Workings of A Public Money System
of Open Macroeconomies
– Modeling the American Monetary Act Completed –
(A Revised Version)

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Abstract

Being intensified by the recent financial crisis in 2008, debt crises seem to be looming ahead among many OECD countries due to the runaway accumulation of government debts. This paper first explores them as a systemic failure of the current *debt money system*. Secondly, with an introduction of open macroeconomies, it examines how the current system can cope with the liquidation of government debt, and obtains that the liquidation of debts triggers recessions, unemployment and foreign economic recessions contagiously. Thirdly, it explores the workings of a *public money system* proposed by the American Monetary Act and finds that the liquidation under this alternative system can be put into effect without causing recessions, unemployment and inflation as well as foreign recessions. Finally, public money policies that incorporate balancing feedback loops such as anti-recession and anti-inflation are introduced for curbing GDP gap and inflation. They are posed to be simpler and more effective than the complicated Keynesian policies.

1   Introduction: Public vs Debt Money

I have explored in the paper [16][1] how accumulating government debts could be liquidated under two different macroeconomic systems; that is, a current

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macroeconomic system of money as debt, and a debt-free macroeconomic system advocated by the American Monetary Act. What I have found is that the liquidation of government debt under the current macroeconomic system of money as debt is very costly; that is, it triggers economic recessions, while the liquidation process under a debt-free money system can be accomplished without causing recessions and inflations. The results are, however, obtained in a simplified closed macroeconomic system in which no labor market exists.

Accordingly, the purpose of this paper is to expand the previous simple macroeconomic system to complete open macroeconomies in which labor market and foreign exchange market exist, and analyze if similar results could be obtained in the open macroeconomies for a system of money as debt and a debt-free money system. For the examination, I have felt a strong necessity to briefly redefine money and its system in this introductory section to avoid further confusions caused by different usage of terminologies. In the previous paper, *a system of money as debt* was used to describe the current monetary system, and *a debt-free money system* was used as a system that is proposed by the American Monetary Act. Let us redefine these terminologies in a uniform fashion as follows.

Public Money

From early days in history money has been in circulation as a legal tender as Aristotle (384-322 BC) phrased that "Money exists not by nature but by law [17]." Hence, money has been by definition *a fiat money* as legal tender. Money thus created, whether it could be tangible or intangible, has to have the following three features as explained by many economics textbooks.

- Medium of Exchange

- Unit of Account

- Store of Value

Using system dynamics concept of stock and flow, these functions of money may be uniformly illustrated in Figure 1 in which flows of money such as receipts and payments accomplish counter-transactions of sales and purchases of commodity (means of exchange) according to a uniform scale (unit of account), and the

Figure 1: Public Money

Fiat Money as Legal Tender

	Public Money	Debt Money
Non-metal Commodities	Shell, Cloth (Silk) Woods, Stones, etc	
Metal Coinage	Non-precious Metals Copper, Silver, Gold	
Paper Notes	Sovereign Notes Government Notes	Gold(smith) Certificates (Central)Bank Notes
Intangible Numbers		Deposits (Credit by Loan)
Digits	Electronic Substitutes	Electronic Substitutes

Table 1: Public vs Debt Money

amount of money thus circulated is stored as a stock of money as a result of these transactions (store of value). In system dynamics stocks of money and commodity can be said to co-flow all the time in an opposite direction.

Money, having the above three features as a legal tender, could take a form of commodities such as shell, silk (cloth) and stone, of precious metals such as copper, silver and gold, of paper such as Goldsmith and gold certificates and bank notes, and of intangible numbers and electronic digits such as deposits and credits. In short, any form that performs three features has been generally accepted as money that has a purchasing power.

Among these various forms of money, let us define public money here as the one that is a fiat money of legal tender and issued only by the government and sovereignty as public utility for transactions. Examples of public money are summarized in Table 1.

Debt Money

Tangible money currently in use are coinage and bank notes. Coins are minted by the government as subsidiary currency. Hence, it is public money by definition. On the other hand, bank notes are issued by central banks that are independent of the government and privately owned in many countries. For instance, Federal Reserve System, the central bank in the United States, is 100% privately owned [2] and Bank of Japan is 45% privately owned. Hence, governments are obliged to borrow from central banks and in this sense bank notes are regarded as a part of debt money.

Theoretically, the issuance of money by the private organizations can be possible only when government or sovereignty legally allow them to create money, since "money exists by law" as pointed out above. Historically this occurred when Bank of England was founded in 1694 and endowed with the right to issue money as its bank notes. In the United States, this was instituted by the Federal Reserve Act in 1913.

In addition to the tangible money such as bank notes and coinage, bank

deposits or credits created as loans by commercial banks also play a role of money, though intangible, because they can be withdrawn any time, at request, for transactions. This process of credit creation is made possible by the so-called a fractional reserve banking system. For detailed analysis see [10].

