Chapter 15

Monetary and Financial Stability

Our economies are currently facing systemic failures of financial and debt crises. To overcome these, an alternative public money system is proposed by the American Monetary Act. This chapter[1], following the previous two chapters, tries to examine the feasibility of the public money system. Previous two chapters have focused on the liquidation of government debt. This chapter explores monetary and financial stability under the public money system in comparison with the current debt money system, by constructing a simplified macroeconomic model. It demonstrates through simulation that monetary and financial instability is built into the current debt money system and "booms and depressions" become inescapable. On the other hand, monetary and financial stability is shown to be accomplished under the public money system.

15.1 The Chicago Plan Revisited

This chapter examines the feasibility of the American Monetary Act, following the previous two chapters. The Act endeavors to restore the proposals of the Chicago Plan and 100% Money by repealing the Federal Reserve Act of 1913. Specifically, it tries to incorporate the following three features. For details see [102] and [113, 114].

- Governmental control over the issue of money
- Abolishment of credit creation with full (100%) reserve ratio
- Constant flow of money into circulation to sustain economic growth and welfare

[1]This chapter is based on the paper: On the Monetary and Financial Stability under A Public Money System – Modeling the American Monetary Act Simplified – submitted to the 30th International Conference of the System Dynamics Society, St. Gallen, Switzerland, July 22-26, 2012.

The macroeconomic system which meets the above conditions is called the *public money* system in [103], while the current system is called the *debt money* system.

Chapter 12 investigated how accumulating government debts could be liquidated under the above two different macroeconomic systems [102] . What was found is that the liquidation of government debt under the current macroeconomic system of debt money is very costly; that is, it triggers economic recessions, while the liquidation process under the public money system can be accomplished without causing recessions and inflations. Chapter 13 expanded the analysis to the open macroeconomies and found that government liquidation can be attained without causing economic recession, unemployment and inflation in both domestic and foreign economies [103]. These two chapters have focused on the liquidation of government debts, because national debts are the most imminent issues many OECD economies are now facing.

Having solved the liquidation issue of national debts, I've strongly felt that something essential might have been missing in these researches. This reflection has led me to revisit the Chicago Plan, specifically a mimeograph called *A Program for Monetary Reform* that had been circulated among American economists in July, 1939, as already examined in Chapter 12. It turned out that the liquidation of national debt is "a by-product" of the Chicago Plan or the 100% reserve system.

What is "a main-product", then, that we have missed in our previous analyses? Revisit of the Chicago Plan, specifically the above mimeograph, convinced me that its main concern was the monetary instability under the fractional reserve system as the following section 9 indicates:

> (9) Fractional reserves give our thousands of commercial banks the power to increase or decrease the volume of our circulating medium by increasing or decreasing bank loans and investments. The banks thus exercise what has always, and justly, been considered a prerogative of sovereign power. As each bank exercises this power independently without any centralized control, the resulting changes in the volume of the circulating medium are largely haphazard. This situation is a most important factor in booms and depressions [12, p.169].

Irving Fisher himself emphasized in his book that the 100% Money plan "would remove the chief cause of both booms and depressions, namely, the instability of demand deposits, tied as they are now, to bank loans." [13, p.8]

The purpose of this chapter is, therefore, to examine the main-product of the Chicago Plan; that is, how monetary and financial stability can be attained under the public money system that incorporates 100% reserve system or the Chicago Plan.

Having inherited the academic tradition of the Chicago Plan, Milton Friedman, Nobel laureate proponent of free market economy, also supported the plan as follows;

> One major reform that I recommended in the third lecture to

> achieve that objective was 100% reserve banking, a proposal that had been made by a group of economists at the University of Chicago during the 1930s and that was strongly supported by the greatest of American economists, Irving Fisher. The proposal is "to require any institution which accepts deposits transferable by check to have one dollar in high-powered money [i.e., currency plus deposits at Federal Reserve Banks] for every dollar in deposit liabilities, ... that is, to have 100% reserves." [34, p.X]
>
> It means that the central problem is not to construct a highly sensitive instrument that can continuously offset instability introduced by other factors, but rather to prevent monetary arrangements from themselves becoming a primary source of instability [34, p.23].

In other words, monetary and financial stability has been the most important concern of all economists among different schools of economic profession. This chapter challenges to demonstrate how it can be attained under the public money system, while monetary and financial instability of "booms and depressions" is inevitably caused under the current debt money system. This chapter, then, completes the validation of the proposals made by the Chicago Plan and the American Monetary Act.

15.2 Debt vs Public Money Systems Simplified

I have already presented two macroeconomic models of the American Monetary Act in [102] and [103] based on the method of accounting system dynamics developed in [94]. To focus on our main concern of the monetary and financial stability in this chapter, a simplified model is constructed here [104], consisting of three economic sectors such as producers, consumers and commercial banks[2] [Companion Model: MonetaryStability.vpm].

Producers

Main transactions of producers are illustrated in Figure 15.1, which are summarized as follows.

- Producers' income is, under the accounting principle, booked as an inflow of the stock of retained earnings when production of GDP is completed, and at the same time inventory is increased by the same amount.
- Their actual income is realized when GDP are sold out and shipped from the inventory to consumers and bankers as consumption and to producers as investment.
- Out of the income thus realized, capital depreciation is subtracted first and interests of their debt are paid to the banks.

[2]The model is also motivated by the work of Steve Keen [44, 2011], specifically his monetary model of capitalism in chapter 14.

- Next, a portion of GDP (say, 20%) are assumed to be made as mark-up profits, and paid to their shareholders (that is, consumers) as dividends. The remaining amount is paid to workers (as consumers) as wages. That implies that workers are placed in a relatively weaker position against shareholders. (Surely, this assumption could be reversed in simulation).
- Producers are thus constantly in a state of cash flow deficits, since all income are paid out to consumers and bankers as factor income and interest income. To make new investment, therefore, they have to borrow money from banks and pay interest to the banks.
- Their debt is assumed to be a long term debt of 10 years.

Consumers

Main transactions of consumers are illustrated in Figure 15.2, which are summarized as follows.

- Consumers receive wages and dividends from producers and interest from banks.
- They spend 80% of the income on the consumption, and the remaining will be saved.
- In this model, their cash/deposits asset is assumed to include demand deposit only when credits are created by banks and lent to producers who pay factor income with credits as well as cash. In other words, demand deposits by consumers are not liabilities of commercial banks.
- Their demand for cash/deposits as transaction payment out of saving account will be constantly adjusted by the currency ratio (of 20%) they wish to hold at hand.

Banks

Main transactions of banks are illustrated in Figure 15.3. Transactions under the debt money system are summarized as follows (transactions under the public money system are explained below in Section 4).

- Banks receive deposits from consumers, against which they pay interests.
- Out of the deposits, loans are made to producers according to the demand for desired borrowing by producers.
- If loanable fund is not enough under the debt money system, banks can create credits and put them into the demand deposits account of producers. In this process, vault cash asset is assumed to play a role of the

