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

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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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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)

Front: Issuance	Public Money	Debt Money (at interest)	
Back: Fiat Status	Money as Legal Tender		Functional-Money
Non-metal Commodities	Shell, Cloth (Silk) Woods, Stones, etc		
Metal Coinage	Non-precious Metal Coins Gold, Silver & Copper Coins		Metal Ingots (such as Gold)
Paper Notes	Public Money Notes by PM Admin.	Goldsmith Certificates Central Bank Notes	
Digital Cards & Accounts	Digital Public Money (PM)	Central Bank Reserves (Central Bank Digital Currency: CBDC)	Bank Deposits (Credits by Loans)
(After 2008)	< **EPM** >	< CBCC >	< Crypto-coin >
Blockchain & Distributed Ledgers	Electronic Public Money issued by PM Admin. (Peer-to-Peer PM)	Central Bank Cryptocurrency (issued as Base Money)	Bitcoin and approx. 1,000 Altcoins
		< Crypto-token (as Notes)	(as Deposits) >
		· M_1-backed Bank token: MUFG coin (Japan)	
		· M_1-backed Non-Bank token: Zen token (Japan)	
		· M_0-backed EPM token (cash)	

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 which 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[1].

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 straighforwardly 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-

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[1]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.
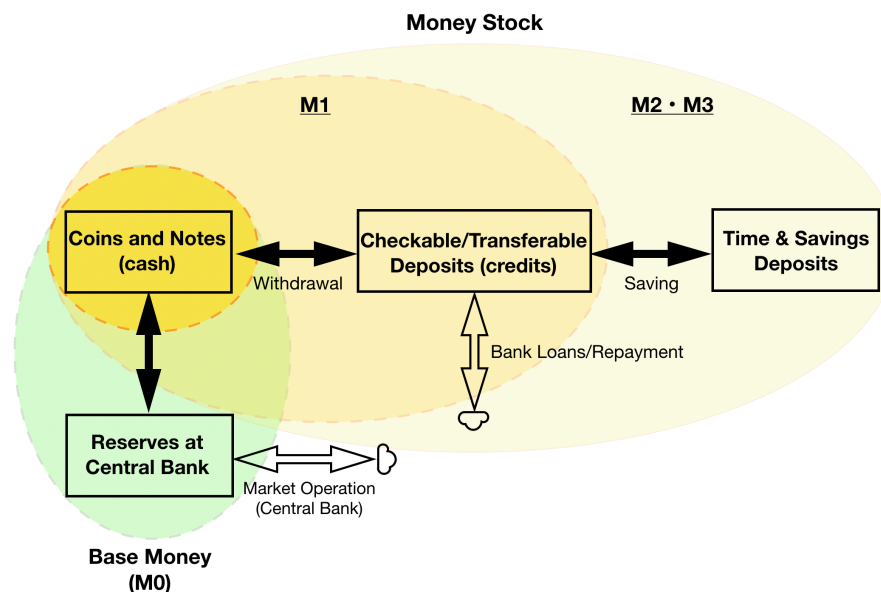
Figure 1: Monetary Aggregates & Life Cycle of Money

ure 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 Rserves 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

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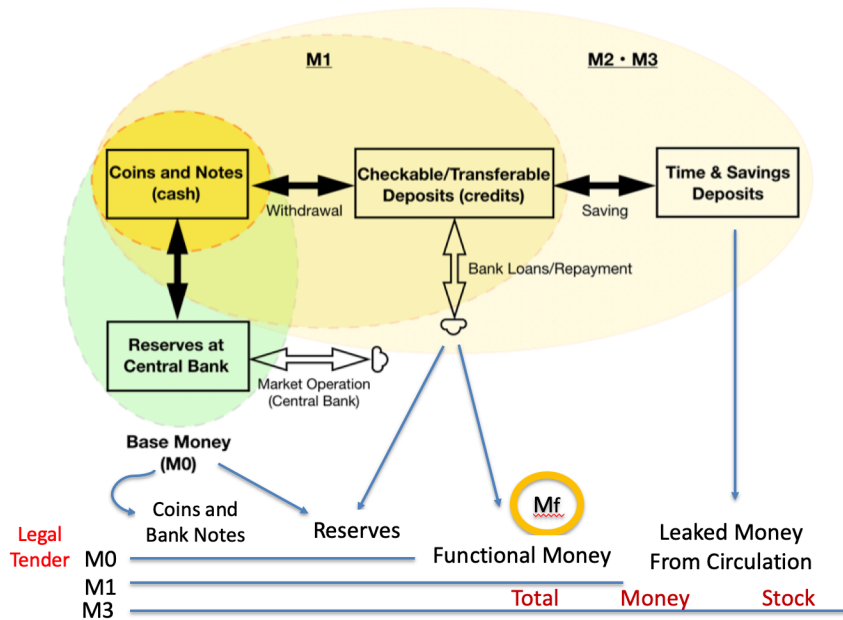
Figure 2: Definition of M_0, M_1, M_f, M_T and M_3

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 *ficticious* 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:

$$
\begin{aligned}
M_0 &= \text{Government Coins} + \text{Bank Notes} + \text{Reserves (Legal Tender)} \quad (1) \\
M_1 &= \text{Government Coins} + \text{Bank Notes} + \text{Demand Deposits} \\
&= \text{Government Coins} + \text{Bank Notes} + \text{Reserves} + \text{Functional Money} \\
&= M_0 \text{ (Base Money)} + M_f \text{ (Functional Money)} \quad (2) \\
M_3 &= M_1 + \text{Time Deposits } (M_T) \\
&= M_0(\text{Base Money}) + M_f(\text{Functional Money}) + M_T(\text{TimeDeposits}) (3)
\end{aligned}
$$

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.
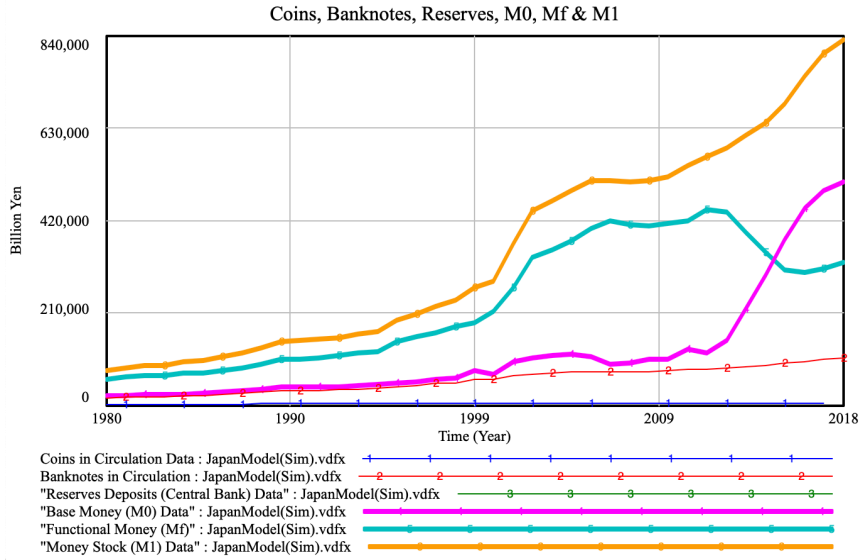
Figure 3: $M_0 + M_f = M_1$ in Japan (1980 - 2018)