In sum, under the current financial system, currency in circulation such as bank notes and coinage and bank deposits play a role of money. The amount of money that is available at a certain point of time is called money supply or stock, which is thus defined as

$$\text{Money Supply} = \text{Currency in Circulation} + \text{Deposits} \qquad (1)$$

In system dynamics terminology, it is nothing but a money stock as illustrated in Figure 2. To distinguish this type of money from *public money*, let us call it *debt money*, because money of this type is only created when government and commercial banks come to borrow from central banks (high-powered money), and producers and consumers come to borrow from commercial banks (bank deposits and credits are called low-powered money). In my previous paper [16], this system is called *system of money as debt*. Almost all of macroeconomic textbooks in use such as [4], [5], [6], [3] justify the current macroeconomic system of debt money without mentioning an alternative system, if any, such as the money system proposed by the American Monetary Act to be explained below.

Figure 2: Debt Money

The American Monetary Act

After the Great Depression in 1929, two banking reforms were proposed to avoid further serious recessions; that is, the Banking Act of 1933 known as the Glass-Steagall Act and the Chicago Plan. The Glass-Steagall Act was intended to separate banking activities between Wall Street investment banks and depository banks. The act was unfortunately repealed in 1999 by the Gramm-Leach-Bliley Act. This repeal was criticized as having triggered the recent financial crisis of subprime mortgage loans, following the collapse of Lehman Brothers in 2008. On-going movement of financial reforms in the US is an attempt to bring back stricter banking regulations in the spirit of the Glass-Steagal Act.

The other reform was simultaneously proclaimed by the great economists in 1930s such as Henry Simons and Paul Douglas of Chicago, Irving Fisher of Yale, Frank Graham and Charles Whittlesley of Princeton, Earl Hamilton of Duke,

and Willford King, etc. [18], who had seen a debt money system as a root cause of the Great Depression. Their solution for avoiding a possible "Great Depression" in the future is called the *Chicago Plan*. For instance, Irving Fisher, a great monetary economist in those days, was active in establishing a monetary reform to stabilize the economy out of recessions such as the Great Depression. His own plan is known as "100% Money Plan"

> I have come to believe that the plan, "properly worked out and applied, is incomparably the best proposal ever offered for speedily and permanently solving the problem of depressions; for it would remove the chief cause of both booms and depressions, namely the instability of demand deposits, tied as they are now, to bank loans." [1, p. 8]

In contrast with the Glass-Steagal Act, the Chicago Plan has failed to be implemented.

The American Monetary Act[2] endeavors to restore the proposal of the Chicago Plan or 100% Money Plan by replacing the Federal Reserve Act of 1913. In our terminology above, it is nothing but the restoration of a *public money* system from a *debt money* system. Specifically, the Act tries to incorporate the following three features. For details see [16] and [17, 18].

- Governmental control over the issue of money

- Abolishment of credit creation with full reserve ratio of 100%

- Constant inflow of money to sustain economic growth and welfare

When full reserve system is implemented by the Act, bank reserves become equal to deposits so that we have

$$
\begin{aligned}
\text{Money Supply} &= \text{Currency in Circulation} + \text{Deposits} \\
&= \text{Currency in Circulation} + \text{Reserves} \\
&= \text{High-Powered Money}
\end{aligned} \tag{2}
$$

Accordingly, under the public money system, money is created only by the government, and money supply becomes public money only[3].

As a system dynamics researcher, I have become interested in the system design of macroeconomics proposed by the American Monetary Act, and posed a

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[2]On Dec. 17, 2010, a bill based on the American Monetary Act was introduced to the US House Committee on Financial Services by the congressman Dennis Kucinich. This bill is called H.R. 6550 National Emergency Employment Defense Act of 2010 (NEED). A similar proposal "Towards A Twenty-First Century Banking And Monetary System" was recently submitted jointly by PositiveMoney, nef(the new economics foundation), and Prof. Richard Werner of the Univ. of Southampton, to the Independent Commission on Banking, UK.

[3]Money supply is also defined in terms of high-powered money as

$$
\text{Money Supply} = m * \text{High-Powered Money} \tag{3}
$$

where m is a money multiplier. Under a full reserve system, money multiplier becomes unitary, $m = 1$, so that money can no longer be created by commercial banks.

question whether this public money system of macroeconomy can solve the most imminent problem our economy is facing; that it, accumulation of government debt. My previous work [16] positively answered the question under a simple modeling framework. Before exploring it under the complete model of open macroeconomies here, let us probe how serious our current issue of accumulating debt is.

2 Debt Crises As A Systemic Failure

Debt Crises Looming Ahead

Being intensified by the recent financial crisis following the collapse of Lehman Brothers in 2008, severe crisis of sovereign or government debts seems to be looming ahead. Let us explore how serious accumulating national debts are. Table 2 shows that, among 33 OECD countries, 18 countries are suffering from higher debt-to-GDP ratios of more than 50% in 2010. Average ratio of these 33 countries is 66.7%, while world average ratio of 131 countries is 58.3%[4]. This implies that developed countries are facing debt crises more seriously than many developing countries. .