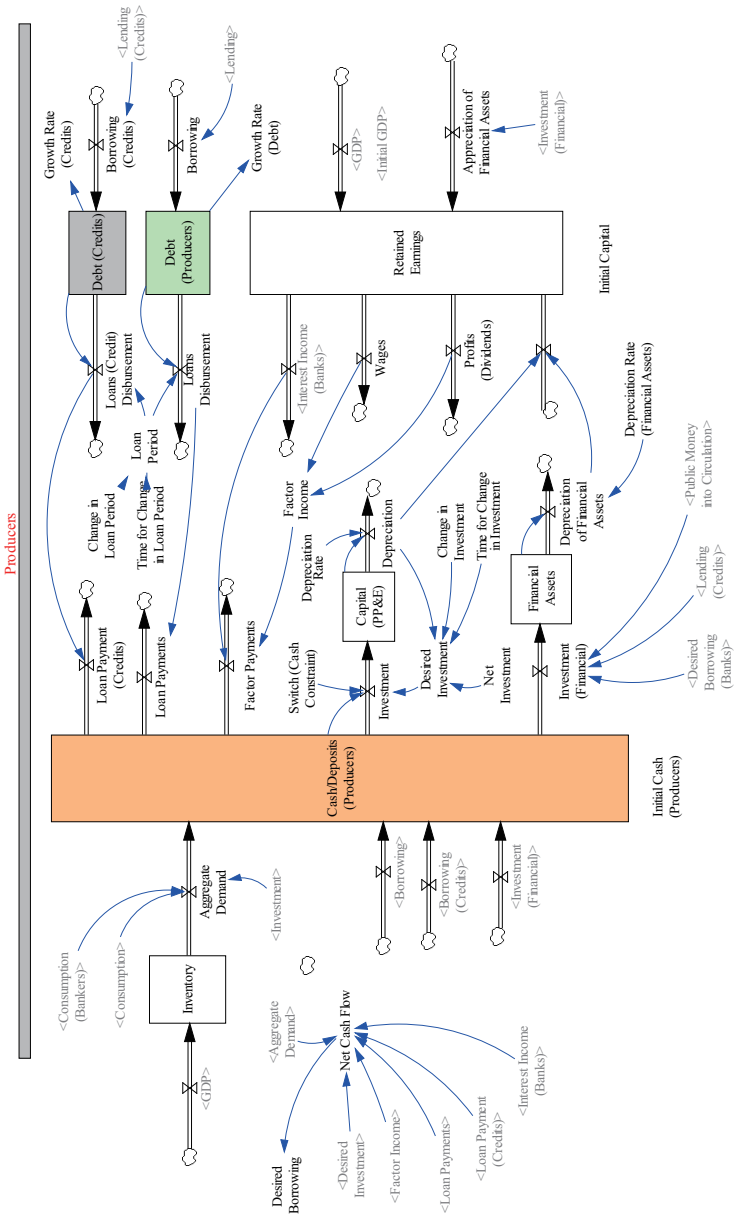

Figure 15.1: Transactions of Producers

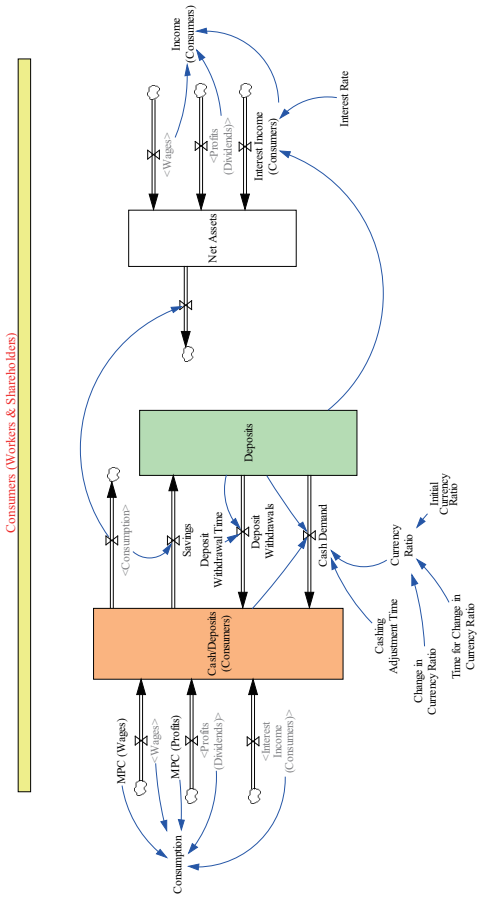

Figure 15.2: Transactions of Consumers

required reserve as well (with the central bank behind the screen), against which credits are created. (This process of credit creation is called money out of nothing under a fractional reserve banking.) The upper limit of the credit is set by a required reserve ratio or a required equity ratio of loans imposed by the BIS rule[3].

- Banks receive income as prime rate interests against their loans. 80% of the income is assumed to be spent on consumption, and the remaining will be retained as equity.

[3]This limit is not explicitly considered in our model

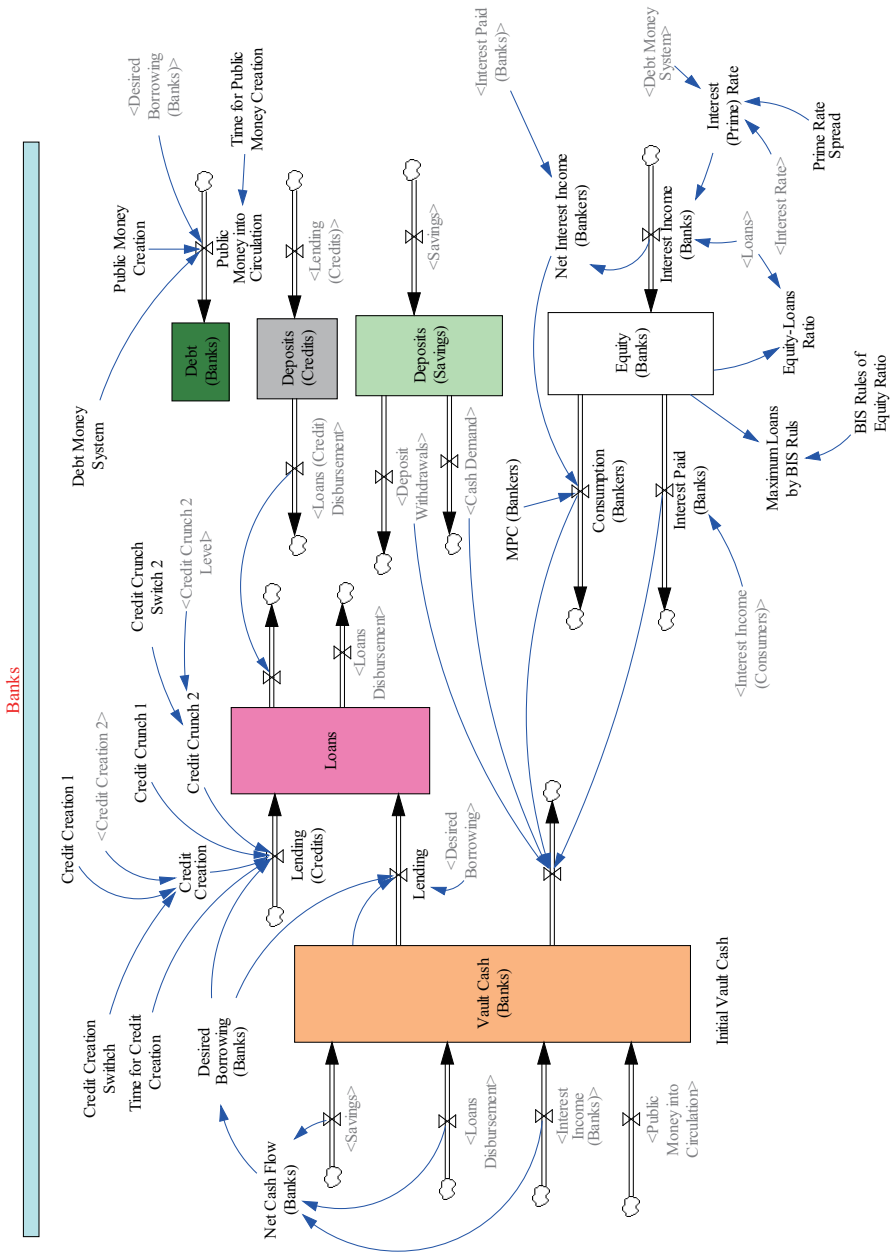

Figure 15.3: Transactions of Banks

Remarks: In our simplified model, the total amount of cash in circulation such as the ones in the cash assets of producers, consumers and banks is considered as base money (M0) (or monetary base, or high-powered money) initially provided by the central bank.

15.3 Behaviors of A Debt Money System

Determination of GDP

Our model is one of the most simplified models of macroeconomy with a focus on the monetary and financial stability. For this purpose, Keynesian determination of GDP is simplified as follows. First, aggregate demand (AD) consists of consumption (C) and investment (I), and investment is assumed to be exogenously determined together with depreciation.

$$AD = C + I \tag{15.1}$$

Next, consumption demand is determined as a portion of actual Gross Domestic Products (GDP or Y), where c is a marginal propensity to consume (whose value is set at $c = 0.8$ in this model).

$$C = cY \tag{15.2}$$

Keynesian model claims that GDP is determined by the level of aggregate demand;

$$Y = AD. \tag{15.3}$$

From these three equations, Keynesian equilibrium of GDP is determined by the following equation:

$$Y = \frac{1}{1-c} I. \tag{15.4}$$

For instance, when exogenous amount of investment without depreciation are $I = 80$, 100, and 120, respectively, equilibrium GDP are determined at $Y = 400$, 500, and 600.

