Money Stock $\simeq$ Total Domestic Debts
– Theory of Debt Money –

JFRC Working Paper No. 04-2019*

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**JEL Codes:** E51 Money Supply, Credit, Money Multipliers
E42 Monetary Systems, Standards, Government and Monetary System and Payment Systems

**Keywords:** Accounting System Dynamics (ASD), Macroeconomic Model, Flow of Funds, Money Stock, Government Debts

**Abstract**

Our economies currently operate under the debt money system in which money is issued as interest-bearing debt. The purpose of this paper is to present the following three findings of debt money system in Japanese economy: (i) money stock $M_3$ approximately equals total domestic debts, (ii) time deposits $M_T$ approximately equals debts of private sectors (producers and households), and (iii) money stock $M_1$ approximately equals...
government debts. To calculate money stock and domestic debts we utilized the Flow of Funds Account (FFA) published by the Bank of Japan. FFA is a collection of time-series data on financial transactions (flows) and stocks, consisting of 51 rows (transactions) and 45 columns (sectors), totaling 2,295 cells in the FFA matrix. Its annual data between 1980 - 2017 includes a total of 87,210 data points. We claim that the first finding is observed in any economy under the debt money system by performing numerical balance sheet analyses of six macroeconomic sectors: central bank, banks, government, producers, households and overseas.

Our second and third findings may be specific to Japanese economy. We claim that Japan’s lost three decades (1992 to the present) is caused by the destruction of private debts, and government debts of GDP equivalent amount to fill in this gap during these decades failed to drive the economy out of recession.

Results from the empirical analysis render the conventional macroeconomic theory questionable; that is, savings leaked from money circulation become sources of investment. Conversely, we claim that investment is made by bank loans first, which then ends up in savings accounts later.

Our research then poses that debt money system has a built-in system design failures that cause (i) boom and bust, (ii) accumulation of government debts and (iii) income inequality. In summary all the above findings may be worth being called as debt money theory.
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</tbody>
</table>
Introduction

When Robert H. Hemphill, who was a credit manager at the Federal Reserve Bank of Atlanta at the time, understood the debt money system under fractional reserve requirement in the midst of the great economic difficulty, he wrote down the following forward to Irving Fisher’s book on full-reserve banking system proposal [3, 1935]:

Neither the banker nor the borrower ordinarily realize that a loan just completed, is putting into circulation that much new money ...
If all bank loans were repaid, no one would have a bank deposit, and there would not be a dollar of currency or coin in circulation.
This is a staggering thought. We are completely dependent on the commercial banks. Someone has to borrow every dollar we have in circulation, cash or credit.

 Monetary system constitutes critical infrastructures. Albeit qualitatively, money creation tied to private financial business was a central part of analysis by Mises [9, 1912], the Chicago school economists [7, 1995] and Fisher on the economic instability in the 1930’s [2, 1932] [1, 1933] [3, 1935] and other leading economists in the U.S [4, 1939]. However, macroeconomic textbooks written in later years and literatures on banking and finance presented divergent views on the role of banks in the economy [10, 2015]. Large portion of general equilibrium family of models developed since 1970’s over-simplified and abstracted away the fundamental role of money and credit creation under the fractional reserve system [6, 2017]. Econometric models are often used in short-term forecasts and tend to pay less inquiries into system structures of the real-world from which dynamic behaviors are observed to be generated. Money creation in the economy still seems equivocal topic to students, and remain largely uninteresting for the general public despite its significance and relevance to a wide range of policy discussions. These situations partially reflects possible absence of introductory material on the topic.

In this paper, we explore the process of money creation by revisiting the definition of defining first in section 1. We then analyze the macroeconomic relationship between debts and money stock by fully utilizing the Flow of Funds Account by the Bank of Japan in section 4, followed by our findings on domestic debts, money stock and GDP in section.

1 Classification of Money

Media of Money

Money is information of value of goods, services, capital, labor, etc. exchanged in markets. Table 1 shows the classification of money from Chapter 17 by Yamaguchi [11, 2019]. A first column classifies various type of media widely utilized
in human history. Latest addition to this is a permission-less blockchain (distributed ledger) since 2008. Blockchain-based money is covered in Yamaguchi & Yamaguchi [12, 2017].

### Classification of Money (after the Year 2008)

<table>
<thead>
<tr>
<th>Media</th>
<th>Public Money</th>
<th>Debt Money</th>
<th>Functional-Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-metal</td>
<td>Shell, Cloth (Silk)</td>
<td>Woods, Stones, etc</td>
<td></td>
</tr>
<tr>
<td>Commodities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Coinage</td>
<td>Non-precious Metal Coins</td>
<td>Gold, Silver &amp; Copper Coins</td>
<td>Metal Ingots (such as Gold)</td>
</tr>
<tr>
<td>Paper Notes</td>
<td>Public Money Notes by PM Admin.</td>
<td>Goldsmith Certificates</td>
<td>Central Bank Notes</td>
</tr>
<tr>
<td>Digital Cards &amp; Accounts</td>
<td>Digital Public Money (PM)</td>
<td>Digital Cash</td>
<td>Central Bank Digital Currency (CBDC)</td>
</tr>
<tr>
<td>(After 2008)</td>
<td>&lt; EPM &gt;</td>
<td>&lt; CBCC &gt;</td>
<td>&lt; Crypto-coin &gt;</td>
</tr>
<tr>
<td>Blockchain &amp; Distributed Ledgers</td>
<td>Electronic Public Money issued by PM Admin. (Peer-to-Peer PM)</td>
<td>Central Bank Cryptocurrency (issued as Base Money)</td>
<td>Bitcoin and approx. 1,000 Altcoins</td>
</tr>
<tr>
<td></td>
<td>&lt; Crypto-token (as Notes) (as Deposits) &gt;</td>
<td>· $M_1$-backed Bank token: MUFG coin (Japan)</td>
<td>· $M_1$-backed Non-Bank token: Zen token (Japan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· $M_0$-backed EPM token (cash)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Classification of Public Money and Debt Money

### Public Money vs Debt Money

On the other hand, columns 2 and 3 classify money into public money and debt money. Public money is the money issued at interest-free by public organizations such as the governments, while debt money is a type of money issued at interest by private institutions. Current types of money are dominated by debt money issued by private banks, including central bank note and reserves. As shown in more detail below, public money issued as government coins constitutes negligible portion of total money in circulation.

In this table, bank deposits are classified as functional-money under the debt money column, which means it is not legal tender such as government coins and bank notes. It only functions as money to the effect that its receipts can be rejected whenever its recipients suspect its credibility as bank deposits.

Under the current debt money system among almost all countries, money consists of government coins, bank notes and bank deposits. Hence, debt money becomes our focus of analysis in this paper.
2 How Money is Created by Debts

2.1 Demand Deposits as Origin of All Debt Money

We claim that except government coins all types of debt money are created by bank loans as debts. Amount of loans made by individual banks in a given period are determined by internal and external factors such as risk attitudes, demand for loans, perceived profitability which is a function of various costs associated to lending including wholesale funding rates. Expectations are formed from locally available information, and fed into a complex process of asset liability management decisions within each banking institutions. In addition to controlling interest rate, central bank such as the Bank of Japan had utilized another policy tool called the window guidance where the central bank decided on credit quotas for each banks.\footnote{Former employees at the Bank of Japan and other observers asserted the critical role of the window guidance played in the determination of overall deposit/credit creation by the banking sector during a period of financial investment boom in Japan and eventually asset price bubble in the latter half of 80’s, though these observations were not acknowledged by the BoJ itself in its official policy notes.}

Yamaguchi&Yamaguchi [13, 2016] examined two different views of bank lending transactions by building simple ASD (Accounting System Dynamics) models, and called them ”flow and stock approaches” of intermediation theory and credit creation theory of banking, respectively. The flow approach describes that bank loans are made out of excess cash/deposits held by banks prior to the transaction. In the stock approach, new loans are made first as creation of new deposits, then banks look for reserves to meet the legal reserve requirement. At the macroeconomic level of money creation, both approaches are shown to be equivalent. However, the fundamental feature of the stock approach at macroeconomic analysis is that money stock can be shown straightforwardly to expand as a direct result of loans to non-banking sectors including the government.