Country	Ratio(%)	Country	Ratio(%)
Japan	196.4	Israel	77.3
Greece	144.0	Germany	74.8
Iceland	123.8	Hungary	72.1
Italy	118.1	Austria	68.6
Belgium	102.5	United Kingdom	68.1
Ireland	98.5	Netherlands	64.6
United States	96.4	Spain	63.4
France	83.5	Poland	50.5
Portugal	83.2	OECD	66.7
Canada	82.9	World	58.3

Table 2: Public Debt-GDP Ratio(%) of OECD Countries in 2010

Let us now take a look at the US national debt. Following the Lehman shock in 2008, US government is forced to bail out troubled banks and corporations with taxpayers's money, and the Fed continued printing money to purchase poisoned subprime and related securities. In fact, according to the Federal Reserve Statistical Release H.4.1 the Fed assets jumped more than doubles in a year from $905 billion, Sept. 3, 2008, to $2,086 billion on Sept. 2, 2009. This unusual yearly increase was mainly caused by the abnormal purchase of federal

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[4]Data of 131 countries for 2010 are taken from CIA Factbook at https://www.cia.gov/library/publications/the-world-factbook/rankorder/2186rank.html except USA Data, which is taken from US National Debt Clock Real Time on Feb. 12, 2011 at http://www.usdebtclock.org/

agency debt securities ($119 billion) and mortgage-backed securities ($625 billion). In addition, US government is obliged to spend more budget on war in Middle East. These factors contributed to accumulate US national debt beyond 14 trillion dollars as of Feb. 2011, more than 4 trillion dollars' increase since Lehman shock in Sept. 2008. Figure 3 (line 2) illustrates how fast US national debt has been accumulating almost exponentially[5]. From a simple calibration

Figure 3: U.S. National Debt and its Forecast: 1970 - 2020

of data between 1970 through 2011 , the best fit of their exponential growth rate is calculated to be 9% !, which in turn implies that a doubling time of accumulating debt is 7.7 years. If the current US national debt continues to grow at this rate, this means that the doubling year of the 14 trillion dollars' debt in 2011 will be 2019. In fact, our debt forecast of that year becomes 29 trillion dollars. Moreover, in 2020, the US national debt will become higher than 31 trillion dollars, while US GDP in 2020 is estimated to be 24 trillion dollars according to the Budget of the U.S. Government, Fiscal Year 2011; that is, the debt-to-GDP ratio in the US will be 129%!.

Can such an exponentially increasing debt be sustained. From system dynamics point of view, it is absolutely impossible. In fact, following the financial crisis of 2008, sovereign debt crisis hit Greece in 2009, then Ireland, and now Portugal is said to be facing her debt crisis. Debt crises are indeed looming ahead among OECD countries.

A Systemic Failure of Debt Money

From the quantity theory of money $MV = PT$, where M is money supply, V is its velocity, P is a price level and T is the amount of annual transactions, it

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[5]Data illustrated in the Figure are obtained from TreasuryDirect Web page, http://www.treasurydirect.gov/govt/reports/pd/histdebt/histdebt.htm

can be easily foreseen that transactions of a constantly growing economy PT demand for more money M being incessantly put into circulation. Under the current debt money system this increasing demand for money has been met by the following monetary standards.

Gold Standard Failed (1930s) Historically speaking gold standard originated from the transactions of goldsmith certificates, which eventually developed into convertible bank notes with gold. Due to the limitation of the supply of gold, this gold standard system of providing money supply was abandoned in 1930s, following the Great Depression.

Gold-Dollar Standard Failed (1971) Gold standard system was replaced with the Bretton Woods system of monetary management in 1944. Under the system, convertibility with gold is maintained indirectly through US dollar as a key currency, and accordingly called the *gold-dollar standard*. Due to the increasing demand for gold from European countries, US president Richard Nixon was forced to suspend gold-dollar convertibility in 1971, and the so-called *Nixon Shock* hit the world economy.

Dollar Standard Collapsing (2010s?) Following the Nixon shock, flexible foreign exchange rates were introduced, and US dollar began to be used as a world-wide key currency without being supported by gold. As a result, central banks acquired a free hand of printing money without being constrained by the amount of gold. Due to the exponentially accumulating debt of the US government as observed above, US dollar is now under a pressure of devaluation, and the dollar standard system of the last 40 years is destined to collapse sooner or later.

As briefly assessed above, we are now facing the third major systemic failures of debt money, following the failures of gold standard and gold-dollar standard systems. Specifically, our current debt money system seems to be heading toward three impasses: defaults, financial meltdown and hyper-inflation. By using causal loop diagram of Figure 4, let us now explore a conceivable systemic failure of the current debt money system.

Defaults

A core loop of the systemic failure is the debt crisis loop. This is a typical reinforcing loop in which debts increase exponentially, which in turn increases interest payment, which contributes to accumulate government deficit into debt. In fact, interest payment is approximately as high as one third of tax revenues in the US and one fourth in Japan. Eventually, governments may get confronted with more difficulties to continue borrowing for debt reimbursements, and eventually be forced to declare defaults.

Figure 4: Impasses of Defaults, Financial Meltdown and Hyper-Inflation

Financial Meltdown[6]

Exponential growth of debt eventually leads to the second loop of financial crisis. To be specific, a runaway accumulation of government debt may cause nominal interest rate to increase eventually, because government would be forced to keep borrowing by paying higher interests[7]. Higher interest rates in turn will surely trigger a drop of government security prices, deteriorating values of financial assets among banks, producers and consumers. Devaluation of financial assets thus set off may force some banks and producers to go bankrupt in due course.

