

Chapter 6

Money as Total Debts

Following the previous chapter that has focused on the back face of money in our classification table of money, this chapter¹ continues to explore the nature of money from the front face of money. That is, money stock is considered here as the sum of public money and debt money. Then, debt money is shown to be equal to total debts. Since public money is negligible under the the current debt money system, it is asserted that money stock is determined by the amount of total debts. This assertion is confirmed as a case study in Japan.

Accordingly, this chapter tries to analyze how total debts are endogenously determined by the behaviors of those who come to banks to borrow such as producers, households and government, and attitudes of banks to make loans to them. We have focused on the destruction of money stock, and identified three main causes of monetary destruction. Then simulations are carried on to find out how these causes destroys money stock. Failures of quantitative easing policies are shown to be produced by the combination of these causes, as well as monetary instability. Finally monetary instability is shown to be subdued by introducing 100% required reserve ratio.

6.1 Money Stock \simeq Total Debts

Front Face of Money: Public vs Debt Money

We have explored in the previous chapter how functional money is created out of nothing under the fractional reserve banking system by focusing on base money as legal tender. Our analysis there was based on the back face of money in our classification tables of money such as Tables 5.2 and 5.5. Consequently our

¹This chapter is partly based on the paper [111, 2016]: The Heads and Tails of Money Creation and its System Design Failures – Toward the Alternative System Design – in “Proceedings of the 34th International Conference of the System Dynamics Society”, Delft, the Netherlands, July 17-21, 2016.

analysis has been carried out by following the monetary equation such that

$$\text{Money Stock} = \text{Legal Tender } (M_0) + \text{Functional Money } (M_f) \quad (6.1)$$

More specifically, only the maximum amount of money stock that is allowed by a fractional reserve has been analyzed. In this sense, our analysis constituted the *supply side* of money creation.

In the same classification tables, money is, as its front face, classified as

$$\text{Money Stock} = \text{Public Money} + \text{Debt Money} \quad (6.2)$$

Public money is referred to as the money that is issued by public (sovereign) authorities *at interest-free*, while debt money as the one issued by private banks *at interest*. Figure 6.1 is conceptually the same as Tables 5.2 and 5.5 in the previous chapter except that it emphasizes a creation process of functional-money M_f out of nothing from base money M_0 as legal tender. In addition, debt money is illustrated to dominate the whole money stock. In fact, public money is shown in Table 5.5 to occupy only 0.3% in Japan. Accordingly, this chapter explores the nature of money from a front face of mostly *debt money* such as who borrowed how much; that is, *demand side* of money creation.

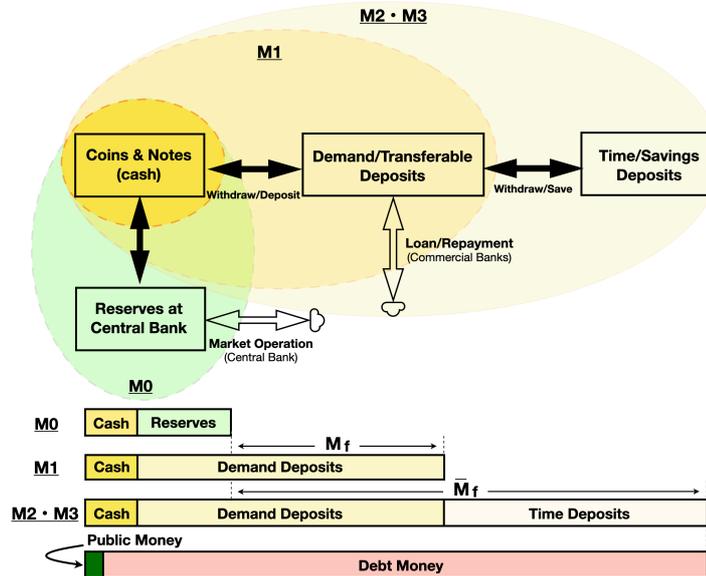


Figure 6.1: Money Stock = Public Money + Debt Money

Figure 6.2 [Companion model: 4a Money(Stock-Instability).vpm²] illustrates these two different classifications of money, front face and back face, which are represented by the equations (6.1) and (6.2), respectively. Equation (6.1), back

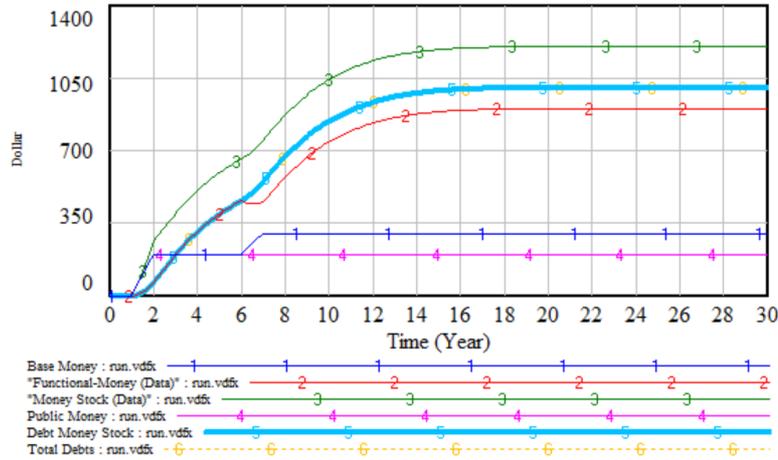


Figure 6.2: Debt Money = Total Debts

face, is illustrated as

$$\text{Money Stock (line 3)} = \text{Base Money (line 1)} + \text{Functional Money (line 2)}.$$

In the model, money stock is \$1,200 and functional money is \$900, while base money consists of gold certificates (\$200) and discount loans to commercial banks (\$100) issued at t=6.

