Measuring Global Flow of Funds: A Case Study on China, Japan and the United States

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Abstract

This paper seeks to define Global Flow of Funds (GFF) based on its inherent mechanisms, determine the statistical domains thereof, and build a salient statistical framework that has practical and policy relevance. Existing data sources from the International Investment Position, the Coordinated Direct Investment Survey, the Coordinated Portfolio Investment Survey, and Consolidated Banking Statistics are integrated for the purpose of measuring GFF. The main outcome is a prototype GFF matrix that includes stock data geographically disaggregated by country/region and selected financial instruments. The paper presented GFF Matrix compiled with the pattern of "Country vis-à-vis Country" matrix, and through using the GFF matrix to analyze the basic status, mutual relationship and existing problems between China, Japan and the United States in the external financial positions.

List of Abbreviations

BIS   Bank for International Settlements

BOP   Balance of Payments

BPM6   Balance of Payments and International Investment Position Manual, sixth edition (2008)

BSA   Balance Sheet Approach

CBS   Consolidated Banking Statistics

CDIS   Coordinated Direct Investment Survey

COFER   Currency Composition of Official Foreign Exchange Reserves

CPIS   Coordinated Portfolio Investment Survey

DAL   Domestic Assets and Liabilities

DI   Direct investment

EAL   External Assets and Liabilities

FD   Financial Derivatives

FFA   Flow of Funds Account

FSB   Financial Stability Board

GFF   Global Flow of Funds

GFFM   Global Flow of Funds Matrix

IBS   International Banking Statistics

ICA   Influence Coefficients of Assets

IFS   International Financial Statistics

IMF   International Monetary Fund

IIP   International Investment Position

MFS   Monetary and Financial Statistics

LBS   Locational Banking Statistics

OI   Other Investment

PI   Portfolio Investment

SCL   Sensitivity Coefficients of Liabilities

SNA   System of National Accounts

W-to-W   From-Whom-to-Whom

Introduction

The Global Flow of Funds (GFF) concept is an extension of the domestic flow of funds. It connects domestic economies with the rest of the world. GFF data could provide valuable information for analyzing interconnectedness across borders and global financial interdependencies. Corresponding to the deregulation of the financial market, researchers began exploring the GFF in the 1990s. Ishida (1993) put forward the idea of GFF analysis, discussed the concept of GFF, and measured international capital flows between Japan, the United States, and Germany. Drawing on the research, Zhang (2005) linked real transactions with financial transactions based on the dynamic process of flow of funds and established the theoretical framework for GFF analysis through three factors: domestic savings–investment, foreign trade, and international capital flows. He built an econometric model of GFF and carried out empirical analysis focusing on the international flow of funds in East Asia.

Based on the GFF concept, Tujimura (2008) conducted pioneering research that used the financial matrix method to test the transmission aspects of financial policy and the effects of international flow of funds in the Euro area using data from Coordinated Portfolio Investment Survey (CPIS) and Consolidated Banking Statistics (CBS).

Allen, Rosenberg, Keller, Setser, and Roubini (2002) proposed a statistical framework for understanding crises in emerging markets based on examination of stock variables in the aggregate balance sheet of a country and the balance sheets of its main sectors (assets and liabilities). It focuses on the risks created by maturity, currency, and capital structure mismatches. This framework is consistent with the advocacy of 2008 SNA, and very instructive for establish GFF matrix based on "from-whom-to-whom (W-to-W)" format.

In April 2009, G20 Finance Ministers and the Central Bank Governors Working Group on

Reinforcing International Co-operation and Promoting Integrity in Financial Markets called on the International Monetary Fund (IMF) and the Financial Stability Board (FSB) to identify information gaps and provide appropriate proposals for strengthening data collection and reporting. As a result, in October 2009 the IMF and FSB proposed 20 recommendations for improving data collection with a view to closing or narrowing identified data gaps in four areas[1]. The principal focus was Recommendation 15, as financial and economic crises are characterized by abrupt revaluations or other changes in the capital positions of key sectors of the economy. Thus, through its reference to compiling "flow of funds" statistics, Recommendation 15 also implies the compilation of sectoral financial positions and flows. Datasets providing this kind of information are said to provide "from-whom-to-whom (W-to-W)" financial statistics. However, we also need to understand and measure the flow of funds between countries, namely the GFF.

Shrestha, Mink and Fassler (2012) noted the importance of using an integrated approach for the compilation of financial flows and positions on a W-to-W basis, one of the main components of Recommendation 15 of the G20 Data Gaps Initiative. The 2008 global financial crisis highlighted the need to understand financial interconnectedness among the various sectors of an economy and their counterparties in the rest of the world. However, analytical applications in this respect have been hampered by data limitations. The preset paper discusses the development of statistical methodologies and data availability, toward the development of data on a W-to-W basis.

Stone (1966) set up the balance sheets of a closed economy in a standard matrix form, distinguishing between financial assets and real assets on the assets side and liabilities side, try to take the U table and V table which in Input-Output Table into the Flow of Funds Table. In

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[1] They are (i) build-up of risk in the financial sector, (ii) cross-border financial linkages, (ii) vulnerability of domestic economies to shocks, and (iv) improving communication of official statistics.

Stone's (1966) matrix, the first n row and column pairs relate to sectors; each row contains a sector's assets, and the corresponding column contains its liabilities. The following m row and column pairs relate to financial claims; each row contains the holdings of a particular claim as a liability, and the corresponding column contains the holdings of the same claim as an asset. The penultimate row and column pair relate to the real assets and accumulated saving in the various sectors, and the final row and column pair simply relate to totals. This paper considers that Flow of Funds Table can be also made as a matrix based on the W-to-W format.

There is international awareness of information limitations vis-à-vis the problem that existing data do not describe the risks inherent in a financial system. Previous research has evolved into a discussion of the basic concept of GFF and a proposal to establish a statistical framework for GFF. Therefore, the IMF's Statistics Department has organized seven economies with systemically important financial centers to construct a geographically disaggregated GFF mapping of domestic and external capital stocks (Luca et al., 2013). The main purpose of Luca et al. is to conceptually map the financial interlinkages reflected in the Balance of Payments (BOP), the International Investment Position (IIP) statistics, and the rest-of-the-world account of national accounts. Those authors delineate key concepts and existing data sources. The BSA is used to break down the rest of the world by IIP components. An external statistics' matrix (metadata) shows external-sector financial data are available by using the IIP concept. The main outcome is a prototype template of stock and flow data, geographically disaggregated by national/regional economies.

Another working paper on GFF was published in 2014, which presents an approach to understanding the United States shadow banking system using a new GFF conceptual framework developed by the IMF's Statistics Department. The GFF uses external stock and flow matrices to map claims between sector–location pairs. Their findings highlight the large positions and gross flows of the United States banking sector and its interconnectedness with

banking sectors in the Euro area and United Kingdom. Errico et al. (2014) also explore the relationship between credit to domestic entities and the growth of non-core liabilities and find that external debt liabilities of the financial sector are procyclical and closely aligned with domestic credit growth.

In order to promote the research on GFF statistics, we submitted the discussion paper (Zhang, 2015) to the 2015 IARIW-OECD Conference. This paper primarily discusses three issues of GFF statistics: the relationship between GFF and the SNA statistical system, its statistical framework, and its data sources and methods. To continue this research, we organized a Special Topic Session for the 60th ISI WSC (STS027) in 2015. At the session, Zhang's paper (2016) discussed the definition of GFF, the theoretical framework of GFF statistics, and its integration in the preparation of data sources. However, due to the lack of rigorous integration of the original data, that paper lacks a systematic relationship to the accounts in this paper. In addition, we also organized an invitation session for the Society for Economic Measurement's 2017 Conference[2]. The main purpose of this session was to measure GFF and apply it to regular monitoring of GFF. We had discussed related problems, such as GFF's data sources, its statistical framework and the analysis method.

The growing incidence of financial crises and their damage to economies has led policy makers to sharpen their focus on financial stability analysis. Recently, the IMF had a working paper that noted that statisticians are responding to the growing interest in this topic by calling for measuring GFF. The Data Gaps Initiative (DGI) has not made a specific recommendation to develop a GFF; the work is still in an embryonic stage.[3]

In view of the existing works that have been carried out in this domain and the gaps therein, we aim to present a new statistical approach to measure GFF, including an empirical example

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[2] Zhang, Session: D-2: Global Financial Stability and Measuring Global Flow of Funds, 4th Annual Conference of the Society for Economic Measurement, MIT, July 26-28, 2017.
[3] Robert Heath and Evrim Bese Goksu, IMF working paper, WP/17/153, 2017, 54.

to illustrate its operational potential. To measure financial stress and observe triggers and spillovers of systematic financial crises through GFF, it is necessary to strengthen the research on GFF statistical methods.

Accordingly, this paper discusses the mechanisms and theoretical underpinning of GFF and sets out an integrated framework based on the balance sheet approach (BSA). In view of the work that has been tried before, we want to present a new statistical approach to measuring GFF, and provide an empirical example. In order to use GFF to measure financial stress and observe the spillover effect of systematic financial crises and to observe the situation triggering an international financial crisis, it is necessary to strengthen research on GFF statistical methods. As a step toward this, first, this paper sets out an integrated framework based on the BSA, using the accounts that are set in the Systems of National Accounts (SNA), which are the BOP, the IIP, the Flow of Funds Accounts (FFA), and the International Banking Statistics (IBS) which are published by the Bank for International Settlements (BIS).

Second, the paper sets out and integrates the existing data sources for measuring GFF, which are available largely in the Coordinated Direct Investment Survey (CDIS), CPIS, IIP data, and Locational Banking Statistics (LBS) that are part of BIS statistics. There is also a need to configure GFF accounts to connect with SNA. This, however, requires additional external financial positions in the new data collection systems.

Third, try to compile a statistical matrix of 12 countries, including the United States, Japan and China. As an illustration, the paper chooses the United States, Japan and China as the country case study to demonstrate how GFF is constructed using data available from various sources because these are the three largest economies in the world, and financial risk therein has increased recently making it a salient example. In addition, in January 2016, the State Administration of Foreign Exchange (SAFE) of China released CPIS and LBS data for the first time covering through the end of June 2015. It makes a possible for international comparisons

under a common international statistical standard. Using the GFF's statistics, we will demonstrate how countries and specific instruments (direct investment, portfolio investment, other investment banks, reserve position in the Fund, and foreign exchange) of financial positions and flows on a W-to-W basis could ideally be moved from aggregated country and instrument details toward disaggregated country and instrument details.

Lastly, we will use the GFF matrix to empirically analyze the fundamental observed facts of China, Japan and the United States and explore the analysis method of GFF matrix.

2. A Statistical Framework for Global-Flow-of-Funds

GFF are external flow of funds that relate to domestic and international capital flows. Our aim is to map domestic and external capital stocks to show the characteristics and structure of external flows of funds, including the flows of all domestic funds with investment-savings, current balances, and connected international capital stocks and flows. Using GFF statistics, we can observe interlinkages of counterparties and transmission channels of cross-border capital flows to analysis the vulnerabilities from financial positions, risk build-up, and causes and effects of imbalances. This can provide a basis for decision making for financial policy authorities.

In order to measure financial stress and observe the spillover effects of systematic financial crises through GFF, a new statistical framework is needed that corresponds to the operational structure of GFF. It is important that an integrated framework be used as the foundation of a statistical monitoring system. When the flow of funds in financial markets is tied up with the BOP, the rest of the world has an excess of outflowing funds (net capital outflows) if the current account is in surplus. Conversely, the domestic sector will have an excess of inflowing funds. Therefore, when the real economic side of the domestic and overseas economy is analyzed

under an open economic system, the balance of savings–investment corresponds to the current account balance. However, the outflow of domestic net funds corresponds to the capital account balance when we examine the financial relationship between domestic and external flows of funds. For this reason, relationships among the domestic savings–investment balance, financial surplus or deficit, current account, and external flow of funds should be expressed in an integrated framework to enable comprehensive and regular monitoring of GFF.