Analysis of determining GDP at the different levels of exogenous investment is called a comparative static analysis. System dynamics modeling method can easily convert this static analysis to a dynamic process of GDP determination as follows:

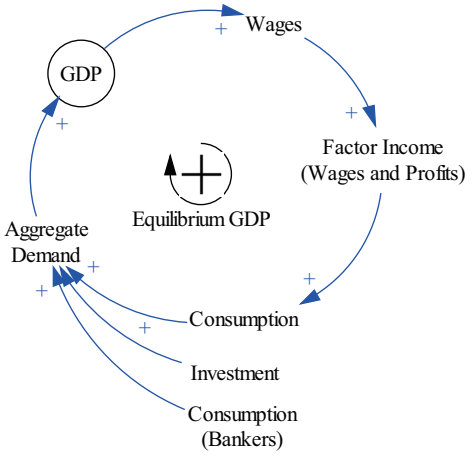

Figure 15.4: Keynesian GDP Determination

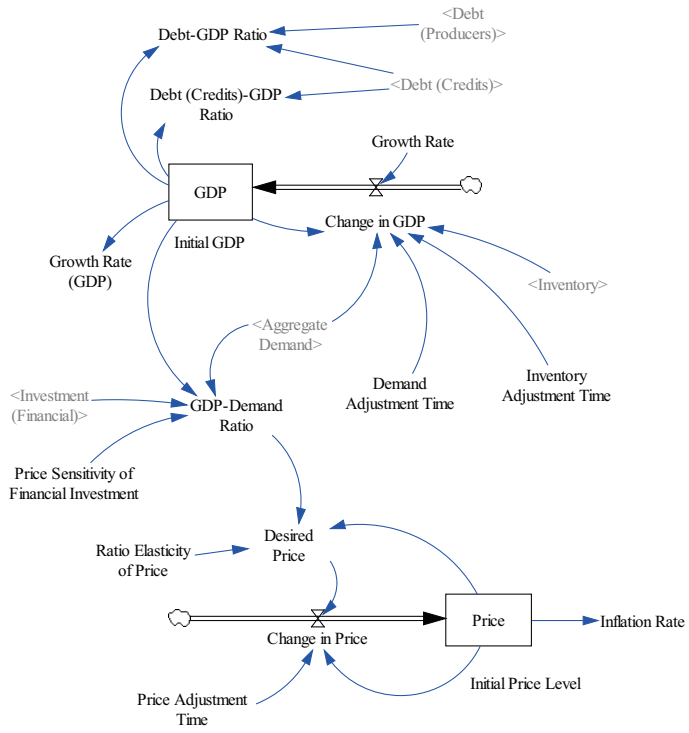

Figure 15.5: Determination of GDP and Price

$$\frac{d\,Y}{dt} = \frac{AD - Y}{AT} \qquad (15.5)$$

where AT is an adjustment time. In our simplified model, this dynamic process is assumed to be further affected by an inventory level, as illustrated in Figure 15.5, such that

$$\frac{d\,Y}{dt} = \frac{AD - Y}{AT} - \frac{I_{inv}}{AT_{inv}} \qquad (15.6)$$

where AT_{inv} is an adjustment time of inventory.

Figure 15.6 illustrates how GDP are determined by the increase in investment by 20 and 40 at t=10 from the initial investment level of $I = 80$. Specifically, lines 1, 2 and 3 correspond to the investment levels of 80, 100 and 120, respectively, while lines 4, 5 and 6 correspond to the same investment levels with 4% depreciation of the existing capital. Surely GDP will become larger to replace capital depreciation, yet capital levels stay the same for the same net investment. Whatever levels of investment, these behaviors demonstrate

that an equilibrium GDP will be eventually attained through the over-shooting fluctuations.

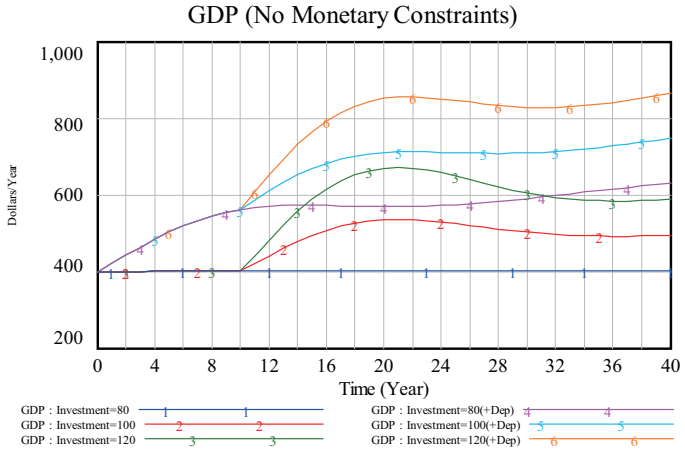

Figure 15.6: Keynesian Determination of GDP

Price Determination

Monetary stability is measured by the price stability or inflation rate. For this purpose, we assume a passive mechanism of the determination of price level. By the passive mechanism, we mean that a price level has no feedback effect on the determination of GDP in our simplified model. Specifically, the price level is, as illustrated in Figure 15.5, assumed to be adjusted by the following dynamics:

$$\frac{dP}{dt} = \frac{P^* - P}{AT} \tag{15.7}$$

in which the desired price P^* is obtained as

$$P^* = \frac{P}{\left(\frac{Y}{AD}\right)^e} \tag{15.8}$$

where e is a GDP-AD ratio elasticity of price[4].

On the other hand financial stability is hard to measure in our simplified model. "To finance" literally means "to provide money". Hence, financial stability is related with credit-creating (crunching) and stable lending behaviors of bankers at a microeconomic level of activities. These micro-level activities affect macro-level behaviors collectively in terms of loan and debt. Since our macroeconomic model, though simplified, is based on micro-foundation behaviors, it would be appropriate to use monetary and financial stability inseparably here.

[4]This is a simplified equation of price flexibility presented in [102].

Monetary Constraints

Dynamical equilibria in Figure 15.6 can be attained only when producers have enough amount of money to pay factor incomes such as wages and profits (dividends) and investment, etc. Most macroeconomic textbook analyses are based on this assumption of unconstrained availability of money or liquidity for transaction.

To examine the effect of monetary constraint on the determination of GDP, let us first calculate net cash flow of producers. It is obtained as inflow and outflow of producers' cash stock in Figure 15.1. Thus, it is calculated as follows:

$$\begin{aligned}\text{Net Cash Flow} &= \text{Cash Inflow - Cash Outflow}\\ &= \text{Consumption (Consumers and Bankers) + Investment}\\ &\quad \text{- Factor Income - Interest Income (Banks) - Investment}\\ &\quad \text{- Loan Payments}\\ &= \text{- Savings (Consumers and Bankers) - Loan Payments}\end{aligned} \tag{15.9}$$

where Factor Income is defined as the sum of wages and profits (dividends).

Net cash flow of producers thus obtained becomes equal to the sum of negative amount of savings by consumers and bankers and loan payments. In other words, producers are destined to be in a state of cash deficiency in a capitalist monetary economy. Accordingly, to make new investment and reimburse loans, they are obliged to constantly raise funds. This amount of fund is called here a desired borrowing amount. This becomes a fundamental framework of our macroeconomy constrained by the liquidity availability.

Theoretically, there are only four ways to raise desired borrowing fund as follows:

- Borrowing from banks (bank loans)
- Issuing corporate bonds (borrowing from the public)
- Issuing corporate shares (sharing ownership)
- Retaining earnings for investment (retained saving)

In this chapter we assume that producers can raise all necessary funds by borrowing from commercial banks.

