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A Flow-of-Funds Analysis of the Japanese Economy: Inequality among Households and among Firms

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Abstract

The first economists who systematically exploited the flow-of-funds accounts were Ragnar Frisch and Paolo Baffi who evaluated the consequences of central bank operations on the financial statements of both financial and non-financial sectors. This paper studies inequality not only among households but also among firms using disaggregated National Accounts of Japan by converting it into a who-to-whom flow-of-funds matrix (payer-payee matrix) based on the ideas proposed by Richard Stone and Lawrence Klein. When the central bank provides a unit of funds through an open market operation, the largest beneficiaries are commercial banks, credit unions, and general government in that order. The largest beneficiaries next to them are large corporations followed by small corporations. Among the households, homeowners and mortgaged homeowners are better off than tenants. We should remember that both the product-flow and funds-flow methods of compiling national accounts have their own strengths and weaknesses.

JEL Codes: C54, C82, E01

Keywords: methods of compiling national accounts, monetary policy, financial system

1. Introduction

Funds was one of the popular academic topics, both in law and economics, at the turn of the nineteenth and twentieth centuries after the excavation at Pompeii of the *tabulae ceratae* (wax-covered tablets) of Lucius Caecilius Iucundus, a first-century *argentarius*¹. *Argentarii*, the ancient Roman equivalent of commercial bankers, were originally a kind of notaries who documented business transactions². The proceeds from sales that were recorded in the *argentarii rationes* (bank ledger) were transferred between the clients of *argentarii* as a means of payment; it was then called *uacua pecunia*, literally meaning ‘virtual currency’, which is the origin of funds as we refer to it today. It was Herbert Davenport (1908, 1913) and Frank Taussig (1911), the alumni of Harvard Law School, who invented the modern concept of funds in relation to the banking operations as summarized in Tsujimura and Tsujimura (2018a). The first economist who made a systematic use of flow-of-funds account was Ragnar Frisch (1935)³. The paper was published as the core of the report prepared by the Monetary Committee of the Norwegian parliament in 1935, which recommended the Norges Bank should start using open market operations in a systematic manner in order to invigorate the credit creation process in the commercial banks. Frisch not only invented the concept of open market operation, the indispensable tool for modern central banking, but also demonstrated the effects of the operations with his three-sector five-instrument model⁴. The three sectors, the central bank, the commercial banks, and the non-bank sector, make and receive payments through five instruments: banknotes, reserve deposits, bank deposits, bank loans, and the open market operations. Paolo Baffi, an assistant professor from Università Bocconi who had been hired by the Banca d’Italia in 1936⁵, evaluated the consequences of central bank operations on the financial statements of various sectors of the economy before and during World War II⁶. His data set christened Bilancio Monetario Nazionale⁷ (National Monetary Balance), which is a depiction of *circolazione monetaria*⁸ or monetary circulation, primarily shows “the distribution of funds between the government and the private sector and the contributions of the various sources. ... The list of these flows serves to complete the picture of central bank money creation and to establish the total of treasury cash drawings other than those derived from taxation and government property, namely, the government’s finance deficit. ... From the detailed statement it may be seen that, against the change in assets of the banks, there are three sources of

¹ The discovery is detailed in De Petra (1876).

² Smith (ed.) (1873), pp. 130-132. The legal aspects of the transactions are thoroughly discussed in Tsujimura and Tsujimura (2021a).

³ English summary of the paper is available in Tsujimura and Tsujimura (2019), pp. 700-701.

⁴ Eitrheim, Klovland and Øksendal (eds.) (2016), p. 371.

⁵ Baffi served as the Governor of the Banca d’Italia between 1975 and 1979.

⁶ De Bonis and Gigliobianco (2012), pp. 29-30.

⁷ Published in Banca d’Italia (1949), pp. 190-191.

⁸ *Ibid.*, p. 192.

finance: (1) the accumulation of funds in savings and time deposit accounts; (2) the creation of bank money as reflected in current accounts; (3) the creation of central bank money, as reflected in the balance of transactions of the banks with the central bank.”⁹

The name ‘flow of funds’ is attributable to *Flow of Funds in the United States 1939-1953*, the first official statistics bore that name, which was published by the Board of Governors of the Federal Reserve System in 1955. In the basic concepts of the Moneyflows Accounts¹⁰, the direct ancestor of the U.S. Flow of Funds Accounts, Wesley Mitchell (1944) and Morris Copeland (1947, 1949, 1952) conceive of the economy as composed of groups of institutional units or institutional sectors; units in each of these sectors make and receive payments to other units in the same and the other sectors. For each sector, a double-entry account is kept with payments classified by the unit and sector making the payment, and the purpose of the payment. The accounts for all institutional sectors for a year are fitted together with each payment reported twice; the basic unit of analysis is a transaction between two parties, payer and payee. Thus, all the transactions are reported four times; that makes quadruple entry¹¹. This part of Moneyflows Accounts is referred to as ‘statement of payments’. The other part of Moneyflows Accounts consists of the financial balance sheets of the institutional sectors. A balance sheet usually is a list of owned assets and owed liabilities; however, a financial balance sheet is a balance sheet that excludes non-financial assets. This part of Moneyflows Accounts is referred to as ‘statement of balances’. The ‘statement of payments’ was omitted from the U.S. Flow of Funds Accounts in 1959 when the Fed started to publish the statistics on a quarterly basis. While ‘statement of payments’ includes both the financial and non-financial transactions, today’s financial accounts do not cover the non-financial payments. It is problematic because the statistics no longer depict the entire circulation of funds throughout the economy. As Stephen Taylor, a prominent economist at the Fed, has remarked, “it is these changes, more than that followed, that may have let Copeland feel that Moneyflows Analysis had been lost somewhere along the way”¹². Copeland’s original idea was completely lost as time passed.

After the Bank of Japan (BOJ) introduced quantitative easing as a policy to the world in 2001, Tsujimura and Mizoshita¹³ (2003) applied input-output methods to analyze the effects of the policy using the formulae proposed by Richard Stone (1966) and Lawrence Klein (1983). The study investigated the effects of each policy option on each sector of the economy while accounting for the lender-borrower relationship among institutional sectors. Some central bankers

⁹ Quoted from Baffi (1957), pp. 317-318.

¹⁰ The world finally departed from the gold standard system in 1971; the Moneyflows Accounts was so called because it was designed during the gold standard era.

¹¹ The terminology first appeared in Copeland (1952), p. 256.

¹² Taylor (1991), p. 104.

¹³ Masako Tsujimura, one of the authors of the present paper.

commented at the XII International Tor Vergata Conference on Banking and Finance held in Rome in December 2003 that it was misleading because the analysis was based on the asset-liability matrix derived from the financial balance sheets, which was published by the BOJ. Their main argument was that the analysis only accounted for the financial market, so that the policy effects on the broader economy, such as on production and employment, were overlooked. The second argument was that the analysis used the lender-borrower relationship rather than the payer-payee relationship so that the secondary-market security transactions were not explicitly contemplated — note that open market operations relate to the secondary market rather than to the primary market. When Tsujimura and Tsujimura (2018a) applied similar analysis to the U.S. quantitative easing, they used newly-developed flow-of-funds matrix reviving the Copeland's original idea of 'statement of payments'. While asset-liability matrix (lender-borrower matrix) is a matrix of stock variables that covers only financial transactions, flow-of-funds matrix (payer-payee matrix) is a matrix of flow variables that includes both financial and non-financial transactions.