The integrated framework is based on the BSA, using stock data. The financial data category includes financial assets, liabilities, and net position, it can be monitored two aspects of external financial positions and flows. Using the integrated framework to construct GFF statistics would provide valuable information for the analysis of interconnectedness across borders, global liquidity flows, and global financial interdependencies. Furthermore, the framework could also be extended to flow data. For this next step, we would then disaggregate the data sources by sector and counterpart country.

Table 1. External Assets and Liabilities Matrix by Balance Sheet Approach

Issuer of liability (debtor) Holder of liability (creditor)	Country A			Country B			Country •••			All other Economies			Total of the World		
	A	L	NP	A	L	NP	A	L	NP	A	L	NP	A	L	NP
Direct Investment															
Portfolio Investment															
Equity Securities															
Debt Securities															
Long-time debt securities															
Short-time bebt securities															
Other Investment															
Other equity															
Debt instruments															
Reserve Assets															
Total of the World															

Notes: All other economies = Total sum of the World - Total sum of the observed countries

As a transitional preparation for producing the GFF matrix, we need to use an External Assets and Liabilities (EAL) matrix. Through Table 1, we can connect the relevant information

between the rest of the world sector of flow of fund account with other countries to construct the GFF matrix. The EAL matrix is also based on the BSA. It depicts for the rest of world sector, the main countries for observation and all other economies , with each financial instrument/stock of the issuer of a liability (the debtor) on the horizontal axis and stocks of the holder of a liability (the creditor) on the vertical axis. This table depicts the external flow of funds matrix for the observed countries or regions, where the EAL have been disaggregated into the counterpart country, by instrument.

The EAL matrix identifies particular sectors, which, like countries, show data for the rest of the world and how this relates to other economies or regions. Each column corresponds to the balance sheet of the sector in question, with assets and liabilities listed per row by instrument, with counterparty sectors identified for each cell.

Table 1 provides a statistical framework for presenting cross-border stocks by counterpart country and sector and instrument. It shows available external-sector financial assets and liabilities' stock data broken down by countries. Data in Columns 2–4 of the EAL matrix shows the assets, liabilities and net assets of county A's external financial, as well as the major financial instruments used by Country A. This is a statistical table of two-dimensional structure, that is, we can know whom did what. The matrix presents external financial asset and liability positions, showing available data by IIP category and instrument: direct investment, portfolio investment equity and debt securities (the latter displayed separately for long-term and short-term debt), other investment (separately for banks and others, using the BIS IBS), and reserve assets. Table 1 shows what may be possible in a GFF framework for a country that permits the monitoring of both regional or national and cross-border (by country and sector) financial positions. However, we haven't been known the funds from whom to whom (W-to-W) by what instruments, which is as a statistical matrix of three-dimensional structure.

Although Table 1 is modeled after a traditional account format, it cannot show the inter-

sectoral W-to-W relationships needed to measure financial positions and flows. Therefore, in order to know "who is financing whom, in what amount, and with which type of financial instrument," we constructed the GFF matrix on a W-to-W basis. Table 2 reflects this approach and shows the financial instrument categories.

Table 2. Financial Instrument Matrix on a W-to-W Basis

Counterpart Countries (Investment from)	Counterpart Countries (Investment in)					
	Country A	Country B	. . .	All other Economies	Total of the World	
Country A						
Country B						
. . .						
All other Economies						
Total of the World						

Table 2 is based on a specific analysis, namely the matrix of a financial instrument designed in accordance with the W-to-W form. According to the specific analytical purpose, the statistical scope can cover only certain relevant countries or regions as the observation object. The columns show a country's fund used by other countries (assets), and rows show if a country should raise funds from other countries (liabilities). Table 2 accurately reflects the relationship between empirical data and the underlying structure. By setting up a sector as the other economies, the relationship of a financial instrument and the GFF is as follows: other economies = total countries in the world − countries under analysis. We can use Table 2 to speculate the corresponding input coefficient, observe the impact of changes in the financial instruments on the financial markets, and determine the extent of the impact on other related countries.

According to analytical need, a GFF matrix resulting from the from-whom-to-whom table can be created to illustrate country vis-à-vis country through each financial instrument. These

instruments show the connections between financial positions, such as direct investment and portfolio investment. Likewise, every financial instrument can be disaggregated within the matrix on a from-whom-to-whom basis. Instruments located in the rows of the table describe a country relative to the counterpart country's assets, while instruments located in the columns describe a country relative to the counterpart country's liabilities. If all the financial instruments are totaled, that amount will equal the sum total of external financial assets and liabilities in the given country. In this way, EAL will have been disaggregated into the counterpart country, as well as by main instruments, based on the IIP.

Table 3 is in accordance with IIP statistical standards and is based on a structure wherein the from-whom-to-whom data are used to establish the GFF statistical framework, and is in keeping with the double-entry principle. According to the statistical standards of IIP, which are based on BPM6, the IIP can be set as foreign financial assets and external debt. Each column corresponds to the balance sheet of a country in question, with country, assets, and liabilities then listed in rows by instrument with the counterparty country identified for each cell.

Table 3 provides a statistical framework for deriving the GFF matrix. Assets are subdivided into five parts: direct investment, portfolio investment, financial derivatives, other investments, and reserve assets. Liabilities are divided into four parts: direct investment, portfolio investment, financial derivatives, and other investments. The net financial position is external financial assets plus reserve assets minus liabilities. By this statistical framework, the GFF statistics can reflect stock information of financial assets and liabilities between the world and a region at a particular time. Importantly, the GFF statistics remain consistent with IIP Statistics Standard, while also exhibiting unique methodological characteristics, which can be summarized as follows:

(1) In order to reflect the relationship between W-to-W, GFF statistics use the parallel processing method wherein transaction and countries (sectors) are rows, namely, by putting the

Table 3. Global Flow of Funds Matrix for a Country

Holder of liability (creditor) / Issuer of liability (debtor)	Financial Instruments	a Country A	b Country B	c Country C	d ...	e All Other Economies	f Total Liabilities of Financial Instruments	g Total Liabities	
Country A	Direct investment								1
	Portfolio investment								2
	Financial derivatives								3
	Other investment								4
Country B	Direct investment								5
	Portfolio investment								6
	Financial derivatives								7
	Other investment								8
Country C	Direct investment								9
	Portfolio investment								10
	Financial derivatives								11
	Other investment								12
……	……								13
All other economies	Direct investment								14
	Portfolio investment								15
	Financial derivatives								16
	Other investment								17
Total Asset of Financial Instruments	Direct investment								18
	Portfolio investment								19
	Financial derivatives								20
	Other investment								21
Total Asset									22
Net Worth									23
Reserve assets									24
Monetary gold									25
Special drawing rights									26
Reserve position in the fund									27
Other reserve assets									28
Adjustment item									29
Net Financial Position									30

Notes: (i) Net worth is the difference between assets and liabilities (2008SNA, P29).

(ii) Adjustment item is an item for balancing the net worth, reserve assets and net financial position in GFFM, and put it in row 29. It is derived from the net worth of each county by:

    a. Adjustment item = Net Financial Position - Net Worth - Reserve assets, and

    b. Net Financial Position = Net Worth + Reserve assets + Adjustment item

transaction items that direct investments, securities investments, financial derivatives, and other investments to countries (sectors) in the rows, whereas each country (sector) is in the columns. Accordingly, we can determine the dual relationship of a transaction item in countries (sectors), which can show the scale of the position item and reflect from-whom-to-whom-by-what

relationships in a two-way format. For example, a5–a8 in the table shows Country A transactions in the columns by showing which financial instruments are used for transactions bringing how much funds to country B. As this can provide two-way information about the financing structure of Country A with country B, we also can identify and understand the financing scale and corresponding information on counterparties. At the same time, we can also capture information of where country A is located in the row vectors from other countries to raise funds. We can also acquire relevant information on country B in the row vectors on its fund-raising from Country A, Country C, etc.

(2) To reflect the actual situation of international capital in a country or a region, and in order to establish the GFF matrix table for the application analysis, we set countries (sectors) in rows and columns by the principle of W-to-W tabulating. We also designed an "all other economies" sector (see column e and row 9–12 that can be represented as e9, e10, e11, e12). The relationship of these "all other economies" and the world total can be expressed as follows: "liabilities of all other economies" = total liabilities – liabilities of the total for specific countries. That is, e9 = f9 - (a9 + b9 + c9 + d9), … , e12 = f12 - (a12 + b12 + c12 + d12).

(3) Each "column" shows a country how to use funds by transaction item, namely, who outputs how much funds by what item; each "row" represent how a country raises funds through four financial instruments, namely, who inputs how much funds by what item. The difference between the total of the row and column in row 23, which shows the balance between use of external funds financing for a certain country at a particular point in time, that is, the net output of funds. For instance, Country A's net worth equals country A's total assets minus its total liabilities, that is, a23 = a22 − (g1 + g2 + g3 + g4).

(4) Corresponding to the various transaction instruments of various countries, rows 24–28 show part of the reserve assets, specifically monetary gold, special drawing rights, reserve positions in the fund, and other reserve assets. Denoting reserve assets as an instrument in Table

3 shows a balance relationship between net worth and net financial position and the components thereof. For example, country A's component of reserve assets can be shown as a24 = a25 + a26 + a27 + a28.

(5) The bottom row in Table 3, namely row 30, reflects net IIP, corresponding to Table 3's Net Financial Position that obtained each country. These data are taken from IIP and reflect overall equilibrium conditions of national external financial positions. Theoretically, adding reserve assets to the net worth of the financial assets of a country should reveal the external net financial position of the country. For example, a30 = a23 + a24, and b30 = b23 + b24..., etc. However, since there are factors, like the non-compatibility of IIP data and other data sets and the difficulty in selecting the financial-investment item, the actual external net financial investment figures are inconsistent with the above theoretical relationship. Therefore, in order to attain balance when adding the net worth in row 23 to the reserve assets in row 24 so they are equal to the financial position in row 30 of Table 3, we need to set up an adjustment item for balancing the net worth, the reserve assets and net financial position in GFFM, ant put is in row 29. Net financial position of each country is calculated using net worth, i.e., net financial investment plus reserve assets and adjustment item is equal to net financial position, such as a30 = a23 + a24 + a29, b30 = b23 + b24 + b29, …, e30 = e23 + e24 + e29.

(6) Because the main purpose of compiling the GFF matrix table is to observe cross-border capital positions, the diagonal line elements in the matrix are zero. Each position is the result of financial investment between the domestic and foreign countries, and does not include a country's internal financial investments.

(7) In the thick line box at the top half of Table 3, if the financial instruments of each country in rows are merged, we can get a square matrix, with the same number of rows as columns, and an orthogonal matrix can be obtained. So we can use this orthogonal matrix to make some statistical inferences about actual cases.

The statistical framework delineated in Table 3, and the corresponding data sources, can provide information about fund-raising. It can indicate financial stability, comparability across GFF within a country and across countries, and the spread effect for taking corresponding financial policies on domestic and global financial markets. On the basis of this, Table 3 can also break down further some special needs of financial supervision, based on the W-to-W, to compile a separate matrix for measuring each financial instruments, such as the Table 2.

In addition, using the form of W-to-W to comply with the GFF matrix can also improve the quality and consistency of data, providing more opportunities for cross checking and balancing information. When linking information with Table 2 and Table 3, we can map the bilateral relationship between a country and a regional economy at a specific point in time. The GFF matrix, which is built using stocks data, can also be extended to flow data, to quantify bilateral flows of funds, but it also then needs to determine the following three factors: (1) volume of transactions; (2) valuation of financial assets and liabilities; and (3) other changes in volume of assets and liabilities. Using Table 3, we can find that the previous statistical information cannot clear the synthesis problems, namely "what is the main section on bilateral financing, what financial instruments are used, and what is the structure and scale of bilateral financing?" Based on the statistical framework, we will discuss the data sources and then give a case of bilateral countries to illustrate the method of compiling the GFF matrix model.