Now suppose that producers initially have \$300 (the reader may consider its unit as billion dollar), while banks have \$500 as their initial vault cash. That is, the monetary base of our economy is \$800. This amount of currency could be interpreted as coins and banknotes in a debt money system, or public money issued by the government in a public money system. From now on, GDP is assumed to be determined by the investment consisting of the net investment of \$80 and capital depreciates of 4%; that is line 4 in Figure 15.6. Accordingly,

(gross) investment becomes a sum of net investment and depreciation. Then GDP will be determined as illustrated by line 1 in the left-hand diagram of Figure 15.7. Line 1 in the right-hand diagram shows that cash assets of producers are running out by the amount of -$517 at the year 40.

Now suppose that producers fail to raise the desired borrowing amount. Under such monetary constraint, produces cannot fully meet their net cash flow deficits; specifically they cannot make desired amount of investment due to the shortage of fund. This in turn decreases aggregate demand, toward which GDP will be eventually pulled back. In short, GDP begins to shrink due to the constraint of the shortage of cash. Line 2 in the left-hand diagram of Figure 15.7 illustrates how GDP gets reduced, while that of the right-hand diagram indicates that producers' cash is getting depleted to zero.

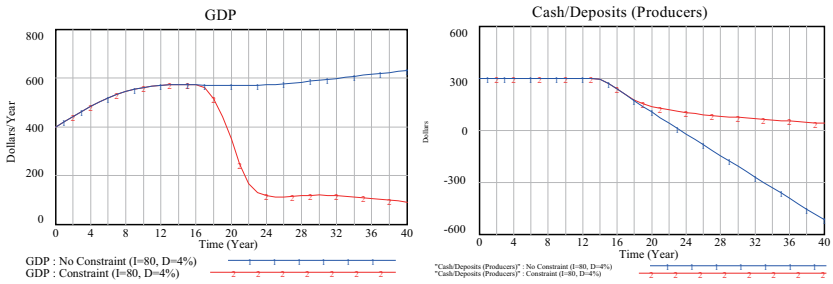

Figure 15.7: Monetary Constraint GDP

This implies that money or liquidity does indeed matter for the attainment of equilibrium GDP. Unfortunately, most macroeconomic textbooks neglect this important role of money, and assume that macroeconomic behaviors are not constrained by the availability of money or liquidity.

Money out of Nothing

How can our economy avoid this monetary constraint and create enough money to attain the equilibrium GDP ? In order to meet the demand for the desired borrowing amount under the current fractional reserve banking system, banks can make loans to producers by creating credits against the bank reserves with the central bank. The credits thus created are put into the demand deposits account of producers. In our model it is denoted as the stock of Deposits (Credits) under the liabilities of banks. In this way, banks are able to create demand deposits out of nothing for producers, who then utilize them for their transactions. Figure 15.8 illustrates how money is created and put into circulation as credit creation.

In this way, whenever producers can raise desired borrowing amount successfully, the equilibrium GDP is attained. Figure 15.9 illustrates how equilibrium GDP is restored by banks who create enough credits and make loans to the producers. In our model, the amount of money banks have to create to attain

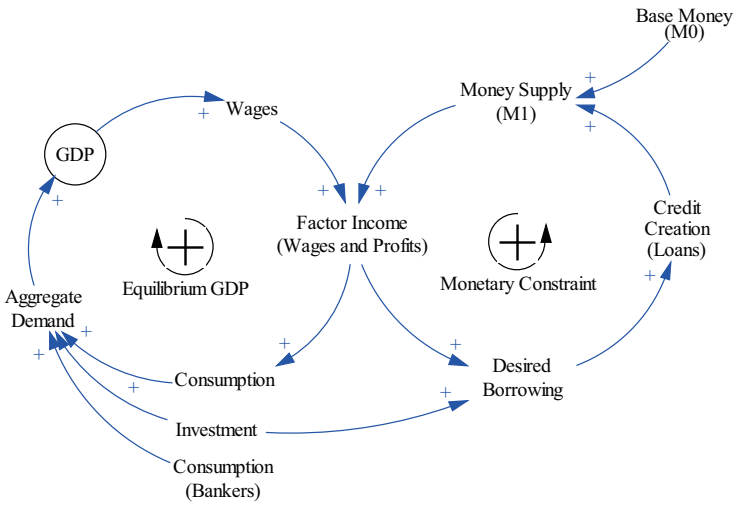

Figure 15.8: Credit Creation

the equilibrium GDP is denoted as "Desired Borrowing (Banks). In the figure, the data file name of Credit Creation(100%) implies that this amount is fully created; that is, 100% of what banks want to borrow to meet their cash deficiency. Consumption (Bankers) (line 4) will become zero if (prime) interest rate is zero and bankers have no income. In this case, lines 5 and 6 become identical and net investment becomes equal to saving.

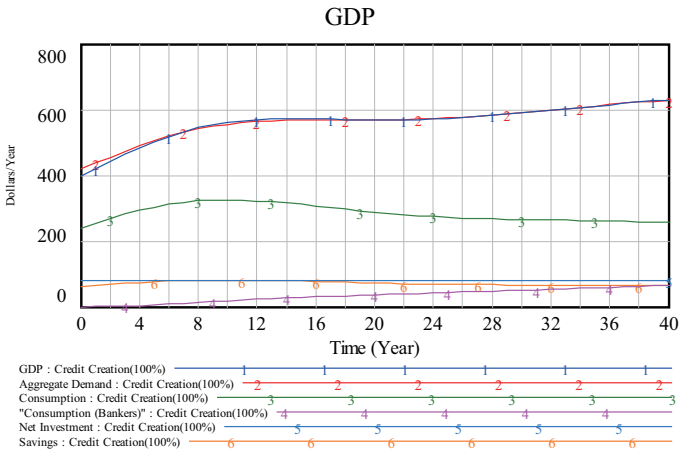

Figure 15.9: Equilibrium GDP by Credit Creation(100%)

It is often said that without credit creation by banks, no growth can be attained. And this reasoning is used as a justification that credit creation through a fractional reserve banking system is essential for economic growth and prosperity. In other words, activities of bankers are good to the society, because they are providing enough money or liquidity for the prosperity of society! If that's the only way to create money for economic growth, we have to be grateful for their banking services of credit creation out of nothing.

Money Supply

Before we examine this justification of banking services of credit creation, let us define the amount of money that is created and put into circulation. In our model, initial currency in circulation is the sum of cash held initially by producers ($300) and banks ($500)); in total, $800. This amount of currency is assumed to be provided by the central bank or the public money administration. Hence,

$$\text{Initial Base Money} = \text{Initial Cash (Producers)} + \text{Initial Vault Cash (Banks)} \tag{15.10}$$

Base money (M0) is increased whenever banks borrow money from the central bank or the public money administration. For the analysis of the current debt money system, money is assumed to be endogenously created as credits by banks. Under a public money system, banks are assumed to borrow money from the public money administration. Hence,

$$\text{Base Money (M0)} = \text{Initial Base Money} + \text{Debt (Banks)} \tag{15.11}$$

where Debt (Banks) constitutes a liability of banks for the money they borrow from the central bank or the public money administration.

Money supply (M1) is generally defined as[5]

$$\text{Money Supply (M1)} = \text{Currency in Circulation} + \text{Demand Deposits} \tag{15.13}$$

Under the debt money system, banks can create credits by setting up new deposit account for producers and typing in the digital figures of credit or loan on it. Nowadays this can be done electronically. This amount of money thus created by banks becomes demand deposits. In the balance sheet of producers this implies that their debt as liability and deposits as asset are simultaneously increase by the same amount. Now producers are ready to use this credit money for factor payments together with original base money. When this payment is done electronically to the deposit account of consumers, their cash account increase by the same amount. As a result, it becomes very difficult to distinguish

[5]Money supply is also defined in terms of base money (M0) as

$$\text{Money Supply} = m * \text{Base Money} \tag{15.12}$$

where m is a money multiplier.

this amount of payment by credit from that of base money as currency. Accordingly, their cash account need to be reinterpreted as cash/deposits account.