Therefore, money stock is better explained to be created first as checkable/transferable deposits (which are interchangeably called demand deposits in this paper). Demand deposits are withdrawn by depositors according to their needs for payment in cash. To meet the customer’s demand for cash, banks withdraw cash from their own deposits or reserves held at the central bank. On the other hand, non-banking sectors such as financial institutions other than banks, producers and households may hold excess amount of checkable/transferable deposits in their bank accounts. They may occasionally save their fraction of transferable deposits to time/savings deposits for higher interest earnings. In this way, every unit of money created from bank loans exists in the form of cash, demand and time deposits. As borrowers repay their debts to banks, the corresponding amount of deposits are destroyed from their balance sheets and money stock decreases.

In an economy operating under the current fractional reserve system, creation and destruction of money occur concurrently. This is how stock approach of bank lending describes money creation process and life cycle of money. Fig-
Figure 1: Monetary Aggregates & Life Cycle of Money

Figure 1 shows definition of monetary aggregates thus defined, and how they shifts from one form of money to another as a result of need and preference on each types of liquidity available under the current financial system. This diagram adopts conventional notations of stock-flow diagram used in system dynamics modeling. Box indicates stock/level variables, which either accumulates or depletes by the flow variables denoted by bi-directional arrows. Clouds connected to arrows indicates that source of contents in stock variable are out of current analysis, meaning it is out of boundary of the system in question. In this specific diagram thick black arrows indicate flow of existing amount of money, whereas blank arrows indicate flows of money that directly increase/decrease base money and money stock.

Based on Figure 1, let us newly define money stocks as illustrated in Figure 2.

\(M_0\) consists of Government Coins (Public Money), Bank Notes and Bank Reserves at the Central Bank. This type of money is simultaneously regarded as legal tender in the sense that no one cannot reject its receipts. It is called base money or monetary base.

\(M_1\) consists of Government Coins, Bank Notes and Demand Deposits that can be used daily as means of payments or transactions. Demand deposits are created out of nothing by depositing a fraction of total demands as
reserves at the central bank. Thus, a fractional reserve banking system is institutionalized under the current debt money system.

$M_f$ is demand deposits less reserves, which is created out of nothing by bank loans and only functions as money for payments during a normal period of economic activities. In case of bank run this amount of deposits fails to be withdrawn because of the non-availability of its corresponding base money. Thus, it is called functional money. The reader may cynically regard this type of deposits as fictitious or fake money.

$M_T$ is the amount of demand deposits that leaked out of circulation. It is equivalent of time deposits, which yields higher interest but with a fixed period of time at the cost of liquidity.

$M_3$ consists of $M_1$ and $M_T$ and constitutes the whole amount of money available in the economy. In many countries this amount of money stock is called $M_2$. In Japan, deposits of Postal Savings used to be excluded from the amount of $M_2$. Hence, the total amount of deposits including Postal Savings needs to be additionally defined as $M_3$.

Now our new definition of money stocks are summarized in equations as below:
\[ M_0 = \text{Government Coins + Bank Notes + Reserves (Legal Tender)} \quad (1) \]
\[ M_1 = \text{Government Coins + Bank Notes + Demand Deposits} \]
\[ = \text{Government Coins + Bank Notes + Reserves + Functional Money} \]
\[ = M_0 \text{ (Base Money) + } M_f \text{ (Functional Money)} \quad (2) \]
\[ M_3 = M_1 + \text{Time Deposits (} M_T \) \]
\[ = M_0 \text{ (Base Money) + } M_f \text{ (Functional Money) + } M_T \text{ (TimeDeposits)} (3) \]

Figure 3 illustrates behaviors of money stocks between 1980 and 2018. Government Coins is denoted by line 1, Bank notes by line 2, Reserves by line 3, Base Money \( M_0 \) by line 4, Functional Money \( M_f \) by line 5, and Money Stock \( M_1 \) by line 6, respectively.

\[ M_0 + M_f = M_1 \text{ in Japan (1980 - 2018)} \]

Figure 4 illustrates behaviors of all money stocks between 1980 and 2018. Base Money \( M_0 \) by line 4, Functional Money \( M_f \) by line 5, and Money Stock \( M_1 \) by line 6; up to this point, line numbers are the same as in Figure 3. Then, Time Deposits \( M_T \) is denoted by line 2, and Money Stock \( M_3 \) by line 1, respectively.

Table 2 indicates decomposition values of \( M_1 \) and \( M_3 \), respectively. Note that public money of government coins is negligible amount of 0.6% of money stock \( M_1 \), and 0.3% of money stock \( M_3 \). Yet, it is essential to understand that interest-free government coins (we call them public money) manage to survive even under the system of debt money at interest! Functional money that cannot be converted to legal tender in a time of bank runs is close to 40% of \( M_1 \). In other words, this is the amount of money created out of nothing, which endogenously
Table 2: Money Stock & its Composition in Japan (2018)

<table>
<thead>
<tr>
<th>Money Stock</th>
<th>Trillion Yen</th>
<th>(% of M₁)</th>
<th>(% of M₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coins (Public Money)</td>
<td>4.8</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Bank Notes</td>
<td>107.6</td>
<td>12.9</td>
<td>7.6</td>
</tr>
<tr>
<td>Reserves</td>
<td>393.9</td>
<td>47.4</td>
<td>27.6</td>
</tr>
<tr>
<td>Base Money M₀</td>
<td>506.3</td>
<td>60.9</td>
<td>35.5</td>
</tr>
<tr>
<td>Functional Money Mᵢ</td>
<td>324.9</td>
<td>39.1</td>
<td>22.8</td>
</tr>
<tr>
<td>Money Stock M₁</td>
<td>831.2</td>
<td>100.0</td>
<td>58.3</td>
</tr>
<tr>
<td>Time Deposits MᵢT</td>
<td>594.5</td>
<td></td>
<td>41.7</td>
</tr>
<tr>
<td>Money Stock M₃</td>
<td>1,425.8</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

increases or decreases, depending on our economic activities, causing booms and bust. To stabilize the economy, Mᵢ needs to be eliminated; that is Mᵢ = 0, so that banks cannot create money out of nothing. This was the original idea of monetary reform called the Chicago Plan.
3 Numerical Analysis of $M_f$ with Balance Sheet

3.1 Macroeconomic Cosmos of Six Sectors

Let us first look at our economy from the highest level of its aggregation conceptually\(^2\). Figure 5 below illustrates balance sheets of six macroeconomic sectors: central bank, commercial banks, the government, producers (non-financial corporations), households and overseas. By looking at changes in their balance sheets, Flow of Funds Account to be discussed below attempts to inclusively look at our national economy by describing inter-sector transactions among these six aggregate sectors. Therefore, Flow of Funds in our economy can be thought of as transactions between institutions within and across sectors. In other words, these six sectors constitute the simplest cosmos of macroeconomy in which behaviors of economic system emerge.

Processes of money creation in our macroeconomy can be described in its simplest form by using the worksheet format shown in Figure 5.