Equation (6.2), front face, is illustrated as

$$\text{Money Stock (line 3)} = \text{Public Money (line 4)} + \text{Debt Money (line 5)}.$$

Public money here only amounts to gold (certificates) of \$200, and debt money is \$1,000.

Debt Money \simeq Total Debts

Historically, public money has been the only money widely used as a means of transactions and payments as legal tender. In this sense, from the beginning of our monetary history money has been treated as

$$\text{Money Stock} = \text{Public Money} = \text{Legal Tender} \tag{6.3}$$

²In this chapter due to the heads-tails nature of money creation we exclusively use a slightly extended stock-approach model of 3a Money(Stock-approach) used in the previous chapter. Its package model is available from the author's web site.

as indicated by the quotation of Greek philosopher Aristotle (384-322 BC) in the previous chapter.

When transaction and payment businesses were taken over by private banks and a fractional reserve banking system was introduced under the control of central banks, the entity of money stock had drastically changed such that functional money as bank deposits began to be created out of nothing by commercial banks as shown in the following relation:

$$\text{Money Stock} = \text{Public Money (Gold)} + \text{Functional Money} \quad (6.4)$$

Under the gold standard, gold has been public money. Accordingly our gold standard model in the previous chapter is constructed to reflect this monetary history, and our analysis of money creation started with the gold standard.

After the abandonment of global gold standard in 1971, only metallic coins of governments have survived as public money. As a result, base money as legal tender has become a mixture of public money and debt money such that

$$\text{Legal Tender} = \text{Public Money (Coins)} + \text{Debt Money (Banknotes \& Reserves)} \quad (6.5)$$

In this way, debt money has become nowadays

$$\text{Debt Money} = \text{Debt Money (Banknotes \& Reserves)} + \text{Functional Money} \quad (6.6)$$

Where does debt money come from, and how is it determined, then? In the previous chapter only functional money was demonstrated to be created as bank deposits by commercial banks out of nothing. Where does a remaining portion of debt money (bank notes and reserves) come from? To answer this question, let us consider the total amount of money stock that non-banking sectors, such as the *public sector* (producers and households) and government, borrow from commercial banks as a whole.

$$\text{Total Debts} = \text{Public Debts} + \text{Government Debts} \quad (6.7)$$

where Government Debt is defined in the model as

$$\text{Government Debts} = \text{Debt (Government)} - \text{Government Securities (Public)} \quad (6.8)$$

That is, securities held by the public sector (households and producers) are excluded from the government debt because it does not borrow from the banks.

From Figure 6.2, we can easily observe that

$$\text{Debt Money (line 5)} = \text{Total Debts (line 6)} \quad (6.9)$$

We have confirmed this equality under all simulations we have carried out in the previous chapter. This implies that debt money as part of our money stock is always determined by the total amount of debts producers, households and government borrow from banks as a whole. Banknotes and reserves as a part of debt money are also determined by the amount of total debts by non-banking sectors. This answers the question posed above. In this way, demand for debts by non-banking sectors determines the amount of debt money.

Money Stock \simeq Total Debts

From the case analysis of Japan, Table 5.5 in the previous chapter, public money (coins) constitutes only 0.3% of money stock M_3 , almost negligible. Nowadays, this situation of public money is comparable in many countries where central banks issue banknotes as legal tender. Hence, from equations (6.2) and (6.9) we have

$$\text{Money Stock} \simeq \text{Debt Money} = \text{Total Debts} \quad (6.10)$$

Moreover, this also implies, from equation (6.1), that

$$\text{Debt Money} \simeq \text{Legal Tender } (M_0) + \text{Functional Money } (M_f) \quad (6.11)$$

Figure 6.3 is produced to analyze the case in which gold as public money becomes negligible. That is, gold deposits of \$200 is replaced with the same amount of discount loans to banks, which now adds up to \$300 at $t=6$.

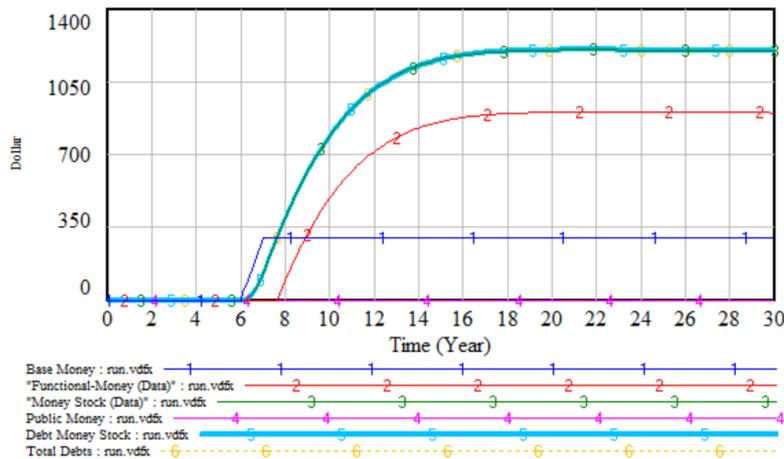


Figure 6.3: Money Stock = Debt Money = Total Debts = $M_0 + M_f$

This figure also confirms equation (6.10) as

$$\text{Money Stock (line 3)} = \text{Debt Money (line 5)} = \text{Total Debts (line 6)}$$

where money stock etc. are all \$1,200.