3. Data Sources for GFF

The GFF data should be based on existing statistical data and therefore share many similarities of approach with them. The GFF data sources include not only the rest-of-the-world account of national accounts but also monetary and financial statistics, IIP statistics, and BIS IBS. The prototype template for the main data is shown in Figure 1. There are two data sources for measuring GFF: (1) data sources for operationalizing the Domestic Assets and Liabilities

(DAL) matrix, and (2) data sources for establishing the EAL matrix. These two matrices could be extended to flow data.
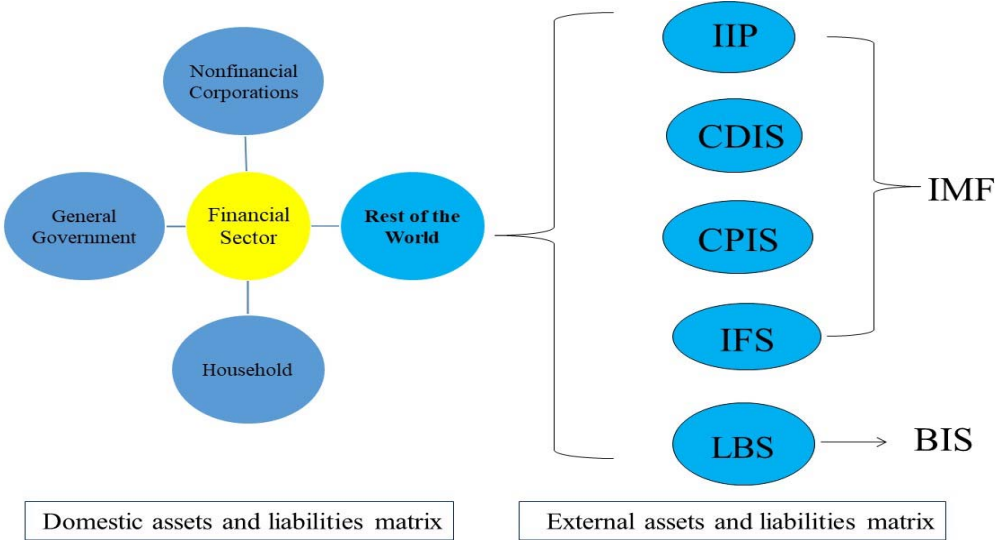
Figure 1. Prototype Template for Measuring GFF

The DAL matrix is based on the BSA, with ROW data drawn from national accounts and IIP. The EAL matrix presents data on whatever external-sector financial stock data are available by IIP category, drawing on IMF and BIS data sources. The IIP is the link between domestic and external matrices. We focus on EAL data sources and integrate with the economic variables to establish the GFF matrix.

Data from IMF's Monetary and Financial Statistics, IIP, and national accounts are used to derive the BSA matrix. The BSA matrix can provide information about a country's or region's financial corporations' stock positions for residents and nonresidents. In the EAL matrix, the datasets with bilateral counterpart country details are collected by the IMF and BIS as follows:

(i) Foreign direct investment (see Errico et al., 2013): The CDIS provides bilateral counterpart country details on inward direct investment positions (i.e., direct investment into the reporting economy) cross-classified by the economy of immediate investors. It also provides

data on outward direct investment positions (i.e., direct investment abroad by the reporting economy), cross-classified by the economy of immediate investment, as well as mirror data for all economies.

(ii) Portfolio investment: CPIS provides bilateral counterpart country details covering holdings of asset stock positions by reporting economies and derived (mirror[4]) liabilities for all economies. The CPIS's purpose is to improve statistics on holdings of portfolio investment assets in the form of equity, long-term debt, and short-term debt. It is also used to collect comprehensive information, including geographical detail on the issuer's country of residence, stock of cross-border equities, long-term bonds and notes, and short-term debt instruments, for use in the compilation or improvement of IIP statistics on portfolio investment capital.

(iii) Other investment: Other investment is a residual category that includes positions and transactions other than those included in direct investment, portfolio investment, financial derivatives and employee stock options, and reserve assets[5]. Other investment includes (a) other equity; (b) currency and deposits; (c) loans (including use of IMF credit and IMF loans); (d) nonlife insurance technical reserves, life insurance and annuity entitlements, pension entitlements, and provisions for calls under standardized guarantees; (e) trade credit and advances; (f) other accounts receivable/payable; and (g) special drawing rights (SDR) allocations (SDR holdings are included in reserve assets). In order to reflect the bilateral counterpart country for loans, deposits, and other assets and liabilities, this paper uses the related dataset with BIS International Banking Statistics (IBS) instead of IIP statistics.

(iv) The BIS compiles and publishes two sets of statistics on international banking activity, namely the Locational Banking Statistics (LBS) and Consolidated Banking Statistics (CBS).

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[4] The term "mirror data" refers to the same data seen from different perspectives. For instance, banks' loans to households could be called mirror data of household debt to banks.

[5] IMF, *Balance of Payments Manual,* 6th edition (BPM6), 111.

This paper use data on cross-border claims and liabilities from LBS[6] as our main source, because these statistics provide information about the currency composition of banks' balance sheets and the geographical breakdown of their counterparties. The LBS data capture outstanding claims and liabilities of internationally active banks located in reporting countries against counterparties residing in more than 200 countries. Banks record their positions on an unconsolidated basis, including intragroup positions between offices of the same banking group. The data is compiled following the residency principle that is consistent with the balance of payments (BOP) statistics, and compatible with IIP, CDIS and CPIS. In this regard, the major advantage of the BIS' LBS data, compared to the banking flows collected from the balance of payments statistics, is the detailed breakdown of the reported series by counterparty countries. This feature enables us to identify changes in the supply factors of banking flows from changes in demand for bank credit in counterparty countries.

(v) For data on reserve assets, we use the IIP as the basic data source, and can reference the Currency Composition of Official Foreign Exchange Reserves (COFER). To supplement data on reserve assets, IFS, which includes World Total Reserves, World Gold, World Reserve Position in the Fund, World SDR Holdings, and World Foreign Exchange, can also be used.

But no matter what kind of reserves assets data are not counterparty information, it cannot constitute a matrix form, and neither can it reflect the relationship between countries based on W-to-W form. Therefore, in order to observe the balance of a country's external assets and overall liabilities; as a reference, IIP data alone can be used to fill the cell on reserve assets.

In order to observe the overall net position, in this paper, IIP data have been used to supplement the data for constructing the EAL matrix. The IIP is a subset of a national balance

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[6] The BIS locational banking statistics (LBS) are reported by banking offices located in selected countries, including many offshore financial centers, and exclude the assets and liabilities of banking offices outside of these countries. The number of LBS-reporting countries increased from 14 in 1977 to 47 in 2016.

sheet, the net IIP plus the value of nonfinancial assets equaling the net worth of the economy, which is the balancing item of the national balance sheet. The IIP relates to a point in time, usually at the beginning (opening value) or the end (closing value) of the financial year.

Table 4. Datasets for Measuring Global Flow of Funds

Items	Data source	Frequency	Geographic coverage	Latest update	Temporal coverage	Benchmark	Web address
Direct Investment	CDIS (IIP)	Annual	106 reporters on Inwart 71 reporters on Outward Cross-classified	12/12/2016	beginning end-2009	BPM6	http://cdis.imf.org
Portfolio Investment	CPIS (IIP)	Annual	86 reporters	03/23/2017	beginning end-2001	BPM6	http://data.imf.org/
		Semi-annual	72 reporters		beginning end-june 2013		
			Cross-classified				
Financial Derivative	CPIS	Annual & Quarterly		03/31/2017	beginning end-june 2013	BPM6	http://data.imf.org/
	IIP	Annual & Quarterly		05/24/2017			
Other Investment	LBS by BIS	Quarterly	47 reporters by locational basis	04/20/2017	Q1.1999-Q4.2016	SNA, BPM6	http://stats.bis.org/sta
	CBS by BIS	Quarterly	31 reporters by ultimate risk basis	04/20/2017	Q2.1998-Q4.2016		http://stats.bis.org/sta
	IIP	Annual & Quarterly					
Reserve Assets	IFS	Annual, Quarterly Monthly	194 reporters	05/24/2017	beginnng 1948	SNA, MFS, BPM6	http://data.imf.org/
	COFER	Quarterly	146 reporters	03/31/2017	beginning 1999	BPM6	http://data.imf.org/
	IIP	Annual	152 reporters	05/24/2017	from 1945 onward	BPM6	http://data.imf.org/
		Quarterly	152 reporters		from 2009 onward		

Notes: IMF, **http://data.imf.org/?sk=388DFA60-1D26-4ADE-B505-A05A558D9A42&sId=1469115547122**
BIS, http://stats.bis.org/statx/toc/LBS.html; http://stats.bis.org/statx/toc/CBS.html, June 1, 2017.

GFF can provide a statistical framework if concepts, definitions, and classifications underlying these statistics are standardized across economies. Fortunately, these standards can be obtained from 2008SNA, the IMF's Monetary and Financial Statistics Manual 2000 and BOP Manual (BPM6), and the BIS's Guidelines for Reporting the BIS IBS. Table 4 shows the various data sources for measuring GFF, how to access them, and their basic features.

Through the above research for constructing the requisite statistical framework and arranging data sources, we can conclude that the key problem for establishing GFF statistics is the benchmark of data sources and timeliness of data reporting. Some data are compiled by the IMF and BIS, which are both based on the BPM6, but some parts of the data are overlapping.

For example, CPIS is compiled by IMF, which mainly consists of securities statistics, while banking statistics emanate from BIS, although banking credit business also includes some securities trading.

4. Creating the GFF Matrix

4.1 A Matrix Model for Measuring a Financial Instrument

According to the framework of Table 2, in order to meet the special tracking analysis of a financial investment, first we created a matrix for measuring a financial instrument, namely the matrix of portfolio investment, as shown in Table 5.

Table 5 uses the data of *geographic breakdown of total portfolio investment* published by the IMF, which includes 18 countries and regions and "Other Economies" that have a larger proportion of the global securities market and greater influence on international politics and economies. Table 5 includes "Other Economies" defined as described above. It is a matrix table based on a W-to-W benchmark: the columns show assets, and the rows represent liabilities. The matrix is a square matrix, with the same number of rows as columns, which is an orthogonal matrix. We can use the matrix to make various statistical estimates for meeting the needs.

Table 5 has the following four characteristics. First, by using the form W-to-W, we can observe and analyze the bilateral relations of relevant countries in portfolio investments; the elements on the diagonal are zero, which means that the matrix does not include domestic financial investment. Second, we can understand the structure of the global securities market, and the proportion and influence of relevant countries in the securities market. Third, using the securities assets located in a column and subtracting the liabilities in each row, we can see the net assets and the relevant information of the counterparty. Fourth, Table 5 shows the balance position on assets and liabilities for each country and the global market in securities investments.