Tsujimura (2004)¹⁴ examined inequality among firms, namely big manufacturers, small manufacturers, big non-manufacturers, and small non-manufacturers, using the asset-liability matrices of the fast-growing Japanese economy 1954-1999. The analysis showed that the small companies had difficulty raising funds directly from financial institutions. After the 1970s, the small manufacturers were mainly financed by the big manufacturers as subcontractors. The small non-manufacturers, most of them belonged to either commerce or service industries, were less lucky. They were mostly depending on local credit unions, however, the small non-manufacturers had hard time raising funds after many of the unions found themselves in a financial crisis while the real estate bubble collapsed in the early 1990s. The present paper examines not only the inequality among firms but also among households using a most recent flow-of-funds matrix of Japan rather than an asset-liability matrix. The mountainous character of the country has caused the population to concentrate within the limited plains and lowlands — notably along the Pacific littoral. The increased population there was absorbed into the expanding urban areas, while the population of rural districts declined considerably; this had the effect of further concentrating population in a limited area. Despite the increases in Japan's overall housing stock, housing shortages persist in large metropolitan areas. Even though housing prices fell significantly after the real-estate boom of the late 1980s, the prices of homes in these urban markets continued to far exceed annual incomes. We will divide the household sector into three categories, homeowners, mortgaged homeowners, and tenants, to find out if there is inequality among them.

¹⁴ In Japanese; a partial translation is available in Tsujimura and Tsujimura (2018b).

2. The relationship between Funds and Reserve Funds

Creation of funds (i.e., granting of a bank loan), also known as *creditum* (creation of credit), is an operation in which a bank credits the customer's account with deposit and the customer incurs loan liability; thus, the asset of the customer and the liability of the bank increase by the same amount with the deposit, and also the asset of the bank and the liability of the customer increase by the same amount with the loan (Figure 1) ¹⁵.

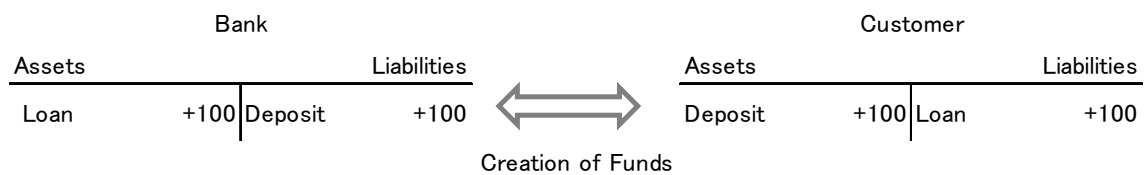


Figure 1. Creation of funds

The created funds eventually disappear as the loan is repaid, or sometimes a bank intentionally withdraw a loan, which is referred to as cancellation of funds. Cancellation of funds is an operation in which the bank debits the customer's account and discharges the customer's loan liability; thus, the deposit of the customer and the corresponding liability of the bank decrease and, at the same time, the loan liability of the customer and the corresponding asset of the bank decrease by the same amount (Figure 2).

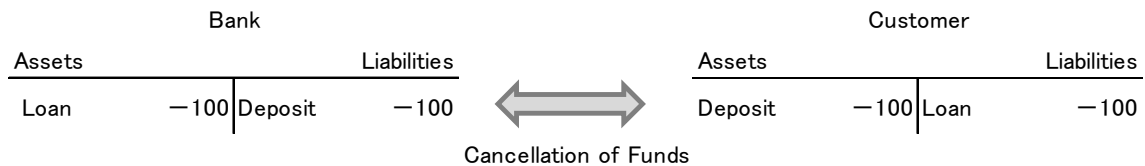


Figure 2. Cancellation of funds

Alternatively, funds are created when a bank purchases a negotiable instrument from its customer, and the funds are cancelled when the instrument is paid; central banks often create funds by purchasing bonds through open market operations. The funds circulate in the economy as a means of payment, which is referred to as transfer of funds. Transfer of funds is a process in which the payer's account is debited and the payee's account is credited for the same amount. If both payer and payee are customers of the same bank, transfer of funds is executed by shifting funds, which

¹⁵ The loan provided by a non-bank lender is often referred to as *mutuum*, in which the lender transfers existing funds in its deposit account to the borrower; thus, no new funds are created.



is also known as in-house transfer. Shifting of funds is a process in which the bank debits the payer's account and credits the payee's account for the same amount (Figure 3).

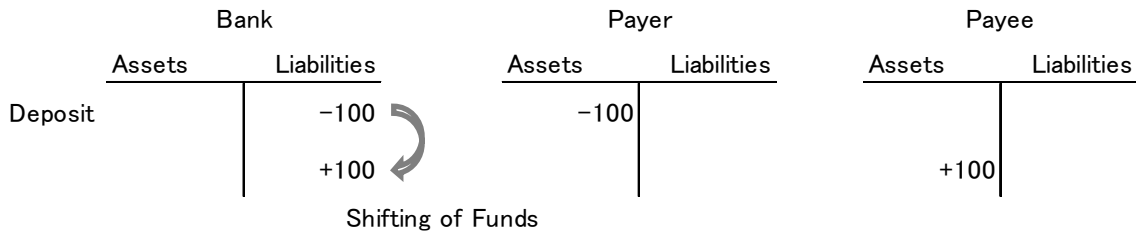


Figure 3. Shifting of Funds

If the payer and the payee have accounts at different banks, transfer of funds involves at least two, but typically three banks: the originator's bank, the intermediary bank (reimbursement bank or clearing bank), and the beneficiary's bank (Figure 4).

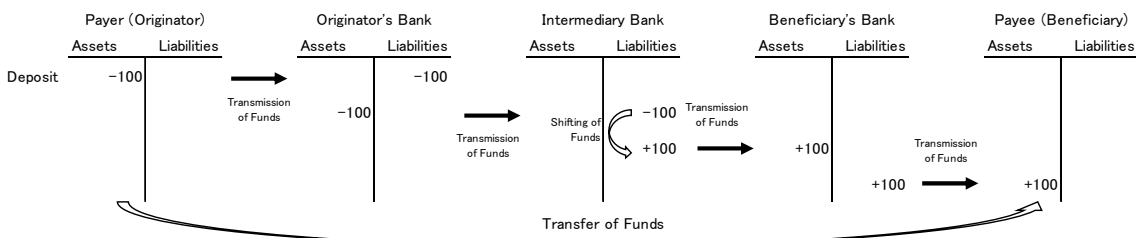


Figure 4. Transfer of Funds

Intermediary bank is a bank that has deposit agreements with both originator's and beneficiary's banks; in many countries, the central bank is assuming the role. While the originator's bank debits the originator's account, the bank requests the beneficiary's bank to credit the beneficiary's account for the same amount; then, the intermediary bank shifts the designated amount from the originator's bank's account to the beneficiary's bank's account.

The funds created by a central bank are referred to as reserve funds; we will call the funds created by depository institutions other than central banks as non-reserve funds when necessary. Reserve funds are mainly held by the financial institutions, such as commercial banks, but also by the government, by the foreign governments and central banks; and also, by the general public in the form of banknotes and coins. In banking terminology, creation of funds is referred to as provision of funds, and intentional cancellation is dubbed as absorption of funds; today's central banks provide and absorb funds mainly through open market operations. Since it is usually a profitable business to purchase bonds from the government and sell them to the central bank, open

market operations create opportunity for the government to issue more bonds; the scheme in which a depository institution sells government bonds in an open market operation is illustrated as Figure 5.

- (1) The central bank provides reserve funds in exchange for the government bonds purchased in the open market operation.
- (2) The depository institution purchases newly-issued bonds from the government using the reserve funds obtained through the open market operation.
- (3) The government makes some payment to a private entity using the newly acquired reserve funds. In this process, a private depository institution creates non-reserve funds, which can be used for day-to-day economic transactions, in exchange for the reserve funds paid by the government.