Under such circumstances, government would be forced to bail out or introduce another stimulus packages, increasing deficit as flow and piling up debt as stock. This financial crisis loop will sooner or later lead our economy toward

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[6]This section name was originally "Meltdown" in the paper submitted in the morning of March 11, 2011, when eastern part of Japan was hit by historical earthquake and tsunami in the afternoon of the day, followed by the meltdown of the Fukushima Dai-ichi nuclear power plants in a day or so. To distinguish it from the nuclear meltdown, it is revised as "Financial Meltdown". We are indeed at a turning point of history revolved by these two major meltdowns.

[7]This feedback loop from the accumulating debt to the higher interest rate is not yet fully incorporated in our model below.

a second impasse which is in this paper called *financial meltdown*, following [8]. Recent financial crisis following the burst of housing bubbles, however, is nothing but a side attack in this financial crisis loop, though reinforcing the debts crisis. Tougher financial regulations being considered in the aftermath of financial crisis might reduce this side attack. Yet they do not vanquish the financial crisis loop originating from the debts crisis loop in Figure 4.

Hyper-Inflation

To avoid higher interest rate caused by two reinforcing crisis loops, central banks would be forced to increase money supply (balancing loop), which inevitably leads to a third impasse of hyper-inflation. Incidentally, this possibility of hyper-inflation in the US may be augmented by the aftermath behaviors of the Fed following the Lehman Shock of 2008. In fact, as seen above monetary base or high-powered money doubled from $905 billion, Sept. 3, 2008, to $1,801 billion, Sept. 2, 2009, within a year (FRB: H.3 Release). Thanks to the drastic credit crunch, however, this doubling increase in monetary base didn't trigger inflation so far. In other words, M1 consisting of currency in circulation, traveler's checks, demand deposits, and other checkable deposits, only increased from $1,461 billion in Sept. 2008 to $1,665 billion in Sept. 2009 (FRB: H.6 Release), which implies that money multiplier dropped from 1.61 to 0.92. As of Feb. 2011, it is 0.91. In short, traditional monetary expansion policy by the Fed didn't work to restore the US economy so far. Yet, these tremendous increase in monetary base will, as a monetary bomb, force the US dollars to be devalued sooner or later. Once it gets burst, hyper-inflation will attack world economy in the foreseeable future. One of the main subject of G20 meetings last year in Seoul, Korea was how to avoid currency wars being led by the devaluation of dollar.

As discussed above in this way, current economies built on a debt money system seems to be getting trapped into one of three impasses, and government may be eventually destined to collapse due to a heavy burden of debts. These are hotly debated scenarios about the consequences of the rapidly accumulating debt in Japan, whose debt-GDP ratio in 2009 was 196.4% as observed above; the highest among OECD countries! Greece has almost experienced this impasse in 2009.

After all, current macroeconomic system has been structurally fabricated by the Keynesian macroeconomic policy framework in which it is proposed that the additional government expenditure can rescue the troubled economy from recession. Yet, it fails to analyze why this fiscal policy is destined to accumulate government debt as mentioned above. In fact, even though GDP gap is very huge in Japan, yet due to the fear of runaway accumulation of debt, the Japanese government is very reluctant to stimulate the economy and, in this sense, it seems to have totally lost its discretion of public policies for the welfare of people even though production capacities and workers have been sitting idle and ready to be called in service. In other words, Keynesian fiscal policy cannot

be applied to the troubled Keynesian macroeconomy. With zero interest rate, its monetary policy has already lost its discretion as well. Isn't this an irony of the Keynesian theory? Current debt money system of macroeconomy seems to have fallen into the dead-end trap.

With these preparatory analysis of the current economic situations in mind, we are now in a position to expand our previous model to a complete model of open macroeconomics, and examine how government debt can be liquidated under two different money systems; that is, debt money system and public money system.

3 Modeling A Debt Money System

Since 2004 I have been working step-by-step on constructing macroeconomic models in [10], [11], [12] and [13] based on the method of accounting system dynamics developed in [9]. This series of macroeconomic modeling was completed in [14] with a follow-up analytical refinement method of price adjustment mechanism in [15]. The model of open macroeconomies in this paper is mostly based on the model in [14].

For the convenience of the reader, main transactions of the open macroeconomies by producers, consumers, government, banks and the central bank are replicated here.

Producers

Main transactions of producers, which are illustrated in Figure 33 in the appendix, are summarized as follows.

- Out of the GDP revenues producers pay excise tax, deduct the amount of depreciation, and pay wages to workers (consumers) and interests to the banks. The remaining revenues become profits before tax.

- They pay corporate tax to the government out of the profits before tax.

- The remaining profits after tax are paid to the owners (that is, consumers) as dividends, including dividends abroad. However, a small portion of profits is allowed to be held as retained earnings.

- Producers are thus constantly in a state of cash flow deficits. To make new investment, therefore, they have to borrow money from banks and pay interest to the banks.

- Producers imports goods and services according to their economic activities, the amount of which is assumed to be a portion of GDP in our model, though actual imports are also assumed to be affected by their demand curves.

- Similarly, their exports are determined by the economic activities of a foreign economy, the amount of which is also assumed to be a portion of foreign GDP.