\(^2\)This section is mainly excerpted from Section 2 of our sister paper: Money Stock Equals Total Debts by Banks Under Debt Money System – Theory and Flow of Funds Analysis in Japan, presented at the 37th International Conference of the System Dynamics Society, Alburquerque, New Mexico, July 22-25.
Quadruple-Entry Bookkeeping

In accounting system each transactions are recorded with double-entry bookkeeping rules for financial reporting and business management. Similarly, for any transaction in macroeconomic analysis, each transaction reflects changes in respective accounts of at least two or four involved sectors due to the need for tracing flow of funds between sectors. This is known as double double-entry or quadruple-entry bookkeeping, which theoretically ensures balances in accounts of all sectors involved in every transaction in the economy, and equality in the amount of transaction items appearing in asset and liability sides. The former rule is referred to as balance sheet test and the latter as flow of funds test, respectively. These tests are applied to our numerical examples of the following worksheets.

Payments through Deposits Transfer

All inter-sector transactions represents flows of funds in the national economy. Payments are made through transfer of deposits from one sector to another. Therefore, existing deposits are decreased from payers account while corresponding amounts are increased in payees account following the quadruple bookkeeping rule.

3.2 Producers going into Debt

Transaction steps of producers are listed as below.

Transactions of Producers

1. Producers request 1,000 million yen of bank loan as Debts (Producers).
2. Banks approve the loan applications, open deposits account for producers and make loans by crediting 1,000 million yen. Simultaneously, Producers receive 1,000 million yen as Demand Deposits (P) as assets.
3. Banks borrow 10 (=1,000 x 0.01) million yen from Central Bank as CB Debts to meet the required reserve ratio of 1%.
4. Producers pay, out of their Demand Deposits (P) account, wages of 970 million yen to households and interest of 30 million yen to banks (3% interest rate per year).
5. Banks process these payment requests from Producers by transferring to households Demand deposits (H) account and to their interest earnings (Equity) respectively.
6. Banks pay dividends to shareholders. Shareholders of banks are called bankers and also belong to households sector. Demand Deposits (of Bankers) account.
In step 1, producers incur debts by taking loans while corresponding amount of deposits are credited to their bank account, thereby increasing the balance-sheets of banks. Figure 6 illustrates change in balance-sheets as a result of these transactions.
3.3 Households going into Debt

Transaction steps of households are listed as below. Figure 7 illustrates the balance sheets from these transactions.

Transactions of Households

<table>
<thead>
<tr>
<th>Central Bank</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>Liabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserves</td>
<td>10</td>
</tr>
<tr>
<td>G Bonds</td>
<td>G Deposits</td>
<td></td>
</tr>
<tr>
<td>CB Loans</td>
<td>10</td>
<td>Equity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Banks</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>Liabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserves</td>
<td>10</td>
</tr>
<tr>
<td>Bank Loans</td>
<td>1,000</td>
<td>CB Deposits</td>
</tr>
<tr>
<td></td>
<td>Demand Deposits</td>
<td>970</td>
</tr>
<tr>
<td></td>
<td>(P)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demand Deposits</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>(H)</td>
<td></td>
</tr>
<tr>
<td>G Bonds</td>
<td>-970</td>
<td>Costs (Wages)</td>
</tr>
<tr>
<td></td>
<td>-30</td>
<td>Income</td>
</tr>
<tr>
<td></td>
<td>(of Bankers)</td>
<td>30</td>
</tr>
<tr>
<td>Time Deposits</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interest</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Dividends</td>
<td>-30</td>
</tr>
</tbody>
</table>

| (Start with Debts (H) of 1,000 million yen) |
|---|---|---|
| Government | Assets | Liabilities |
| | G Deposits | Debts (G) |
| | Equity | |
| | G Expenditures | Interest |

<table>
<thead>
<tr>
<th>Producers</th>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Dep.</td>
<td>970</td>
<td>Debts (P)</td>
</tr>
<tr>
<td></td>
<td>Equity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>970</td>
</tr>
<tr>
<td></td>
<td>Costs (Wages)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interest</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Households</th>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Deposits</td>
<td>1,000</td>
<td>Debts (H)</td>
</tr>
<tr>
<td>(H)</td>
<td>-970</td>
<td></td>
</tr>
<tr>
<td>(of Bankers)</td>
<td>30</td>
<td>Equity</td>
</tr>
<tr>
<td>Time Deposits</td>
<td>Income (Interest)</td>
<td>-30</td>
</tr>
<tr>
<td>Houses</td>
<td>970</td>
<td>Dividends (Bankers)</td>
</tr>
</tbody>
</table>

Figure 7: Money Creation by Bank Loans - Households
1. Households decide to purchase houses and request 1,000 million yen of Loans from Banks as Debts (Households)

2. Banks approve the applications, open Demand Deposits account for households, then make loans of 1,000 million yen.

3. Banks borrow 10 (=1,000 x 0.01) million yen from Central Bank to meet the required reserve ratio of 1%.

4. Households can now readily use Demand Deposits account for payments and pay 970 million yen to producers.

5. Households incur debt obligation and pay interests of 30 million yen on their loans to banks (interest rate of 3% per year).

6. Banks process these requests for payments by Households by transferring to producers’ deposits account and interest earnings to their Equity.

7. Banks pay dividends out of their Equity to bankers (households)’s demand deposits account.

3.4 Government going into Debt

Transaction steps of the government are listed as below. Figure 8 illustrates the balance sheets from these transactions.

Transactions of Government

1. Government issues Bonds worth of 1,000 million yen as Debts (G) in Liability in order to finance its deficits.

2. Banks underwrite those newly issued Bonds of 1,000 million yen out of their Reserves at Central Bank.

3. Central Bank processes the payment request by transferring 1,000 million yen from Bank’s Reserves to G Deposits accounts at the central bank.

4. Government is ready to use Deposits at the central bank for its expenditure. Specifically it pays welfare subsidies of 970 million yen to households and interest of 30 million yen on the bonds held by banks (3% interest rate).

5. Central Bank and Banks transfer subsidies from the Government to households deposits account through Reserves account, and interest to their Equity.

6. Banks borrow 10 (=1,000x0.01) million yen from Central Bank to meet the required reserve ratio of 1%.

7. Banks pay dividends out of their Equity to bankers (households)’s demand deposits account.
### Observations

Reserves of banks decreased as a result of investment in government bonds at transaction step 3. All of these payment transactions are reflected in the liability side of central bank’s balance sheet. Hence, no money creation occurs when bank lend their money to the government in the form of investment in...
government bonds.

However, as in cases of bank loans to producers and households, bank lending to the government will eventually lead to creation of new deposits once the government spend back as its expenditures to producers and households (transaction step 5 above). Money stock, or more precisely M1 in Figure 1, increases at this stage.

3.5 Central Bank’s Operation of Purchasing Assets

Let us now consider a case where central bank perceives the need for monetary easing and conducts market purchase operation. Market operations by central bank essentially purchase existing financial assets held by financial institutions such as banks. This result in injection of additional liquidity into bank’s reserve accounts at the central bank. Transaction steps of central bank are listed as below.

Transactions of Central Bank

1. Central Bank purchases G Bonds of 600 million yen from banks.

2. Government divides interest payment of 30 million yen on its bonds according to its holding ratio: 12 million yen goes to banks and 18 million yen goes to central banks respectively.

3. Eventually those interest earnings are payed out as dividends to shareholders. 18 million yen goes to Central Bankers’ demand deposits out of central bank’s Equity.

4. 12 million yen goes to Bankers’ demand deposits out of banks’ Equity.

Figure 9 illustrates all changes in balance-sheets as a result of these transactions.

Observations

Only the Bank’s Reserves held at the central bank increase as a result of purchase operation by 600 million yen while money stock remained unaffected in step 1. Therefore purchase/withdrawal operation by the central bank directly affects base money shown in Figure 1. Only after step 3 and 4 did money stock increase slightly as independent from market operations.