(1) Open market operation (security purchase)

	The Central Bank		Depository Institution	
	Assets	Liabilities	Assets	Liabilities
Government Bonds	+100		-100	
Reserve Funds		+100	+100	
Non-Reserve Funds				

Creation of Reserve Funds

(2) Purchase of newly-issued bonds

	Government		Depository Institution	
	Assets	Liabilities	Assets	Liabilities
Government Bonds		+100	+100	
Reserve Funds	+100		-100	
Non-Reserve Funds				

Shifting of Reserve Funds

(3) Government's payment to a private entity

	Government		Depository Institution		Private Entity	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Reserve Funds	-100		+100			
Non-Reserve Funds					+100	

Transfer of Funds

Creation of Non-Reserve Funds

Figure 5. Open Market Operation

3. The Data

It is well known that there are two methods of preparing cash flow statements in business accounting: the direct method and the indirect method. While the former directly records the payments and receipts of funds, the latter uses profit and loss statement and the changes between the opening and closing balance sheets as a starting point, and makes adjustments for all transactions to extract necessary information. The indirect method is more popular among business accountants because it is suitable to analyze the causes of the changes in the amount of available funds. Likewise, we use the National Accounts of Japan (JSNA)¹⁶, which includes industry-to-industry input-output table, as the framework of our flow-of-funds accounts, which depict the payments and receipts of each institutional sector. The 2020 JSNA¹⁷ statistics that conforms to SNA 2008 consists of five institutional sectors and the rest of the world; the five sectors are non-financial corporations, financial corporations, general government, households, and non-profit institutions serving households (NPISHs). We have divided financial corporations into four types, using the detailed Financial Accounts published by the Bank of Japan and the financial statements published either by the institution or by the trade association. The subsectors are ‘central bank’, ‘commercial banks’, ‘credit unions’, and the other financial corporations dubbed as ‘insurers, pension funds, etc.’. A credit union is a nonprofit cooperative that is owned by the subscribers who use its financial services. Credit union members can access the same kind of services as offered by a commercial bank, such as deposit accounts and loans. In this study, any nonprofit cooperative that is authorized to provide banking services is categorized as ‘credit union’.

Since the households as a JSNA institutional sector includes unincorporated enterprises, we have removed them using the data available in the Unincorporated Enterprise Survey before grouping the households into three categories, homeowners, mortgaged homeowners, and tenants, using the Family Income and Expenditure Survey¹⁸. The gross profit or loss of unincorporated enterprises known as ‘mixed income’ is directly transferred to the entrepreneurs’ households because the enterprises are supposed to have no assets or liabilities of their own. We have categorized the non-financial corporations with a capital of JPY 100 million (approx. USD 970 thousand or EUR 787 thousand as of end 2020) or more as large corporations; otherwise, they are classified as small corporations. The source data are available in the Financial Statements Statistics of Corporations by Industry compiled by the Ministry of Finance. The large and small corporations as well as the unincorporated enterprises are further sorted into three industries: primary (I), secondary (II), and tertiary (III). Primary industry includes agriculture, forestry, and

¹⁶ Prepared by the Cabinet Office of Japan.

¹⁷ Since 2020 is a census year in Japan, some additional data are available.

¹⁸ Both survey data are published by the Statistics Bureau of Japan.

fishery; secondary industry consists of manufacturing, construction, and mining; all other industries are categorized as tertiary. The proportions obtained from 2005 Input-Output Table by the Size of Enterprise¹⁹ have been used where data are not directly available elsewhere.

The production account is the starting point for the sequence of JSNA accounts for the institutional sectors displaying how income is generated, distributed and used throughout the economy. The generation of income account shows the sectors and industries in which the primary incomes originate, as distinct from the sectors destined to receive such incomes. The allocation of primary income account shows where the items payable in the generation of income account are receivable and also includes the amounts of property incomes receivable and payable by institutional sectors. The secondary distribution of income account shows how the balance of primary incomes of an institutional sector is transformed into its disposable income by the receipt and payment of current transfers. Disposable income, the balancing item carried forward from the account, less final consumption expenditure is referred to as saving. Saving, being the balancing item of the distribution of income account is the starting element of the capital account. The capital account records transactions linked to acquisitions of non-financial assets and capital transfers involving the redistribution of wealth. The financial account records transactions in financial assets and liabilities for each financial instrument. The identity between the balancing items of the capital account and the financial account is an important feature of the set of the accounts as a whole; what is borrowed by one unit must be lent by another and vice versa.

We have excluded all the balancing items and the transactions that involve no actual payment except for 'mixed income' in the preparation of \mathbf{P} and \mathbf{R} matrices. Both the payment matrix \mathbf{P} , whose summary is presented in Table 1, and the receipt matrix \mathbf{R} shown in Table 2 consist of 19 institutional sectors and 82 categories of transactions including 'mixed income' and the 'dummy instruments' explained in the next paragraph. 'Residential Rent', which is treated as production of service in the SNA 2008, is classified as an independent transaction category in this study. Since \mathbf{P} depicts payments while \mathbf{R} represents the corresponding receipts, the row sum of the former is equivalent to that of the latter. However, the total payment of a sector does not necessarily match the total receipt of the sector so that either surplus of funds (ψ_i) or deficiency of funds (ρ_i) is calculated as the difference: $\psi_i > 0$ and $\rho_i = 0$ if total receipt of the sector is larger than total payment; $\rho_i > 0$ and $\psi_i = 0$ if total payment of the sector is larger than total receipt, where i ($i = 1, \dots, m$) stands for institutional sector. If the non-banking sector in total has surplus of funds, it means the banking sector²⁰ has provided the amount of funds:

¹⁹ Prepared by the Small and Medium Enterprise Agency of Japan.

²⁰ The banking sector includes 'central bank', 'commercial banks', and 'credit unions'.

$\sum_{NonBanking} \psi_i = \sum_{Banking} \rho_i$. If the non-banking sector in total has deficiency of funds, it denotes that the

banking sector has absorbed the funds: $\sum_{NonBanking} \rho_i = \sum_{Banking} \psi_i$.

Two methods of converting \mathbf{P} and \mathbf{R} matrices into a who-to-whom matrix were proposed independently by Richard Stone (1966) and Lawrence Klein (1983). As Tsujimura and Mizoshita (2003) proved it using financial balance sheets, the Stone and Klein formulae can be used as a pair because the two methods are mathematically symmetrical. While the Klein formula uses the payment portfolio, the Stone formula applies the receipt portfolio to distribute the payments among institutional sectors on the pro rata basis. We have used dummy rows where who-to-whom information is readily available. Just for example, if we know the amount of mortgage loans provided by ‘credit unions’ to ‘mortgaged homeowners’, we add a row that records solely this transaction so that the amount is correctly recorded at the exact cell in the flow-of-funds matrix; the technique is known as ‘dummy instrument method’²¹. The flow-of-funds matrices (payer-payee matrices) \mathbf{Y}^S and \mathbf{Y}^K , and the corresponding coefficient matrices \mathbf{C}^S and \mathbf{C}^K , where the superscripts stand for Stone- and Klein-formula respectively, are obtained in the following manner:

$$\mathbf{C}^S = \mathbf{D}^S \mathbf{B}^S \quad \text{where} \quad \mathbf{B}^S = \mathbf{R} \hat{\mathbf{T}}^{-1} \quad \text{and} \quad \mathbf{D}^S = \mathbf{P}' (\hat{\mathbf{T}}^P)^{-1}; \quad (1)$$

$$\mathbf{C}^K = \mathbf{D}^K \mathbf{B}^K \quad \text{where} \quad \mathbf{B}^K = \mathbf{P} \hat{\mathbf{T}}^{-1} \quad \text{and} \quad \mathbf{D}^K = \mathbf{R}' (\hat{\mathbf{T}}^R)^{-1}; \quad (2)$$

$$\mathbf{Y}^S = \mathbf{C}^S \hat{\mathbf{T}}; \quad \mathbf{Y}^K = \mathbf{C}^K \hat{\mathbf{T}}. \quad (3)$$