Equation (6.11) is similarly confirmed as

$$\text{Debt Money (line 5)} = \text{Base Money (line 1)} + \text{Functional Money (line 2)}$$

where debt money is \$1,200, base money is \$300 and functional money is \$900.

This relation implies that base money consisting of only discount loans to banks could be created by central banks as legal tender (M_0) out of nothing

only when someone comes to central banks to borrow. Someone in this case are commercial banks. Then, debts by commercial banks are passed on to those of non-banking sectors later, because debt money equals their total debts. The reader can easily confirm that someone could also be government when central banks purchase government securities as their open market purchase operations.

In addition to functional money (M_f) that is created out of nothing, we have now revealed that almost all money stock (more than 99%) are created only when non-banking sectors come to banks to borrow. Under the modern debt money system, money stock is created out of nothing as two stages. First, by central banks as creation of legal tender or base money, then by commercial banks as creation of functional money or bank deposits. In this way all money stock is issued at interest under a debt money system, and interest incomes thus raised from debt money issuance are shared within central banks and commercial banks. We will explore this issue of income distribution among banking and non-banking sectors in the next chapter.

6.2 Money Stock \simeq Total Debts: A Case in Japan

This section continues our analysis of money creation in Japan from our previous study in Chapter 5: Base Money and Money Stock: A Case in Japan.³ We have already presented all types of money stock such as M_0, M_1, M_f, M_T and M_3 in the previous case study. For this case study, we also use the same Flow of Funds Account (FFA) statistics by the Bank of Japan. Transaction items of FFA 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.

Using these transaction items, let us now define Total Domestic Debts, Loans and Government Debts as follows.

$$\begin{aligned} \text{Total Domestic Debts} &= \text{Loans (Banks Domestic)(C-c)} \\ &\quad + \text{Government Debts (Domestic)} \end{aligned} \quad (6.12)$$

$$\begin{aligned} \text{Loans (Banks Domestic)(C-c)} &= \text{Loans (Banks)(C-c)} \\ &\quad - \text{Debts (Overseas)} \end{aligned} \quad (6.13)$$

$$\begin{aligned} \text{Government Debts (Domestic)} &= \text{Treasury Securities Debt (Government)} \\ &\quad + \text{Treasury Bills Debt (Government)} \\ &\quad - \text{Treasury Securities (Overseas)} \\ &\quad - \text{Treasury Bills (Overseas)} \end{aligned} \quad (6.14)$$

³This section is based on the paper [110, 2019]: Money Stock \simeq Total Domestic Debts – Theory of Debt Money.

To deepen our understanding of money creation among these amounts, we have carried out correlation analysis by applying Python's big data analysis method, and obtained their correlation coefficients in Figure 6.4. Total Domestic Debts, Loans (Banks Domestic)(C-c) and Government Debts (Domestic) defined above are denoted in the Figure by Debts, Loans (P) and Debts (G), respectively.

	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 6.4: Correlation Coefficients of All Money Stocks and Debts

From the Figure, we have identified a close correlation between M_3 and Total Domestic Debts, whose correlation coefficient is 0.992 as expected from our discussions above.⁴ Unexpectedly, in the Japanese economy between 1980 through 2018 we have also identified two more close correlations; (1) Government Domestic Debts and M_1 with correlation coefficient of 0.983, and (2) Private Domestic Loans and M_T (Time Deposits) with correlation coefficient of 0.958.

Figure 6.5 illustrates time-series behaviors of these highly correlated six variables. Specifically, we have observed the following three findings.

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 out of nothing by the borrowings of non-banking sectors.*

2. Loans (Bank Domestic) (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 bank 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*.

⁴ 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.

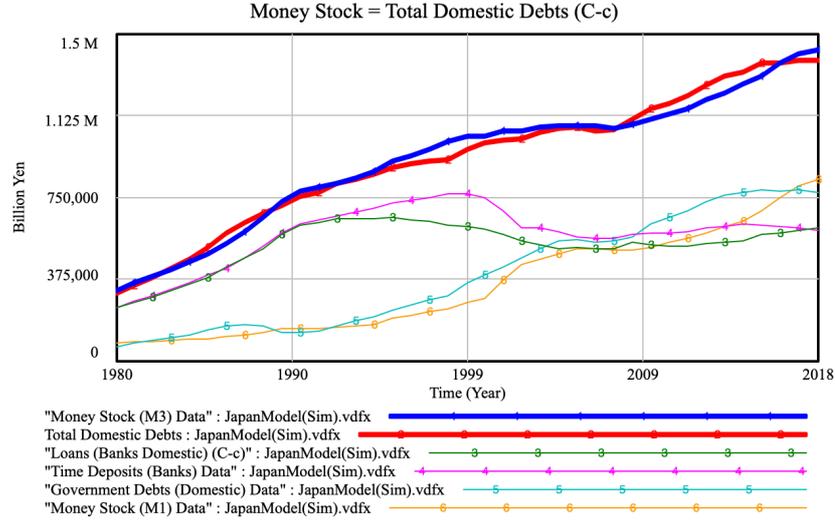


Figure 6.5: Money Stock $M_3 \simeq$ Total Domestic Debts (1980-2018)

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.