3.6 Money Stock equals Total Debts

By considering numerical transactions, we have looked at how money stock increases as non-banking sectors going into debt with banks. Figure 10 summarizes final values aggregated from each sectors to analyze relationship between debts and money stock. It is shown that total debts in the economy, 3,000 million yen, equals the sum of money in the economy, that is, money stock of
Figure 9: Money Creation by Purchase Operation of Assets

3,000 million yen. As explained at the beginning of this Section, demand deposits are first created as bank loans, and held by different sectors as a result of inter-sector transactions.
4 Analyzing Flow of Funds in Japan

To examine our insights gained from our numerical examples on the relationship between money stock and amount of debts by banks in the economy, we look into the case of Japanese economy since 1980 in this section through the Flow of Funds statistics by the Bank of Japan.

4.1 Flow of Funds Statistics of Japan

Flow of Funds Account (FFA) statistics has been compiled and published by the Bank of Japan on quarterly basis. It is known to be one of the most comprehensive data set available for financial accounts data in the world. Due to the data availability, and richness of supplementary guides on the statistics provide by the BoJ, we decided to consider it as a point of reference for Flow of Funds analysis in the current research. FFA is provided in a matrix format available from the BoJ’s website\(^3\). The columns into which economic entities are classified

are known as sectors. They are broadly divided into six sectors such as Financial institutions, Non-financial corporations, General government, Households, Private nonprofit institutions serving households, and Overseas, and the first three sectors are further broken down into sub-sectors. In total there are 45 sectors. Appendix A shows all sectors classified in the FFA statistics in Japan.

Transaction items are classified into rows. They consist of top-level domain items such as Currency and deposits (A), Deposits with Fiscal Loan Funds (B), Loans (C), Debt securities (D), and sub-items under each corresponding items in the top-level such as Currency (A-a), Deposits with the Bank of Japan (A-b), Government deposits (A-c), Bank of Japan loans (C-a), Loans by private financial institutions (C-c), etc. In summary there are 51 rows (transactions items) and 45 columns (sectors) at the most detail level, which is equal to 2,295 cells in the FFA matrix for a single year. Accordingly, time series data from 1980 through 2017 includes the total of 87,210 data points. In a case of quarterly data, it contains 348,840 data.

In order to systematically handle such large set of FFA data, we have built a model with system dynamics modeling software called Vensim that imports all stock and flow data since 1980. The use of this reference data model helped us quickly jump across all sectors in the original FFA and compare different time series swiftly when testing working hypothesis. This is in contrast with the interactive web server at the Bank of Japan that requires users to reload the data page every time when adding new items under the constrained maximum number of comparisons at a single time.

Six (sub) sectors of the FFA are selected as relevant to study the relationship between money stock and total debts in the Japanese economy during the period of 1980-2017. They are: central bank (1-1), depository corporations (1-2), non-financial corporations (2), general government (3), households (4), and Overseas (6).

Definitions of Money Stock M1 and M3

For money stock data, the BoJ provides a separate statistics called Money Stock Statistics. However, in our analysis, for internal consistency in data types and collection method (timing and frequency), we have calculated money stock directly from the FFA data. This is done by taking net value of transferable and time deposits (transaction item A-d and A-e, respectively) of depository corporations (1-2).

To be more strict, however, government deposits have to be a part of money stock, because they constitute a part of means of payments by non-banking sectors. Yet, they are not covered with the above-mentioned calculation of transferable and time deposits. As Figure 11 indicates, the difference between M3 (line 2) and M3+G (line 1, that is: M3 + Government deposits) is negligible. This is why Money Stock M3 is used in our following discussions.

\footnote{Data series of "Postal savings" and "Private life insurance companies" are available only until the third quarter of 2007.}
5 Our Main Finding: $M_3 \sim \text{Total Domestic Debts}$

5.1 How Money Stocks Get Created by Borrowing

Who are borrowers in our economy and who make loans? Among macroeconomic sectors, producers, households and government are borrowers, and banks make loans. Producers and households borrow directly from banks, while government borrows from banks and financial institutions by selling its bonds. Additionally, households and producers make loans to the government by purchasing its bonds. These relations among borrowers and lenders are illustrated in Figure 12.

Bank loans to producers and households become their debts. To examine the above flows of payments, let us consider debts created within the domestic loans and define total domestic debts as follows;

**Definitions of Domestic Debts**

\[
\text{Total Domestic Debts} = \text{Loans (Banks Domestic)}(C-c) + \text{Government Debts (Domestic)}
\]

(4)

where

\[
\text{Loans (Banks Domestic)}(C-c) = \text{Loans (Banks)}(C-c) - \text{Debts (Overseas)}
\]

(5)
Figure 12: Diagram of Debts and Loans

5.2 Our Findings: Loans ⇒ Debts ⇒ Money Stocks

So far we have defined all types of money stock such as $M_0, M_1, M_f, M_T, M_3,$ and aggregate amounts of debts such as Total Domestic Debts, Loans and Government Debts. In addition, we have discussed their causal relations from our structural analysis of money creation.

\[
\text{Government Debts (Domestic)} = \text{Treasury Securities Debt (Government)} + \text{Treasury Bills Debt (Government)} - \text{Treasury Securities (Overseas)} - \text{Treasury Bills (Overseas)}
\] (6)

and
Figure 13: Correlation Coefficients of All Money Stocks and Debts

To deepen our understanding of these amounts, we have calculated their correlation coefficients by applying Python big data analysis method as indicated in Figure 13. Heatmap diagram of these coefficients is illustrated in Figure 14\textsuperscript{5}.

\begin{table}[h]
\centering
\begin{tabular}{|l|cccccc|}
\hline
 & M3 & MT & M1 & Mf & M0 & Debts \\
\hline
M3 & 1.000000 & 0.688660 & 0.905513 & 0.818160 & 0.747855 & 0.992026 \\
MT & 0.688660 & 1.000000 & 0.315922 & 0.332758 & 0.210169 & 0.638985 \\
M1 & 0.905513 & 0.315922 & 1.000000 & 0.875844 & 0.855591 & 0.924148 \\
Mf & 0.818160 & 0.332758 & 1.000000 & 0.499548 & 0.845127 & 0.624334 \\
M0 & 0.747855 & 0.210169 & 0.855591 & 1.000000 & 0.752381 & 0.624334 \\
Debts & 0.992026 & 0.875844 & 0.924148 & 0.845127 & 0.752381 & 1.000000 \\
Loans(P) & 0.668909 & 0.314628 & 0.267611 & 0.277726 & 0.791018 & 0.624334 \\
Debts(G) & 0.909638 & 0.353722 & 0.983277 & 0.908059 & 0.908059 & 0.938950 \\
\hline
\end{tabular}
\caption{Correlation Coefficients of All Money Stocks and Debts}
\end{table}

Figure 14: Python’s Heatmap Diagram of All Coefficients

From these Figures, we have identified a close correlation between $M_3$ and Total Domestic Debts, whose coefficient is 0.992 as expected from our discussions above\textsuperscript{6}. Unexpectedly, in the Japanese economy between 1980 through 2018 we have also identified two more close correlations; (1) Government Domestic Debts and $M_1$ of coefficient 0.983, and (2) Private Domestic Loans and $M_T$ (Time Deposits) of coefficient 0.958.

Figure 15 illustrates time-series behaviors of these highly correlated six variables. Specifically, we have observed the following three findings.

\textsuperscript{5}In this figure, GDP is additionally included for our analysis below.

\textsuperscript{6}$M_3$ and Government Domestic Loans also indicate a high correlation of 0.9096, which implies, as we discuss below, that a large portion of $M_3$ has been created by the huge amount of government debts between 1995 and 2018.

24
1. Money Stock $M_3$ (line 1) $\simeq$ Total Domestic Debts (line 2).
   This is our main observation attained in Japan; that is, money stock $M_3$ is approximately equal to the total domestic debts in Japan. Moreover, we claim that this approximate relation universally holds under the debt money system so that money stock $M_3$ is endogenously created by bank loans out of nothing.