Hence, money supply (M1) is also redefined as

$$\begin{aligned} \text{Money Supply (M1)} &= \text{Currency in Circulation} && (15.14)\\ &= \text{Cash/Deposits(Producers)} \\ &\quad + \text{Cash/Deposits (Consumers)} \\ &\quad + \text{Vault Cash (Banks)}. && (15.15) \end{aligned}$$

The difference between money supply (M1) and base money (M0) is nothing but the money endogenously created by banks out of nothing (or thin air):

$$\text{Money out of Nothing} = \text{Money Supply (M1)} - \text{Base Money (M0)} \quad (15.16)$$

Deposits of consumers are made out of their cash/deposits assets as savings after consumption expenditure is made. Accordingly, it could be interpreted as time deposits. Money supply (M2) is then defined as

$$\text{Money Supply (M2)} = \text{Money Supply (M1)} + \text{Time Deposits} \quad (15.17)$$

With these dentitions of money in mind, let us examine how money is created. In Figure 15.10, line 1 represents initial base money that is made initially available, which is also regarded as base money (M0) of line 2. On the other hand, demand deposits are created by bank loans as credit creation, which is illustrated by line 5. Hence, M1 is obtained here by adding line 2 and line 5 as line 3. At the year 40, the amount of credit creation or money out of nothing

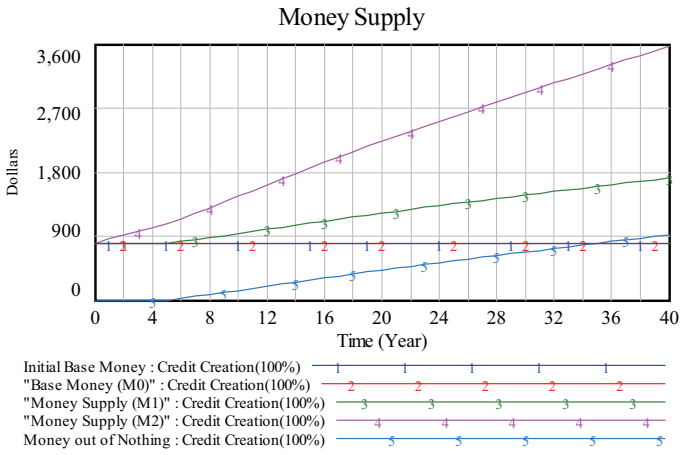

Figure 15.10: Money Supply: M0, M1 and M2

becomes $918. Accordingly, M1 becomes $1,718 together with the base money (M0) of $800.

In conclusion, the Keynesian equilibrium GDP can only be attained with the appropriate amount of money, half of which is in our model created by commercial banks out of nothing under the current fractional reserve banking system of debt money. Most macroeconomic textbooks neglect this important role of money in the process of GDP determination, while many monetary economists defend credit creation process as an essential banking service to drive economic growth.

Driving Forces of Credit Creation: Greed

We are now in a position to explore the motives of bankers to create credits by making loans. Generally speaking, for the attainment of mostly equilibria, enough amount of money has to be put into circulation to avoid recessions caused by credit crunches such as analyzed in [98]. This amount is denoted in our analysis by the file name of Credit Creation (100%). What drives bankers to create credits, then? Are they really social philanthropists, as often claimed, who create credits for the economic growth and welfare of people?

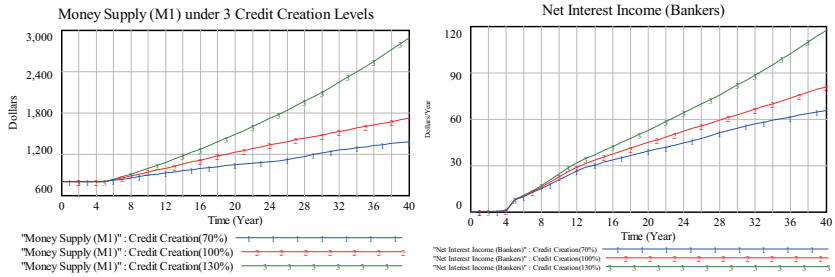

Figure 15.11: Changes in Money Supply and Net Interest Income of Bankers

Left-hand diagram of Figure 15.11 illustrates three different levels of money supply (M1) created by banks. M1 increases as the level of credit creation by banks increases from 70% (line 1) to 100% (line 2), then to 130% (line 3). Right-hand diagram indicates how net interest income of bankers increases as credit creation expands by increasing loans. It costs almost nothing for bankers to create credit. Accordingly, their income will be increased as they make more loans. Since interest income is increased without incurring cost, all bankers will surely tend to make more loans. It may be concluded, thus, that greed is the motive of bankers for their credit creation.

Even so, their greedy behaviors may be justified as rational ones in a market economy, because all agents are allowed to pursue their own self-interest according to market rules. Accordingly, a fractional reserves banking system or debt money system which allows greedy behaviors of bankers should be to blame.

Figure 15.12 demonstrates the existence of a built-in positive feedback loop that enhances credit creation in our debt money system. It is called "Bankers' Greed" loop in this chapter.

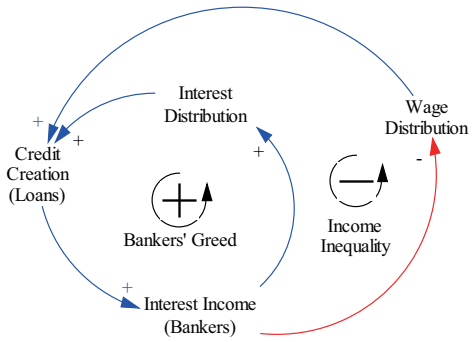

Figure 15.12: Greed of Bankers

Consequences of Greed

Now we have identified a positive feedback loop of bankers' greed built in the debt money system. This has been a driving force of capitalist economic development, and justified by its proponents. What will happen if credit creation of banks overshoots 100% level of desired borrowing of banks for further loans and interest income? Figure 15.13 of prices and inflation rates indicates how our economy tends to become inflationary as a consequence of bankers' greed to make more loans than 100%.

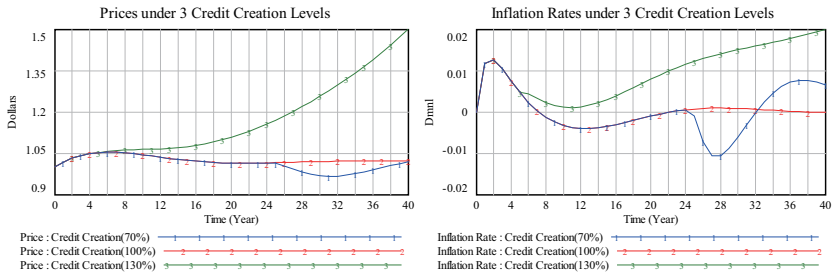

Figure 15.13: Price Levels and Inflation Rates with Credit Overshooting

The other consequence is the inequality of income distribution in terms of wage distribution. It is defined as a portion of wages out of net national income (NNI); that is, wage/NNI. NNI here becomes the same as GDP less Depreciation in our model. Left-hand diagram of Figure 15.14 illustrates a decreasing trend of wage distribution irrespective of the levels of credit creation from 70% through 130%! Furthermore, it is observed that income inequalities at the credit creation levels of 70% and 130% (lines 1 and 3) get worsened compared with the level of 100% credit creation (line 2).

When income inequality gets worsened for workers, their income is reduced, followed by the deduction of their consumption, which in turn reduces aggregate demand. That is, bankers' greed to create more credits to increase their own income, sooner or later, triggers the decrease in GDP and economic recession.

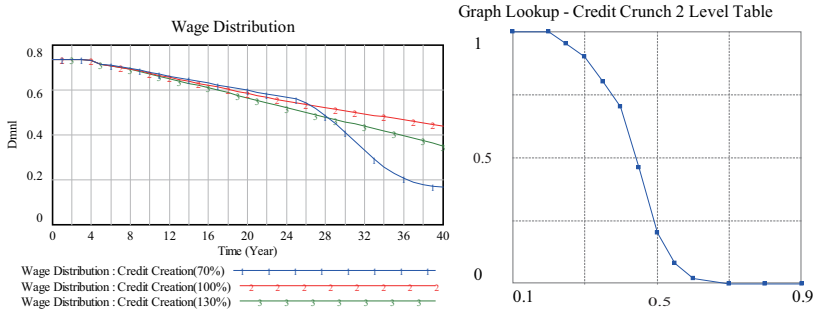

Figure 15.14: Interest-Wage Ratio and Wage Distribution

Once recession gets started, bankers lose confidence in the safety of their loans, and surely try to reduce and/or retrieve them. This reducing behavior is called "Kashi-shiburi", and retrieving one is called "Kashi-hagashi" in Japanese. There two terminologies became household names in Japan during the lost two decades starting 1990's. This balancing feedback loop is called "Income Inequality" loop in Figure 15.12. Once this loop gets triggered, positive feedback loop of Bankers' Greed may begin to be dominated by this balancing feedback loop. In other words, under the debt money system, a reinforcing process of credit creation could be easily reversed into the process of credit crunch.