Table 5. Total Portfolio Investment Matrix of Geographic Breakdown (as of end-2016, millions of US dollars)

Issuer of liability (debtor) \ Holder of liability (creditor)	Canada	Cayman Islands	Hong Kong	China	France	Germany	India	Italy	Japan	Korea	Luxembourg	Netherlands	Russian Federation	Singapore	Switzerland	United Kingdom	United States	Other Economies	Total of World	Net Assets	Total L.
Canada		30351	14244	5553	25813	48142	1	4041	70860	4881	77823	23673	250	18333	36807	55454	826639	246151	1489016	0	1489016
Cayman Islands	28526		375142	21833	14117	19044	14	2581	684228	8361	86436	23592	190	24358	60245	57754	1254358	135970	2796750	0	2796750
Hong Kong	9645	16457		92206	4175	4788	6	371	19100	9460	26778	12142	3	25411	5342	48282	122599	67025	463787	905171	1368958
China	13749	30388	314871		13470	3510	229	436	15445	11522	33589	12020	29	94603	4484	40919	107805	132994	830064	0	830064
France	33303	35198	10193	5431		359306	2	150859	252108	12083	361026	179248	812		76318	202251	482972	752582	2913691	0	2913691
Germany	35534	53056	17457	6558	212441		2	79907	123469	6158	294266	215459	1461	24916	83842	200214	372832	1014755	2742327	234460	2976787
India	10212	6437	6750	792	4141	3223		331	11399	1956	36227	9004	2	47381	2789	26759	132680	106921	407005	0	407005
Italy	6542	14520		1079	253093	159755	0		53148	1244	183428	39178	7		8835	63398	92112	274383	1150721	135055	1285776
Japan	60270	68261	50492	11894	98948	23920	4	5450		14737	123431	52485	11		26596	263692	861587	379739	2041518	1836192	3877710
Korea	14747	5662	14996	2700	8394	7836	9	549	23934		36097	11696	18	37303	9198	36215	179534	100262	489150	0	489150
Luxembourg	12468	15328	58677	5527	340081	550848	245	496886	99120	13493		93194	24191	20880	199726	101549	134242	761324	2927780	923160	3850940
Netherlands	19565	19056	7483	3100	258758	238844	0	54492	116360	4174	181761		5091		68477	151937	448078	382046	1959223	0	1959223
Russian Federation	2551	4127	47	387	2234	4226	0	1165	1929	933	22120	7291			2291	11395	61322	22260	144278	0	144278
Singapore	5791	4896	18595	5773	1591	3898	17	437	20238	3786	16382	8150	21		3499	19674	115272	64496	292517	732145	1024662
Switzerland	24062	9396	2075	4345	24519	48592	11	8455	28263	4552	82305	21008	189			82263	430555	154302	924891	335634	1260525
United Kingdom	77039	75906	75403	14457	232128	189062	293	65760	166578	20586	302112	107874	2208	36989	74092		1182407	700079	3322974	245270	3568244
United States	793370	1200683	134070	125687	255673	364398	1482	105045	1595299	139742	951086	473853	3558	312110	293416	1075336		4380617	12205426	0	12205426
Other Economies	149568	203399	268464	52338	764149	947393	275	309009	596232	45092	1036072	453434	34019	382378	304569	1131153	2956665		14987195	41697	15028892
Total of World	1296944	1793121	1368958	359659	2513726	2976787	2588	1285776	3877710	302761	3850940	1743301	72060	1024662	1260525	3568244	9761659	15028892	52088314		
Net Liabilities	192072	1003629	0	470405	399966	0	404416	0	0	186389	0	215922	72218	0	0	0	2443767	0			
Total A.	1489016	2796750	1368958	830064	2913691	2976787	407005	1285776	3877710	489150	3850940	1959223	144278	1024662	1260525	3568244	12205426	15028892			

Table 6. International Direct Investment Matrix (millions of USD, as of end-2016)

Investment in:	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	United Kingdom	United States	Other Economies	Total of World	Net Assets	Total L
Canada		15933	6002	11591	1005	21673	1088	69608	41110	31128	292002	123464	614604	162882	777486
China	10001		22191	60404	7054	142021	95068	29221	11439	19390	70120	2067623	2534532	0	2534532
France	4021	1935		63817	19737	16154	839	92986	73634	81927	57187	285343	697579	367202	1064781
Germany	2398	2313	45526		35418	22968	5114	146029	64989	66523	74792	319980	786051	467995	1254046
Italy	96	-10	62647	29520		2899	404	67952	17685	45350	8748	109458	344749	0	344749
Japan	1328	885	27984	3383	1013		3419	22230	10457	12985	52215	54645	190544	1035384	1225928
Korea	2202	5576	4205	6951	325	43505		17581	3419	14086	31778	45723	175350	31196	206546
Netherlands	31081	23827	125078	217940	102944	79262	2348		279504	357744	758146	2105959	4083833	0	4083833
Switzerland	-172	0	37212	24762	4762	5168	0	317138		50729	122028	424097	985724	366814	1352538
United Kingdom	19276	2673	81821	81712	4098	56170	2342	162198	53878		452475	471630	1388273	971216	2359490
United States	371468	27475	252864	291697	30010	421103	40937	355242	310759	555687		1068176	3725418	328496	4053914
Other Economies	335788	496503	399250	462269	136368	415005	54987	1956115	485663	1123941	2134424		14807862	0	14807862
Total of World	777486	577109	1064781	1254046	342733	1225928	206546	3236300	1352538	2359490	4053914	13883648	30334519		
Net Liabilities	0	1957423	0	0	2016	0	0	847533	0	0	0	924214			
Total A	777486	2534532	1064781	1254046	344749	1225928	206546	4083833	1352538	2359490	4053914	14807862			

Data Source: IMF, http://data.imf.org/?sk=40313609-F037-48C1-84B1-E1F1CE54D6D5, April 10, 2018.

Table 7. International Credit Matrix (millions of USD, as of end-2016)

Claims / Liabilities	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	United Kingdom	United States	Other Economies	Total of World	Net Assets	Total L
Canada		7969	18912	22917	1010	44280	1226	7337	5860	70300	188528	216811	585150	0	585150
China	6041		32168	19124	1067	52114	38749	7122	2680	52331	29419	515189	756004	0	756004
France	5097	14473		193096	67031	190958	1725	92396	56137	397420	88815	953576	2060724	81209	2141933
Germany	8047	18395	112586		68574	92105	3167	78201	53942	406278	44706	1122183	2008184	0	2008184
Italy	0	624	169825	73854		28964	495	15356	7105	71516	4378	69072	441189	0	441189
Japan	16466	30479	185334	18409	493		6562	3791	5843	297463	447235	2442655	3454730	0	3454730
Korea	518	21559	9388	3484	24	31729		0	2116	16913	15857	110476	212064	21277	233341
Netherlands	5291	0	97339	158942	11566	64424	837		24382	240554	54265	388433	1046033	0	1046033
Switzerland	684	2337	57199	62477	4201	22985	990	20701		214665	59821	337551	783611	91663	875274
United Kingdom	54000	67640	332931	320428	86907	254770	5669	288385	169534		684582	2142998	4407844	0	4407844
United States	310732	100803	249946	153439	38690	1195123	30524	117308	90892	974775		1405593	4667825	0	4667825
Other Economies	82695	409688	876305	581373	44536	533244	143397	288849	456783	1629881	1669501		6655215	2875746	9530961
Total of World	489571	673967	2141933	1607543	436638	2510696	233341	919446	875274	4372096	3287107	9530961	27078573		
Net Liabilities	95579	82037	0	400641	4551	944034	0	126587	0	35748	1380718	0			
Total A.	585150	756004	2141933	2008184	441189	3454730	233341	1046033	875274	4407844	4667825	9530961			

Data Source: BIS, https://www.bis.org/statistics/about_banking_stats.htm, June 20, 2018.

The specific instructions for using Table 5 are as follows: if the net assets figure is positive, a zero appears in the net row, which indicates the net liabilities of the corresponding country. If the net assets figure is negative, a zero appears in in the net column, which indicates the net assets of the corresponding country. After this processing, we can see the balance, that is, the total of each row is equal to the total of the each column, and the sum of the rows in the matrix equals the sum of the columns. In the next section, we will use the matrix data to do an empirical analysis.

In accordance with the same method, we also used the data of CDIS and the data of LBS to compile the International Direct Investment Matrix and the International Credit Matrix, and display the two tables below Table 5, as Table 6 and 7, respectively. Corresponds to the special needs of policy authorities, we can use the Table 6 to observe the structure and scale of international direct between counterpart countries; and also can use Table 7 to see the main issue of understanding the international distribution of credit and the attending risk.

4.2. A Matrix of Multiple Financial Instruments

Based on the layout of Table 3, this section discusses how to create external stock matrices. As an example, Table 8 shows what may be possible in a GFF framework for a country to enable monitoring of financial positions at both region/nation and cross-border levels through financial instruments. Table 8 also based on W-to-W benchmark, the "column" as an Assets, and "row" represents liabilities. The matrix here has the same number of rows as columns too, which a square matrix.

Table 8 is an illustration of the GFF matrix as of the end of December 2016. Each row of the matrix has two statistical groupings, including countries and three financial instruments for showing the source of funds, that is, direct investment (DI), portfolio investment (PI) and other

Table 8 External Asset and Liabilities Matrix for the End of 2016(millions of US dollars)

Issuer of liability (debtor)	Financial Instruments	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	United Kingdom	United States	Other	Total of Financial Instruments	Total Liabilities
Canada	Direct investment		15933	6002	11591	1005	21673	1088	69608	41110	31128	292002	123464	614604	
	Portfolio investment		5553	25813	48142	4041	70860	4881	23673	36807	55454	826639	387153	1489016	2688771
	Other investment		7969	18912	22917	1010	44280	1226	7337	5860	70300	188528	216811	585150	
China	Direct investment	10001		22191	60404	7054	142021	95068	29221	11439	19390	70120	2067623	2534532	
	Portfolio investment	13749		13470	3510	436	15445	11522	12020	4484	40919	107805	606704	830064	4120600
	Other investment	6041		32168	19124	1067	52114	38749	7122	2680	52331	29419	515189	756004	
France	Direct investment	4021	1935		63817	19737	16154	839	92986	73634	81927	57187	285343	697579	
	Portfolio investment	33303	5431		359306	150859	252108	12083	179248	76318	202251	482972	1159813	2913691	5671994
	Other investment	5097	14473		193096	67031	190958	1725	92396	56137	397420	88815	953576	2060724	
Germany	Direct investment	2398	2313	45526		35418	22968	5114	146029	64989	66523	74792	319980	786051	
	Portfolio investment	35534	6558	212441		79907	123469	6158	215459	83842	200214	372832	1405912	2742327	5536561
	Other investment	8047	18395	112586		68574	92105	3167	78201	53942	406278	44706	1122183	2008184	
Italy	Direct investment	96	-10	62647	29520		2899	404	67952	17685	45350	8748	109458	344749	
	Portfolio investment	6542	1079	253093	159755		53148	1244	39178	8835	63398	92112	472337	1150721	1936659
	Other investment	0	624	169825	73854		28964	495	15356	7105	71516	4378	69072	441189	
Japan	Direct investment	1328	885	27984	3383	1013		3419	22230	10457	12985	52215	54645	190544	
	Portfolio investment	60270	11894	98948	23920	5450		14737	52485	26596	263692	861587	621939	2041518	5686792
	Other investment	16466	30479	185334	18409	493		6562	3791	5843	297463	447235	2442655	3454730	
Korea	Direct investment	2202	5576	4205	6951	325	43505		17581	3419	14086	31778	45723	175350	
	Portfolio investment	14747	2700	8394	7836	549	23934		11696	9198	36215	179534	194346	489150	876563
	Other investment	518	21559	9388	3484	24	31729		0	2116	16913	15857	110476	212064	
Netherlands	Direct investment	31081	23827	125078	217940	102944	79262	2348		279504	357744	758146	2105959	4083833	
	Portfolio investment	19565	3100	258758	238844	54492	116360	4174		68477	151937	448078	595437	1959223	7089089
	Other investment	5291	0	97339	158942	11566	64424	837		24382	240554	54265	388433	1046033	
Switzerland	Direct investment	-172	0	37212	24762	4762	5168	0	317138		50729	122028	424097	985724	
	Portfolio investment	24062	4345	24519	48592	8455	28263	4552	21008		82263	430555	219215	895827	2665162
	Other investment	684	2337	57199	62477	4201	22985	990	20701		214665	59821	337551	783611	
United Kingdom	Direct investment	19276	2673	81821	81712	4098	56170	2342	162198	53878		452475	471630	1388273	
	Portfolio investment	77039	14457	232128	189062	65760	166578	20586	107874	74092		1182407	1192991	3322974	9119092
	Other investment	54000	67640	332931	320428	86907	254770	5669	288385	169534		684582	2142998	4407844	
United States	Direct investment	371468	27475	252864	291697	30010	421103	40937	355242	310759	555687		1068176	3725418	
	Portfolio investment	793370	125687	255673	364398	105045	1595299	139742	473853	293416	1075336		6983607	12205426	20598669
	Other investment	310732	100803	249946	153439	38690	1195123	30524	117308	90892	974775		1405593	4667825	
Other	Direct investment	335788	496503	399250	462269	136368	415005	54987	1956115	485663	1123941	2134424		14807862	
	Portfolio investment	218762	178856	1130488	1533421	810782	1432246	83081	606807	578461	1396565	4777138		19376996	40840073
	Other investment	82695	409688	876305	581373	157075	533244	143397	288849	456783	1629881	1669501		6655215	
Total Asset of Financial Instruments	Direct investment	777486	577109	1064781	1254046	342733	1225928	206546	3236300	1352538	2359490	4053914	13883648	30334519	
	Portfolio investment	1296944	359659	2513726	2976787	1285776	3877710	302761	1743301	1260525	3568244	9761659	20469841	49416934	106830026
	Other investment	489571	673967	2141933	1607543	436638	2510696	233341	919446	875274	4372096	3287107	9530961	27078573	
Total Asset		2564001	1610735	5720439	5838375	2065147	7614334	742648	5899047	3488337	10299830	17102680	43884451	106830026	
Net Worth		-124769	-2509865	48445	301814	128488	1927543	-133915	-1190043	823175	1180738	-3495989	3044378		
Reserve assets		82718	3097845	146770	185287	136043	1220418	371103	36166	679620	134642	407223			
Monetary gold		0	67878	90645	125705	91241	28592	4795	22824	38780	11505	301090			
Special drawing rights		7578	9661	10166	15755	6894	18087	2887	6031	4335	10261	48882			
Reserve position in the fund		2191	9597	5157	6941	2634	11959	1719	1433	1319	6699	18385			
Other reserve assets		72949	3010708	40802	36886	35275	1161781	361701	5878	635186	106177	38865			
Adjustment item		170400	1212557	-565207	1314216	-438526	-159080	41298	1654918	-732272	-1422134	-5229612			
Net Financial Position		128349	1800537	-369991	1801316	-173995	2988881	278485	501042	770523	-106753	-8318378			