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
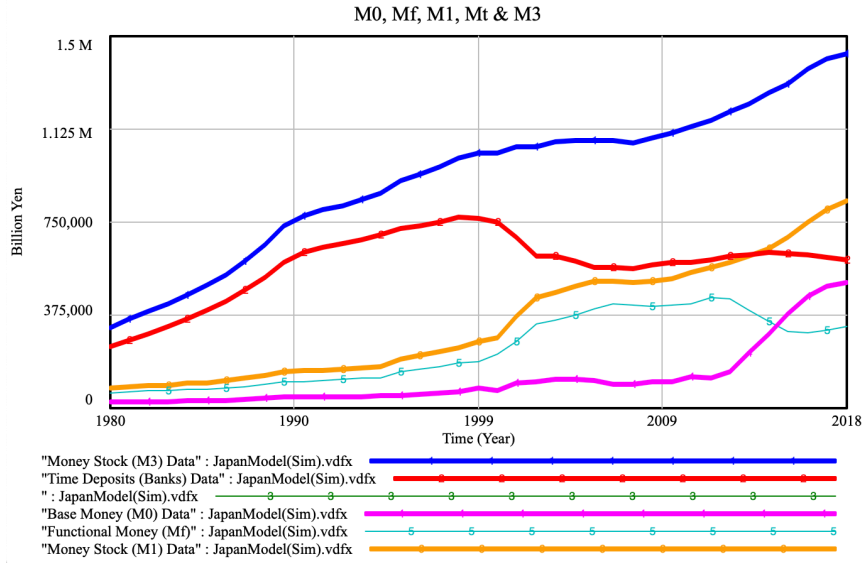
Figure 4: $M_0 + M_f = M_1$ and $M_1 + M_T = M_3$ in Japan

Money Stock	Trillion Yen	(% of M_1)	(% of M_3)
Coins (Public Money)	4.8	0.6	0.3
Bank Notes	107.6	12.9	7.6
Reserves	393.9	47.4	27.6
Base Money M_0	506.3	60.9	35.5
Functional Money M_f	324.9	39.1	22.8
Money Stock M_1	831.2	100.0	58.3
Time Deposits M_T	594.5		41.7
Money Stock M_3	1,425.8		100.0

Table 2: Money Stock & its Composition in Japan (2018)

increases or decreases, depending on our economic activities, causing booms and bust. To stabilize the economy, M_f needs to be eliminated; that is $M_f = 0$, so that banks cannot create money out of nothing. This was the original idea of monetary reform called t*he 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

Figure 5: Balance sheets of Six Sectors as Worksheet of Macroeconomy

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.

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[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 book-keeping 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.

(Start with Debts (F) of 1,000 million yen)

Central Bank			
Assets		Liabilities	
		Reserves	10
G Bonds			
		G Deposits	
CB Loans	10		
		Equity	

Government			
Assets		Liabilities	
G Deposits		Debts (G)	
		Equity	
		G Expenditures	
		Interest	

Banks			
Assets		Liabilities	
Reserves	10	CB Debts	10
		Demand Deposits (P)	1,000
Bank Loans	1,000		-970
			-30
G Bonds			
		Demand Deposits (H)	970
		(of Bankers)	30
		Time Deposits	
		Equity	
		Interest	30
		Dividends	-30

Producers			
Assets		Liabilities	
Demand Deposits (P)	1,000	Debts (P)	1,000
	-970		
	-30		
		Equity	
		Income	
		Costs (Wage	-970
		Interest	-30

Households			
Assets		Liabilities	
Demand Deposits (H)	970	Debts (H)	
(of Bankers)	30		
Time Deposits		Equity	
		Income (Wages)	970
		Interest	
		Dividends (Bankers)	30

Figure 6: Money Creation by Bank Loans - Producers

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

(Start with Debts (H) of 1,000 million yen)

Central Bank			
Assets		Liabilities	
		Reserves	10
G Bonds			
		G Deposits	
CB Loans	10		
		Equity	

Government			
Assets		Liabilities	
G Deposits		Debts (G)	
		Equity	
		G Expenditures	
		Interest	

Banks			
Assets		Liabilities	
Reserves	10	CB Debts	10
		Demand Deposits (P)	970
Bank Loans	1,000	Demand Deposits (H)	1,000
G Bonds			-970
			-30
		(of Bankers)	30
		Time Deposits	
		Equity	
		Interest	30
		Dividends	-30

Producers			
Assets		Liabilities	
Demand Dep	970	Debts (P)	
		Equity	
		Income	970
		Costs (Wages)	
		Interest	

Households			
Assets		Liabilities	
Demand Deposits (H)	1,000	Debts (H)	1,000
	-970		
	-30		
(of Bankers)	30	Equity	
Time Deposits		Income (Interest)	-30
Houses	970	Dividends (Bankers)	30

Figure 7: Money Creation by Bank Loans - Households

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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 transfering 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.