2. Private Domestic Loans (line 3) $\simeq$ Time Deposits (line 4).
   Time deposits in Japan are shown to be approximately equal to the sum of loans by households as housing loans and by producers as capital investment. This observation supports macroeconomic textbook explanation that savings (time deposits) are used for housing and capital investment through loans.

   Yet, it is essential to understand from our discussions above that a textbook causal relation of saving to investment is reversed; that is Loans $\Rightarrow$ Investment $\Rightarrow$ Savings (Time Deposits), not vice versa.

3. Government Domestic Debts (line 5) $\simeq$ Money Stock $M_1$ (line 6).
   Money stock $M_1$ used for our daily transaction payments are shown in Japan to be approximately equal to government domestic debts.

   More compactly, we have observed the following three high correlations in the Japanese economy.
\[ M_3 \equiv \text{Total Domestic Debts (corr. coef = 0.992)} (\equiv M_T + M_1) \quad (7) \]
\[ M_T \simeq \text{Private Debts by Producers and Households (corr. coef = 0.958)} \quad (8) \]
\[ M_1 \simeq \text{Government Debts (corr. coef = 0.983)} \quad (9) \]

Equations (8) and (9) may be specific to Japan, but equation (7) holds true in any economy under debt money system.

5.3 Our Main Finding: \( M_3 \simeq \text{Total Domestic Debts} \)

Our main finding of equation (7) is now illustrated in Figure 16.

![Figure 16: Regression of Money Stock \( M_3 \simeq \text{Total Domestic Debts} \)](image)

Its linear regression is described as

\[ M_3 = 19397.74189 + 0.98008 \times \text{Total Domestic Debts} \; (R^2 = 0.98412) \quad (10) \]

Coefficient of total domestic debts in this linear equation is 0.98008, which means that \( M_3 \) is increased by the amount almost close to the total domestic debts. In other words, money stock \( M_3 \) is created endogenously by the sum of private and government debts.
5.4 How Loans End with Demand/Time Deposits

To understand our second and third findings observed above, let us further consider how bank loans are put into circulation and end up with stocks such as Demand Deposits and Time Deposits by using stock-flow diagram of system dynamics modeling of Figure 17. It illustrates a simplified balance sheet of banks in which money flows from banks to borrowers in terms of stocks. Specifically the following flows of payments in our economic activities are observed.

![Figure 17: Loans ⇒ Time Deposits, and Government Debts ⇒ M1](image)

**Loans ⇒ Demand Deposits ⇒ Time Deposits.** Banks make loans to private sectors (producers and households) and the amount of loans becomes their assets of Loans. The amount of loans are put into Demand Deposits of private sectors, out of which some amount leaks to their Time Deposits.

**Government Debts ⇒ Reserves ⇒ M1.** Banks purchase government bonds out of their Reserves. Now government spend these amounts as government expenditures through banks’ Reserves to Demand Deposits (M1) of recipients. Some amount leaks to Time Deposits.

Figure 18 illustrates a linear regression of the above-discussed second finding.

Its linear regression equation is obtained as follows:

\[ M_T = -41029.936203 + 1.166703 \times \text{Private Loans} \quad (R^2 = 0.91785) \]  \( (11) \)

It indicates that the increased amount of private loans by producers and households ends up with the time deposits by the factor of 1.1667.

Figure 19 illustrates a linear regression of the above-discussed third finding.
Figure 18: Private Loans $\Rightarrow$ Time Deposits

Figure 19: Government Debts $\Rightarrow$ M1
The corresponding regression equation is obtained as follows.

\[ M_1 = -7371.91838 + 0.90122 \times \text{Government Debts} \quad (R^2 = 0.96683) \quad (12) \]

The increased amount of government debts ends up with the demand deposits by the factor of 0.9012.

6 Summary of How \( M_1 \) (and \( M_3 \)) is Created

Before we discuss some implications derived from our findings, let us here summarize how \( M_1 \) (and ultimately \( M_3 \)) is created by the borrowings of private and government sectors as Figure 20\(^7\).

![Figure 20: How \( M_1 \) is created by Debts?](image)

1. Debts by private sectors such as producers and households end with the increases in \( M_f \) and \( M_1 \). They do not increase \( M_0 \).
2. Government bonds (debts) purchased directly by the central bank end with the increases in \( M_0 \) and \( M_1 \), but \( M_f \) does not increase.
3. Government bonds (debts) purchased by banks end with the increases in \( M_f \) and \( M_1 \), but \( M_0 \) does not increase.
4. Government bonds (debts) purchased by private sectors do not increase \( M_0, M_f \) and \( M_1 \).
5. Existing government bonds (debts) purchased by the central bank from banks (this operation is called \textit{Quantitative Easing or QE}) end with the increases in \( M_0 \), but \( M_f \), but \( M_f \) may decrease. As a result, \( M_1 \) may not increase as expected (to be discussed below).

\(^7\)Impacts of debts to GDP will be added to the last column in advance of our discussions below; that is, only private sectors contribute to GDP.
7 Implications of Our Findings on Debt Money

7.1 Japan’s Three Decades-long Recessions

Our findings confirmed the observation quoted in Section by Robert H. Hemphill; "If all bank loans were repaid, no one would have a bank deposit, and there would not be a dollar of currency or coin in circulation.". Without money stocks, all economic activities are forced to stand still. To investigate this relation between money stocks and economic activities, let us here focus on GDP as a representative indicators of economic activities.

Figure 21: GDP and Growth Rate

Figure 21 shows GDP and its growth rates in Japan between 1980 and 2018. Japanese economy continued to grow at the growth rate of between the lowest 3.6% (1986) and the highest 8.6% (1990) over the period 1980 through 1991\(^8\). Nikkei stock price hit the historically highest peak of 38,957 yen in Dec. 29, 1989 when the Japanese asset-price bubble got burst. Since then, stock prices plunged and remained the level lower than the peak till today. Along with the burst, the GDP growth rates hovered between the range with the lowest at -4% (2008) and highest at 2.9% (2015); that is, below 3% all through the period since 1992. That is why this period is called the lost three decades.

Now we are in a position to take a new look at the relations between various money stocks and GDP. Figure 22 presents the correlation coefficients of GDP and debts.

GDP is highly correlated with private debts (corr.coef=0.877), which is also highly correlated with time deposits (corr.coef=0.958). This indicates

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\(^8\)Japan’s high growth in fact started around 1973, following the Nixon Shock which suspended the direct convertibility of US dollars into gold on Aug. 15, 1971.
that debts by private sectors such as producers and households have dominantly contributed to the GDP growth and ended up with time deposits. On the other hand, GDP is not so highly correlated with government debts (corr.coef=0.6658), which is, though, highly correlated with Money Stock $M_1$ (corr.coef=0.983). This indicates that government debts have not so influentially contributed to the growth of GDP in Japan, and only ended up with the inflated demand deposits of $M_1$.

From these observations, let us now examine the impacts of debts by private and government sectors on Japan’s GDP more comprehensively, and derive some implications on the economic behaviors in Japan.

### 7.2 Implication 1: Root Cause of Boom and Bust

**GDP is driven by the increase in Private Debts: 1980 - 1991**

Based on the above observation on GDP, we can divide the period of 1980 - 2018 into two sub-periods: high growth period of 1980-1991 and stagnated period of 1992-2018. How have money stocks affected the growth of GDP in these two period?