$\hat{\mathbf{T}}^P$, $\hat{\mathbf{T}}^R$ and $\hat{\mathbf{T}}$ are diagonal matrices whose elements are row sum of \mathbf{P} , row sum of \mathbf{R} , and the column sum of \mathbf{P} and \mathbf{R} including ψ_i and ρ_i , respectively; the apostrophe denotes transpose. In the Stone-formula flow-of-funds matrix \mathbf{Y}^S , the rows denote payers, and the columns represent payees. In the Klein-formula flow-of-funds matrix \mathbf{Y}^K , the columns denote payers, and the rows represent payees. The two matrices are symmetrical about the diagonal, $\mathbf{Y}^K = (\mathbf{Y}^S)'$ if $\hat{\mathbf{T}}^P = \hat{\mathbf{T}}^R$, however, the coefficient matrices are not necessarily symmetric, i.e.,

$\mathbf{C}^K \neq (\mathbf{C}^S)'$. The conversion procedure is detailed in Sections 4 and 5 of Tsujimura and Tsujimura (2018a). The Stone-formula flow-of-funds matrix is presented in Table 3, in which the vector of surplus of funds $\boldsymbol{\psi}$ whose elements are ψ_i is a vertical vector while the vector of deficiency of funds $\boldsymbol{\rho}$ whose elements are ρ_i is a horizontal vector.

²¹ Tsujimura and Tsujimura (2018b), p. 18.

4. Flow of Funds Analysis

4.1 Surplus or Deficiency of Funds

‘Surplus of funds’ means either an increase in deposit or repayment of loan; ‘deficiency of funds’ means withdrawal of deposit often after getting new credit. In 2020, the banking sector provided new funds that amounted to JPY 142 trillion. While the ‘central bank’ and the ‘credit unions’ provided JPY 158 and 175 trillion of funds respectively, the ‘commercial banks’ absorbed as much as JPY 191 trillion. Although the ‘general government’ heavily subsidized pandemic-hit households and businesses during the year, it marked surplus of JPY 45 trillion because it successfully raised JPY 89 trillion through bond issuance at negative interest rate. ‘NPISHs’ had neither significant surplus nor deficiency of funds. Among the households, the ‘homeowners’ and ‘mortgaged homeowners’ had JPY 44 and 38 trillion surpluses, while the ‘tenants’ suffered a deficiency of funds amounting to JPY 61 trillion. The ‘unincorporated enterprises’ of all three industries had gross loss in their operation during the pandemic, which were incurred by the owner’s households. Although primary- and secondary-industry ‘small corporations’ managed to generate surpluses of JPY 1 and 24 trillion respectively, tertiary-industry ‘small corporations’ incurred deficiency of funds totaling JPY 64 trillion during the pandemic year. In any of the three industries, ‘large corporations’ failed to make significant surplus of funds: JPY 1 trillion for primary, 2 trillion for secondary, and 8 trillion for tertiary industry. The ‘rest of the world’ accumulated JPY 91 trillion of surplus, which means that the Japanese economy in total had deficiency of funds in 2020.

4.2 Triangulation

Triangulation of a matrix is a technique to rearrange its rows and columns in the same order so that the maximum number of non-zero cells fall below the diagonal running from the upper left corner to the lower right corner. Tsujimura and Tsujimura (2021b) have applied this technique to the flow-of-funds matrix of the United States. In the hierarchical order of an economy with a strictly triangular Stone-formula flow-of-funds matrix, the sectors below are payers and the sectors above are payees. The flow of funds between institutional sectors are usually bidirectional rather than unidirectional so that, following the example of the above literature, we have offset the payments from sector ‘ i to j ’ and ‘ j to i ’ before triangulation:

$$\tilde{y}_{ij} = y_{ij} - y_{ji} \quad (i, j = 1, \dots, m) ;$$
$$\check{y}_{ij} = \begin{cases} 1 & \text{if } \tilde{y}_{ij} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (i, j = 1, \dots, m) ;$$

where y_{ij} , \tilde{y}_{ij} , and \check{y}_{ij} are the elements of $m \times m$ matrices \mathbf{Y} , $\tilde{\mathbf{Y}}$, and $\check{\mathbf{Y}}$, respectively.

Let \mathbf{z}_C be a vector whose elements are the number of non-zero cells in each column of $\check{\mathbf{Y}}$; and \mathbf{z}_R be a vector whose elements are the number of non-zero cells in each row of the matrix. We further define

$$\mathbf{z} = m \cdot \mathbf{i} - \mathbf{z}_C + \mathbf{z}_R = m \cdot \mathbf{i} - \check{\mathbf{Y}}' \mathbf{i} + \check{\mathbf{Y}} \mathbf{i} ;$$

where \mathbf{i} is a unit vector. Matrix \mathbf{Y} is triangulated by sorting the rows and columns in the ascending order of z_i , which is the i th element of vector \mathbf{z} .

Table 4 shows the triangulation order of the Stone-formula flow-of-funds matrix, whose rows are payers and columns are payees. The sectors in the lower part (right-hand side) of the triangle (table) receive net payments from limited number of sectors and make net payments to numerous sectors; in other words, they are the principal payers in the economy. Meanwhile, the sectors in the upper part (left-hand side) of the triangle (table) receive net payments from many sectors but make net payments to limited number of sectors; they are the principal recipients. ‘Central bank’ is at the bottom of the triangle meaning that it is not only the last-resort provider of funds to the financial institutions, but also pay a lot to the non-financial sectors for printing and transporting banknotes, etc. ‘NPISHs’, which receives funds mainly from ‘general government’ and distribute it to the public, is second from the bottom. Among the business enterprises, ‘unincorporated enterprises’ stay mainly at the lower part of the triangle. The small businesses, especially ‘unincorporated enterprises’ belonging to the tertiary industry, which is positioned just above ‘NPISHs’, such as mom-and-pop stores and restaurants, are indispensable in keeping funds flowing throughout the economy. Tertiary-industry ‘small corporations’, which is fifth from the bottom of the triangle, are also playing an important role in keeping funds circulating; even small family businesses are often incorporated in Japan. Among ‘large corporations’, only those belonging to the secondary industry, which is at the middle of the triangle, are contributing to the flow of funds in the economy, by outsourcing jobs to subcontractors. For example, Toyota, an auto manufacturer, has more than 38 thousand subcontractors in Japan alone. Primary- and tertiary-industry ‘large corporations’ as well as primary- and secondary-industry ‘small corporations’ are in the upper part of the triangle implying that they have little to do with the circulation of funds.