Central Bank

Assets		Liabilities	
		Reserves	-1,000
G Bonds			970
			30
			10
		G Deposits	1,000
CB Loans	10		-970
			-30
		Equity	

Banks

Assets		Liabilities	
Reserves	-1,000	CB Debts	10
	970		
		Demand	
	30	Deposits	
		(P)	
	10		
Bank Loans			
		Demand	
		Deposits	970
		(H)	
G Bonds	1,000	(of Bankers)	30
		Time Deposits	
		Equity	
		Interest	30
		Dividends	-30

Government

Assets		Liabilities	
G Deposits	1,000	Debts (G)	1,000
	-970		
	-30		
		Equity	
		G Expenditur	-970
		Interest	-30

Producers

Assets		Liabilities	
Demand			
Deposits		Debts (P)	
(P)			
		Equity	
		Income	
		Costs (Wages)	
		Interest	

Households

Assets		Liabilities	
Demand			
Deposits	970	Debts (H)	
(H)			
(of Bankers)	30		
		Equity	
Time Deposits		Income	970
		Interest	
		Dividends (Bank	30

Figure 8: Money Creation by Bank Loans - Government

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

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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

Central Bank

Assets		Liabilities	
		Reserves	-1,000
G Bonds	600		970
			600
			12
		(Dividends payment)	18
			10
		G Deposits	1,000
CB Loans	10		-970
			-12
			-18
		Equity	
		Interest	18
		Dividends	-18

Banks

Assets		Liabilities	
Reserves	-1,000	CB Debts	10
	970	Demand Deposits (P)	
	12		
	18		
	10		
	600	Demand Deposits (H)	970
Bank Loans		(of Bankers)	12
		(of C Banker	18
G Bonds	1,000	Time Deposits	
	-600		
		Equity	
		Interest	12
		Dividends	-12

Government

Assets		Liabilities	
G Deposits	1,000	Debts (G)	1,000
	-970		
	-12		
	-18	Equity	
		G Expenditur	-970
		Interest (Bar	-12
		Interest (CB	-18

Producers

Assets	Liabilities	
Demand Deposits (P)	Debts (F)	
	Equity	
Income		
Costs (Wages)		
Interest		

Households

Assets		Liabilities	
Demand Deposits (H)	970	Debts (H)	
(of Bankers)	12		
(of C Banker	18		
Time Deposits		Equity	
		Income	970
		Interest	
		Dividends (Bankers)	12
		Dividends (C Bankers)	18

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.

Debts (Loans)		Money Stock (M1) = Demand Deposits	
		Producers (Assets)	Households (Assets)
Producers	1,000		Demand Depoists (H) 970
			(Bankers) 30
Households	1,000	Demand Deposits 970	Demand Deposits (Bankers) 30
Government	1,000		Demand Deposits (H) 970
			(Bankers) 30
CB/Govern ment (QE)	(Sales of G Bonds only)		(Bankers) (12)
			(CB Owners) (18)
Total Debts	3,000	Total Deposits	3,000
		(Details)	
		Demand Deposits (P) 970	Demand Deposits (H) 1,940
			(Bankers) 90

Figure 10: Money Stock equals Total Debts

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

[3]Bank of Japan's website for FFA statistics and related materials are available at: http://www.boj.or.jp/en/statistics/sj/index.htm/

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[4]. 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.

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[4]Data series of ″Postal savings″ and ″Private life insurance companies″ are available only until the third quarter of 2007.
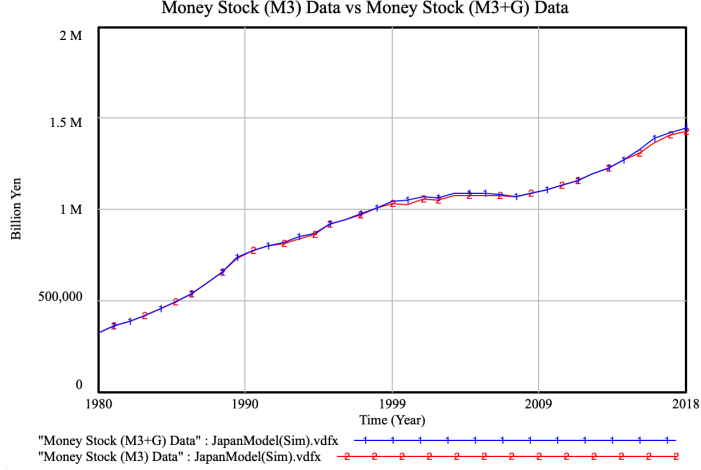
Figure 11: Money Stock M3 vs M3+G

5 Our Main Finding: $M_3 \simeq$ 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

$$
\begin{aligned}
\text{Total Domestic Debts} \quad = \quad & \text{Loans (Banks Domestic)(C-c)} \\
& + \text{Government Debts (Domestic)} \quad (4)
\end{aligned}
$$

where

$$
\begin{aligned}
\text{Loans (Banks Domestic)(C-c)} \quad = \quad & \text{Loans (Banks)(C-c)} \\
& - \text{Debts (Overseas)} \quad (5)
\end{aligned}
$$

22
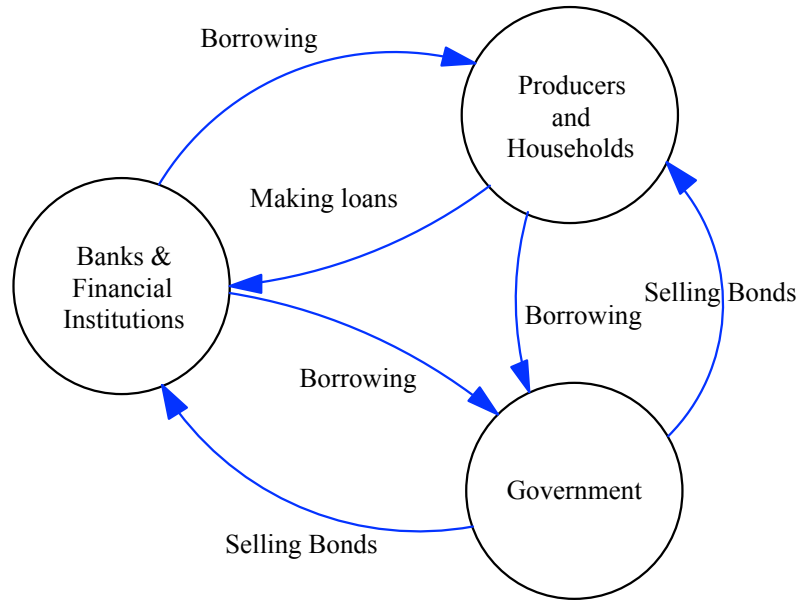
Figure 12: Diagram of Debts and Loans

and

$$
\begin{aligned}
\text{Government } &\text{Debts (Domestic)} \\
= \quad &\text{Treasury Securities Debt (Government)} \\
+ \; &\text{Treasury Bills Debt (Government)} \\
- \; &\text{Treasury Securities (Overseas)} \\
- \; &\text{Treasury Bills (Overseas)} \tag{6}
\end{aligned}
$$

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.

```
                  M3         MT         M1         Mf         M0      Debts
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   0.875844   1.000000   0.499548   0.845127
M0          0.747855   0.210169   0.855591   0.499548   1.000000   0.752381
Debts       0.992026   0.638985   0.924148   0.845127   0.752381   1.000000
Loans(P)    0.668909   0.958048   0.314628   0.267611   0.277726   0.624334
Debts(G)    0.909638   0.353722   0.983277   0.908059   0.791018   0.938950
```