investment (OI), covering the main structural elements of external financial liabilities. Financial assets are listed by country in the columns to show fund uses, with the counterparty sectors identified for each cell. The columns of the matrix delineate 14 sectors, that is, 11 country sectors, all other economies, total of financial instruments, and total liabilities. The total of all sector's assets or liabilities is equal to the total assets or liabilities of world. The columns of the matrix are configured to understand the external assets for many countries, thereby displaying both national and regional perspectives. Each column corresponds to the balance sheet of the sector in question; which countries or regions should appear in the matrix depends on the specific purpose of the analysis. The data in Table 8 are derived from IMF Data Warehouse and BIS' IBS. But FD data are not used in Table 8 because many countries lack such data.

We used data from CDIS, CPIS, and LBS instead of OIs to compile the GFF matrices on a per country basis. Table 8 shows cross-border liabilities of debtors (rows) and cross-border claims of asset holders (columns). The GFF matrix reveals structural equilibrium relationships as follows. First, we can determine both the distribution and scale of EAL for a country and show the basic structure of its external investment position. By analyzing the rows of the matrix, we can determine the sources of inward financial investment to a country (debtor), and through analysis of the columns of the matrix, we can also identify the destinations of outward financial investments from a country (creditor). At the same time, we also know that the rows in the matrix will always sum to the columns; that is, total global assets = total global liabilities.

Second, the point on a row "a country held the total liabilities of financial instruments = total liabilities of the country"; and from the point on column "a country held the total assets of financial instruments = total assets of the country." Therefore, we can observe the structure of EAL for a country.

Third, from the balance of external financial assets and liabilities, we can get the balance relationship between "total liabilities of a country − total assets of a country = the country's net

financial assets," which can reveal the balance between domestic and foreign financial assets and liabilities.

Table 8 can further indicate the scope of external financing conditions, such as (1) the proportion of and relationship with the international financial market; (2) the risk of imbalance in external financial assets and liabilities; an (3) transmission route of impacts from the outbreak of a financial crisis in a country or region as well as a country to enable implementation of an effective financial policy in terms of the impacts arising from other countries. For brevity, we focus on China, Japan and the United States to trace the effects of external financing such as DI, PIs, and bank credit funds.

In order to compare, we also compiled the GFF matrix of the end of 2015, and display it at the end of this paper as Annex Table 1.

5. Analysis Using the GFF Matrix: Focus on China, Japan and the United States

Table 8 can provide an overview of the distribution of DIs, securities investments, and international bank credit funds in each country. From the direction of the rows, we can understand which countries raised how much funds in what ways, and from the direction of the columns, we can grasp how many countries used how much funds in what instruments. This information can clarify the following relationships. First, it shows the basic condition of a country's external position, holdings extent of creditor's rights and debt, through which financial instruments and counterparties, namely, from whom-to-whom and by what. Second, it shows the country's influence on the GFF, mode of financing, structure, and scale. Third, structural changes and equilibrium conditions in the direct investment market, global bond market and international bank credit market are revealed. Fourth, the spread effect from a financial crisis in one country or a region is shown. Finally, it allows for monitoring the stability

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of GFF and the equilibrium state. In the next section, we will use the GFF matrix to demonstrate a statistical descriptive analysis.

5.1. Basic Characteristics of the GFF between China, Japan and the United States

Let us first look at the basic situation of the external net financial position in each country. The bottom row of Table 8 shows the external net assets in each country, which is the difference between total financial assets and total liabilities for each country. If this value is positive, a country's external financial assets are greater than its liabilities, meaning the country is in a position of having net financial assets. However, if the value of net financial assets becomes negative, it means that the country is in the position of having external net liabilities. In the analysis of 11 countries at the end of 2016, countries with net external financial liabilities are France, Italy, the United Kingdom, and the United States, whereas the other analyzed countries have net external financial assets. The United States is the largest holder of external financial liabilities, having the highest net liabilities by $8.32 trillion; Japan is the largest holder of foreign financial assets by $2.99 trillion. At the same time, China holds net foreign assets of $1.8 trillion.

In order to understand the reasons for forming an external net financial position according to the structural relationships shown in Table 8, namely net worth + reserve assets + adjustment item = net financial position, we should first analyze the composition of net worth to find the cause and effect relationships. Through foreign DI, external PIs, and OIs, which are the three forms of international capital operations, we can observe the U.S., Japan and China's fundamental situation regarding external financial assets and liabilities at the end of December 2016. Specifically, for the U.S., its net worth, that is, the total assets of external finance minus the total liabilities of external finance is -$3496 billion. From its composition, the net assets of DI were $328.5 billion, the net liabilities of PI were $2443.8 billion, and the net liabilities of

OI were $1380.72 billion. Taking the total of DI and PI and OI, combined with reserve assets and adjustment item, we can get the net financial position in the U.S., which is -$8.32 trillion as showed the result of Table 8.

Similarly, by using Table 8, we find that Japan's external net worth is $1927.5 billion. The composition of this figure is: the net assets of DI are $1035.38 billion, the net assets of PI are $1836.2 billion, and the net liabilities of OI are $944 billion. In contrast, China's external net worth is -$2509.9 billion. Its composition is as follows: the net liabilities of DI are $1957.4 billion, the net liabilities of PI are $470.4 billion, and the net liabilities of OI are $82.04 billion.

Although the United States has been keeping the net external financial liabilities, but compared with the data of end-2015 (see the Annex Table 1), China's net external financial liabilities reached $2722.4 billion at the end-2015, that larger than the $1947.8 billion in the United States. China has been continuing to be a net financial debt in 2016. China is in a state of increasing financial risk caused by an increase in its net external financial liabilities. However, in terms of the elements of foreign exchange reserves, because China holds reserve assets of $3.098 trillion (higher than Japan and the United States), China's net external financial position is larger than that of the United States, but lower than that of Japan.

5.2 The Structure of GFF between China, Japan and the United States

Figure 2 shows the proportion of countries holding various financial assets with DI, PI and OI at the end of 2016. Looking at the composition of the various kinds of financial assets held by each country, overall, the United States is ranked first. The United States accounts for 13.36% of DI and its foreign direct investment assets were $4.05 trillion at the end of 2016, the largest in the world. In particular, the United States has the largest share of assets in the global securities market with strong liquidity; its assets account for 19.75 % of the global market, and the United States held $9.76 trillion in securities assets. In the global bank credit market, the

United States still held the largest share of assets, accounting for 12.14% of the global market, and it held credit assets of $3.29 trillion (see Table 8).Japan's share of the financial assets in the market is slightly lower than that of the UK, ranking third. Japan accounts for 4.04% of DI, holds assets of foreign direct investment of $1.23 trillion, which is lower than those of the United States but higher than those of China. Japan's securities assets are also sizeable, lower than those of the United States, but still higher than those of the UK and China accounting for 7.85 % of the global market. Japan holds $3.88 trillion in securities assets. In the global bank credit market, Japan also has a large share of assets, accounting for 9.27% of the global market. It held credit assets of $2.51 trillion, less than the United States and the UK.
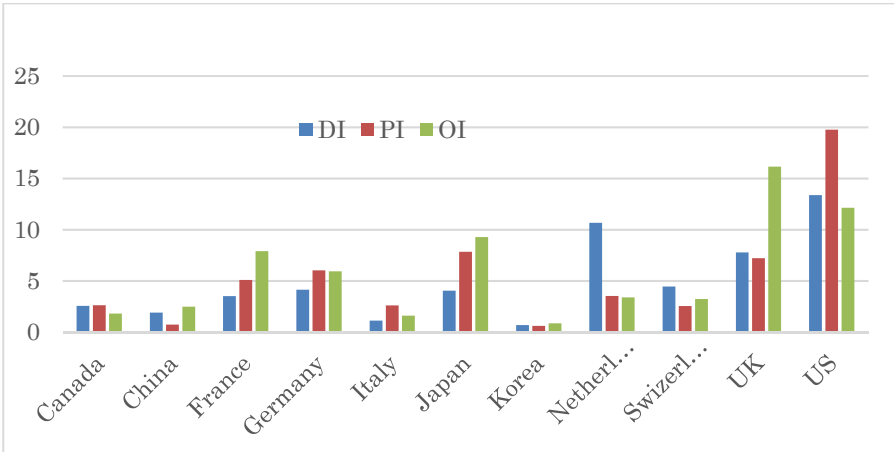

Figure 2. Structure of Fund Use in the Global Market (%, as of end-2016)

At the end of 2016, China ranked third in the world in net financial position, including reserve assets, below Japan and Germany (see Table 8). However, compared with the United States and Japan, in terms of the size of international financial market, China's share is still relatively low, only slightly higher than that of South Korea. China accounted for 1.9% of DI and held assets of foreign direct investment of $0.58 trillion at the end of 2016. In addition, China accounted for 0.73% of the global market, and held $0.36 trillion in securities assets. In the global bank credit market, China still held the low share of assets, accounting for 2.49% of

the global market, and held credit assets of $0.67 trillion (see Table 8).

Next, we also need to observe the situation of financing in the global financial markets between China, Japan and the United States Figure 3 shows the financing scale and the composition of countries by DI, PI and OI. It reveals that the United States also has held the largest share of DI, PI and OI in the world, comprising almost 12.3% of DI, 24.7% of PI, and 17.24% of OI. It is particularly clear that the United States has used securities financing to reach $12.2 trillion, comprising almost a quarter of the global stock market.