We have now confirmed the above section's argument that almost all money stock are created only when non-banking sectors come to banks to borrow in the case of Japanese economy. Additionally, we have found highly correlated relation of time deposits and private loans by producers and households, and that of M_1 and government debts.

Furthermore, from these correlations we have unquestionably derived the following causal relations as equations of linear regression.

$$M_3 = 19397.74189 + 0.98008 * \text{Total Domestic Debts} \quad (6.15)$$

$(R^2 = 0.98412)$

$$M_T = -41029.936203 + 1.166703 * \text{Bank Domestic Loans} \quad (6.16)$$

$(R^2 = 0.91785)$

$$M_1 = -7371.91838 + 0.90122 * \text{Government Debts} \quad (6.17)$$

$(R^2 = 0.96683)$

Equation (6.15) holds true in any economy under debt money system. 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 that of the total domestic

debts. In other words, money stock M_3 is created endogenously by the sum of non-banking sectors' debts such as producers, households and government. Equation (6.16) indicates that the increased amount of bank domestic loans to producers and households ends up with time deposits by the factor of 1.1667. Equation (6.17) indicates the increased amount of government debts ends up with demand deposits by the factor of 0.9012. Monetary equations (6.16) and (6.17) may be specific to the case of Japanese economy.

6.3 Destruction of Money Stock

Now that money stock is substantiated to be endogenously determined by the demand for debts from non-banking sectors, let us take a closer look at the causes of their demand for debts one by one. Specifically our interest here is in the endogenous destruction of money stock.

6.3.1 Causes of Monetary Destruction

Loans Cutbacks

Debts (Public) in our model as a part of total debts is a stock amount whose stock level is determined by its inflow and outflow. Its inflow is determined by the borrowing behaviors of the public and lending attitudes of the banks.

(a) *Borrowing by Producers.* In Chapter 4 we have analyzed that "in a capitalist market economy producers are all the time in a state of cash deficiency". Accordingly, borrowing from banks for real investment becomes one of their options to raise fund for running their corporate economic activities. This tends to increase money stock constantly so long as the economy continues to grow. In the days of bubbles they additionally tend to borrow as much as their financial investments (such as financial securities and bonds) make quick profits. Once bubbles pop, values of their financial assets begin to plummet, which forces producers as financial investors to sell these financial assets for cash, followed by the sudden plunges of their borrowings.

(b) *Borrowing by Households.* Most households are also in a state of cash deficiency to buy durable goods such as automobiles and houses for better lives. Therefore, their borrowing demand constitutes a relatively large amount of demand for debts. In the days of bubbles real estates and financial securities also become their targets of financial investments. When bubbles burst, their demand for borrowing as a whole all of sudden get subdued due to an immediate decline in their expected incomes in the future.

(c) *Lending by Banks.* Generally speaking banks are ready to make loans so long as they can secure sound collaterals or expect higher returns from such loans. Banks are in this way always in a position to make loans so long as there exists borrowing demand from producers and households under the debt money system. In Japan real estates have been the most favored collaterals for bank loans. As a result, so long as the prices of real estates continued to hike in the days of bubbles in late 1980's, Japanese banks made loans almost in

an unlimited fashion. Once bubbles pop, their lending attitudes were quickly reversed and tried to restrict their lending.

Repayments of Debts

Now let us consider the outflow side of Debts (Public) in our models that affects total debts and money stock. Borrowers have to repay their debts, which constantly reduces the amount of debts and money stock as well. At a microeconomic level, some borrow and some repay daily, so that money stock increases or decreases daily as well. Yet money stock has to continue to be provided to sustain an economic growth. That is to say, at a macroeconomic level, borrowings as inflows of debts has to constantly exceed outflows of repayments in a growing economy. This is the essence of stock-flow analysis of system dynamics. Consequently, commercial banks continue to prosper as well under the debt money system.

Once this "inflow > outflow" relation of system dynamics breaks, money stock begins to decline, causing economic recessions and depressions. This happens when bubbles pop and all of sudden prices of financial assets begin to plummet. Under such circumstances, banks, being afraid of losing their loans, compel borrowers to make unusually earlier repayments. On the other hand, borrowers, specifically producers, find their balance sheets are sinking under water due to the depreciation of financial assets they purchased during the days of bubbles. To restore good shapes of their balance sheets, they are also forced to repay their debts out of the profits they earned from their normal business operations. In this way forced repayments trend take place from both sides of banks and producers (as financial investors). These unusual behaviors of forced repayments tend to decrease money stock, which is claimed to have caused decades-long prolonged recessions in Japan. Richard Koo called this type of recession *Balance Sheet Recession*[47, 2009].

Liquidity Preferences

Producers and households want to keep more cash or currency at hand in the days of recessions, partly because of lower interest rates and partly because of fears of losing their bank deposits. Such unstable states of their mind rush them to the banks once they receive rumors of bankruptcies; so-called *bank runs* take place any time during recessions or immediately after the bubble burst. This type of destruction of money stock really happened during the Great Depression between 1929 and 1933 in the United States, as Irving Fisher described more metaphorically as follows.

The shrinkage of 8 billions in the nations's check-book money⁵ reflects the increase of 1 billion (i.e. from 4 to 5) in pocket-book money. The public withdrew this billion of cash from the banks and the banks, to provide it, had to destroy the 8 billions of credit.

⁵Check-book money here means demand deposits or functional-money in our terminology. Meanwhile, pocket-book money here implies cash or currency.