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[5].
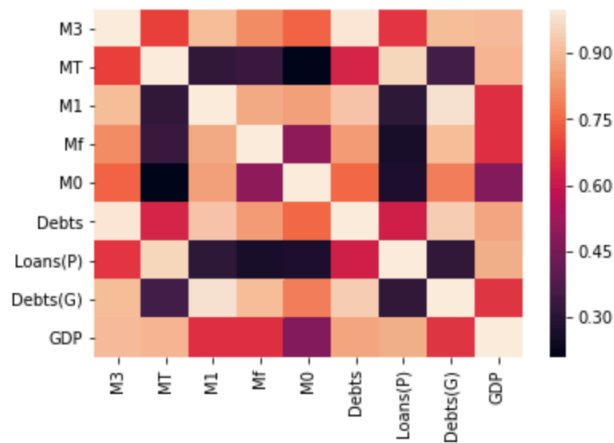
Figure 14: Python's Heatmap Diagram of All Coefficients

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[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.

---

[5]In this figure, GDP is additionally included for our analysis below.

[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.

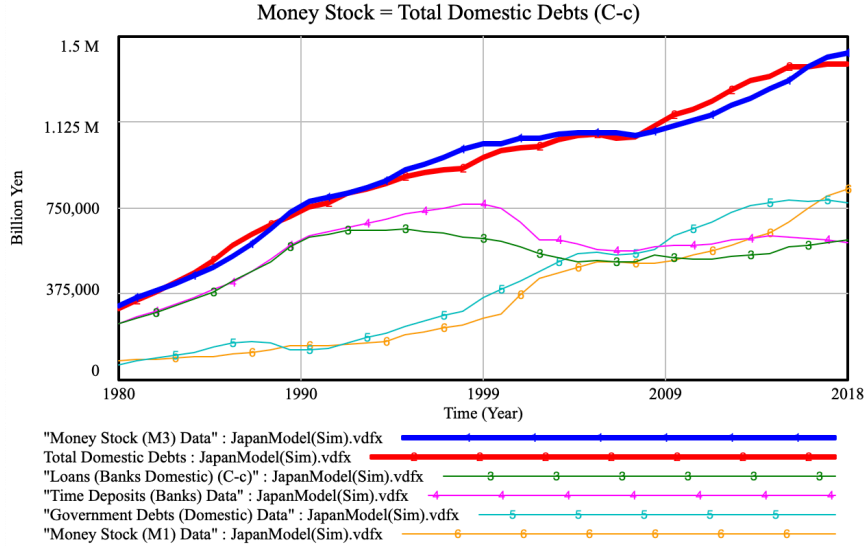Figure 15: Money Stock $M_3 \simeq$ Total Domestic Debts (1980-2018)

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.

$$M_3 \simeq \text{Total Domestic Debts (corr.coef =0.992) } (\equiv M_T + M_1) \qquad (7)$$
$$M_T \simeq \text{Private Debts by Producers and Households (corr.coef =0.958)} \quad (8)$$
$$M_1 \simeq \text{Government Debts (corr.coef =0.983)} \qquad (9)$$

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: $M_3 \simeq$ Total Domestic Debts

Our main finding of equation (7) is now illustrated in Figure 16.
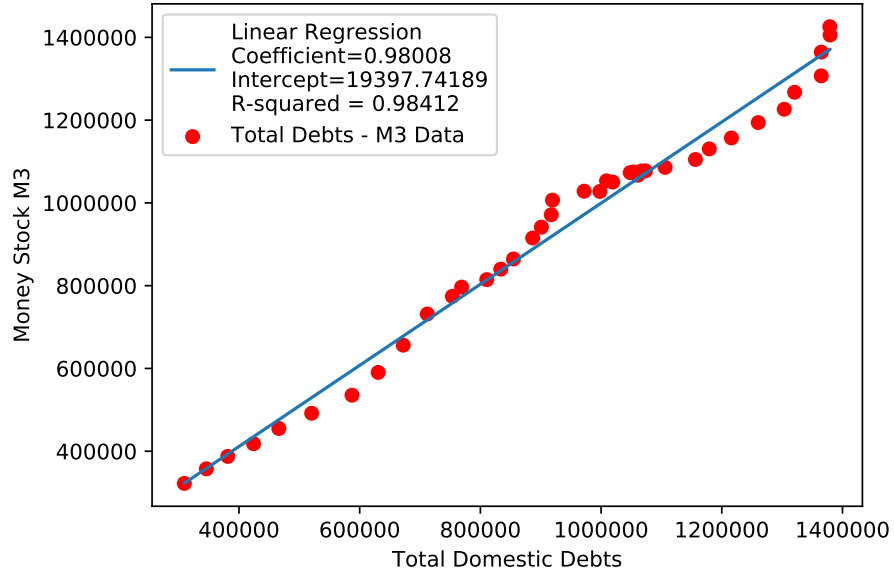
Figure 16: Regression of Money Stock $M_3 \simeq$ Total Domestic Debts

Its linear regression is described as

$$M_3 = 19397.74189 + 0.98008 * \text{Total Domestic Debts } (R^2 = 0.98412) \qquad (10)$$

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.
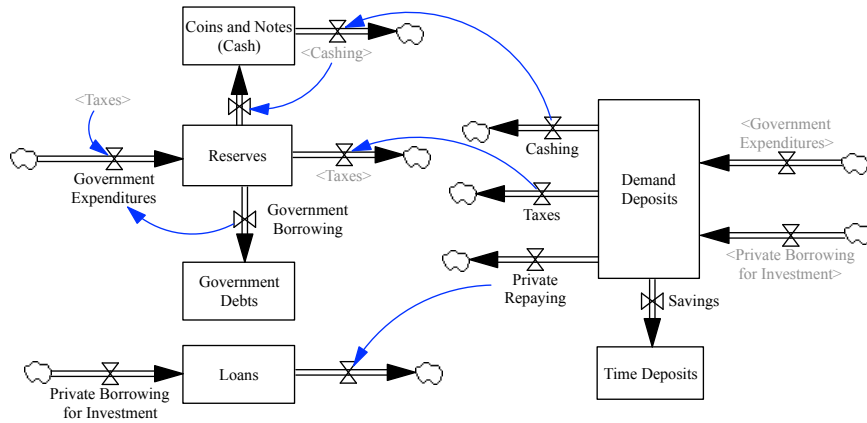
Figure 17: Loans $\Rightarrow$ Time Deposits, and Government Debts $\Rightarrow$ M1