- Produces are also allowed to make direct investment abroad as a portion of their investment. Investment income from these investment abroad are paid by foreign producers as dividends directly to consumers as owners of assets abroad. Meanwhile, producers are required to pay foreign investment income (returns) as dividends to foreign investors (consumers) according to their foreign financial liabilities.

- Foreign producers are assumed to behave in a similar fashion as a mirror image of domestic producers

Consumers

Main transactions of consumers, which are illustrated in Figure 34 in the appendix, are summarized as follows.

- Sources of consumers' income are their labor supply, financial assets they hold such as bank deposits, shares (including direct assets abroad), and deposits abroad. Hence, consumers receive wages and dividends from producers, interest from banks and government, and direct and financial investment income from abroad.

- Financial assets of consumers consist of bank deposits and government securities, against which they receive financial income of interests from banks and government.

- In addition to the income such as wages, interests, and dividends, consumers receive cash whenever previous securities are partly redeemed annually by the government.

- Out of these cash income as a whole, consumers pay income taxes, and the remaining income becomes their disposal income.

- Out of their disposable income, they spend on consumption. The remaining amount is either spent to purchase government securities or saved.

- Consumers are now allowed to make financial investment abroad out of their financial assets consisting of stocks, bonds and cash. For simplicity, however, their financial investment are assumed to be a portion out of their deposits . Hence, returns from financial investment are uniformly evaluated in terms of deposit returns.

- Consumers now receive direct and financial investment income. Similar investment income are paid to foreign investors by producers and banks. The difference between receipt and payment of those investment income

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is called income balance. When this amount is added to the GDP revenues, GNP (Gross National Product) is calculated. If capital depreciation is further deducted, the remaining amount is called NNP (Net National Product).

- NNP thus obtained is completely paid out to consumers, consisting of workers and shareholders, as wages to workers and dividends to shareholders, including foreign shareholders.

- Foreign consumers are assumed to behave in a similar fashion as a mirror image of domestic consumers.

Government

Transactions of the government are illustrated in Figure 35 in the appendix, some of which are summarized as follows.

- Government receives, as tax revenues, income taxes from consumers and corporate taxes from producers.

- Government spending consists of government expenditures and payments to the consumers for its partial debt redemption and interests against its securities.

- Government expenditures are assumed to be endogenously determined by either the growth-dependent expenditures or tax revenue-dependent expenditures.

- If spending exceeds tax revenues, government has to borrow cash from consumers and banks by newly issuing government securities.

- Foreign government is assumed to behave in a similar fashion as a mirror image of domestic government.

Banks

Main transactions of banks, which are illustrated in Figure 36 in the appendix, are summarized as follows.

- Banks receive deposits from consumers and consumers abroad as foreign investors, against which they pay interests.

- They are obliged to deposit a portion of the deposits as the required reserves with the central bank.

- Out of the remaining deposits, loans are made to producers and banks receive interests to which a prime rate is applied.

- If loanable fund is not enough, banks can borrow from the central bank to which discount rate is applied.

- Their retained earnings thus become interest receipts from producers less interest payment to consumers and to the central bank. Positive earnings will be distributed among bank workers as consumers.

- Banks buy and sell foreign exchange at the request of producers, consumers and the central bank.

- Their foreign exchange are held as bank reserves and evaluated in terms of book value. In other words, foreign exchange reserves are not deposited with foreign banks. Thus net gains realized by the changes in foreign exchange rate become part of their retained earnings (or losses).

- Foreign currency (dollars in our model) is assumed to play a role of *key* currency or *vehicle* currency. Accordingly foreign banks need not set up foreign exchange account. This is a point where a mirror image of open macroeconomic symmetry breaks down.

Central Bank

Main transactions of the central bank, which are illustrated in Figure 37 in the appendix, are summarized as follows.

- The central bank issues currencies against the gold deposited by the public.

- It can also issue currency by accepting government securities through open market operation, specifically by purchasing government securities from the public (consumers) and banks. Moreover, it can issue currency by making credit loans to commercial banks. (These activities are sometimes called *money out of nothing.*)

- It can similarly withdraw currencies by selling government securities to the public (consumers) and banks, and through debt redemption by banks.

- Banks are required by law to reserve a certain amount of deposits with the central bank. By controlling this required reserve ratio, the central bank can control the monetary base directly.

- The central bank can additionally control the amount of money supply through monetary policies such as open market operations and discount rate.

- Another powerful but hidden control method is through its direct influence over the amount of credit loans to banks (known as *window guidance* in Japan.)

- The central bank is allowed to intervene foreign exchange market; that is, it can buy and sell foreign exchange to keep a foreign exchange ratio stable (though this intervention is actually exerted by the Ministry of Finance in Japan, it is regarded as a part of policy by the central bank in our model).

- Foreign exchange reserves held by the central bank is usually reinvested with foreign deposits and foreign government securities, which are, however, not assumed here as inessential.