As presented in Figure 3, the scale of Japan's fund-raising in the international financial market is smaller than its fund-use. It only accounted for 0.63% of DI and 4.13% of PI. However, its proportion of financing through international bank credit is larger than that of China, accounting for 12.76% of OI. Japan's foreign bank debt reached $3.45 trillion at the end of 2016. Thus, even from an external financing structure, the size of Japan's indirect financial is more than its direct financing (such as securities financing). It is clear that Japan's external financing structure is based on indirect financing and the United States is based on direct financing.
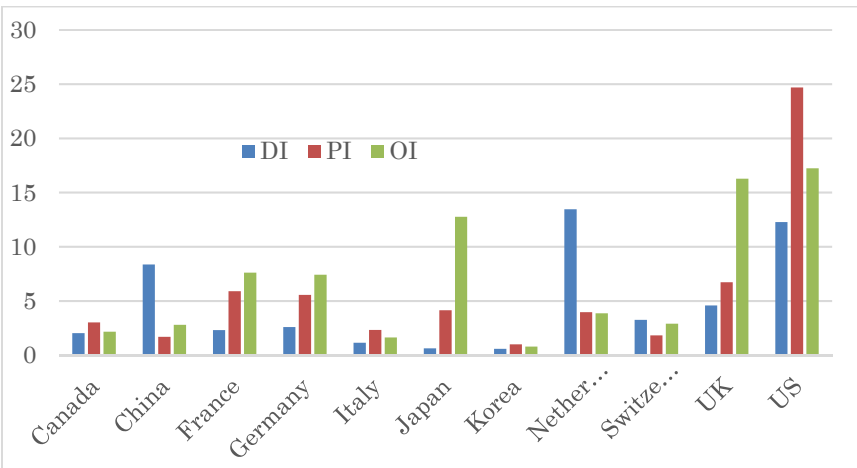

Figure 3. Structure of Fund-raising in the Global Market (%, as of end-2016)

According to the structure of financing shown in Figure 3, China had a large proportion of

DI, accounting for 8.36% of the world's total DI, with $2.53 trillion at the end of 2016. However, its share of PI and OI is relatively lower in the world, comprising only 1.68% and 2.79% of the global total. The scale of Chinese financing in the PI market is small at $830 billion, which accounted for only 1.68% of the world's total PI and only slightly higher than South Korea's 0.9%. Moreover, China had a relatively small amount of international bank credit, at only $756 billion. That is about one fifth of the United States level.

5.3 The Composition of External Investment between China, Japan and the United States

In order to observe the external outward investment and inward investment between China, Japan and the United States, we combined DI, PI, and OI in Table 8 to make Table 9, which shows the counterparty proportion of external investment between countries by the assets side and the liabilities side.

Table 9. The Composition of External Investment Position (% as of end 2016)

China	Canada	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	UK	US	Other
Liablities	0.72	1.65	2.02	0.21	5.09	3.53	1.17	0.45	2.73	5.03	77.40
Assets	1.83	1.36	1.69	0.11	2.69	1.85	1.67	0.41	5.26	15.77	67.36

Japan	Canada	China	France	Germany	Italy	Korea	Netherlands	Switzerland	UK	US	Other
Liablities	1.37	0.76	5.49	0.80	0.12	0.43	1.38	0.75	10.10	23.93	54.85
Assets	1.80	2.75	6.03	3.13	1.12	1.30	3.42	0.74	6.27	42.18	31.26

United States	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	UK	Other
Liablities	7.16	1.23	3.68	3.93	0.84	15.59	1.03	4.59	3.37	12.65	45.91
Assets	7.64	1.21	3.68	2.88	0.62	7.96	1.33	7.37	3.58	13.56	50.17

According to the structure of external investment position shown in Table 9, the top two countries in terms of scale of investment in China were Japan and the United States. At the end of 2016, Japan was largest financing country to China, with a financing scale of $209.6 billion,

accounting for 5.09% of China's external financing. In addition, financial investment from the United States to China amounted to $207.3 billion, accounting for 5.03% of China's external financing. From the perspective of the asset side, China' largest outward investment country is the United States, with a scale of 254 billion, accounting for 15.77% of China's total outward investment. By Table 9, we also can know that China's financial investment to Japan amounted to $43.26 billion, accounting for 2.69% of China's external financial investment.

By the same view, Japan's largest foreign financier is the United States, accounting for 23.93% of Japan's external financing. In second country is the United Kingdom, which accounting for 10.1% of Japan's external financing. Nevertheless, financial investment from China to Japan accounting for only 0.76% of Japan's external financing. On the other hand, Japan's financial investment to the United States was $3211.5 billion, accounting for 42.2% of its external financial investment. In the second country also is the United Kingdom, which accounting for 6.26%. Moreover, Japan's financial investment to China amounted to $209.58 billion, accounting for 2.73 of Japan's external financial investment. Form Table 9, we can know that the financial relationship between the United States and Japan is much closer than that between the United States and China.

From Table 10, we can know the composition of mutual financial investment between China, Japan and the United States. As in Table 8, in Table 10, "row" means fund raising, and "column" means fund use. By the perspective of China's "row", DI accounts for 34% of the total investment from the United States to China, PI accounts for 52%, and OI accounting for 14%. In addition, DI from Japan to China amounted to $142 billion, accounting for 68% of the total financial investment from Japan to China. PI accounts for 7.4%, and OI accounts for 25%. As a result, we see that the United States focuses on securities investment, while Japan focuses on direct investment and bank loans in China. The composition of the more detailed bilateral investment between China, Japan, and the United States can be seen in Table 10 constructed by

a W-to-W benchmark.

Table 10. The Composition of Bilateral Investment by W-to-W (US Dollars, Millions)

creditor		China			Japan			United States		
debtor		DI	PI	OI	DI	PI	OI	DI	PI	OI
China	DI				142021 (68%)			70120 (34%)		
	PI					15445 (7%)			107805 (52%)	
	OI						52114 (25%)			29419 (14%)
Japan	DI	885 (2%)						52215 (4%)		
	PI		11984 (27%)						861587 (63%)	
	OI			30479 (71%)						447235 (33%)
United States	DI	27475 (11%)			421103 (13%)					
	PI		125687 (49%)			1595299 (50%)				
	OI			100803 (40%)			1195123 (37%)			

By the "columns" in Table 10, we can know that China's DI to the United States is $27.48 billion, ranking first in China's outward investment, and accounting for 11% of the total financial investment from China to the United States. Among them, China's PI to the United States is $125.69 billion, PI accounts for 49%; and OI accounts for 40 (see Table 10). China's PI in the United States is mainly reflected in holding of United States treasury bonds. Moreover, looking at the composition of Chinese investment in Japan, China's DI in Japan is $0.885 billion; Japan is the third largest recipient of China's outward investment, DI accounts for 2% of the total investment from China to Japan, PI accounts for 27%, and OI accounts for 71% (see Table 10). Thus, China's outward investment in Japan primarily focuses on providing international bank credit. In addition to the United States and Japan, the UK and South Korea are also large recipients of China's external investment.

Regarding Japan's external investment, as shown in Table 10, DI accounts for 13% of the total investment from Japan to the United States, PI accounts for 50%, and OI accounting for 37%. As a result, Japan and the United States focus on securities and bank credit, while Japan

and China focuses on direct investment. In addition to the United States and China, the UK and France are also larger recipients of Japan's external investments.

By analyzing the size and ratio of the counterparties' foreign investment in China and Japan, we can understand the external debt and creditor relationship held by the United States to China and Japan, based on the claims of counterparties' own debts. This triangular relationship has three basic characteristics. The first is that the financial relationship between the United States and Japan is far stronger than that between China and the United States. About 23.93% of Japan's foreign financing comes from the United States and 42.18% of Japan's outward investment flows to the United States. However, between China and the United States, only 5.03% of China's foreign investment comes from the United States and 15.77% of China's outward investment goes to the United States.

The second feature is that the emphasis of the external investment is different between the three countries. External investment by China and Japan is mainly in the form of direct investment. However, investment between the United States and Japan are in the form of securities investment and bank credit. In addition, investment between China and the United States is mainly in the form of securities investment.

The third feature is that compared with the United States and Japan, the scale of Chinese external investment is still relatively low. Japan's is five times that of China, while the United States' is 11 times that of China. Moreover, at the end of 2016, China had net liability with Japan, but had net asset with the United States. That is, China's net liabilities to Japan was 166.3 billion, and net assets to the United States was $46.6 billion, respectively. Moreover, China also had net liabilities to Japan and net assets to the United States at the end of 2015, which were -$176.79 billion and $4.23 billion respectively. In addition, Japan has been increasing its financial net assets to the United States since 2015 (see Annex Table 1).

5.4. Influence and Sensitivity to Global Flow of Funds

The financial crisis, such as the United States subprime mortgage crisis in 2008, shows that a country's financial crisis will affect global financial markets. As such, financial crises in the GFF will appear in the resulting chain reaction and give shocks to regional or national economic growth. The primary purpose of establishing GFF statistics is to observe the GFF's basic situation and the relationship between countries, and measure the spread effect arising from a financial crisis in a country or a region. Accordingly, it is necessary to discuss the methods used to calculate the influence coefficient and sensitivity coefficient used in the analysis of flow of funds (Tsujimura and Mizoshita, 2002).

Table 11. A Comprehensive Matrix of External Asset and Liabilities

(End of December 2016, USD Millions)

Issuer of claim (debtor) \ Holder of liability (creditor)	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	United Kingdom	United States	Other	Total of World	Net Assets	Total Liabilities
Canada	0	29455	50727	82650	6056	136814	7195	100618	83777	156882	1307169	727428	2688771	0	2688771
China	29791	0	67829	83038	8557	209580	145339	48363	18603	112640	207344	3189516	4120600	0	4120600
France	42421	21839	0	616219	237627	459220	14647	364629	206089	681597	628974	2398732	5671994	48445	5720439
Germany	45979	27266	370553	0	183899	238542	14439	439689	202773	673016	492330	2848076	5536561	301814	5838375
Italy	6638	1692	485565	263130	0	85011	2143	122486	33625	180264	105238	650868	1936659	128488	2065147
Japan	78065	43258	312266	45712	6956	0	24717	78506	42896	574140	1361037	3119239	5686792	1927543	7614335
Korea	17467	29835	21987	18271	898	99168	0	29277	14733	67214	227169	350545	876563	0	876563
Netherlands	55937	26927	481175	615726	169002	260046	7360	0	372363	750235	1260489	3089829	7089089	0	7089089
Switzerland	24574	6682	118930	135831	17418	56416	5542	358847	0	347657	612404	980863	2665162	823175	3488337
UK	150315	84770	646879	591203	156765	477518	28598	558458	297504	0	2319464	3807619	9119092	1180738	10299830
US	1475570	253965	758483	809534	173745	3211525	211203	946403	695067	2605798	0	9457376	20598669	0	20598669
Other	637245	1085047	2406043	2577063	1104225	2380496	281465	2851771	1520907	4150387	8581063	0	40840073	3044378	43884451
Total of world	2564001	1610735	5720439	5838375	2065147	7614334	742648	5899047	3488337	10299830	17102680	43884451	106830026		
Net Liabilities	124769	2509865					133915	1190043			3495989				
Total Assets	2688771	4120600	5720439	5838375	2065147	7614334	876563	7089089	3488337	10299830	20598669	43884451			

To calculate the influence and sensitivity coefficients, we need to adjust the data in Table 8, which we then move to Table 11 in the new form that is a Comprehensive Matrix of External Asset and Liabilities. First, we omit items in Table 8 pertaining from Net Worth to Net financial position, i.e., the bottom seven rows in Table 8. Second, we merge the three items of financial instruments of each country in Table 8 into one row. Through Table 11, we can understand and explore countries' external financial position vis-à-vis financing with other countries more clearly; this can provide a W-to-W form of financial assets and liabilities matrix. Moreover, the total number of rows and columns in each country has not changed, which is consistent with Table 8. This method was originally used in the input-output analysis; it is defined as a standardization that uses the row's sum and the columns' sum of Leontief inverse to divide its averages. For illustrative purposes a schematic of Table 11 is provided in Figure 4.
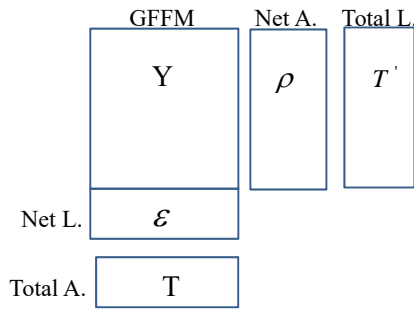

Figure 4. Schematic of Table 11.   Note: $T^{'}$ is the transposed matrix of T.