Homeownership is the decisive factor to determine the position of households in the triangle. While ‘tenants’ is the fourth sector from the bottom, ‘homeowners’ and ‘mortgaged homeowners’ are at the middle of the triangle. Although ‘general government’ is net payers to the households regardless of homeownership in Japan in which 30% of the population are pensioners, the government is third from the top of the triangle. ‘General government’ was a net receiver from most of the sectors in 2020 when the pandemic hit the country; while subsidy payments increased

substantially, many public works were canceled²². Most of the sectors are net payers to the rest of the world in a country that lacks natural resources so that it is at the top of the triangle. The domestic sector at the uppermost of the triangle is ‘commercial banks’, which have been busy withdrawing credit during the pandemic year. In sharp contrast to this, ‘credit unions’ remained at the lower side of the triangle; they eagerly helped keeping small businesses afloat during COVID-19 shutdowns. ‘Insurers, pension funds, etc.’ is at the middle of the triangle bypassing funds from the banking sector to the households.

4.3 The Consequences of Provision of Funds

As we have mentioned in Section 2 above, new funds are solely provided by the banking sector, which consists of ‘central bank’, ‘commercial banks’ and ‘credit unions’. The consequences of the provision of funds could be evaluated in the following manner using the Klein formula expressed in Equation (2). Let Ω be a $m \times m$ matrix whose elements are $\omega_i = 1$ for the banking sectors, and 0 elsewhere; thus Ω means that a unit of funds is provided by each type of the banks. The funds provided by the banking sector are distributed among each category of transactions according to its payment portfolio represented by the i th column of the payment matrix \mathbf{P} , i.e., $\mathbf{B}^K \Omega$, which is then redistributed among the institutional sectors proportional to the rows of the receipt matrix \mathbf{R} , i.e., $\mathbf{D}^K \mathbf{B}^K \Omega$. Since a recipient of the funds increases its payment unless the sector hoards the funds as deposit, the provision of funds creates a series of payments until the last cent is hoarded. The sequence of the payments is written as $\mathbf{D}^K \mathbf{B}^K \mathbf{D}^K \mathbf{B}^K \dots \mathbf{D}^K \mathbf{B}^K \Omega$ so that the total payment $\zeta_{v \rightarrow \infty}$ created by the provision of funds is expressed in the following manner:

$$\begin{aligned}
\zeta_{v \rightarrow \infty} &= \Omega + \mathbf{D}^K \mathbf{B}^K \Omega + (\mathbf{D}^K \mathbf{B}^K)^2 \Omega + (\mathbf{D}^K \mathbf{B}^K)^3 \Omega + \dots + (\mathbf{D}^K \mathbf{B}^K)^v \Omega \\
&= \left\{ \mathbf{I} + \mathbf{D}^K \mathbf{B}^K + (\mathbf{D}^K \mathbf{B}^K)^2 + (\mathbf{D}^K \mathbf{B}^K)^3 + \dots + (\mathbf{D}^K \mathbf{B}^K)^v \right\} \Omega \\
&= (\mathbf{I} - \mathbf{D}^K \mathbf{B}^K)^{-1} \Omega \\
&= (\mathbf{I} - \mathbf{C}^K)^{-1} \Omega.
\end{aligned} \tag{4}$$

$\Gamma^K = (\mathbf{I} - \mathbf{C}^K)^{-1}$ is the Klein-formula Leontief inverse, which is a depiction of the propagation process of payment²³. The Leontief inverse, which is traditionally used to describe an inter-industry input-output structure of an economy, is a useful tool to analyze a flow-of-funds structure

²² The Tokyo Olympic Games 2020 were postponed for one year.

²³ See Tsujimura and Tsujimura (2011), Section 2.2, for details including the sufficient condition for the existence of the Leontief inverse.

as well²⁴.

Table 5, which represents $(\mathbf{I} - \mathbf{C}^K)^{-1} \mathbf{\Omega}$ or the columns of the banking sectors of the Leontief inverse, shows total amount of payment each sector ultimately receives when each type of banks provides a unit of funds to its customer. When ‘central bank’ provides a unit of funds through either an open market operation or a lending, the largest beneficiaries are ‘commercial banks’, ‘credit unions’, and ‘general government’ in that order. The largest beneficiaries next to them are secondary- and tertiary-industry ‘large corporations’ followed by tertiary-industry ‘small corporations’. Among the households, ‘homeowners’ and ‘mortgaged homeowners’ are better off than their ‘tenant’ counterparts whose share is less than a half. When ‘commercial banks’ provide a unit of funds, the largest recipients are their fellow ‘commercial banks’, and ‘credit unions’; most funds are redistributed through the interbank market rather than directly to the non-banking sectors. ‘General government’ is the third, followed by secondary- and tertiary-industry ‘large corporations’ and tertiary-industry ‘small corporations’. Again, ‘tenants’ are less benefited than ‘homeowners’ and ‘mortgaged homeowners’. When ‘credit unions’ create a unit of credit, the funds circulate within their own circle, however, also spills into ‘commercial banks’ and ‘general government’. Both ‘commercial banks’ and ‘credit unions’ not only invest heavily in ‘government bonds’ but also lend a significant amount to the local governments. Despite the fact that ‘credit unions’ seldom lend directly to ‘large corporations’, they are still benefiting from the unions more than ‘small corporations’ and ‘unincorporated enterprises’. ‘Unincorporated enterprises’ as well as ‘tenants’ are completely left outside of the Japanese financial system.

As it is apparent from Equation (4) above, the columns of the banking sectors of the matrix $\mathbf{B}^K (\mathbf{I} - \mathbf{C}^K)^{-1} \mathbf{\Omega}$ shown in Table 6 represent the total amount of each type of transaction produced in a sequence of payments originated from the provision of a unit of funds. According to the table, ‘compensation of employees’ and ‘household final consumption expenditure’ will increase 0.51 and 0.41 respectively when ‘central bank’ provides a unit of new funds; non-financial transactions and financial transactions will increase 3.78 and 4.80 in total. Since the flow-of-funds matrix is comparable to SNA, we can also predict the growth rate of GDP, or GDE to be exact, by summing up final consumption expenditures, capital formation, changes in inventories, and exports less imports; GDP will increase 1.78 as a result of a unit provision of funds by ‘central bank’. A unit provision of funds by ‘commercial banks’ and ‘credit unions’ will ultimately produce GDP amounting to 1.27 and 1.47 respectively.

²⁴ The application of the Leontief inverse to a flow-of-funds analysis is thoroughly discussed in Tsujimura and Tsujimura (2021b), Section 4.2.

5. Concluding Remarks

We have experimentally constructed a who-to-whom flow-of-funds matrix to evaluate the distributive impact of monetary policy both on the households and on the firms in the framework of the SNA 2008. The accounting framework, which SNA 2008 is based on, “is the product-flow method of compiling national accounts, whereby the total supplies and uses of individual types of goods and services have to be balanced with each other.”²⁵ On the other hand, funds-flow method of national accounting, the basis for the flow-of-funds matrix, records “who has paid and who has received how much on account of various types of transactions or objects of payment.”²⁶ The difference between the two methods is obvious. For example, in SNA 2008, “the purchases of goods for resale by wholesalers and retailers are not recorded by these units explicitly, and they are viewed as selling, not the goods, but the services of storing and displaying a selection of goods in convenient locations and making them easily available for customers”²⁷; thus, our flow-of-funds analysis must have underestimated the contribution of the wholesalers and retailers in terms of macroeconomic circulation of funds.

There are several conceptual differences between the product-flow and funds-flow methods of compiling national accounts²⁸. While in the product-flow method, the observation units are economic entities such as households and business establishments, in the funds-flow method, the units are legal entities such as individuals and corporations, because the latter is more closely related to the legal status such as debtor and creditor. While the product-flow method is on the accrual basis, the funds-flow method is on the cash basis because the latter records the transfer of funds at the time of the transfer. While the product-flow method is on the current-cost basis²⁹, the funds-flow method is on the historical-cost basis because the latter records the amount of funds that has actually changed hands. While the product-flow method defines income as products, which is the value added obtainable in the supply and use tables, the funds-flow method defines income as earnings, which is equivalent to the increase in net worth³⁰. While ‘income as earnings’, the funds-flow definition of income, includes realized capital gain and loss, ‘income as product’, the product-flow definition, excludes such gains and losses. Since the realized capital gain or loss is distributed from one sector to another through current payments along with income from other

²⁵ SNA 2008, 1.24.