This loss or destruction, of 8 billions of check-book money has been realized by few and seldom mentioned. There would have been big newspaper headlines if 8 thousand miles out of ever 23 thousand miles of railway had been destroyed. Yet such a disaster would have been a small one compared with the destruction of 8 billions out of 23 billions of our main monetary highway. That destruction of 8 billion dollars of what the public counted on as their money was the chief sinister fact in the depression from which followed the two chief tragedies, unemployment and bankruptcies. Irving Fisher[12, pp. 6 - 7, 1935].

As we have analyzed in the previous chapter, liquidity preferences are represented by Currency Ratio in our models. Though it influentially affects money stock, monetary authorities such as central banks cannot control such liquidity preferences, causing endogenous instability of money stock in our economies.

6.3.2 How Destruction of Money Stock Takes Place?

We have now discussed how money stock as total debts are endogenously destroyed by the causes such as Loans Cutbacks, Repayments of Debts and Liquidity Preferences. Figure 6.6 illustrates how these three causes destroy money stocks. Line 1 indicates the maximum money stock created by the discount loans to banks, that is the same as line 3 in Figure 6.2. Destruction of money stock caused by Loans Cutbacks, Liquidity Preferences (Bank runs) and Repayments of Debts are assumed to take place simultaneously at $t=10$ as shown by lines 2, 3, and 4, respectively. Liquidity preferences (line 3) and repayments of debts (line 4) end up at the same level of monetary destruction in our simulation.

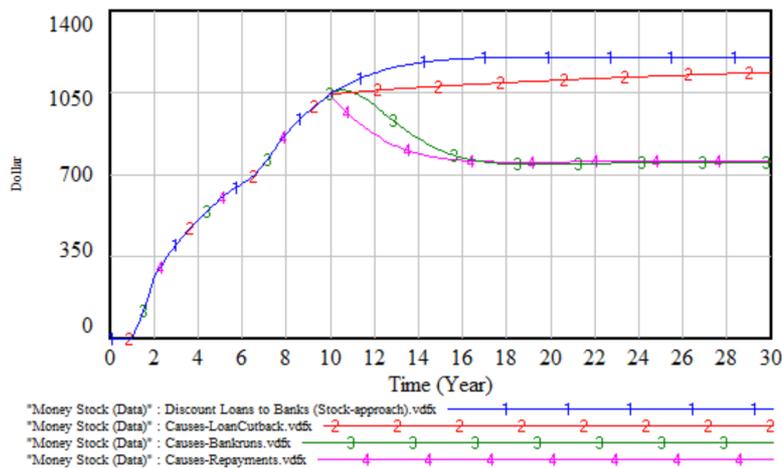


Figure 6.6: Causes of Money Stock Destruction

Historically, the Great Depression in 1929 was caused by the destruction of money stock, specifically by the Liquidity Preferences (line 3) as demonstrated by the above quotation from Irving Fisher. Financial crises in 2008, followed by the lost decades of economic recessions in Japan as balance sheet recessions, might have been caused by the Repayments of Debts (line 4). More generally, we have discussed in Chapter 4 how money stock could affect Goodwin Growth model. In this way, we could easily predict that endogenous destruction of money stock is deeply correlated with economic recessions. Therefore, understanding the causes of monetary destruction per se must be our prime concern in this chapter for further economic analyses under a debt money system.

From our discussion above, it may be more generally stated that destruction of money stock takes place by a composite mixture of Loans Cutbacks, Repayments and Liquidity Preferences. In this sense, it becomes essential to analyze how money stock is endogenously destroyed by the composite combination of these three causes. Let us first start with the following composite combination of causes in order.

- (1) Loans Cutbacks at $t=10$. Destruction of money stock starts by cutting back bank loans such that Lending Ratio = $0.3 \rightarrow 0.1$, and Lending Period = $3 \rightarrow 6$.
- (2) Liquidity Preferences at $t=15$. Following the loans cutbacks, we now assume people prefer cash or currency, followed likely by bank runs such that Currency Ratio = $0.2 \rightarrow 0.5$.
- (3) Repayments of Debts at $t=20$. Finally, forced repayments start taking place such that Repayment Ratio = $0 \rightarrow 0.2$.

Left-hand diagram of Figure 6.7 illustrates how destruction of money stock takes place as a composite behavior along with the order specified above; that is, lines 2, 3 and 4 against the original level of money stock (line 1).

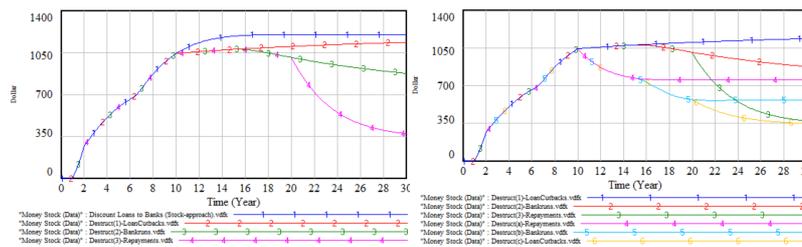


Figure 6.7: Destruction of Money Stock Compared

What will happen if the composite combination of three causes takes place in a reversed order as follows?

- (a) Repayments of Debts at $t=10$. That is, Repayment Ratio = $0 \rightarrow 0.2$.

- (b) Liquidity Preferences: Bank runs at $t=15$. That is, Currency Ratio = 0.2 \rightarrow 0.5.
- (c) Loans Cutbacks at $t=20$. That is, Lending Ratio = 0.3 \rightarrow 0.1, and Lending Period = 3 \rightarrow 6.