Loans $\Rightarrow$ Demand Deposits $\Rightarrow$ 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 $\Rightarrow$ Reserves $\Rightarrow M_1$. Banks purchase government bonds out of their Reserves. Now government spend these amounts as government expenditures through banks' Reserves to Demand Deposits (M_1) 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:

$$M_T = -41029.936203 + 1.166703 * \text{Private Loans } (R^2 = 0.91785) \qquad (11)$$

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
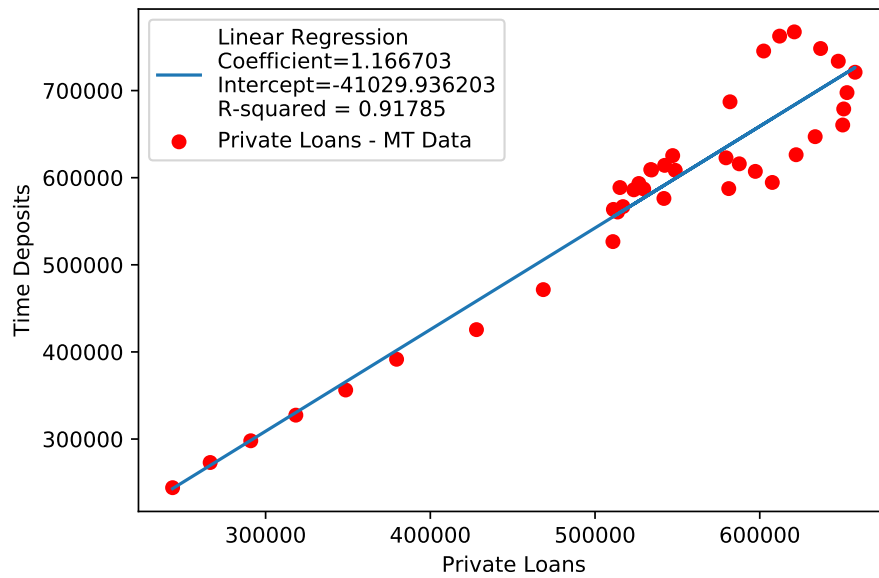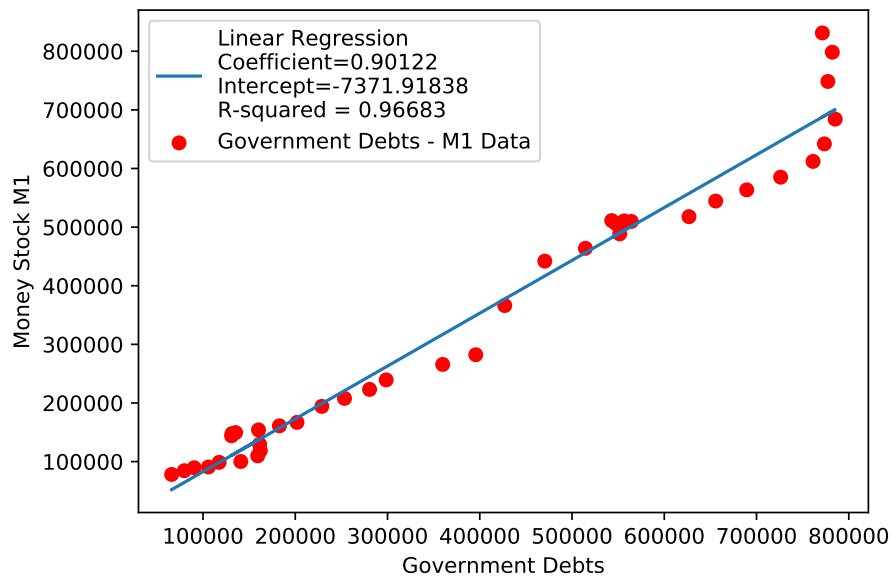
The corresponding regression equation is obtained as follows.

$$M_1 = -7371.91838 + 0.90122 * \text{Government Debts} \ (R^2 = 0.96683) \qquad (12)$$

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 fo private and government sectors as Figure 20[7].

Debtors	Creditors	M0 (Reserves)	Mf (Deposits)	M1	GDP
Private Sectors (Producers & Households)	Banks	0	+	+	+
Governmement	Central Bank	+	-	+	0
	Banks	0	+	+	0
	Private Sector	0	0	0	0
Quantitative Easing (QE)					
Banks	Central Bank	+	-	0	0

(M0 + Mf = M1)

Figure 20: How M_1 is created by Debts?

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 <u>the central bank</u> end with the increases in M_0 and M_1, but M_f does not increase.

3. Government bonds (debts) purchased by <u>banks</u> end with the increases in M_f and M_1, but M_0 does not increase.

4. Government bonds (debts) purchased by <u>private sectors</u> do not increase M_0, M_f and M_1.

5. Existing government bonds (debts) purchased by <u>the central bank</u> from banks (this operation is called *Quantitative Easing or QE*) end with the increases in M_0, 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.
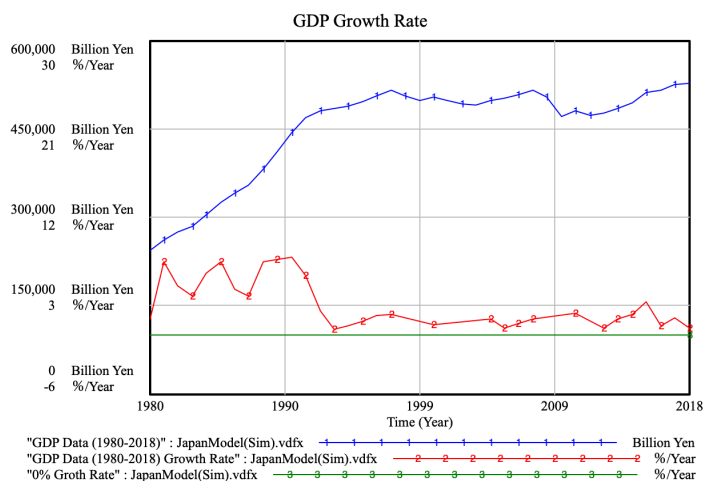
Figure 21: GDP and Growth Rate

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 4% (1987) and the highest 8% (1990) over the period 1981 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 - 6.6% (2009) and highest at 3.4% (2015); that is, almost 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.

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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.

```
              Loans(P)   Debts(G)        GDP
    M3        0.668909   0.909638   0.902364
    MT        0.958048   0.353722   0.893339
    M1        0.314628   0.983277   0.657975
    Mf        0.267611   0.908059   0.658236
    M0        0.277726   0.791018   0.475052
    Debts     0.624334   0.938950   0.866796
    Loans(P)  1.000000   0.317459   0.877330
    Debts(G)  0.317459   1.000000   0.665820
    GDP       0.877330   0.665820   1.000000
```

Figure 22: 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 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

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[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.