4 Behaviors of A Debt Money System

Mostly Equilibria in the Real Sector

Our open macroeconomic model is now completely presented. It is a generic model, out of which diverse macroeconomic behaviors are generated, depending on the purpose of simulations. In this paper let us focus on an equilibrium growth path as a benchmark for our analysis to follow. An equilibrium state is called *a full capacity aggregate demand equilibrium* if the following three output and demand levels are met:

$$\text{Full Capacity GDP} = \text{Desired Output} = \text{Aggregate Demand} \qquad (4)$$

If the economy is not in the equilibrium state, then actual GDP is determined by

$$\text{GDP} = \text{MIN (Full Capacity GDP, Desired Output)} \qquad (5)$$

In other words, if desired output is greater than full capacity GDP, then actual GDP is constrained by the production capacity, meanwhile in the opposite case, GDP is determined by the amount of desired output which producers wish to produce, leaving the capacity idle, and workers being laid off.

Even though full capacity GDP is attained, full employment may not be realized unless the following equation is not met;

$$\text{Potential GDP} = \text{Full Capacity GDP}. \qquad (6)$$

Does the equilibrium state, then, exist in the sense of full capacity GDP and full employment? To answer these questions, let us define GDP gap as a difference between potential GDP and actual GDP, and its ratio to the potential GDP as

$$\text{GDP Gap Ratio} = \frac{\text{Potential GDP - GDP}}{\text{Potential GDP}} \qquad (7)$$

By trial and error, mostly equilibrium states are attained when price elasticity e is 3, together with all other adjusted parameters, as illustrated in Figure 5.

Our open macrodynamic model has more than 900 variables that are interrelated one another, among which, as benchmark variables for comparative analyses in this paper, we mainly focus on two variables: GDP gap ratio and unemployment rate. Figure 6 illustrates these two figures at the mostly equilibrium states. GDP gap ratios are maintained below 1% after the year 6, and unemployment ratios are less than 0.65% at their highest around the year 6, approaching to zero; that is, full employment. The reader may wonder why these are a state of mostly equilibria, because some fluctuations are being observed.

Potential GDP, GDP and Aggregate Demand

Figure 5: Mostly Equilibrium States

Economic activities are alive like human bodies, whose heart pulse rates, even of healthy persons, fluctuate between 60 and 70 per minute in average. Yet, they are a normal state. In a similar fashion, it is reasonable to consider these fluctuations as normal equilibrium states.

Figure 6: GDP Gap and Unemployment Rate of Mostly Equilibrium States

Money out of Nothing

For the attainment of mostly equilibria, enough amount of money has to be put into circulation to avoid recessions caused by credit crunch as analyzed in [12]. Demand for money mainly comes from banks and producers. Banks are assumed to make loans to producers as much as desired so long as their vault cash is available. Thus, they are persistently in a state of shortage of cash as well as producers. In the case of producers, they could borrow enough fund from banks. From whom, then, should the banks borrow in case of cash shortage?

In a closed economic system, money has to be issued or created within the system. Under the current financial system of debt money, only the central bank is endowed with a power to issue money within the system, and make loans to the commercial banks directly and to the government indirectly through the open market operations. Commercial banks then 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 this way, money and credits are only crated when commercial banks and government as well as producers and consumers come to borrow at interest. Under such circumstances, if all debts are repaid, money ceases to exist. This is an essence of a debt money system. The process of creating money is known as *money out of nothing*.

Figure 7 indicates unconditional amount of annual discount loans and its growth rate by the central bank at the request of desired borrowing by banks. In other words, money has to be incessantly created and put into circulation in order to sustain an economic growth under mostly equilibrium states. Roughly speaking, a growth rate of credit creation by the central bank has to be in average equal to or slightly greater than the economic growth rate as suggested by the right hand diagram of Figure 7, in which line 1 is a growth rate of credit

Figure 7: Lending by the Central Bank and its Growth Rate

and line 2 is an economic growth rate. In this way, the central bank begins to exert an enormous power over the economy through its credit control.

Accumulation of Government Debt

So long as the mostly equilibria are realized in the economy, through monetary and fiscal policies in the days of recession, no macroeconomic problem seems to exist. This is a positive side of the Keynesian macroeconomic theory. Yet behind the full capacity aggregate demand growth path in Figure 5 government debt continues to accumulate as the line 1 in the left diagram of Figure 8 illustrates. This is a negative side of the Keynesian theory. Yet most macroeconomic textbooks neglect or less emphasize this negative side, partly because their macroeconomic frameworks cannot handle this negative side of the debt money system.

In the model here primary balance ratio is initially set to be one and balanced

budget is assumed to the effect that government expenditure is set to be equal
to tax revenues, and no deficit arises. Why, then, does the government continue
to accumulate debt? Government deficit is precisely defined as

Figure 8: Accumulation of Government Debt and Debt-GDP Ratio

$$\text{Deficit} = \text{Tax Revenues - Expenditure - Debt Redemption - Interest} \qquad (8)$$

Therefore, even if balanced budget is maintained, government still has to keep
paying its debt redemption and interest. This is why it has to keep borrowing
and accumulating its debt; that is to say, it is not balanced in an expanded sense
of budget. Initial GDP in the model is attained to be 300, while government
debt is initially set to be 200. Hence, the initial debt-GDP ratio is around 0.667
year. Yet, the ratio continues to increase to 1.473 year at the year 50 in the
model as illustrated by the line 1 in the right diagram of Figure 8. This implies
the government debt becomes 1.473 years as high as the annual level of GDP.