These observations suggest that it is legitimate to assume that the level of credit creation is forced to be reduced according to the reduction of wage distribution. To bring this feedback structure to the model, a table function is constructed such that a level of credit creation is determined by the wage distribution. Specifically, it is assumed that whenever wage distribution drops to 50%, credit creation level gets reduced by 20%, as illustrated in the right-hand diagram of Figure 15.14.

In the case of 100% level of credit creation, wage distribution drops to 50% at the year 30, as shown by line 2 in the left-hand diagram of Figure 15.14; that is, a start of credit crunch of 20%. Left-hand diagram of Figure 15.15 illustrates how this credit crunch reduces credit creation of money out of nothing (line 2), which triggers deflation as shown by line 2 in the right-hand diagram. Figure 15.16 illustrates how this credit crunch affects GDP level and its growth rate.

As seen above, the balancing loop of "Income Inequality" we have observed here is the most fundamental endogenous feedback mechanism, built in our simple debt money system, that causes "booms and depressions" as criticized by the Chicago Plan.

Monetary and Financial Instability

In a closed economic system, money has to be issued or created within the system. Under the current debt money system, only the central bank is endowed with a power to issue money (called base money or monetary base) within the

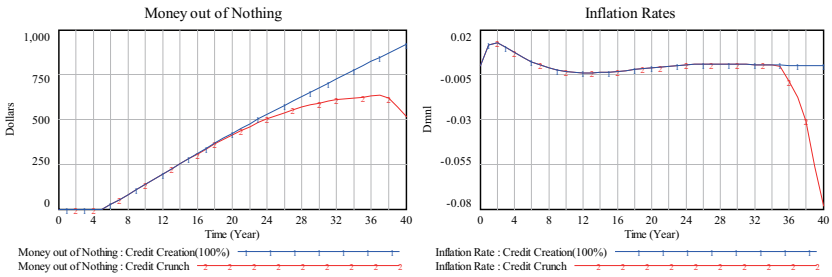

Figure 15.15: Reduction of M1 and Deflation by Credit Crunch

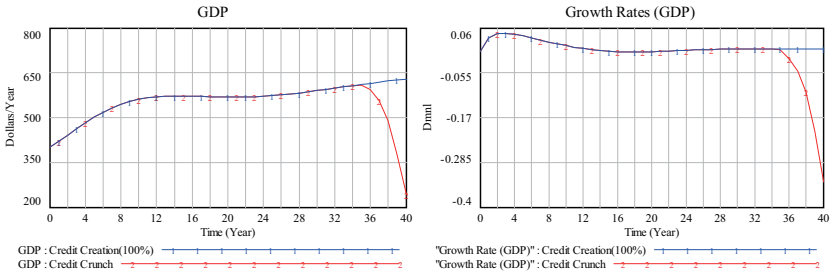

Figure 15.16: Recession (GDP and Growth Rate) triggered by Credit Crunch

system, and make loans to the commercial banks directly and to the government indirectly through the open market operations. With this base money, commercial banks create credits under a fractional reserve banking system by making loans to producers and consumers. These credits constitute a great portion of money supply. In Japan, 82.5% of money supply (M1) in 2009 was credit loans and deposits. In this way , money and credits are only created when commercial banks and government as well as producers and consumers come to borrow at interest. Under such circumstances, if all debts are to be repaid, money ceases to exist. This is an essence of the endogenous money supply in a debt money system.

In our simplified model, this process is summarized as a causal loop diagram of debt money system in Figure 15.17. In the diagram, there are 4 reinforcing loops to stimulate economic growth through credit creation, meanwhile there is only one balancing feedback loop of Income Inequality. Yet, it could trigger credit crunch easily, because money created by loans can be easily crunched by the restriction and withdrawal of loans.

From the left-hand diagram of wage distribution in Figure 15.14, income inequality gets worsened whenever the level of credit creation under-shoot or over-shoot the 100% desired borrowing level of credit creation, causing credit crunch, price fluctuation and recessions. Since these feedback mechanism is built in the debt money system, no one in the system cannot control these

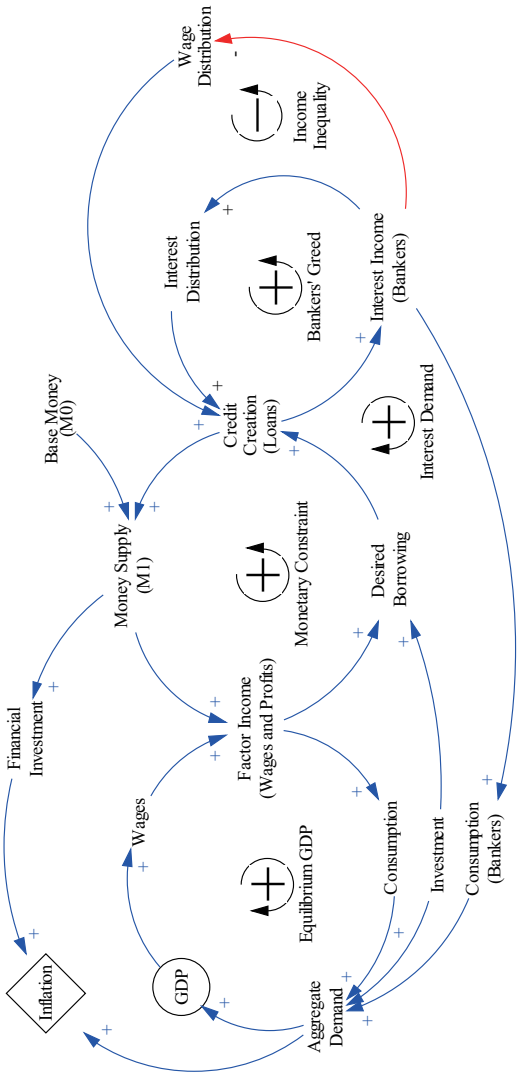

Figure 15.17: Causal Loop Diagram of Debt Money System

cycles of "booms and depressions". To see these effects of monetary and financial instability, let us run sensitivity analysis using random normal distribution with mean value of 0 and standard deviation of 0.2 around the 100% level of credit creation. That is, 68% of credit creation levels occur within the range of 80% level through 120%.

Figure 15.18 illustrates how economic growth rates are affected by the mon-

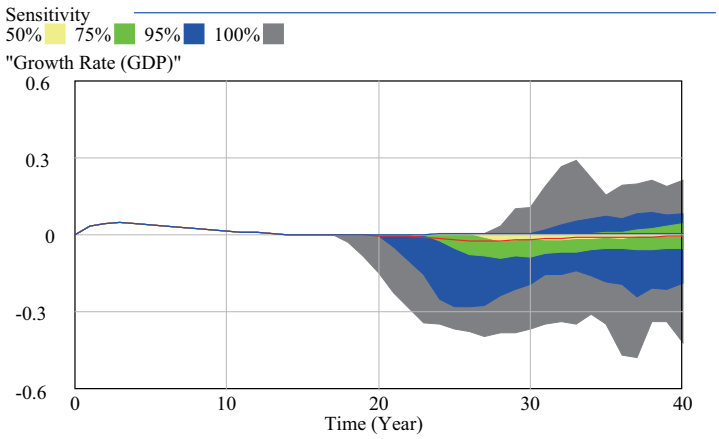

Figure 15.18: Sensitivity of Credit Creation on Growth Rates

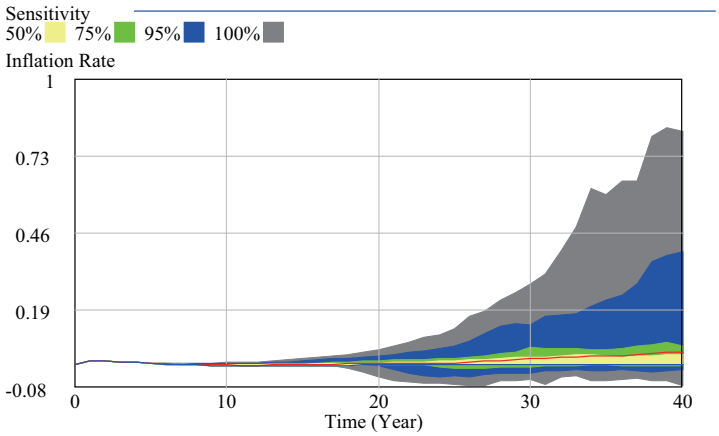

Figure 15.19: Sensitivity of Credit Creation on Inflation Rates

etary and financial instability, while Figure 15.19 shows how inflation rates fluctuate along with the fluctuation of growth rates.