Private Loans --> GDP --> Time Deposits
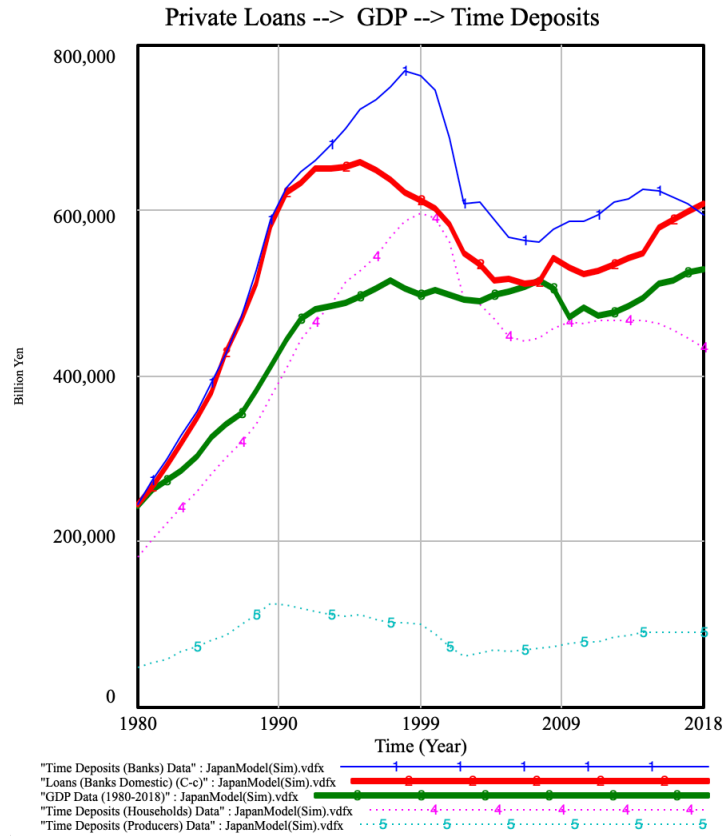
Figure 23: GDP and Time Deposits M_T = Private Debts

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 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.
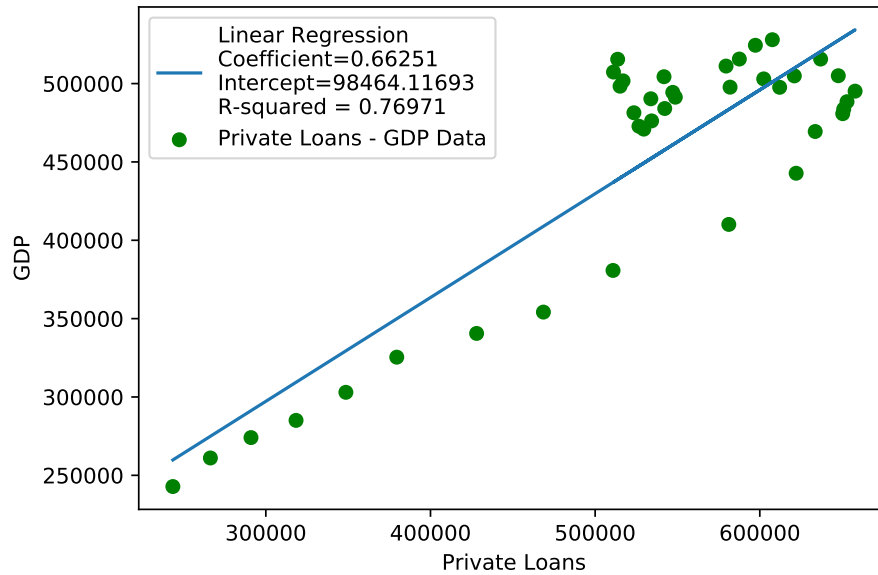
Figure 24: Regression of Private Debts $\Rightarrow$ GDP

Its corresponding regression equation is obtained as follows:

$$\text{GDP} = 98464.11693 + 0.66251 * \text{Private Loans} \ (R^2 = 0.76971) \qquad (13)$$

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 event 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

Figure 25: GDP and Money Stock M_1 = Government Debts

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*

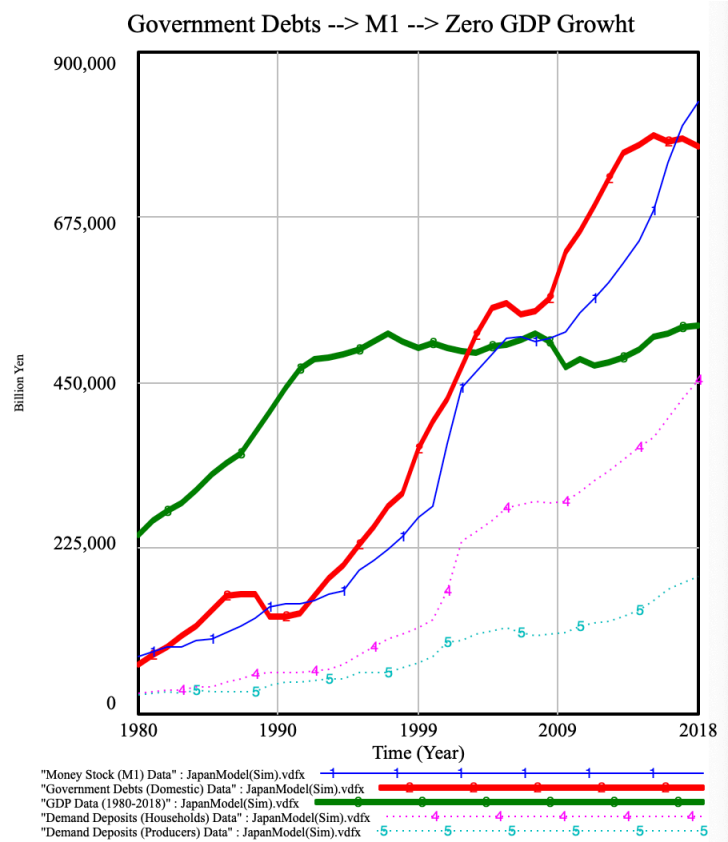*of 8 billions of dollars of nation's chief circulating medium which we all need as a common highway for business.* (p.15)

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.