Remarks: Even if a debt crisis due to the runaway accumulation of debt fails
to be observed in the near future, still there exit some ethical reasons to stop
accumulating debts. First, it continues to create unfair income distribution in
favor of creditors, that is, bankers and financial elite, causing inefficient allo-
cation of resources and economic performances, and eventually social turmoils
among the poor. Secondly, obligatory payment of interest forces the indebted
producers to drive incessant economic growth to the limit of environmental car-
rying capacity, which eventually leads to the collapse of environment. In short,
a debt money system is unsustainable as a macroeconomic system.

Liquidation Policies of Government Debt

Let us now consider how we could avoid such a debt crisis under the current
debt money system. At the face of the debt crisis as discussed above, suppose
that government is forced to reduce its debt-GDP ratio to less than 0.6 by the
year 50, as currently required to all EU members by the Maastricht treaty.

To attain this goal, though, only two policies are available to the government;
that is, to spend less or to tax more. Let us consider them, respectively.

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Policy A: Spend Less

This policy assumes that the government spend 10% less than its equilibrium tax revenues, so that a primary balance ratio is reduced to 0.9 in our economy. In other words, the government has to make a strong commitment to repay its debt annually by the amount of 10 % of its tax revenues. Let us assume that this reduction is put into action at the year 6. Line 2 of the left diagram of Figure 9 illustrates this reduction of spending.

Under such a radical financial reform, debt-GDP ratio will begin to get reduced to around 0.65 at the year 25, as illustrated by line 3 of the same diagram, and to around 0.44 at the year 50, as illustrated by line 2 in the right diagram of Figure 8. Accordingly, the accumulation of debt will be eventually curved as shown byline 2 in the left diagram of Figure 8.

Figure 9: Liquidation Policies: Spend Less and Tax More

Policy B: Tax More (and Spend More)

Among various sources of taxes to be levied by the government such as income tax, excise tax, and corporate tax, let us assume here that excise tax is increased, partly because an increase in consumption (or excise) tax has become a hot political issue recently in Japan. Specifically the excise tax is assumed to be increased to 10% from the initial value of 5% in our model; that is, 5% increase. Line 1 of the right diagram of Figure 9 illustrates the increased tax revenues.

Out of these increased tax revenues, spending is now reduced by 8.5% to repay the accumulated debt. Though spending is reduced in the sense of primary balance, it has indeed increased in the absolute amount, compared with the original equilibrium spending level, as illustrated by line 2 of the same right diagram of Figure 9. Accordingly the government needs not be forced to reduce the equilibrium level of budget.

As a result this policy can also successfully reduces debt as illustrated by line 3 of the same diagram up to the year 25, and further up to the year 50 as illustrated by line 3 in the left diagram of Figure 8.

Triggered Recession and Unemployment

These liquidation policies seem to be working well as debt begins to get reduced. However, the implementation of these policies turns out to be very costly to the government and its people as well.

Let us examine the policy A in detail. At the next year of the implementation of 10 % reduction of a primary balance ratio, growth rate is forced to drop to minus 2 %, and the economy fails to sustain its full capacity aggregate demand equilibrium of line 1 as illustrated by line 2 in Figure 10. Compared with the mostly equilibrium path of line 1, debt-reducing path of line 2 brings about business cycles. Similarly, line 3 indicates another business cycle triggered by Policy B.

Figure 10: Recessions triggered by Debt Liquidation

Figure 11 (lines 2) shows how this policy of debt liquidation triggers GDP gap and unemployment. GDP gap jumps from 0.3% to 3.9% at the year 7, an increase of 13 times. Unemployment jumps from 0.5% to 4.8% at the year 7, more than 9 times. In similar fashion, lines 3 indicate another gaps triggered by Policy B.

In the previous paper [16], unemployment was left unanalyzed. In this sense, the result here is a new finding on the effect of debt liquidation under the current debt money system. The reader should understand that the absolute number is not essential here, because our analysis is based on arbitrary numerical values. Instead, comparative changes in factors need be paid more attention.

Figure 12 illustrates how fast wage rate plummets (line 2 in the left diagram) - another finding in this paper. Concurrently inflation rate plunges to -0.98% from -0.16%, close to 6 times drop, that is, the economy becomes deflationary (line 2 in the right diagram). Lines 3, likewise, indicate another behaviors

Figure 11: GDP Gap and Unemployment

triggered by Policy B.

Figure 12: Wage Rate and Inflation

These recessionary effects triggered by the liquidation of debt turn out to cross over a national border and become contagious to foreign countries. Figure 13 illustrates how GDP gap and unemployment in a foreign country get worsened by the domestic liquidation policy A (lines 2) and policy B (lines 3). These contagious effects under open macroeconomies are observed for the first time in our expanded macroeconomic model - the third finding in this paper. In this sense, in a global world economy, no country can be free from a contagious effect of recessions caused by the debt liquidation policy in other country.

Figure 13: Foreign Recessions Contagiously Triggered

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Liquidation Traps of Government Debt

Under a debt money system, liquidation policy of government dept will be eventually captured into a liquidation trap as follows. The liquidation policy is only implemented with the reduction of budget deficit by spending less or levying tax; that is; policy A or B in our case. Whichever policy is taken, it causes an economic recession as analyzed above.