²⁶ Copeland (1947), p. 31.

²⁷ SNA 2008, 3.68.

²⁸ See Tsujimura and Tsujimura (2012), Section 3, for more details. The paper was prepared for the 32nd General Conference of the IARIW held in Boston in August 2012. The authors would like to thank Peter van de Ven, the chair, and Soli Peleg, the discussant, for their useful comments and constructive suggestions.

²⁹ Opportunity-cost or replacement-cost to be more precise; SNA 2008, 1.65.

³⁰ Lindahl (1933) compares four alternative definitions of income: ‘income as earnings’, ‘income as produce’, ‘income as interest’, and ‘income as consumption’. Income as produce is widely known as ‘income as product’ today.

sources, it could be problematic; for example, a financial institution that has incurred capital loss during a financial crisis might cut salaries or dismiss employees. The same argument applies to the reuse of consumer goods; ‘income as earnings’ includes the proceed from sale of used goods, which is excluded from ‘income as product’.

Nowadays, most payments are made electronically so that we can collect real-time who-to-whom flow-of-funds data directly from payment data exchange systems, such as the Single Euro Payments Area (SEPA) and U.S. Automated Clearing House. It is time to build a new data-gathering system that will automatically visualize the macroeconomic payment flows; such a system will make it possible for policy makers as well as for market participants to develop effective surveillance and timely responses in a financial crisis like the one that has hit the world in 2008-09. However, as a final word, let us stress that, both the product-flow and funds-flow methods of compiling national accounts have their own strengths and weaknesses. We should remember that the SNA 1968, which has introduced the product-flow method, then known as commodity-flow method, to the world, rapidly gained popularity among national accountants during the 1973-74 economic crisis that was caused by the supply shortages of oil and grains. What we need is two sets of national accounts rather than just one.

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Table 1. Payment matrix (2020, Billion yen)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		Central bank	Commercial banks	Credit unions	Insurers, pension funds, etc.	General government	NPISHs	Households (Homeowners)	Households (Mortgaged homeowners)	Households (Tenants)	Unincorporated enterprises I	Unincorporated enterprises II	Unincorporated enterprises III	Small corporations I	Small corporations II	Small corporations III	Large corporations I	Large corporations II	Large corporations III	Rest of the world	Total	
Non-financial Transactions	1 Intermediate consumption	37	1360	2854	6433	20520	4469	0	0	0	6708	4249	10638	953	77892	90877	124	144719	71933	0	443766	
	2 Household final consumption expenditure	0	0	0	0	0	0	89831	96842	45615	0	0	0	0	0	0	0	0	0	0	0	232288
	3 Government final consumption expenditure	0	0	0	0	113185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113185
	4 Public capital formation	0	0	0	0	30918	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30918
	5 Private non-residential capital formation	0	772	384	1465	0	442	0	0	0	955	80	361	386	4823	11610	37	13046	18671	0	53031	
	6 Private residential capital formation	0	557	277	1056	221	411	227	4233	12714	2450	205	927	294	3676	8850	28	9944	14232	0	60302	
	7 Goods for resale	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	41	0	0	0	55
	8 Exports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	84931	84931
	9 Imports	0	63	149	2250	0	0	0	0	0	1805	730	728	256	18983	8093	33	45892	7959	0	86941	
	10 Compensation of employees	58	3419	596	5758	29597	10941	0	0	0	899	383	4422	1286	35237	100455	131	35691	54372	0	283246	
	11 Taxes on production and imports	0	17	154	228	147	350	0	0	0	0	313	1071	0	5729	13880	0	10374	10883	0	43147	
	12 Interest	666	10309	7089	2717	8031	18	394	1158	217	0	0	0	14	281	775	1	307	1095	9796	42867	
	13 Distributed income of corporations	0	228	1687	4321	0	0	0	0	0	0	0	0	1	585	1700	14	8777	14292	5439	37045	
	14 Investment income disbursements	0	0	0	10229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10229
	15 Rent on land, etc.	1	37	18	68	375	23	4	3	243	0	0	0	11	392	1675	1	418	1902	0	5170	
	16 Residential rent	0	0	0	0	0	0	914	703	61261	0	0	0	0	0	0	0	0	0	0	0	62878
	17 Current taxes on income, wealth, etc.	281	1254	573	2491	0	0	9984	14949	5379	0	0	1	39	2804	5910	13	5212	7289	0	56181	
	18 Social benefits	0	16	3	9114	69234	503	0	0	0	0	0	0	4	215	443	0	216	273	0	80022	
	19 Employers social contributions	6	485	84	815	2730	364	0	0	0	0	52	223	158	6729	16852	16	4760	8464	0	41739	
	20 Households' social contributions	0	0	0	0	0	0	13873	19461	7002	0	0	0	0	0	0	0	0	0	0	0	40336
	21 Other current transfers	0	48	782	5564	124762	84	5877	7175	3054	2	1	4	35	712	1656	3	1907	3297	0	154963	
	22 Net acquisitions of land, etc.	0	51	0	0	1166	299	199	0	0	0	0	0	14	236	1967	2	128	913	0	4975	
	23 Capital transfers	0	176	50	1510	4752	0	1268	1125	257	0	0	0	1	102	195	1	215	262	0	9912	
	24 Mixed income	0	0	0	0	0	0	9949	0	1423	0	0	0	0	0	0	0	0	0	0	0	11372
Financial Transactions	25 Loans	75631	47320	442837	43951	4763	219	7290	198	1006	0	0	0	125	4778	8689	1	1335	2703	27416	668260	
	26 Debt securities	50923	584256	364165	13860	1790	1503	347	207	221	0	0	0	2	41	457	0	20758	3302	26952	1068782	
	27 Equities	6236	1504	3842	10851	4638	124	1964	1169	1248	0	0	0	16	957	7146	9	5359	10978	646	56687	
	28 Insurance and pension reserves	0	0	0	1359	0	0	1582	2210	688	0	0	0	0	0	0	0	0	0	0	0	5840
	29 Other accounts receivable/payable	25085	38883	6975	25950	16242	453	938	456	592	0	0	0	2381	5992	8029	4	21262	85500	110	238850	
	30 Surplus of funds ϕ	0	191440	0	12783	45367	9	44294	38144	0	0	0	0	1131	23533	0	877	1619	7853	90576	457627	
31 Total	158924	882196	832520	162772	478438	20211	188936	188032	140920	12818	6013	18374	7109	193711	289257	1293	331981	326173	245866	4485545		

Notes: Compiled by authors. Source data are detailed in Sections 3.