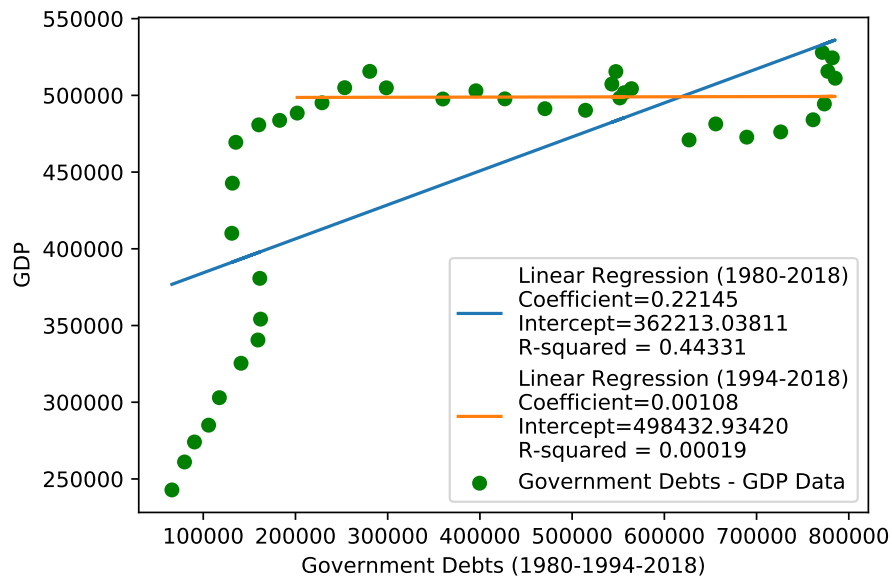Figure 26: Regression of Government Debts $\Rightarrow$ GDP

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

$$\text{GDP} = 362213.03811 + 0.22145 * \text{Government Debts (1980-2018)} \ (R^2 = 0.44331) \tag{14}$$

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

35

between 1994 and 2018, we obtain

$$\text{GDP} = 498432.93420 + 0.00108 * \text{Government Debts (1994-2018)} \ (R^2 = 0.00019) \tag{15}$$

and the coefficient of government debts becomes almost negligible, that is, 0.00108^{10}. In other word, as illustrated in Figure 26, fiscal policy by government debts have thoroughly failed to drive GDP in Japan[11].

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.
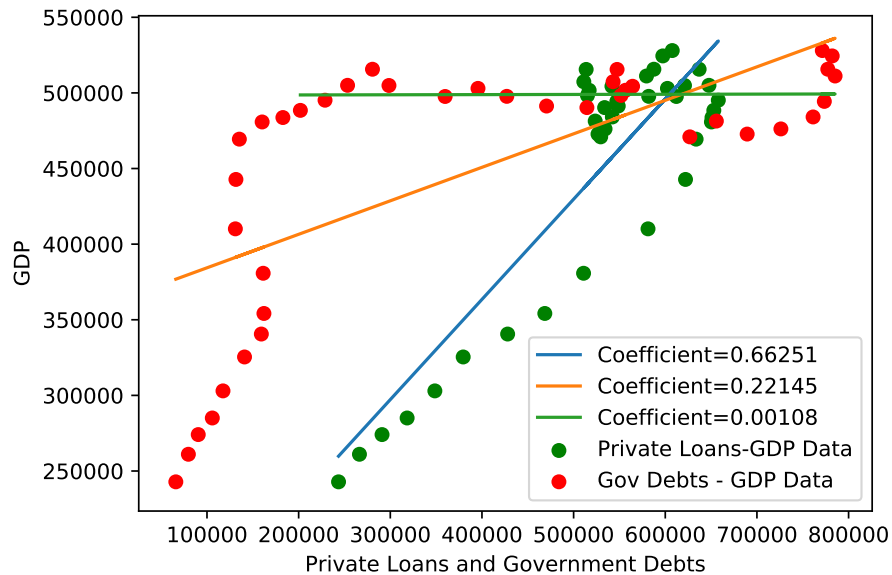
Figure 27: Compared Regressions of Loans(Private) and Debts(G)

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[10]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.

[11]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.

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

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

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 Δ 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:

$$\Delta M_1 = m_m \Delta M_0 \tag{17}$$

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

$$\Delta M_1 \cdot V_m = \Delta GDP \tag{18}$$

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 ΔM_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

$$\Delta GDP = m_G \Delta M_0 \tag{19}$$

Quantitative Easing (QE) Failed to Increase M1 and GDP

"Reserves (Central Bank) Data" : JapanModel(Sim).vdfx
"Base Money (M0) Data" : JapanModel(Sim).vdfx
"GDP Data (1980-2018)" : JapanModel(Sim).vdfx
"Money Stock (M1) Data" : JapanModel(Sim).vdfx
"Functional Money (Mf)" : JapanModel(Sim).vdfx
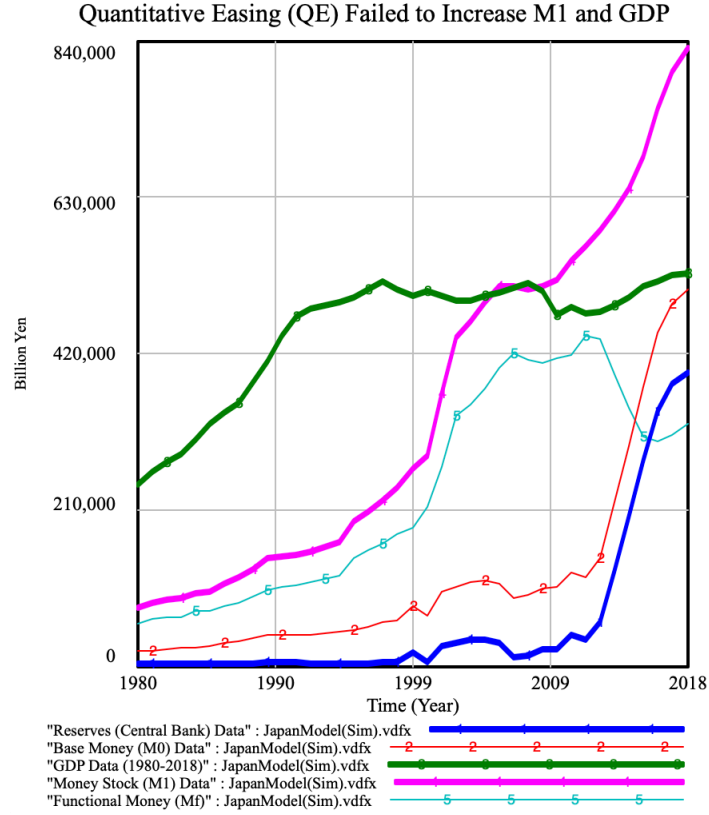
Figure 28: QE policies failed to increase M_1 and GDP

