	3	20	77	75	89	107	11	
IS10												0	1	22	8	5	4	2	5	1	1	6	65	3	
IS11												0	19	209	114	60	57	9	47	5	6	31	495	36	
IS12	0	0	0	0	0	0	0	0	0	0	0	0	28	363	344	36	176	375	52	6	39	28	280	0	
ROW																									

## 6. Application example: cross-border propagation effect of credit contraction

The last few decades were marked by the rapid development of cross-national production networks and a consequent deepening of economic interdependency among countries. An economic shock that occurs in one country will be quickly and widely transmitted to the rest of the world through extensive cross-border supply chains. The decline in US demand for Japanese cars, for example, causes a decrease of Japanese car exports, and hence of car production in Japan. The output decline of Japanese cars reduces its import demand for tires made in Korea, which further reduces Korea's import demand for rubber from Indonesia, and so on. The global economic crisis that we experienced a decade ago was a clear reflection of today's intertwined production system, for which the international input-output table was devised as a key analytical tool.

Likewise, the rapid integration of financial markets across borders made a country's financial portfolio more dependent on, and thus vulnerable to, the changes in other countries' financial positions. The worldwide propagation of credit contraction, triggered by the burst of subprime loans and the global financial crisis that followed, provided a phenomenal case for the realization of such an underlying mechanism.

Because the framework of an international financial input-output table proposed in this paper has the same basic structure as the conventional international input-output table, it is possible to conduct analogous analyses of negative shocks with respect to financial markets. Here, the cross-border propagation effect of credit contraction is formally presented as follows.

Define matrix  $\mathbf{A}$  for a system of financial flows among two sectors (1, 2) in two countries (A, B), such that

$$\mathbf{A} = \begin{bmatrix} a_{11}^{AA} & a_{12}^{AA} & a_{11}^{AB} & a_{12}^{AB} \\ a_{21}^{AA} & a_{22}^{AA} & a_{21}^{AB} & a_{22}^{AB} \\ a_{11}^{BA} & a_{12}^{BA} & a_{11}^{BB} & a_{12}^{BB} \\ a_{21}^{BA} & a_{22}^{BA} & a_{21}^{BB} & a_{22}^{BB} \end{bmatrix}$$

where each element  $a_{ij}^{rs}$  represents a first-order induced financial flow from sector  $i$  of country  $r$  to sector  $j$  of country  $s$ , for a unit liability in the latter. An element  $a_{ij}^{rs}$  can be derived from the information in a financial input-output table such that

$$a_{ij}^{rs} = z_{ij}^{rs} / \left( \sum_r \sum_i z_{ij}^{rs} + o_j^s \right)$$

where  $z_{ij}^{rs}$  is a financial flow from sector  $i$  of country  $r$  to sector  $j$  of country  $s$ , and  $o_j^s$  is a financial flow from rest of the world into sector  $j$  of country  $s$ .

Then, the total asset decrease in each sector as a result of the initial credit contraction is given by

$$\Delta \mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1} \Delta \mathbf{q}$$

where  $\mathbf{I}$  is an identity matrix of the dimension (4 x 4),  $\Delta \mathbf{q}$  is a column vector of the length (4 x 1) with negative values by the amount of credit contraction (entering the elements that correspond to the sectors in which the credit contraction has occurred), and  $\Delta \mathbf{x}$  is a column vector of the same size that shows the consequent decrease in assets in each sector across two countries.

## 7. Future work

This paper presented a method of compiling an international FIO table for Japan, Korea, the U.S. and Canada from the national tables of respective country, each of which is converted from the original national FFAs. This is a preliminary work for the prospective scheme of compiling an international FIO table covering the entire Asia-Pacific region, which currently earns a close attention of international statistical communities in relation to their long-term plan for constructing global FFAs. For example, the IMF Statistics Department shows a strong interest in our effort for expanding the country coverage such as to include Indonesia, Columbia and Peru to which they provide technical and financial assistance for developing national FFAs, as reported at the IMF Statistics Forum. The construction of this brand-new database, therefore, is considered to make a significant contribution to the international statistical assets.

Here, the inclusion of China's data in our scheme poses a difficult yet important challenge. The relevant statistical infrastructure of the country evolves at a different stage of development compared to those of Japan and Korea. Specifically, FFAs' stock data have not yet published and extended CPIS<sup>8</sup> with sector breakdowns has not yet been provided at the time of year 2018. Continuous and in-depth dialogues with national data providers, such as People's Bank of China and State Administration of Foreign Exchange, are indispensable.

Also, the information on investments through off-shore countries in CPIS needs a special care. Cayman Islands, for example, provide CPIS but they do not identify ultimate investors. It is recorded in the CPIS that Hong Kong is one of the major investors, yet China is suspected to be an ultimate investor to Cayman Islands in many cases. In this light, cross-border claims/obligations of China need be carefully examined.

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<sup>8</sup> The submission of the China's CPIS data to the IMF started only in 2011.

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