As observed from Figure 23, during the high growth period (1980 - 1991), GDP has been driven by the private debts borrowed by producers as corporate investment and by households as housing investment. Because of this high growth, Japanese economy has been regarded as "Japan as Number 1 [8, 1979]", with miracle and respect, toward the end of 1980\(^9\). Under such a high-rising growth, Japan was forced to accept the unfair appreciation of yen in 1985, known as Plaza Accord. As a result, Japan’s foreign exchange rate per US dollar began to plunge from 238 yen in 1985 to 144 yen in 1990, a very rapid depreciation of dollar by 40% in 5 years, and abnormally high appreciation of yen. This caused an inevitable economic recession due to the rapid appreciation

\(^9\)In fact, Japan’s high growth period started in 1971, following the so-called Nixon Shock of the suspension of gold-dollar convertibility, through 1980s.
of yen. To overcome this recession, the Bank of Japan decreased interest rate from 8% to 3%, causing economic bubbles that has brought an historical peak of Japanese stock price of 38,957 yen on Dec. 29, 1989. To subdue the bubbles, the Bank of Japan this time reversed interest rate from 3% to 8%, forcing the stock prices to plunge. This policy popped Japanese bubbles into burst.

**GDP is destructed by the decrease in Private Debts: 1992 - 2018**

We can easily confirm the burst of Japanese bubbles from Figure 23. Bank loans (and private debts) (line 2) began to make a small fluctuation during 1991 and 1996, then eventually tumbled. Along with this decline of private debts, GDP (line 3) stoped growing, leading to the prolonged recessions of three decades long.
In this way, boom and bust of Japanese economy have been caused by the increase and decrease of private debts, which in turn have been caused by the decrease and increase of interest rate by the Bank of Japan. Root cause of these business cycles lies in the nature of debt money system itself in which money stocks are endogenously created and destroyed by capricious attitudes of borrowing money mainly by producers.

**Overall Relation of GDP an Private Debts**

Figure 24 shows how GDP has been affected by private debts with an equation of linear regression.

![Figure 24: Regression of Private Debts ⇒ GDP](image)

Its corresponding regression equation is obtained as follows:

\[
\text{GDP} = 98464.11693 + 0.66251 \times \text{Private Loans} \quad (R^2 = 0.76971)
\]  

This implies that 66.3% of the increase in private debts contributes to the increase in GDP.

### 7.3 Implication 2: Accumulated Government Debts

**Government Debts Do Not Increases GDP: 1990 - 2018**

Whenever bank loans are forced to be repaid out of borrows' (time) deposits during the recessions, money stock must also decrease accordingly. The Great
Depression in the 1930's was one of the earliest events when such phenomena was observed at a dramatic scale in the U.S. economy. Fisher [3, 1935] noted that in 1929, total circulating medium was reported to be 27 billion dollars. Out of the 27 billion, 4 billion were cash and 23 billion were "check-book money" (bank deposits). By 1933, however, the figures dramatically changed as Fisher pointed out as follows:

> An essential part of this depression has been the shrinkage from the 23 to the 15 billions in checkbook money, that is, the wiping out of 8 billions of dollars of nation’s chief circulating medium which we all need as a common highway for business. (p.15)

Unlike the Great Depression, however, the sharp decline of bank loans during 1990’s (line 2 in Figure 23) in Japan has not resulted in the decline of money stock $M_3$ (line 1 in Figure 15). The continuous fiscal spending by the Japanese...
government is launched by the amount of the government debt as shown by line 2 in Figure 25. As a matter of fact, between 1997 and 2017, government debts increased by 600 trillion yen, larger than the GDP of around 530 trillion yen; that is, 30 trillion yen per year in average.

However, during the depressed period (1995-2017), GDP stopped growing in spite of this huge amount of increase in money stock $M_1$ (and $M_3$) injected by the government debts. That is to say, this huge amount of $M_1$ by the government deficits failed to stimulate Japanese GDP. This indicates the traditional Keynesian Fiscal Policy failed to work effectively in Japan. Figure 26 illustrates our linear regression equations between GDP and Government Debts during the two different periods.

![Figure 26: Regression of Government Debts ⇒ GDP](image)

A linear regression of GDP and Government Debts between the period of 1980 and 2018 is calculated as

$$GDP = 362213.03811 + 0.22145 \times \text{Government Debts (1980-2018)} \quad (R^2 = 0.44331)$$  

(14)

Coefficient of the Government Debts turned out to be very small; that is, 0.22145. Moreover, if we confine our linear regression after the bubble burst between 1994 and 2018, we obtain

$$GDP = 498432.93420 + 0.00108 \times \text{Government Debts (1994-2018)} \quad (R^2 = 0.00019)$$  

(15)

and the coefficient of government debts becomes almost negligible, that is,
In other word, as illustrated in Figure 26, fiscal policy by government debts have thoroughly failed to drive GDP in Japan.

7.4 Whose Debts Have Driven GDP More Efficiently?

Figure 27 integrates three linear regressions discussed above for comparison. When the linear regression of GDP and Private Loans is calculated, we have obtained a coefficient of private loans = 0.66251, while for the regression of GDP and Government Debts we have obtained the coefficient of government debts = 0.22145. The coefficient of private loans becomes 2.992 times more efficient than that of government debts.

Let us further perform a multiple linear regression by Private Loans and Government Debts. Then, we have obtained the following equation:

\[
\text{GDP} = 96724.97724 + 0.55926 \times \text{Private Loans} + 0.14325 \times \text{Government Debts} \quad (R^2 = 0.93652) \quad (16)
\]

This regression analysis indicates its limitation, because coefficient values of regression depend on the data periods of government debts we select; that is, between 1980-2018 or 1994-2018. Which period should we, then, use to calculate the impact of government debts on GDP? This is why we need ASD macroeconomic model to explore its structural change in macroeconomic system.

According to [5, 2009], Japan’s GDP would have fallen further deeper if fiscal policy of government deficits is not implemented. In this sense, huge amount of fiscal policy helped sustain GDP from declining, and, in this sense, worked out passively.
The coefficient of private loans (=0.55926) is, this time, 3.904 times larger than that of government debts (=0.14325). For the both cases of single and multiple regressions, driving forces of private loans to GDP growth turned out to be roughly 3~4 times more effective than those of government debts. This suggests an important GDP growth strategy of macroeconomic policy in Japan. Keynesian fiscal policy of government expenditures is not unconditionally efficient to drive the economic growth, compared with policies that directly drive private loans among producers and households.

Accordingly, now is the time to reconsider Keynesian fiscal policy for stimulating economic recession caused by the debt money system itself. We claim that a transition to the public money system from the current debt money system is a solution for sustained economic growth as demonstrated in [11, 2019].

### 7.5 Implication 3: Failures of QE Policies

Quantitative Easing (QE) policy was, among OECD countries, introduced for the first time in Japan in March 2001 as an exceptional monetary policy in order to recover her economy from a decade-long recession as illustrated in Figure 28. The QE policy was carried out till 2006. During this period, the QE policy in Japan has increased $M_0$ (line 2) by $\Delta M_0 = 23.4$ trillion yen, which in turn increased $M_1$ by $\Delta M_1 = 228.8$ trillion yen. Yet, GDP has increased only by $\Delta GDP = 4.4$ trillion yen (line 3).

According to the mainstream economics of reflation theory, the increase in exogenous amount of money would increase $m$ factors of $M_0$ as formulated by the following equation:

$$\Delta M_1 = m_m \Delta M_0$$

where $m_m$ is a marginal money multiplier that is assumed by the theory to be a constant but larger than a unitary value. In fact, during the period between 2001 and 2006, it fulfilled as expected; that is, $m_m = 9.7$.

Now let us define a marginal velocity of money $V_m$ such that

$$\Delta M_1 \cdot V_m = \Delta GDP$$

Then, during the first period of QE policy, it became $V_m = 0.019(= 4.4/228.8)$. This indicates that the increased money stock $\Delta M_1$ did not circulate as means of payment transactions at all. In other words, government expenditures became only one-time spending.

Let us, furthermore, define a money multiplier of GDP $m_G$ such that

$$\Delta GDP = m_G \Delta M_0$$

From equations (17) and (18), we obtain

$$m_G = V_m \cdot m_m = 0.019 \times 9.7 = 0.1843^{12}.$$
This implies only 18% of an increase in base money has contributed to the increase in GDP.