Right-hand diagram of Figure 6.7 illustrates how money destruction takes place in a reversed order; that is, lines 4, 5 and 6, respectively. The first simulation of destruction processes is shown by lines 1, 2 and 3, respectively in the same right-hand diagram. We can easily observe that the reversed order of causal appearances destroy money stock faster than the first original order. In this way, the order of causal appearances can be said to affect the destruction speed of money stock, and the levels of economic recessions. Theoretically speaking, there are 6 combinations of composite order appearances. Our insight obtained here will be of practical help for empirical researches of economic recessions.

6.4 Open Market Operations as QE

After bubble burst in 1990s Japan has been suffering from decades-long recessions. Traditional Keynesian monetary and fiscal policies all failed. Under such circumstances, the Bank of Japan took an abnormal policy called Quantitative Easing (QE). It is an expanded version of open market operations. That is, the BoJ purchased government securities intensively and increased bank reserves (base money) with an expectation that this rapid increase in base money sends a signal of expected inflation (target of 2%) to the markets so that it stimulates bank lending, which eventually lead to the increase in money stock, and economic growth. After the financial crises in 2008, many OECD countries are obliged to follow the BoJ's QE policies. Yet, all such policies failed.

What went wrong with QE policies? Using the above analytical reasonings we try to investigate here root causes of these failures. Let us first trigger recessions at $t=10$ as balance sheet recessions such that repayments of debts increases from 0 to 30%. Left-hand diagram of Figure 6.8 illustrates a prolonged destruction of money stock to \$655.

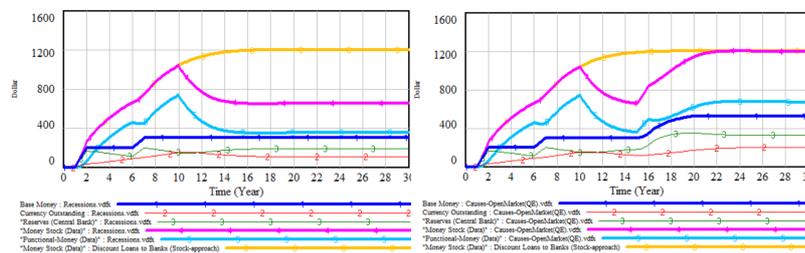


Figure 6.8: Recessions and Open Market QE policy

To rescue from this shortage of money stock, and following recessions, government now implements Keynesian fiscal policies by issuing securities of \$250 at $t=15$. Simultaneously at $t=15$, central bank enacts its QE policy by purchasing 50% of the government securities for 5 years. The QE policy increases base money from \$300 to \$524.4; that is, 74.8% increase. This increased base money successfully restores money stock from \$657 at $t=15$ to the almost original level of \$1,195 at $t=30$; that is, 81.9% increase. In this way, the QE policy seems to have successfully expanded money stock thanks to government debts followed by the QE policy of the central bank as illustrated by the right-hand diagram of Figure 6.8. This is the so-called *reflationary theory* proposed by mainstream economists. In other words, they claim that central bank can control money stock as if it is exogenously manipulated by the amount of base money. Their claims seem to work under *ceteris paribus* conditions.

In reality, the QE policies didn't work as predicted by the reflationary theory.⁶ That is, money stock failed to increase as base money increases. Let us continue our simulation to reproduce this failure. One such failure may be produced if we can trigger a cause of Loans Cutbacks simultaneously at $t=15$ when QE policy is introduced such that Lending Ratio = $0.3 \rightarrow 0.1$. This assumption may be justified because bank loans are still being discouraged when QE policies are introduced.

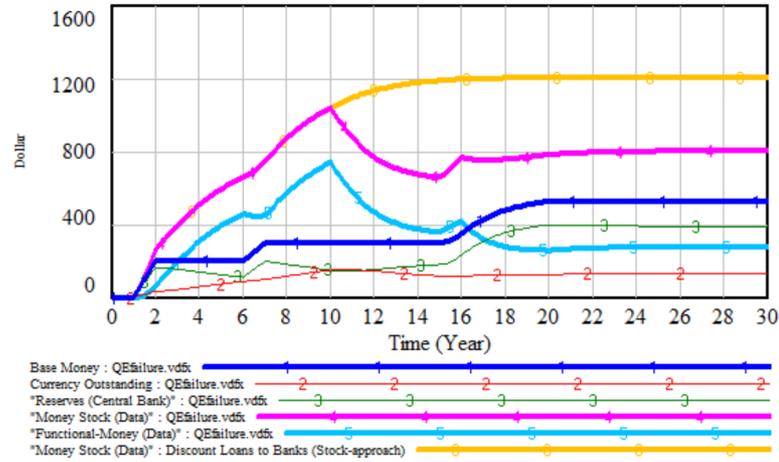


Figure 6.9: Failure of QE policy

Figure 6.9 indicates how money stock failed to increase after $t=16$ against the increase in base money. Money stock increased from \$657 at $t=15$ only to \$802 at $t=30$; that is, only 22.1% increase against the base money increase in 74.8%. This simulation suggests that the QE policy in this simulation failed to

⁶For the case of QE failure in Japan, see our paper [110, 2019]: Money Stock \simeq Total Domestic Debts – Theory of Debt Money, Section 7.5: Implication 3: Failures of QE Policies.

stimulate bank loans. Our ASD model is successful to refute the mainstream deflationary theory such that expected inflation with lowered interest rate will increase bank loans, and eventually stimulate economic growth.