Influence and sensitivity coefficients are defined as follows. Set the position of two-way financial investment as y_{ij}, which is given from country i (as a row) to country j (as a column) ; set the number of observation objects as n, then Table 11 can be set by y_{ij} forms with the matrix Y of EAL by n's rows and n's columns, as shown in Table 11.

$$\text{Set}\, T_i = T_j = \max(\sum_{i=1}^{n} y_{ij}, \sum_{j=1}^{n} y_{ij}),$$

$$\varepsilon_i = T_i - \sum_{j=1}^{n} y_{ij},$$

$$\rho_i = T_j - \sum_{i=1}^{n} y_{ij}$$

T is the total of rows or the total of columns for the matrix Y of external assets/liabilities, and the total of the rows equals the total of the columns for each country. Designate ε_i as net liabilities of country i, and ρ_j as net assets of country j. If the net assets of country i is non-negative, we have $\varepsilon_i = 0$ and $\rho_j > 0$; and if the net assets of country i is negative, we have $\varepsilon_i > 0$, and $\rho_j = 0$. To illustrate the effect of the influence and sensitivity coefficients, we first need to define the input coefficient c_{ij}. The input coefficient c_{ij} is the ratio of funds raised from country i to the total external financing of country j. That is,

$$c_{ij} = \frac{y_{ij}}{T_j}$$

From the direction of the rows in Table 11, we arrive at the following equilibrium equation.

$$\sum_{j=1}^{n} y_{ij} + \varepsilon_i = \sum_{j=1}^{n} c_{ij} T_j + \varepsilon_i = T_i \tag{1}$$

Where C is the matrix of c_{ij} determined by the form of the n × n order, and ε is an n-dimensional vector that is formed by ε_j; thus the equilibrium equations can be rewritten as the following equation.

$$C * T + \varepsilon = T \tag{2}$$

Solving for T in Equation (2) yields Equation (3).

$$T = (I - C)^{-1} \varepsilon \tag{3}$$

Where Equation (3) is the inverse matrix of input-output analysis that was proposed by Leontief. Put the inverse matrix as $\Gamma = (I - C)^{-1}$, and the vector of row i and column j as $\gamma_{i,j}$, then country j's Influence Coefficients (IC) by IC_j^y and country 's Sensitivity Coefficients (SC) by SC_i^y can be defined as follows.

$$IC_j^y = \frac{\displaystyle\sum_{i=1}^{n} r_{i,j}}{\dfrac{1}{n}\displaystyle\sum_{j=1}^{n}\sum_{i=1}^{n} r_{i,j}} \qquad (4) \qquad\qquad SC_i^y = \frac{\displaystyle\sum_{j=1}^{n} r_{i,j}}{\dfrac{1}{n}\displaystyle\sum_{i=1}^{n}\sum_{j=1}^{n} r_{i,j}} \qquad (5)$$

The numerator in Equation (4) is the total rows (the total assets of a country) in Leontief's inverse matrix, and its denominator is the average of the total of rows in Leontief's inverse matrix, and we can get the country j's IC by Equation (4) .The numerator in Equation (5) is the total columns (the total liabilities of a country) in Leontief's inverse matrix, and the denominator is the average column total in Leontief's inverse matrix, and we can get the country i's SC by Equation (5). Thus, the influence coefficient of country j's assets is the ratio of the total of column j to the column average, and the sensitivity coefficient of country i's liabilities is the ratio of the total of row i with the row average. The two coefficients are based on the average value of the row and column calculated in the inverse matrix. If a country's row or column total is greater than average, the ratio is greater than 1; while if a country's row or column total is lower than average, the ratio is less than 1. The Influence Coefficient of Assets (ICA) indicates that when $IC_j^y > 1$, the influence degree of country j's funds supply to other countries is higher than the average level of the world. When $IC_j^y = 1$, the influence degree of country j's funds supply to other countries equals the average level of global influence. When $IC_j^y < 1$, the influence degree of country j's funds supply to other countries is lower than the average level of global influence. Clearly, if the ICA is higher, the effect of a country's money supply is bigger in the international capital market.

Similarly, the Sensitivity Coefficient of Liabilities (SCL) is indicates that when $SC_i^y > 1$, the sensitivity degree of country i's funds demand to other countries is higher than the average level of the world. When $SC_i^y = 1$, the sensitivity degree of country i's funds demand to other

countries equals the average level of the world. When $SC_i^y < 1$, the sensitivity degree of country i's funds demand to other countries is lower than the average level of the world. Similar to the influence coefficient, if a country exhibits a large sensitivity coefficient, the degree of induced increased funds demand is strong. Conversely, it means that the demand induction of a country for global capital market is relatively weak. According to the above definition of the ICA and SCL, we use the data in Table 11 to calculate the influence coefficient and the sensitivity coefficient for assets and liabilities as of end-December of 2016.

By the two different aspects of the supply and demand of funds, ICA and SCL both serve as an indicator that reflects the funds supply and demand for a country. ICA reflects the limit effect, which includes the indirect effects on the global financial market supply when a country increases its money supply. It is an indicator compared with that from another country, so it is highly correlated with the external assets portfolio. Countries having a high SCL will have an increased tendency to supply funds to other countries (domestic assets) when the demand for funds is increasing, so much depends on the counterparty country's financing needs. In order to observe the situation and impact for using funds in each country, we put the ICA as the horizontal axis, and set SCL in the vertical axis to create a coordinate to analyze the comprehensive effect of countries in the international financial market (Figure 5).

The coordinate in Figure 5 is divided in four quadrants counterclockwise. The ICA and SCL in the first quadrant are higher than the average value (greater than 1). In the second quadrant, the ICA is less than 1 but the SCL is greater than 1. However, in the third quadrant, both ICA and SCL are less than 1, which is below the average. In the fourth quadrant, ICA is greater than 1 but SCL is less than 1. The countries are set in different quadrants as their coordinate can show different influences and inductions in the global financial markets.

Figure 5 demonstrates the following three characteristics. First, the overall distribution of ICA and SCL suggests these two variables have relatively weak negative correlation, and the

degree of change is different. If the ICA exhibited a rising or falling trend, then the SCL would be in non-accordance with ICA changes in terms of having the different scale of any increase or decrease. We have compiled the financial matrix by flow of funds statistics based on domestic sector (W-to-W), but have not found this phenomenon, so it can be considered a unique feature of GFF matrix analysis.
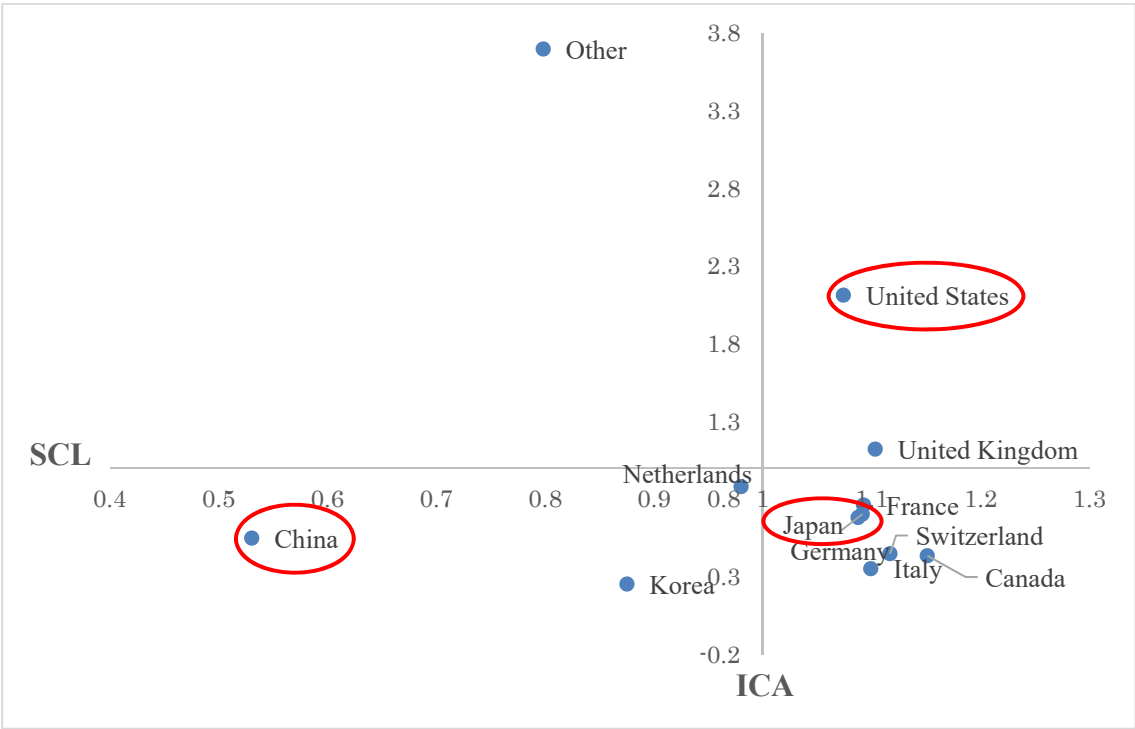

Figure 5. Influence Coefficient of Assets & Sensitivity Coefficient of Liabilities by GFF
(as the end of 2016)

Second, countries' ICA and SCL values have been put in different quadrants, and the ICA and SCL distributions in each quadrant show the different countries' status and influence in the international financial market. The United States and the United Kingdom are located in the first quadrant, indicating that both countries have a strong influence in the international financial market. In particular, the ICA of the United States is 1.074, and its SCL is 2.113, the largest in the world. The United States' total amount of financing raised $20598.67 billion (see Table 11) through the DI, PI and OI, accounting for 19.3% of total global financing; and external

funds used through the DI, PI and OI reached $17102.68 billion (see Table 11), accounting for 16% of global total assets. We can appreciate that the United States' external investment represented a net debt of $3495.99 billion (see Table 11) at the end of 2016.

Compared with Other Economies, Other Economies are located in the second quadrant, which contains many countries but discussion thereof is omitted here for brevity.

The ICA and SCL of China, the Netherlands and Korea are located in the third quadrant. China's ICA and SCL were the lowest, at 0.5213 and 0.5497, respectively, far lower than the international average. China's total amount of financing raised $4120.6 billion through the DI, PI and OI, accounting for 3.8% of total global financing. On the other hand, external funds used through the DI, PI and OI reached $1610.745 billion, accounting for 1.5% of global total assets. That is, when we look at the total assets and liabilities of DI, PI and OI, we can appreciate that China's external investment represented a net debt of $2509.87 billion (see Table 11) at the end of 2016. And we also have been seen that China had net debt of $2722.44 billion at the end of 2015 (see Annex Table 1), which was unexpected. In addition, China's share of global financial markets is still low, and it has not matched its commensurate positon as the world's second-largest economy, which suggests that China has much work to do vis-à-vis opening its capital market to the international financial market.