The QE policy in Japan was re-activated in 2013 to regain the failure of the first QE policy between 2001 and 2006. It has been carried out till today. During this period, \( M_0 \) (line 2) has been increased by \( \Delta M_0 = 360.3 \text{ trillion yen} \), which in turn increased \( M_1 \) by \( \Delta M_1 = 246 \text{ trillion yen} \). Yet, GDP has increased only by \( \Delta \text{GDP} = 51.8 \text{ trillion yen} \) (line 3).

Hence, this time we have \( m_m = 246/360.3 = 0.683 \), less than a unitary value. \( V_m = 51.8/246 = 0.2106 \), which is larger than the first period’s \( V_m = 0.019 \). In sum, we have \( m_G = V_m \cdot m_m = 0.2106 \times 0.683 = 0.1438 \), which became smaller than the first period’s \( m_G = 0.1834 \). Table 3 summarizes these performances of QE policies in Japan.

In this way, the increase in base money \( M_0 \) failed to stimulate \( M_1 \) and GDP against the traditional Keynesian and monetarist theories.

The reflation theory was originally proposed by Irving Fisher, then refuted after the Great Depression of 1929 by himself [2, 1933] by pointing out that
Table 3: Performance of QE Policies in Japan

<table>
<thead>
<tr>
<th>QE1 (2001-2006)</th>
<th>m_m</th>
<th>V_m</th>
<th>mG = V_m · m_m</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.9</td>
<td>0.019</td>
<td>0.1843</td>
<td></td>
</tr>
<tr>
<td>QE2 (2013-2018)</td>
<td>0.683</td>
<td>0.216</td>
<td>0.1483</td>
</tr>
</tbody>
</table>

m is not an exogenous parameter, but endogenously determined. Using our terminology, this implies the following identity, not the equation.

$$\Delta M_1 \equiv m_m (\Delta M_1) \Delta M_0$$  \hspace{1cm} (21)

That is, there is no way of determining \(m_m\) and \(\Delta M_1\) exogenously, by the Bank of Japan. In fact, above simple calculations of money multiplies during the first and second QE periods produced its wide fluctuation such that \(m_m = 9.7\), and 0.683, respectively. Moreover, Figure 29 shows how a money multiplier \(m = M_1/M_0\) has fluctuated between 1980 and 2018\(^\ddagger\).

\[\text{Figure 29: Money Multiplier (m) between 1980 and 2018}\]

Tragedy of our current economic theory is that this Fisher’s refusal of reflation theory has been entirely neglected by the mainstream economists over more than a century up to the present day.

Figure 30 shows our linear regressions between GDP and base money \(M_0\). Then we have

$$\text{GDP} = 413500.65762 + 0.30944 * M_0 \ (1980-2018) \ (R^2 = 0.22567)$$  \hspace{1cm} (22)

\[\text{\ddagger When } m = 1, \text{ we have } M_1 = M_0, \text{ a 100% state of required reserves ratio, or } M_f = 0.}\]
That is, a coefficient of $M_0$ is 0.3024.

After the introduction of QE policy in 2001, we have

\[ \text{GDP} = 483260.13453 + 0.07287 \times M_0 \quad (2001-2018) \quad (R^2 = 0.40110) \tag{23} \]

That is to say, a coefficient of $M_0$ becomes almost negligible amount of 0.07287. Linear regression after the introduction of QE policy looks like a flat line, which implies that QE policy of increasing $M_0$ had no impact on GDP.

In this way, Japanese QE policies are now demonstrated to have entirely failed with our calculations of linear regressions. Concurrently, the reflation theory itself has been once again refuted, following the arguments by Irving Fisher.

### 7.6 Implication 4: Income Inequality

So far we have discussed three implications derived from our findings that money stock $M_3$ is almost equal to total domestic debts. The fourth and ultimate implication of our findings is that under the debt money system, income inequality continues to be generated.

\[ \tag{14} \text{This overall value of coefficient is considerably smaller than our simple calculations of } m_b \text{ which are obtained as 0.1843 and 0.1438, respectively, during the first QE period of 2001-2006 and second QE period of 2013-2018. In other words, the amount of base money } M_0 \text{ has less room to determine the size of GDP. The story will be very different when } M_0 = M_1 \text{ under the public money system we are proposing [11, 2019].} \]
Table 2 indicates that only 0.3% of $M_3$ (and 0.6% of $M_1$) is issued as public money at interest-free. In other words, 99.7% of $M_3$ (and 99.4% of $M_1$) is issued as debt money at interest. Hence, in the economy where almost all money stocks for transactions are endogenously created by bank loans, those who borrow from them such as producers and households are obliged to pay interests to bankers without exception. Moreover, government is also obliged to pay interest to (central) bankers out of taxes levied from producers and households. In this way, under the debt money system interest payments continue to flow into bankers and become their unearned incomes: that is, forced income transfer is executed from producers and households to (central) bankers.

This constitutes the root cause of income inequality between bankers and non-bankers. Our main finding that money stock is almost equal to total domestic debts reveals this hidden unfair income distribution. Unless this unfair system is replaced with public money system, we cannot solve income inequality problem forever. Let us discard our illusion that income inequality can be solved by the public policy of income redistribution under the debt money system.

Final Remark: Limitations of Econometric Analysis

This paper is our sister paper of "Money Stock Equals Total Debts by Banks Under Debt Money System - Theory and Flow of Funds Analysis in Japan", as explained in the footnote of page 1. In the sister paper only analytical method of system dynamics is utilized, while econometric analysis of linear regression is applied in this paper.

In the econometric analysis, correlation approach can be very effectively applied, yet analysis of causal relation is not founded on a robust analytical foundation. Accordingly, we have derived our causal relations between loans and money stock from the system dynamics analysis of our sister paper, and applied them to the linear regression analysis here. We believe that system dynamics method is more comprehensive for the understanding of complicated system structure of money and macroeconomic behaviors.

In this sense, econometric analysis should be confined to a partial analysis of data behaviors caused by their system structure. In this paper causal analysis of GDP and money stocks cannot be well performed by running only regression models. It can only be successfully carried out through a construction or a wholistic macroeconomic model by the accounting system dynamics approach.

Conclusion

The purpose of this paper is to show that money stock $M_3$ is almost equal to the total domestic debts by private and government sectors. We started our analysis by presenting our classification of money and confined our analysis to debt money, then discussed how money is created by debts. In this process new definition of money stocks is introduced such as functional money $M_f$, and behaviors of money stocks such as $M_0, M_f, M_1, M_T, M_3$ are illustrated.
To understand the money creation process as bank loans, simple balance sheets of six macroeconomic sectors are introduced and some numerical analyses are performed, out of which we obtained the intuition that money stock equals total debts.

To examine this intuition we utilized the Flow of Funds Account data provided by the Bank of Japan, out of which domestic debts are calculated. Then correlation coefficients are calculated to obtain high correlations between (1) total domestic debts and money stock $M_3$, (2) private domestic loans and time deposits $M_T$, (3) government domestic debts and money stock $M_1$. We run linear regressions of these highly correlated relations as our new findings in this paper.

Finally, we discussed four implications of our findings on debt money system. Namely, it causes (1) book and bust, (2) government debts, (3) failures of QE policies, and (4) income inequality.