6.5 Monetary Instability

So far we have discussed how money stock can be endogenously created and destroyed, and showed even central bank cannot stabilize money stock. We now examine how monetary instability could take place in our model.

Cyclical Random Walk of Liquidity Preferences

For this purpose Currency Ratio is now assumed to be determined by the following cyclical random walk behaviors. That is, Liquidity Preferences of households are governed by business cycles and random walks as follows.

$$\begin{aligned} \text{Currency Ratio} &= 0.2 \\ &+ (\text{SIN}(2*\text{Pi}*\text{Time}/\text{Business Cycle Period})*\text{Business Cycle Scale} \\ &+ \text{RANDOM NORMAL}(\text{Min}, \text{Max}, \text{C Ratio Mean}, \text{C Ratio SD}, \text{Seed}) \end{aligned} \quad (6.18)$$

where SIN is a trigonometric sine function and RANDOM NORMAL is a random normal distribution with minimum and maximum ranges of tails. Parameter values of these functions are assigned as follows: $\text{Pi} = 3.14159$, Business Cycle Period = 8 years, Business Cycle Scale = 0.07, Min = -0.2, Max = 0.2, C Ratio Mean = 0, C Ratio SD (Standard Deviation) = 0.2, and Random Walk Seed = 10. As a period of business cycle, we have assumed Juglar cycle of 8 years. Figure 6.10 illustrates two separate behaviors of business cycle and random normal distribution of currency ratio.

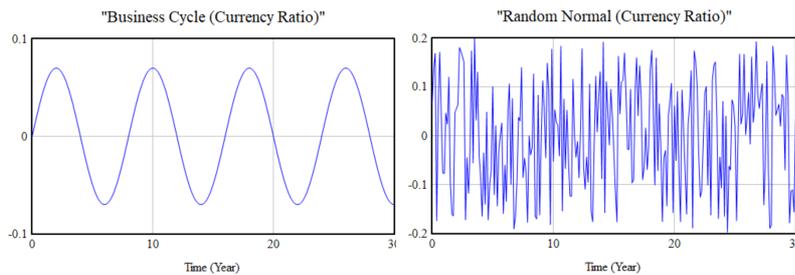


Figure 6.10: Business Cycle and Random Normal Distribution

In addition to a composite behavior of these two cyclical random walk, we have assumed a bullish lending attitude of loans by banks from the beginning of $t=1$ such that Lending Ratio= $0.3 \rightarrow 0.6$, and Lending Period= $3 \rightarrow 1$. As a result

we have obtained an extremely volatile behaviors of money stock as illustrated in Figure 6.11. Line 1 indicates a very stable base money, within which composition of currency outstanding (line 2) and reserves (line 3) fluctuates. These inner fluctuation produces extremely unstable money stock (line 4) as well as functional money (line 5). Between the year 6 and 30, money stock fluctuates with minimum value of \$953 and maximum value of \$1,548 with mean value of \$1,180. If currency ratio is stable and could be governed by central bank, money stock would have behaved very steadily as line 6 indicates (\$1,200 at $t=30$).

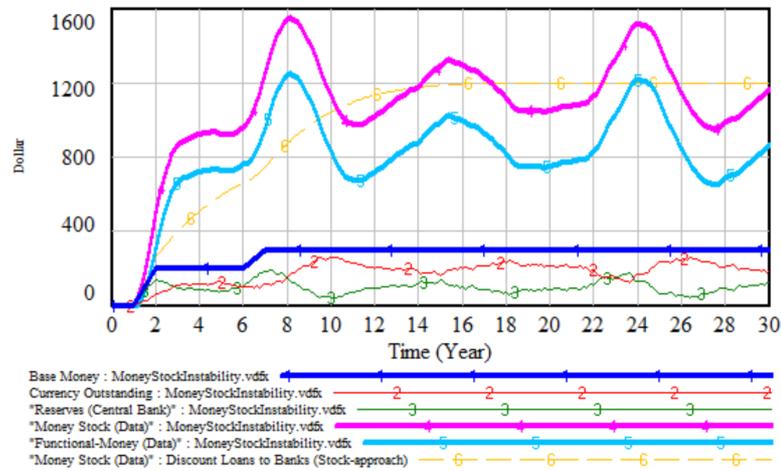


Figure 6.11: Instability of Money Stock

This amplified behaviors of the system reminds us of "Bullwhip Effect" in supply chain; that is, roaring production in upper stream caused by relatively stable downstream demand. Even at this stage of investigation, system dynamics researchers would unanimously say that this debt money system of money creation and destruction is another example of *system design failure!*

6.6 "100%Money" for Monetary Stability

Is there a way to stabilize this roaring behaviors of money stock? Yes, there is. From our discussions so far on the nature of money creation, it can be comprehensively understood that monetary instability is caused by a fractional reserve banking system. To prove this, let us increase the current required reserve ratio of 10% in the model to 100% such that RR ratio: $0.1 \rightarrow 1$ at $t=10$. From the left-hand diagram of Figure 6.12 we can easily observe that money stock (line 4) converges to base money (line 1).