Table 2. Receipt matrix (2020, Billion yen)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Central bank	Commercial banks	Credit unions	Insurers, pension funds, etc.	General government	NPISHs	Households (Homeowners)	Households (Mortgaged homeowners)	Households (Tenants)	Unincorporated enterprises I	Unincorporated enterprises II	Unincorporated enterprises III	Small corporations I	Small corporations II	Small corporations III	Large corporations I	Large corporations II	Large corporations III	Rest of the world	Total
1 Intermediate consumption	0	5817	4484	7050	1081	1171	0	0	0	7664	819	3964	4027	51027	57861	822	144387	96034	57558	443766
2 Household final consumption expenditure	0	4232	7315	5130	1198	4020	0	0	0	3781	1198	5808	1987	21254	45836	406	63588	48590	18803	232288
3 Government final consumption expenditure	0	0	0	0	97479	452	0	0	0	0	0	416	0	0	3848	0	0	10546	444	113185
4 Public capital formation	0	0	0	0	0	0	0	0	0	0	382	88	0	16022	1649	0	9560	2486	733	30918
5 Private non-residential capital formation	0	0	0	0	0	0	0	0	0	131	410	0	69	19482	0	14	28057	0	4869	53031
6 Private residential capital formation	0	0	0	0	0	0	0	0	0	0	324	710	0	13433	14545	0	6829	21908	2553	60302
7 Goods for resale	0	0	0	0	0	0	0	0	0	8	0	0	4	0	9	1	0	31	3	55
8 Exports	0	60	584	1330	0	220	0	0	0	80	255	418	42	15996	8758	9	47834	9346	0	84931
9 Imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86941	86941
10 Compensation of employees	0	0	0	0	0	0	96153	135723	51370	0	0	0	0	0	0	0	0	0	0	283246
11 Taxes on production and imports	0	0	0	0	43020	0	0	0	0	110	0	0	0	16	0	2	0	0	0	43147
12 Interest	0	3936	6473	14954	5567	117	4764	1380	706	0	0	0	56	551	1355	1	1799	1207	0	42867
13 Distributed income of corporations	63	2442	3273	8210	2281	174	4421	1281	655	0	0	0	161	1580	3884	4	5157	3461	0	37045
14 Investment income disbursements	5	62	100	228	0	2	6801	1970	1008	0	0	0	1	6	14	0	19	13	0	10229
15 Rent on land, etc.	0	0	0	0	17	58	1848	923	480	0	0	52	0	0	0	0	0	1732	60	5170
16 Residential rent	0	0	0	0	100	0	2725	1360	708	0	0	77	0	0	0	0	0	57909	0	62878
17 Current taxes on income, wealth, etc.	0	0	0	0	56181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56181
18 Social benefits	0	0	0	0	0	0	48130	20546	11346	0	0	0	0	0	0	0	0	0	0	80022
19 Employers social contributions	0	0	0	8582	33157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41739
20 Households' social contributions	0	0	0	2039	38297	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40336
21 Other current transfers	14	1064	1976	4186	90872	11165	10535	14745	5178	0	0	0	59	1111	4556	4	3686	3473	2337	154963
22 Net acquisitions of land, etc.	0	0	108	87	0	0	0	1273	3508	0	0	0	0	0	0	0	0	0	0	4975
23 Capital transfers	0	280	279	491	3725	20	226	316	111	0	0	0	20	369	1513	1	1224	1153	184	9912
24 Mixed income	0	0	0	0	0	0	0	0	0	1045	3485	6843	0	0	0	0	0	0	0	11372
25 Loans	0	494395	44960	35410	4997	1358	9721	6108	1584	0	0	0	316	10286	19806	7	6749	25497	7067	668260
26 Debt securities	0	361527	554677	40556	78467	1233	301	179	191	0	0	0	1	290	1350	0	4534	20692	4785	1068782
27 Equities	352	61	1316	23806	2447	0	1167	695	742	0	0	0	16	1251	9599	9	5516	9576	135	56687
28 Insurance and pension reserves	0	2	0	5218	0	0	217	303	94	0	0	0	0	0	1	0	0	4	0	5840
29 Other accounts receivable/payable	546	8318	31904	5495	19552	221	1928	1228	2515	0	0	0	336	41054	50789	12	3043	12516	59393	238850
30 Deficiency of funds ρ	157944	0	175072	0	0	0	0	0	60725	0	0	0	0	0	63885	0	0	0	0	457627
31 Total	158924	882196	832520	162772	478438	20211	188936	188032	140920	12818	6013	18374	7109	193711	289257	1293	331981	326173	245866	4485545

Notes: Compiled by authors. Source data are detailed in Sections 3.

Table 3. Stone-formula flow-of-funds matrix (2020, Billion yen)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Surplus of funds ϕ	Total
	Central bank	Commercial banks	Credit unions	Insurers, pension funds, etc.	General government	NPISHs	Households (Homeowners)	Households (Mortgaged homeowners)	Households (Tenants)	Unincorporated enterprises I	Unincorporated enterprises II	Unincorporated enterprises III	Small corporations I	Small corporations II	Small corporations III	Large corporations I	Large corporations II	Large corporations III	Rest of the world		
1 Central bank	0	77403	10751	17224	21603	8	111	59	32	0	0	1	71	259	868	1	1179	5478	23875	0	158924
2 Commercial banks	9	4438	596858	15692	36579	88	2453	5501	874	3	7	35	43	3614	5449	3	1769	8024	9319	191440	882196
3 Credit unions	5	703172	1795	41609	17086	1995	11113	2644	1956	3	4	57	298	10802	20420	2	4693	7579	7287	0	832520
4 Insurers, pension funds, etc.	265	45332	9845	12959	12958	697	16501	9372	4501	8	14	137	97	3597	7026	6	5018	13789	7869	12783	162772
5 General government	189	9140	4698	9880	177362	9614	61854	44969	21139	9	403	829	139	20559	19626	8	17919	27372	7360	45367	478438
6 NPISHs	0	140	1623	305	838	21	4036	5463	2274	26	12	53	14	744	901	3	1617	1519	611	9	20211
7 Households (Homeowners)	5	4804	3219	7197	28066	2081	555	711	425	2376	3183	8234	775	8620	18532	158	25695	22555	7453	44294	188936
8 Households (Mortgaged homeowners)	2	2132	3484	7013	38826	2201	690	782	302	1576	203	2429	835	11626	19877	170	28231	21509	7998	38144	188032
9 Households (Tenants)	1	1351	1764	3422	14488	1027	2989	1681	833	873	689	2095	392	12027	9751	80	16666	67021	3768	0	140920
10 Unincorporated enterprises I	0	45	35	54	10	9	305	431	163	1175	44	46	617	2080	750	126	2911	1181	2837	0	12818
11 Unincorporated enterprises II	0	35	27	54	361	7	130	184	69	189	12	25	99	702	378	20	1737	622	1361	0	6013
12 Unincorporated enterprises III	0	192	148	279	1283	39	1501	2119	802	145	27	137	75	1416	2029	15	2881	3343	1942	0	18374
13 Small corporations I	1	137	163	108	313	7	459	635	262	168	5	9	88	953	1009	18	488	308	848	1131	7109
14 Small corporations II	90	3087	827	3101	14993	237	12565	17290	6865	3478	212	508	1874	12701	8023	373	33930	16546	33478	23533	193711
15 Small corporations III	229	6075	2283	7494	36231	572	36002	49688	20427	1272	217	1285	736	12294	19911	136	30359	41489	22557	0	289257
16 Large corporations I	0	2	2	10	30	0	47	65	26	22	0	1	12	27	22	2	58	34	55	877	1293
17 Large corporations II	65	4155	8343	9638	22663	390	13857	17923	7093	1193	489	812	661	35895	23604	129	77073	31925	74452	1619	331981
18 Large corporations III	100	8584	8600	12538	32729	711	21961	27941	11848	223	237	1263	180	38670	55994	30	28111	35806	32795	7853	326173
19 Rest of the world	17	11970	2983	14195	22019	505	1808	575	303	80	255	418	103	17124	11203	12	51646	20073	0	90576	245866
Deficiency of funds ρ	157944	0	175072	0	0	0	0	0	60725	0	0	0	0	0	63885	0	0	0	0		
Total	158924	882196	832520	162772	478438	20211	188936	188032	140920	12818	6013	18374	7109	193711	289257	1293	331981	326173	245866		

Note: Obtained from Tables 1 and 2.