In addition, Canada, Switzerland, Italy, Germany and Japan were located in the fourth quadrant. The ICA of these countries was greater than 1, but the SCL was below the average level of the observation object countries. The ICA of Japan was 1.113, and its SCL was 0.714 that was put in the second quadrant. By foreign DIs, issuing securities and international bank credit, Japan's financing funds reached $5686.79 billion (see Table 11), accounting for 5.3% of global financing; and through foreign DI, purchasing securities, and international bank credit, Japan holdings of overseas funds reached $7614.33 billion and accounted for 7.1% of total global assets. Japan's external investment represented a net credit of $1927.54 billion (see

Table 11) at the end of 2016.

The third characteristic is used as a reference, namely to specify that the reserve assets listed in the GFF data matrix can be obtained from a balanced comprehensive judgment. From the overall equilibrium point of view, although the ICA and SCL of the United States and UK were placed in the first quadrant, their net financial positions are negative, the United States holds net external debt of $-8.32 trillion (see Table 8), whereas Britain's debt is $-106.75 billion. China's ICA and SCL are lower than the international average, but its foreign reserve assets is the world's largest at $3.98 trillion (see Table 8), for a net foreign position of $1.8 trillion (see Table 8). This shows that China has a strong external payment capacity and is in a strong position to counter international financial risks and also can keep the country's external financial environment relatively stable. However, at the end of 2016, China's external financial investments including DI, PI and OI had have larger net liabilities as shown in Table 8. Contemporary China has experienced gradually increasing financial risk in external financial investment. Accordingly, China needs to improve the statistical monitoring of financial risks and increase market transparency. Moreover, that country also needs to learn the rules of international financial investment and fully grasp the skills of modern financial investment.

As an extension of GFF analysis, we also can use the data of Table 5, Table 6 and Table 7 to calculate the ICA and SCL, and specifically describe the structure, characteristics and financial risk of DI, PI and OI between bilateral countries for more in-depth analysis. However, limited to the length of this paper, this will continue as the future work.

6. Concluding Remarks

The theoretical intention of an economics concept determines its statistical extension. In order to determine the theoretical framework of GFF statistics, this paper discusses the

definition of GFF, clarified the statistical framework for measuring GFF, integrated data sources from the IMF and BIS, and compiled the GFF matrix on a from-whom-to-whom basis. In addition, the paper addressed some important data gaps in currently available macroeconomic statistics. The paper elaborates on the main attributes of integrated macroeconomic accounts and the GFF matrix, which allowed it to serve as the framework for compiling sector accounts, including financial positions and flows on a From-Whom-to-Whom basis. In particular, the GFF integrated framework upholds the following three consistency rules.

The core statistical structure of the GFF for external financial positions and flows focuses on showing not only who does what, but also who does what with whom. In order to observe the risk of international investment and prevent financial crisis, this paper recommends that the GFF statistical method should be popularized in relevant countries with certain statistical basis in future, incorporate the from-whom-to-whom relationship as the main underlying principle for compiling and disseminating external financial positions and flows.

The advantage of using IMF and BIS data to compile a GFF matrix within the integrated SNA framework (as opposed to using fragmentary data from different sources) is that such a framework ensures data consistency for CDIS, CPIS, IIP, IBS, LBS, FFA, and BOP. This thus allows for a systematic understanding of the relationships between economic flows in the real and financial spheres; financial interconnectedness; and linkages between the domestic economic and external economic matrices.

This paper uses a sample of 12 countries, which includes China, Japan and the United States to illustrate actual establishment of the proposed GFF matrix method and summarized the specific sources of data. As an empirical analysis, this paper mainly analyzed the financing of China, Japan and the United States by GFF statistics. We can know the structure relation of fund using and raising on the financing tools and financial scale between China, Japan and the United States, we also can understand the external debt and creditor relationship between China,

Japan and the United States, The United States and Japan is far stronger than that between China and the United States. By using the GFF matrix, this study has calculated influence coefficients of assets and sensitivity coefficients of liabilities, revealed the foreign financing situation of countries and the proportion and relationship in the international financial market. China's ICA and SCL are still lower than the international average. China's external investment has been continuously negative in recent years, and China has experienced gradually increasing financial risk in external financial investment.

This paper suggests that, considering the difficulties countries are likely to face in compiling GFF accounts, implementation could occur in steps depending on a country's current statistical development status, resource requirements, and analytical and policy needs. As GFF statistics are established and improved in the near future, the following steps should also be taken:

(i) To establish GFF statistics, there is a need to integrate data sources that include CDIS, CPIS, IIP, IFS, and BIS statistics, in accordance with the SNA framework. There is likewise a need to set up GFF accounts to connect with the Flow of Funds Account in the SNA. This, however, requires additional external financial positions in new data-collection systems, as described above for GFFS databases.

(ii) As an improvement, this study selects LBS data to replace the used CBS data which have ever used before to establish the GFF matrix. Because there is an obvious difference in the coverage of the CPIS and the CBS. Especially, CBS also includes debt security held by banks, so there are numerous repeated calculations with CPIS. Nevertheless, LBS data is based on the same concept as IIP, and its concept and statistical range are more consistent with that of CDIS, CPIS and IIP.

(iii) Improve the classification of main sectors and instruments. Further details for the main observation countries by subsectors and other economic flows may also be considered.

W-to-W external financial positions, flows for subsectors of the main observation countries, and possibly other economic should be taken into account. Sectors (subsectors) and specific instruments (loans, deposits, DI, PI, OI banks, reserve position in the Fund, and foreign exchange) of financial positions and flows on a from-whom-to-whom basis should ideally move from aggregated subsector and instrument details toward disaggregated subsector and instrument details.

(iv) The BSA and external-sector matrices could potentially be extended to flow data to identify transactions, revaluation changes, and other changes in volume of an asset/liability. This may be an even more challenging task, given that the flow data would need to be broken down by counterpart country, as relevant.

(v) Lastly, based on those needs, it is necessary to improve the accuracy of GFF statistics, and to explore the analysis methods to carry out more detailed and in-depth study and practice using GFF statistics.

Annex Table 1.The GFF matrix of the end of 2015 (millions of US dollars)

Issuer of liability (debtor)	Financial Instruments	Canada	China	France	Germany	Italy	Japan	Korea	Netherlands	Switzerland	United Kingdom	United States	Other	Total of Financial Instruments	Total Liabilities
Canada	Direct investment		14871	5705	9749	1155	15896	2329	64350	8857	24759	280124	127457	555251	2248494
	Portfolio investment		3710	18658	38808	3676	55607	3294	18489	34680	37483	703300	306614	1224319	
	Other investment		7344	15997	21310	1113	40284	1201	7142	6821	62594	200252	104866	468924	
China	Direct investment	11313		23292	66637	7430	151926	61239	31459	12142	18912	78490	2116724	2579564	4112102
	Portfolio investment	19396		10317	5265	418	16630	13955	11795	5417	47982	113816	531419	776410	
	Other investment	7940		24770	16151	1417	42414	36750	5903	2399	46210	27144	545030	756128	
France	Direct investment	3391	2022		63414	15126	15802	1077	80190	76958	71696	71504	258925	660107	5089380
	Portfolio investment	35265	4906		359091	141637	222314	10593	187006	82509	302137	469625	1101541	2916625	
	Other investment	3822	16836		215499	71201	169062	1271	89746	57994	411095	65079	411043	1512648	
Germany	Direct investment	1737	1963	45145		36931	20946	4961	151506	52333	68035	78123	325262	786941	4843074
	Portfolio investment	29426	4999	231018		74816	128649	5155	225401	82766	288405	378630	1351440	2800704	
	Other investment	5000	12640	125375		62699	97428	3151	80112	47328	339249	40904	441543	1255429	
Italy	Direct investment	334	107	59058	23765		3009	399	68319	17731	39444	7565	117352	337083	2222769
	Portfolio investment	6990	1164	263595	183564		53713	1159	45932	9945	131576	106171	492602	1296410	
	Other investment	43	5323	175795	86722		28467	523	18055	7096	99594	5865	161793	589276	
Japan	Direct investment	1160	655	24865	2332	930		3190	24719	8966	13173	51573	39136	170698	3198739
	Portfolio investment	53301	10691	109160	27305	5147		11665	41081	26431	213004	806703	547489	1851976	
	Other investment	14051	22837	149348	16330	404		5204	8257	6456	269298	422609	261270	1176064	
Korea	Direct investment	1500	4669	5315	6921	198	44767		15428	3492	13112	33034	41222	169659	779822
	Portfolio investment	13865	3251	7350	8296	776	25196		10491	10864	37311	171011	139122	427533	
	Other investment	1152	16642	10239	4679	41	33124		0	2248	18086	16300	80119	182630	
Netherlands	Direct investment	8406	22460	131413	170863	88976	50684	2628		256832	364574	790385	2052195	3939415	6781904
	Portfolio investment	16909	2647	259375	228784	47253	118160	4055		70714	177752	412984	552359	1890991	
	Other investment	7273	715	90316	159147	10669	64820	968		22448	262518	52537	280087	951498	
Switzerland	Direct investment	-311		40662	25506	4374	5765		183523		38968	93969	470170	862624	2372187
	Portfolio investment	25486	4105	27053	47986	9867	28919	4320	23601		85498	431068	212426	900329	
	Other investment	1647	1842	63374	71436	6502	23278	693	27250		193611	89858	129743	609234	
United Kingdom	Direct investment	34399	2707	109080	82782	9520	67729	3614	231565	61917		432987	518003	1554303	8506544
	Portfolio investment	77623	12452	239845	198978	67767	171104	16509	114334	78949		1244554	1127021	3349136	
	Other investment	59926	78695	378839	315623	105663	250242	6262	317489	212744		616721	1260901	3603105	
United States	Direct investment	268972	14838	233844	255471	28648	411201	40130	282525	257859	483841		856870	3134199	18110486
	Portfolio investment	748521	111144	245894	320482	84124	1369423	98555	425217	272133	968186		5592270	10235949	
	Other investment	243761	97705	210069	147804	32215	1063809	25480	111646	92177	1096336		1619336	4740338	
Other	Direct investment	307177	452526	381373	423680	113543	374340	51444	1729565	357084	1089795	2140655		13655760	43495286
	Portfolio investment	188559	121761	1117771	1487060	774606	1321977	66613	606882	558235	1489395	4609854		18555376	
	Other investment	163501	331439	835270	1025552	158828	1359164	126130	420347	388117	1742774	1119257		11284150	
Total Asset of Financial Instruments	Direct investment	638078	516818	1059751	1131120	306831	1162065	171011	2863149	1114170	2226308	4058409	13157896	28405605	101760786
	Portfolio investment	1215340	280830	2530037	2905617	1210087	3511692	235872	1710229	1232641	3778730	9447716	18166966	46225757	
	Other investment	508116	592018	2079392	2080253	450752	3172092	207633	1085947	845828	4541365	2656526	8909502	27129424	
Total Asset		2361534	1389666	5669179	6116990	1967670	7845849	614515	5659325	3192638	10546403	16162651	40234364	101760786	
Net Worth		113041	-2722436	579799	1273916	-255099	4647110	-165306	-1122579	820451	2039859	-1947835	-3260921		
Reserve assets		79753	3406112	138154	173684	130770	1232756	367944	38258	606109	129536	383601			
Monetary gold		58	60191	82963	115176	83736	26116	4795	20917	35749	10593	277189			
Special drawing rights		7899	10284	13058	16533	8307	18047	3239	6535	4716	13238	49688			
Reserve position in the fund		2719	4547	4113	5588	3014	9471	1397	1970	1611	4197	17609			
Other reserve assets		69077	3331089	38020	36387	35714	1179122	358514	8836	564032	101509	39115			
Adjustment item		157631	912777	-1132280	165850	-306362	-3064464	-7376	1532163	-813029	-2568368	-5716403			
Net Financial Position		350425	1596453	-414327	1613450	-430691	2815402	195262	447841	613531	-398972	-7280637			

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