References


Appendix A: Sectors of FFA Statistics in Japan

Table 1. List of Sectors and Major Institutions (last update: October 2013)

<table>
<thead>
<tr>
<th>Name of sector</th>
<th>Major financial institutions</th>
<th>Code*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial institutions</td>
<td>Bank of Japan</td>
<td>1-1</td>
</tr>
<tr>
<td>Depository corporations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banks</td>
<td></td>
<td>1-2</td>
</tr>
<tr>
<td>Domestically licensed banks</td>
<td>Domestic licensed banks, holding companies</td>
<td>1-2-1-1</td>
</tr>
<tr>
<td>Foreign banks in Japan</td>
<td></td>
<td>1-2-1-2</td>
</tr>
<tr>
<td>Financial institutions for agriculture, forestry, and fisheries</td>
<td>Norin Chukin Bank, Agricultural Cooperatives, Credit Federations of Agricultural Cooperatives, Fishery Cooperatives, Prefectural Credit Federations of Fishery Cooperatives</td>
<td>1-2-1-3</td>
</tr>
<tr>
<td>Financial institutions for small businesses**</td>
<td>Shinkin banks, Shinkin Central bank, Shoko Chukin Bank, Credit Cooperatives, Sunkumi Federation Bank, The Rokumon Bank, Labor Banks, Japan Post Bank</td>
<td>1-2-1-4</td>
</tr>
<tr>
<td>Postal savings (until 3rd Quarter 2007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collectively managed trusts</td>
<td></td>
<td>1-2-2</td>
</tr>
<tr>
<td>Insurance and pension funds</td>
<td></td>
<td>1-3</td>
</tr>
<tr>
<td>Life insurance</td>
<td>&lt;Other than the following&gt; Japan Post Insurance (former Japan Post Postal Life Insurance Services)</td>
<td>1-3-1-1</td>
</tr>
<tr>
<td>Of which: private life insurance, companies (until 2nd Quarter 2007)</td>
<td>Private life insurance companies, holding companies</td>
<td>1-3-1-1-1</td>
</tr>
<tr>
<td>Nonlife insurance</td>
<td>&lt;Other than the following&gt; a part of the National Special Accounts, independent administrative institutions, credit insurance institutions, etc.</td>
<td>1-3-1-2</td>
</tr>
<tr>
<td>Of which: private nonlife insurance companies</td>
<td>Private nonlife insurance companies, holding companies</td>
<td>1-3-1-2-1</td>
</tr>
<tr>
<td>Mutual aid insurance</td>
<td>The National Mutual aid Insurance Federation of Agricultural Cooperatives, Prefectural Mutual Aid Insurance Federations of Fisheries Cooperatives, National Federation of Workers and Consumers Insurance Cooperatives, Prefectural Federations of Workers and Consumers Insurance Cooperatives</td>
<td>1-3-1-3</td>
</tr>
<tr>
<td>Pension funds</td>
<td></td>
<td>1-3-2</td>
</tr>
<tr>
<td>Corporate pensions</td>
<td>Employees’ pension funds, former qualified retirement pension plans, defined-contribution pension plans (corporate-type), defined-benefit corporate pension</td>
<td>1-3-2-1</td>
</tr>
<tr>
<td>Other pensions</td>
<td>Defined-contribution pension plans (personal-type), National Pension Fund, etc.</td>
<td>1-3-2-2</td>
</tr>
<tr>
<td>Other financial intermediaries</td>
<td></td>
<td>1-4</td>
</tr>
<tr>
<td>Securities investment trusts</td>
<td>Investment trust management companies</td>
<td>1-4-1</td>
</tr>
<tr>
<td>Bond investment trusts</td>
<td></td>
<td>1-4-1-1</td>
</tr>
<tr>
<td>Of which: MMP, MRF</td>
<td></td>
<td>1-4-1-1-1</td>
</tr>
<tr>
<td>Stock investment trusts</td>
<td></td>
<td>1-4-1-2</td>
</tr>
<tr>
<td>Nonbanks</td>
<td></td>
<td>1-4-2</td>
</tr>
<tr>
<td>Finance companies</td>
<td>Finance companies (excluding construction, real estate, securities finance company, former Industrial Revitalization Corporation of Japan, The Resolution and Collection Corporation, etc.)</td>
<td>1-4-2-1</td>
</tr>
<tr>
<td>Structured financing special purpose companies and trusts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public financial institutions</td>
<td></td>
<td>1-4-3</td>
</tr>
<tr>
<td>Fiscal Loan Fund</td>
<td></td>
<td>1-4-3-1</td>
</tr>
<tr>
<td>Government financial institutions</td>
<td>Special Account for Public Investment and Loans other than the Fiscal Loan Fund, government financial institutions, other government-affiliated corporations, and independent administrative institutions whose main business is financial intermediation</td>
<td>1-4-3-2</td>
</tr>
<tr>
<td>Financial dealers and brokers</td>
<td>&lt;Other than the following&gt; &quot;Tanshi&quot; companies (money market dealers), Banks’ Shareholdings Purchase Corporation (special account)</td>
<td>1-4-4</td>
</tr>
<tr>
<td>Of which: securities companies</td>
<td>Securities companies, holding companies</td>
<td>1-4-4-1</td>
</tr>
<tr>
<td>Financial auxiliaries (financial institutions other than intermediaries)</td>
<td>Institutions that guarantee financial instruments, stock exchanges, financial exchange, Banks’ Shareholdings Purchase Corporation (general account), foreign exchange brokers, foreign exchange margin trading firms</td>
<td>1-5</td>
</tr>
</tbody>
</table>

Figure 31: Sectors in Flow of Funds Account in Japan
Appendix B: Legal Status of Deposits in Japan

In Japan lending of money in a legal contract represents loans for consumption under article 587 of the Japanese Civil Code as follows.

**Article 587** A loan for consumption shall become effective when one of the parties receives money or other things from the other party by promising that he/she will return by means of things that are the same in kind, quality and quantity.

On the other hand, deposits to banks represent a claim of the party who made deposits on another party (banks) to have the thing returned. In fact, deposits of money represent deposits for consumption under article 666 of the Japanese Civil Code as follows.

**Article 666** The provisions of Section 5 (Loans for Consumption) shall apply mutatis mutandis to cases where a depositary may, under the contract, consume the Thing deposited.

Therefore, bank deposits are essentially a "promise" by the receivers of such loans (banks) to return things that are the same in kind. In the case of loans made by banks, it would be central bank notes or reserves, both of which are legal tender and base money (M0) of Japan. In case of loans to banks (bank deposits), it would be banks who must be able to return the things that are the same in kind. Hence, bank deposits should be considered more as lo ans to banks rather than a custody of things, which seems what the word deposits tend to be associated with by the general public. Once money is loaned to banks
(“deposits”), the legal ownership of the original money is transferred from the original party who made deposits to the other party who received the money, namely banks (Kai, 2007).

However, it is questionable what banks are "loaning" out when they do not fully possess what it is purported to be "lending" in the first place.

Appendix C: Coins, Notes & Seigniorage in Japan

Figure ?? shows historical changes of monetary aggregates in Japan since 1980. Note that all figures end at the end of 2017. As described in Figure 1, physical coins and bank notes are part of both base money and money stock. Depending on each nation and currency area, physical coins and notes are issued by governments or central bank respectively. Thus the term seigniorage can mean differently in different nations as it is defined as profit made by a government by issuing currency, especially the difference between the face value of coins/notes and their production costs.

In case of Japan, coins are first manufactured at the Japan Mint. They are then delivered to the Bank of Japan and become deposits of the government to the bank. At this point, new coins are considered to be issued as legal tender. When commercial banks withdraw part of their reserves by coins, they are now going into circulation. Bank of Japan notes are first manufactured at the National Printing Bureau and purchased by the Bank as commodity. Similar to coins, when banks withdraw their reserves from Bank of Japan by notes, they are ready to go into circulation.

In other words, seigniorage in Japanese context means the sum of profit realized by the government from minting and issuing coins, and fraction of Bank of Japan’s profits accrued from notes issuance of which are returned back to the treasury. The former is calculated by the difference between the face value of coins delivered to the Bank of Japan and minting costs accrued at the Japan Mint. The latter is calculated by the difference between the face value of notes, and interest and arbitrage profits from market operations by the Bank of Japan and costs accrued during production process and maintenance of data centers.