Table 4. Triangulation order of the Stone-formula flow-of-funds matrix (2020, Billion yen)

Order	Sectors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Rest of the world	Commercial banks	Large corporations I	General government	Small corporations II	Large corporations III	Small corporations I	Households (Mortgaged homeowners)	Insurers, pension funds, etc.	Large corporations II	Unincorporated enterprises I	Households (Homeowners)	Credit unions	Small corporations III	Unincorporated enterprises II	Households (Tenants)	Unincorporated enterprises III	NPISHs	Central bank
1	Rest of the world	0	2651	0	14659	0	0	0	0	6327	0	0	0	0	0	0	0	0	0	0
2	Commercial banks	0	0	0	27439	527	0	0	3368	0	0	0	0	0	0	0	0	0	0	0
3	Large corporations I	43	0	0	21	0	5	0	0	3	0	0	0	0	0	0	0	0	0	0
4	General government	0	0	0	0	5566	0	0	6143	0	0	0	33788	0	0	42	6651	0	8776	0
5	Small corporations II	16353	0	345	0	0	0	922	5664	0	0	1398	3944	0	0	0	0	0	0	0
6	Large corporations III	12721	560	0	5358	22124	0	0	6432	0	0	0	0	1021	14505	0	0	0	0	0
7	Small corporations I	745	94	7	174	0	128	0	0	11	0	0	0	0	273	0	0	0	0	0
8	Households (Mortgaged homeowners)	7423	0	105	0	0	0	201	0	0	10308	1145	0	841	0	20	0	310	0	0
9	Insurers, pension funds, etc.	0	29640	0	3078	496	1251	0	2358	0	0	0	9304	0	0	0	1079	0	392	0
10	Large corporations II	22807	2387	71	4744	1965	3815	173	0	4620	0	0	0	3651	0	0	0	0	0	0
11	Unincorporated enterprises I	2757	42	104	1	0	958	450	0	47	1718	0	0	32	0	0	0	0	0	0
12	Households (Homeowners)	5645	2351	111	0	0	594	315	21	0	11839	2071	0	0	0	3053	0	6732	0	0
13	Credit unions	4304	106315	0	12388	9975	0	135	0	31764	0	0	7894	0	18137	0	192	0	372	0
14	Small corporations III	11354	626	114	16605	4271	0	0	29811	468	6755	522	17470	0	0	0	10676	0	0	0
15	Unincorporated enterprises II	1106	29	20	0	490	385	94	0	40	1248	145	0	23	161	0	0	0	0	0
16	Households (Tenants)	3466	477	54	0	5163	55173	130	1379	0	9573	710	2564	0	0	620	0	1293	0	0
17	Unincorporated enterprises III	1523	157	14	454	908	2080	66	0	142	2069	99	0	91	744	1	0	0	0	0
18	NPISHs	106	52	2	0	506	808	7	3263	0	1227	17	1954	0	330	5	1247	14	0	0
19	Central bank	23858	77394	1	21414	169	5378	70	57	16958	1115	0	106	10746	639	0	31	0	8	0

Note: Obtained from Table 3.

Table 5. Total amount of payment each sector ultimately receives when each type of banks provides a unit of funds to its customer.

		Central bank			Commercial banks			Credit unions
1	Commercial banks	1.992	1	Commercial banks	2.854	1	Credit unions	2.830
2	Credit unions	1.516	2	Credit unions	2.004	2	Commercial banks	2.578
3	General government	1.063	3	General government	0.732	3	General government	0.822
4	Central bank	1.002	4	Large corporations II	0.452	4	Large corporations II	0.528
5	Large corporations II	0.643	5	Large corporations III	0.426	5	Large corporations III	0.494
6	Large corporations III	0.599	6	Small corporations III	0.334	6	Small corporations III	0.396
7	Rest of the world	0.570	7	Rest of the world	0.327	7	Rest of the world	0.378
8	Small corporations III	0.429	8	Households (Homeowners)	0.280	8	Insurers, pension funds, etc.	0.331
9	Insurers, pension funds, etc.	0.398	9	Small corporations II	0.277	9	Households (Homeowners)	0.329
10	Households (Homeowners)	0.371	10	Insurers, pension funds, etc.	0.274	10	Small corporations II	0.325
11	Small corporations II	0.370	11	Households (Mortgaged homeowners)	0.269	11	Households (Mortgaged homeowners)	0.310
12	Households (Mortgaged homeowners)	0.357	12	Households (Tenants)	0.114	12	Households (Tenants)	0.132
13	Households (Tenants)	0.153	13	NPISHs	0.031	13	NPISHs	0.037
14	NPISHs	0.041	14	Unincorporated enterprises III	0.025	14	Unincorporated enterprises III	0.029
15	Unincorporated enterprises III	0.034	15	Unincorporated enterprises I	0.017	15	Unincorporated enterprises I	0.020
16	Unincorporated enterprises I	0.023	16	Small corporations I	0.010	16	Small corporations I	0.012
17	Small corporations I	0.013	17	Unincorporated enterprises II	0.008	17	Unincorporated enterprises II	0.010
18	Unincorporated enterprises II	0.011	18	Large corporations I	0.002	18	Central bank	0.002
19	Large corporations I	0.002	19	Central bank	0.001	19	Large corporations I	0.002

Note: Obtained from Klein–formula flow–of–funds matrix.

Table 6. Total amount of each type of transaction produced in the sequence of payments when each type of banks provides a unit of funds to its customer.

		Central bank	Commercial banks	Credit unions	
Non-financial Transactions	1	Intermediate consumption	0.815	0.596	0.698
	2	Household final consumption expenditure	0.410	0.308	0.359
	3	Government final consumption expenditure	0.252	0.173	0.195
	4	Public capital formation	0.069	0.048	0.053
	5	Private non-residential capital formation	0.095	0.071	0.082
	6	Private residential capital formation	0.100	0.075	0.086
	7	Goods for resale	0.000	0.000	0.000
	8	Exports	0.197	0.113	0.131
	9	Imports	0.163	0.118	0.138
	10	Compensation of employees	0.510	0.381	0.443
	11	Taxes on production and imports	0.075	0.055	0.065
	12	Interest	0.097	0.088	0.098
	13	Distributed income of corporations	0.073	0.052	0.062
	14	Investment income disbursements	0.025	0.017	0.021
	15	Rent on land, etc.	0.009	0.007	0.008
	16	Residential rent	0.070	0.052	0.060
	17	Current taxes on income, wealth, etc.	0.103	0.077	0.090
	18	Social benefits	0.180	0.124	0.141
	19	Employers social contributions	0.074	0.056	0.065
	20	Households' social contributions	0.072	0.054	0.063
	21	Other current transfers	0.335	0.234	0.266
	22	Net acquisitions of land, etc.	0.008	0.006	0.007
	23	Capital transfers	0.021	0.015	0.017
	24	Mixed income	0.021	0.016	0.019
Financial Transactions	25	Loans	1.613	1.367	1.819
	26	Debt securities	2.455	2.865	3.061
	27	Equities	0.136	0.074	0.088
	28	Insurance and pension reserves	0.012	0.009	0.010
	29	Other accounts receivable/payable	0.585	0.374	0.408
Total non-financial transactions		3.775	2.737	3.165	
Total financial transactions		4.801	4.689	5.387	
Δ GDP		1.775	1.266	1.466	

Note: Obtained from Klein-formula flow-of-funds matrix.