Simultaneously, functional money (line 5) tends to be eliminated from the

circulation: $M_f \rightarrow 0$, so that from equation (6.1), we have

$$\text{Money Stock} = \text{Legal Tender} (M_0) \tag{6.19}$$

Under such circumstances, unstable fluctuation of money stock has fully died out, and currency ratio or liquidity preferences stopped affecting money stock. In this way 100% or full reserve requirement becomes an important condition to overcome instability of money stock under a debt money system. This is a state of "100% Money" proposed by Irving Fisher [12, 1945].

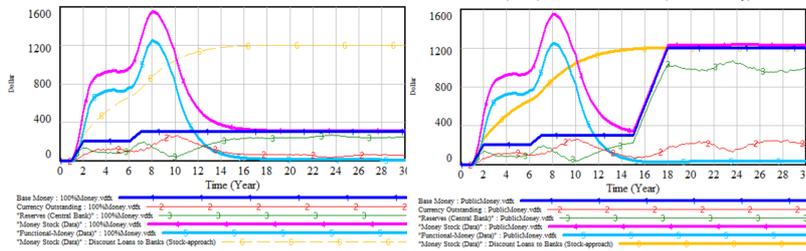


Figure 6.12: From 100% Money Stock to Public Money Stock

As a result, money stock now is severely decreased from the peak of \$1,548 (at $t=8$) to the base money level of \$300. How can we restore the original level of money stock, then? It can be increased by issuing public money at interest-free. Specifically, at $t=15$ we issue Public Money \$300 for 3 years (= \$900). Money Stock then increases to \$1,221 from the original level: \$340 at $t=15$, as illustrated by the right-hand diagram of Figure 6.12. By putting public money into circulation we have successfully restored the original level to money stock with a stable monetary condition such that base money = money stock (= \$1,221).

Yet even under this stable situation we still have, from the equation (6.2),

$$\text{Legal Tender}(M_0) = \text{Public Money} + \text{Debt Money} \tag{6.20}$$

That is, original debt money of \$100 (issued as discount loans to banks) still remains in the base money. Numerically speaking we still have

$$\text{Legal Tender}(\$1,221) = \text{Public Money}(\$1,121) + \text{Debt Money}(\$100).$$

This relation can be easily confirmed from Figure 6.1. To transform the current debt money system fully to the public money system, we have to remove this remaining debt money issued at interest.

Public Money System

It is now clear from the above analysis that monetary stability can be attained only when the following two conditions are met:

- a. Elimination of debt money: Front-face transformation.

- b. Elimination of functional-money ($M_f \rightarrow 0$): Back-face transformation.

Classification table of money presented in the previous chapter Table 5.2 that reflects these two eliminations are now revised as follows:

Debt Money System		
Front: Issuance	Public Money	Debt Money (at interest)
Back: Fiat Status	Money as Legal Tender	Functional-Money (M_f)
↓	↓	↓
Public Money System		
Front: Issuance	Public Money (Debt Money) → Public Money	
Back: Fiat Status	Money as Legal Tender (M_f) → Legal Tender	

Table 6.1: From Debt Money System to Public Money System

This indeed becomes our graphical presentation of public money system: the main theme of this book. These issues of transition from debt money to public money system will be discussed in detail in Part V: Macroeconomic Systems of Public Money.

Conclusion

We have started this chapter by defining money stock as the sum of public money and debt money; that is, a front face of money. Under the current debt money system it is shown that money stock is almost equal to total debts. This has led to the analysis of demand side of money stock; that is, money stock is endogenously determined by the behaviors of those who come to banks to borrow such as producers, households and government as well as attitudes of banks to make loans to them. We have identified three causes of monetary destructions and analyzed how they affect monetary destruction as well as monetary instability. Finally it is posed that such destruction and instability can be fixed by introducing 100% money with graphical presentation of transition from debt money to public money system.

Questions for Deeper Understanding

1. This chapter showed that “money stock is equal to total debts” under a fractional reserve banking system. Total debts are sum of the debts of non-banking sectors such as producers, households and government. This implies that money stock in our economy is endogenously determined by the behaviors of those who come to banks to borrow and attitudes of banks to make loans to them. Specifically, we have identified three major causes that determine total debts as the causes of monetary destruction and run simulations according to the following order.

- (1) Loans Cutbacks at $t=10$ in which Lending Ratio = $0.3 \rightarrow 0.1$, and Lending Period = $3 \rightarrow 6$.

- (2) Liquidity Preferences at $t=15$ in which Currency Ratio = $0.2 \rightarrow 0.5$.

- (3) Repayments of Debts at $t=20$ in which Repayment Ratio = $0 \rightarrow 0.2$.

We have also run simulations for the case in which the above order is reversed to take place. There still remain four more different orders that cause destruction of money stock. Run in total 6 simulations and compare their behaviors graphically by focusing on the speed and level of monetary destruction.

2. Figure 6.11 analyzed how Jugular business cycle of 8 years gets amplified and produces fluctuating behaviors that look like “Bullwhip Effect” in supply chain. Obtain similar business cycles of 4 years and 16 years under the same amplified conditions in the model, and compare three business cycles of 4, 8 and 16 years. How are money stocks affected under these 3 business cycles? For your comparative analysis you may use “Statistics” tool in the left-side Analysis Tools of Vensim Model Reader.
3. (**Challenge**) Figure 6.5 presents the correlation of Money Stock M_3 and Total Domestic Debts in Japan. For deeper understanding of the nature of contemporary debt money system, the reader is encouraged to create a similar correlation diagram in his/her country. How about correlations between Time Deposits M_T and Debts of Private Sectors as well as between Money Stock M_1 and Government Debts as shown in Japan?