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

$$m_G = V_m \cdot m_m = 0.019 \times 9.7 = 0.1843^{12}. \tag{20}$$

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 $\Delta M_0 = 360.3$ trillion yen, which in turn increased M_1 by $\Delta M_1 = 246$ trillion yen. Yet, GDP has increased only by Δ GDP $= 51.8$ 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

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[12]m_G thus defined can be interpreted as a coefficient of M_0 of a linear regression:
$GDP = \alpha + m_G M_0$.

than the first period's $m_G = 0.1834$. Table 3 summarizes these performances of QE policies in Japan.

	m_m	V_m	$m_G = V_m \cdot m_m$
QE1 (2001-2006)	9.9	0.019	0.1843
QE2 (2013-2018)	0.683	0.216	0.1483

Table 3: Performance 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 m is not an exogenous parameter, but endogenously determined. Using our terminology, this implies the following identity, not the equation.

$$\Delta M_1 \equiv m_m(\Delta M_1)\Delta M_0 \tag{21}$$

That is, there is no way of determining m_m and ΔM_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[13].

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

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

That is, a coefficient of M_0 is 0.3024.

After the introduction of QE policy in 2001, we have

$$\text{GDP} = 483260.13453 + 0.07287 * M_0 \ (2001\text{-}2018) \ (R^2 = 0.40110)^{14} \tag{23}$$

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.

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[13]When m = 1, we have $M_1 = M_0$, a 100% state of required reserves ratio, or $M_f = 0$. In other words, this is one of the conditions of public money system. Japan's QE policies ironically have been attaining this ideal state of financial stability we are proposing.

[14]This overall value of coefficient is considerably smaller than our simple calculations of m_b 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 has less room to determine the size of GDP. The story will be very different when $M_0 = M_1$ under the public money system we are proposing [11, 2019].
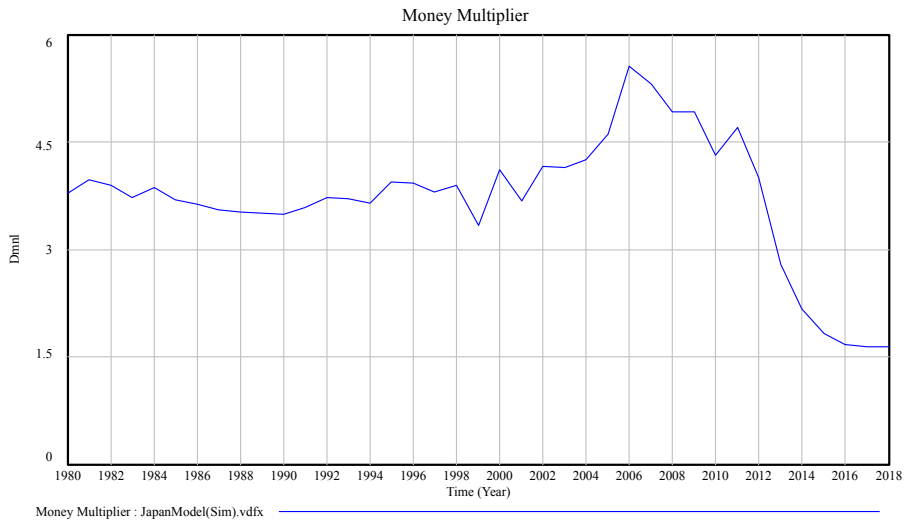
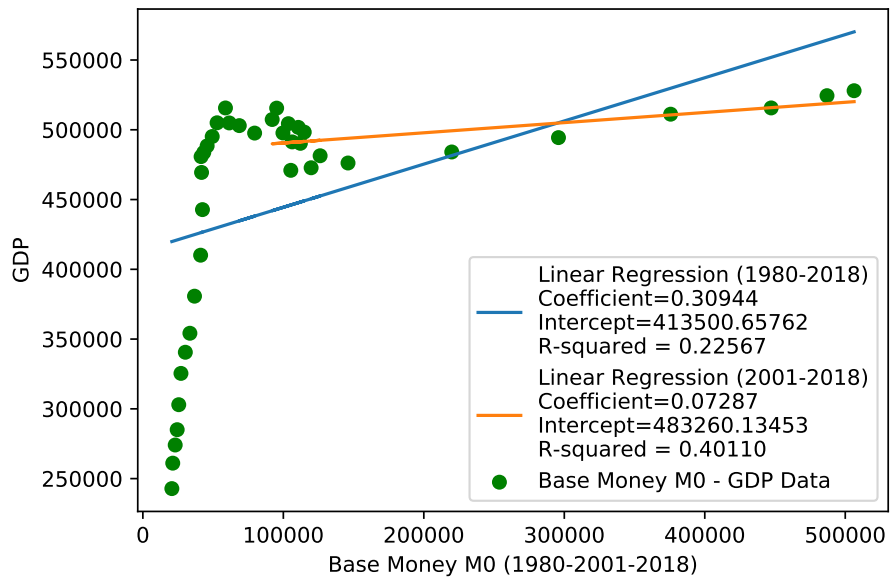Figure 29: Money Multiplier (m) between 1980 and 2018

Figure 30: QE Regressions: GDP - M_0

In this way, Japanese QE policies are now demonstrated to have entirely failed with our calculatins 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.

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.

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Appendix A: Sectors of FFA Statistics in Japan

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

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

Figure 31: Sectors in Flow of Funds Account in Japan

Nonfinancial corporations			2
	Private nonfinancial corporations	Profit-making corporations, medical corporations, etc.	2-1
	Public nonfinancial corporations	Certain government-affiliated corporations such as public corporations, government financial corporations and independent administrative institutions, Enterprise Special Accounts of the Central Government, local public corporations, local public enterprises	2-2
General government			3
	Central government	Central Government General Account, National Special Accounts that are not included into other sectors, certain government-affiliated corporations such as government financial corporations, certificated corporations, other independent administrative institutions	3-1
	Local governments	Urban and rural prefectures, towns, villages and special wards	3-2
	Social security funds	<Other than the following> Part of the National Special Accounts, health insurance associations, funds, etc.	3-3
	Of which: public pensions	Part of the National Special Accounts, long-term accounts of mutual aid associations, Farmers' Pension Funds	3-3-1
Households			4
Private nonprofit institutions serving households			5
Overseas			6

Figure 32: Sectors in Flow of Funds Account in Japan (continued)

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 *loans 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, 200?).

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.