15.4 Behaviors of A Public Money System

We are now in a position to explore monetary and financial stability under the public money system where the central bank is incorporated as one of the governmental organization. In our simplified model, however, the central bank is not explicitly modeled and left out of the model boundary. Transactions of

commercial banks under the public money system are now revised as follows (transactions of producers and consumers remain the same).

- Banks are obliged to deposit a 100% fraction of the demand deposits as the required reserves with the public money administration. Specifically, this requirement is assumed to be met and demand deposits are accordingly left behind the balance sheet of bankers in the model. Hence, cash in the vault cash stock becomes the only source for bankers to make loans.
- When the amount of vault cash is not enough to meet the demand for loans from producers, banks are allowed to borrow from the public money administration free of interest; that is, discount rate of public money now becomes zero. In the model, it is done as a flow of money into circulation that is managed by a level of public money creation (similar to the level of credit creation under the debt money system) by the Public Money Administration (PMA) (see [102] and [103]).

Monetary Constraints

Let us now explore monetary and financial behaviors under the public money system in comparison with those under the debt money system. To attain equilibrium GDP, banks have to create enough amount of money which is denoted as "Desired Borrowing (Banks)" in the model. In what follows, a data file name of "Public Money Creation (100%)" implies that this desired amount of borrowing by banks is 100% met by the PMA, while that of "Credit Creation (100%)" means that it is 100% met by the credit creation activities of the banks as already analyzed above.

Figure 15.20 illustrates how different levels of GDP are determined under the debt and public money systems. When money supply is only met by 70%, equilibrium GDP cannot be attained under both systems (lines 1 and 4), though GDP under the public money system is slightly higher. Only when more than 100% money is created, equilibrium GDP are attained (lines 2, 3, 5, 6) under both systems. As lines 3 and 6 indicate, over-supply of money (130%) could only be justified for the attainment of equilibrium GDP. In other words, it becomes necessary to provide more than enough amount of money to attain an equilibrium GDP by avoiding the constrained levels of GDP.

Monetary Stability

Doesn't the over-supply of money, however, cause monetary instability? Before answering this question, let us revisit the definition of money. When full reserve system is implemented in the public money system, bank reserves become equal to deposits so that we have

$$\begin{aligned} \text{Money Supply (M1)} &= \text{Currency in Circulation} + \text{Demand Deposits} \\ &= \text{Currency in Circulation} + \text{Reserves} \\ &= \text{Base Money (M0)} \end{aligned} \tag{15.18}$$

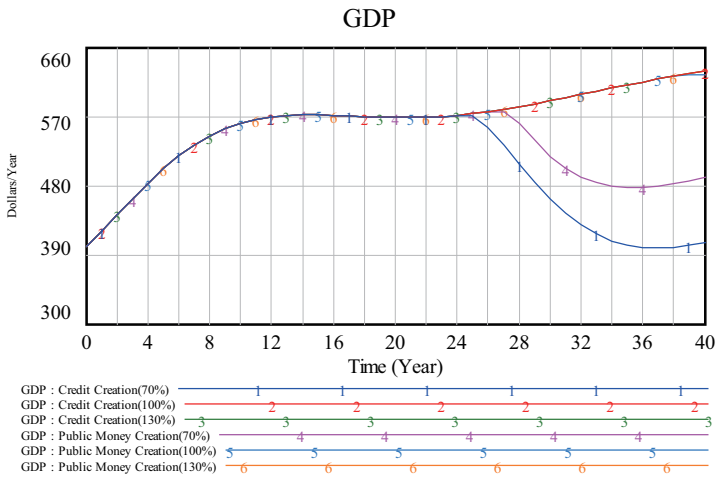

Figure 15.20: GDP under Debt vs Public Money System

Accordingly, under the public money system, money supply (M1) becomes equivalent to base money (M0)[6].

With these in mind, let us examine the effect of over-supply of money on monetary stability. Left-hand diagram of Figure 15.21 shows that the equilibrium GDPs are attained by the similar amounts of money supply (M1) under debt and public money systems (lines 1 and 3). When over-supply of money (130%) is newly provided, money supply (M1) becomes larger under the debt money system (line 2) than that under the public money system (line 4). This indicates that money supply tends to be inflated under the debt money system by the same amount of newly created credit. Right-hand diagram demonstrates that inflation rates tend to become larger under the debt money system (line 2) than under the public money system (line 4) against the over-supply of money (130%). From these observations, it is concluded that monetary stability is better preserved under the public money system than under the debt money system.

Greed and Income Inequality

Under the debt money system, greed becomes a driving force to expand credit creation due to the increase in interest income of bankers. This drive is shown to

[6]Money supply is also defined in terms of base money as

$$\text{Money Supply (M1)} = m * \text{Base Money (M0)} \tag{15.19}$$

where m is a money multiplier. Under a full reserve system, money multiplier becomes unitary, $m = 1$, so that no more money can be created by commercial banks than base money; that is to say, no money out of nothing is created.

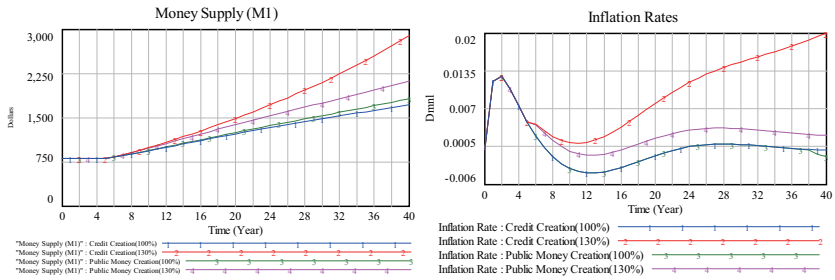

Figure 15.21: Money Supply and Inflation under Debt vs Public Money

worsen wage distribution simultaneously, triggering credit crunch and economic recession. In short, debt money system is demonstrated to be a system of monetary and financial instability. This can be reconfirmed here by Figure 15.22. Specifically, lines 1 and 2 in the left-hand diagram show that net interest income of bankers under a debt money system increases for a higher level of credit creation, as already shown above. Compared with these behaviors, lines 3 and 4 indicate that net interest income of bankers does not increase extremely for a higher level of public money creation under the public money system. Moreover, net interest incomes of bankers (lines 1 and 2) become all the time higher than those of bankers under a public money system (lines 3 and 4).

This may systemically discourage bankers to borrow more money from the Public Money Administration for higher interest income, compared with the case of debt money system in which they can create credits by themselves unboundedly. In other words, greed will be subdued under the public money system. This doesn't imply that the banking activities to pursue their self-interest are suppressed. On the contrary, they will become more competitive one another in a more fair financial market under the public money system.

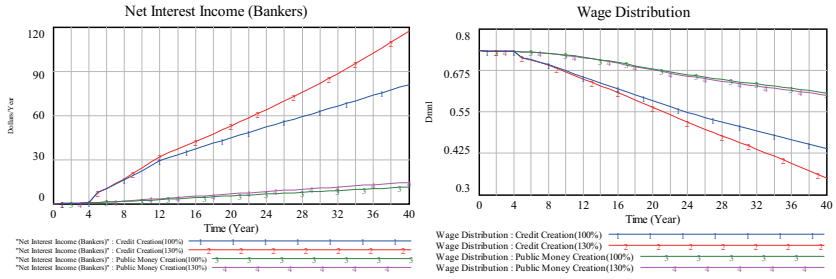

Figure 15.22: Interest Income and Wage Distribution under Debt vs Public Money

Lines 1 and 2 in the right-hand diagram show that wage distributions get worsened under a debt money system, while lines 3 and 4 show that wage dis-

tributions do not so seriously get worsened for a higher level of public money creation under the pubic money system. In addition, they stay closer one another at a higher level compared with those under the debt money system. In the case of debt money system, worsening distribution is shown to trigger credit crunch. On the contrary, no such credit crunch will occur under the public money system, simply because money (M0=M1) created by the PMA never get crunched, and continue to stay in circulation, and be efficiently used for higher opportunities. Hence, financial stability can be more likely accomplished under the public money system. Quoting Irving Fisher's words again, "it would remove the chief cause of both booms and depressions [13, p.8, 1936]".

Monetary and Financial Stability

From the behavioral analyses above, it could be concluded that monetary and financial stability can be better attained under the public money system than the debt money system. This feature of stability can be fully illustrated by the causal loop diagram of the public money system in Figure 15.23. Compared with the causal loop diagram of the debt money system in Figure 15.17, bankers'greed loop no longer exits. This implies that the reinforcing loop of credit creation (or bankers' greed loop) is gone. Moreover, the balancing loop of credit crunch (or income inequality loop) which has played a decisive role of causing "booms and depressions" fails to find its place under the public money system.

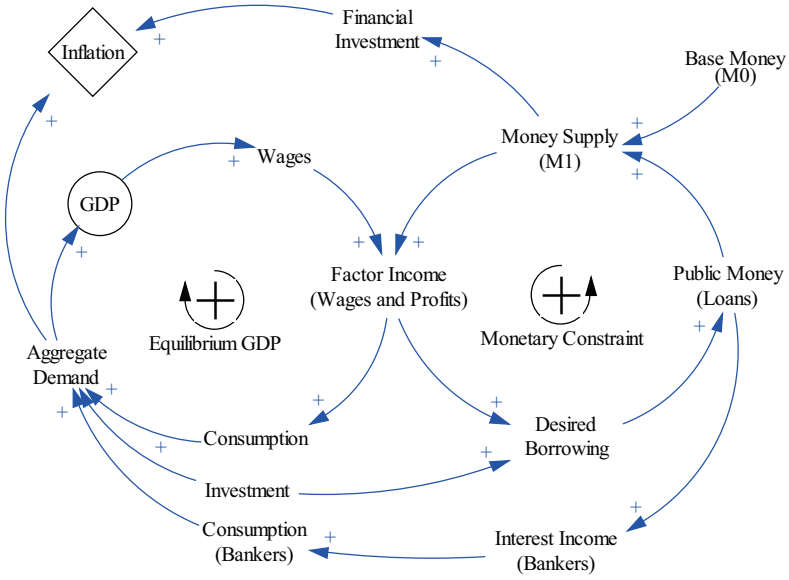

Figure 15.23: Causal Loop Diagram of Public Money System

To examine these qualitative differences, comparative sensitivity tests are

performed for the variable of Desired Borrowing (Banks) that is the amount of money banks want to raise to meet the loan demand from producers. Specifically, this amount is assumed to change between 20% and 180% according to random normal distribution with mean = 1 and standard deviation = 0.2:

$$20\% \leq \text{Level of Desired Borrowing(Banks)} \leq 180\% \tag{15.20}$$

Figure 15.24 compares how inflation rates tend to occur under debt and public money systems. Under the debt money system, inflation rates approximately range between -1.1% and 3% with 95% of chance, while its range only falls, roughly speaking, between -0.1% and 0.5%, a factor of 7 smaller under the public money system! Indeed, monetary stability is shown to be most likely attained under the public money system.

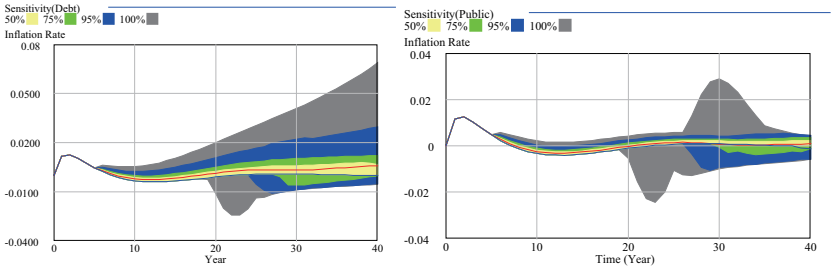

Figure 15.24: Debt-vs-Public System Sensitivity: Inflation Rates

Figure 15.25 compares how wage distributions tend to get worsened. Under the public money system wage distribution is maintained above 53% with 95% of chance. On the contrary, the minimum range seems to further decline to 15% with the same 95% of chance under the debt money system due to the existence of bankers' greed loop as discussed above.

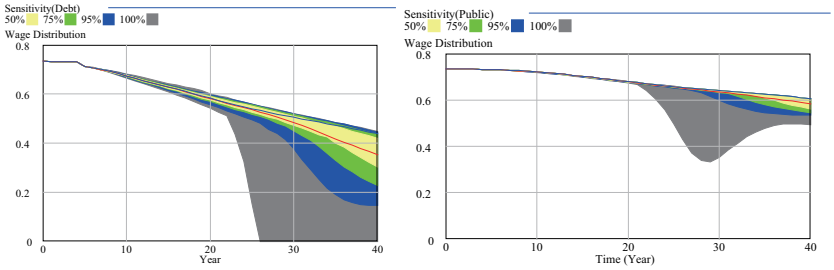

Figure 15.25: Debt-vs-Public System Sensitivity: Wage Distribution

These substantial differences of wage distribution affect the behaviors of GDP. Figure 15.26 compares how GDP are attained. With 95% of chance, GDP will remain within the range of $460 and$630 under the public money

system, while GDP ranges from $380 to $630. This may be due to the financial instability under the debt money system so that producers cannot rely on the stable loans.

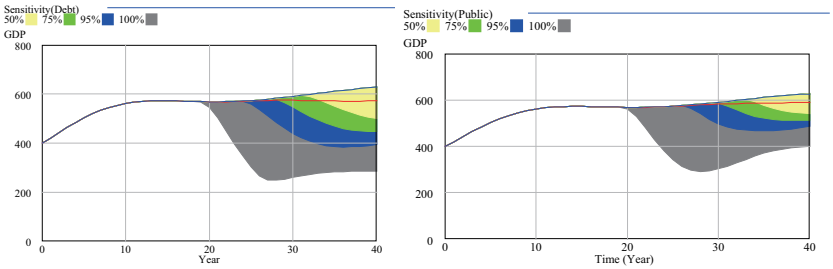

Figure 15.26: Debt-vs-Public System Sensitivity: GDP

These comparative analyses, however, do not imply that the public money system fully attains monetary and financial stability and becomes free from "booms and depressions" as Irving Fisher correctly pointed out that "The 100% system would be no cure-all for business fluctuations though it would help reduce them [12, p.216]." Yet, as I have demonstrated in [103], monetary and financial instabilities, once triggered by inflation and recession, can be better managed by applying public money policies under the public money system than traditional Keynesian monetary policies under the current debt money system.

Conclusion

This chapter tries to comparatively explore monetary and financial stability under the current debt money system and alternative public money system (proposed by the American Monetary Act) by constructing a simplified macroeconomic model of endogenous money creation. In the debt money system we have identified a reinforcing loop of credit creation called "Bankers' Greed", and a balancing loop of credit crunch called "Income Inequality". Due to these two opposing loops built in the system, our simulation analysis found, unstable behaviors of economic growth and inflation rates are inescapably triggered. In other words, monetary and financial instability is built in the debt money system.

On the other hand, Bankers' Greed motives that increase bankers' interest income and worsen income inequality are shown to be averted under the public money system, because bankers lose their power to create credit. In addition, a relatively small income inequality that still remains does not trigger credit crunch, simply because public money never get crunched. Hence, two opposing loops that cause credit creation and crunch are shown to be gone from the public money system, subduing "boom and depressions".

From these analyses it is concluded that the current debt money system is

a system of monetary and financial instability, while the public money system is a system of the true monetary and financial stability.