Figure 14: Liquidation Traps of Debt

The immediate effects of recession either by policy A or B are the reduction of tax revenues as illustrated by lines 2 in Figure 14. Eventually revenue reduction will worsen budget deficit. In other words, policies to reduce deficit result in an increase in deficit. This constitutes a typical balancing feedback loop, which is illustrated as "Revenues Crisis" loop in Figure 15.

The other effect of recession will be a forced bailout/stimulus package by the government, which in turn increases government expenditures, worsening budget deficit again. This adds up a second balancing feedback loop, which is illustrated as "Spending Crisis" loop in Figure 15.

Figure 15: Causal Loop Diagram of Liquidation Traps of Debt

In this way the liquidation policies of government debt are retarded by two

balancing feedback loops of revenues crisis and spending crisis, making up liquidation traps of government debt. This indicates that the debt money system combined with the traditional Keynesian fiscal policy becomes a dead end as a macroeconomic monetary system.

5 Modeling A Public Money System

We are now in a position to implement the alternative macroeconomic system discussed in the introduction, as proposed by the American Monetary Act, in which central bank is incorporated into a branch of government and a fractional reserve banking system is abolished. Let us call this new system a public money system of open macroeconomies. Money issued under this new system plays a role of public utility of medium of exchange. Hence the newly incorporated institution may be appropriately called *the Public Money Administration (PMA)* in this paper.

Under the new system, transactions of only government, commercial banks and the public money administration (formally the central bank) need be revised slightly. All domestic models of a public money system of open macroeconomies as well as foreign exchange and balance of payment are supplemented to the appendix of this paper. Let us start with the description of the revised transactions of the government.

Government

- Balanced budget is assumed to be maintained; that is, a primary balance ratio is unitary. Yet the government may still incur deficit due to the debt redemption and interest payment.

- Government now has the right to newly issue money whenever its deficit needs to be funded. The newly issued money becomes seigniorage inflow of the government into its equity or retained earnings account.

- The newly issued money is simultaneously deposited with the reserve account of the Public Money Administration. It is also booked to its deposits account of the government assets.

- Government could further issue money to fill in GDP gap.

Revised transaction of the government is illustrated in Figure 35 in the appendix, where green stock box of deposits is newly added to the assets.

Banks

Revised transactions of commercial banks are summarized as follows.

- Banks are now obliged to deposit a 100% fraction of the deposits as the required reserves with the public money administration. Time deposits are excluded from this obligation.

- When the amount of time deposits 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, former discount rate is now zero. Allocation of loans to the banks will be prioritized according to the public policies of the government. (This constitutes a market-oriented issue of new money. Alternatively, the government can also issue new money directly through its public policies to fill in GDP gap as already discussed above.)

Line 1 in Figure 16 illustrates the initial required reserve ratio of 5% in our model. We have here assumed three different ways of abolishing a fractional reserve banking system. Line 2 shows that a 100% fraction is immediately attained in the following year of its implementation, while line 3 illustrates it is attained in 5 years. Line 4 indicates it is gradually attained in 10 years, starting from the year 6. In our analysis below, 100% fraction will be assumed to be attained in 5 years as a representative illustration of fractional behaviors.

Figure 16: Required Reserve Ratios

Public Money Administration (Formerly Central Bank)

The central bank is now incorporated as one of the governmental organizations which is here called the Public Money Administration (PMA). Its revised transactions become as follows.

- The PMA accepts newly issued money of the government as seigniorage assets and enter the same amount into the government reserve account. Under this transaction, the government needs not print hard currency, instead it only sends digital figures of the new money to the PMA.

- When the government want to withdraw money from their reserve accounts at the PMA, the PMA could issue new money according to the requested amount. In this way, for a time being, former central bank notes and government money coexist in the market.

- With the new issue of money the PMA meets the demand for money by commercial banks, free of interest, according to the guideline set by the government public policies.

Under the revised transactions, open market operations of sales and purchases of government securities become ineffective, simply because government

debt gradually diminishes to zero. Furthermore, discount loan is replaced with interest-free loan. This lending procedure becomes a sort of open and public *window guidance*, which once led to the rapid economic growth after world war II in Japan [7]. Accordingly, interest incomes from discount loans and government securities are reduced to be zero eventually. Transactions of the public money administration are illustrated in Figure 37 in the appendix, with green stock boxes of seigniorage assets and government reserves being added.

6 Behaviors of A Public Money System

Liquidation of Government Debt

Under the public money system of open macroeconomies, the accumulated debt of the government gets gradually liquidated as demonstrated by line 4 in the left diagram of Figure 17, which is the same as the left diagram of Figure 8 except the line 4. Recollect that line 1 is a benchmark debt accumulation of

Figure 17: Liquidation of Government Debt and Debt-GDP Ratio

the mostly equilibria under the debt money system, while lines 2 and 3 are the decreasing debt lines when debt-ratio are reduced under the same system. Now newly added line 4 indicates that the government debt continues to decline when a 100% fraction ratio is applied in 5 years, starting at the year 6. The other two cases of attaining the 100% fractional reserve discussed above, that is, in a year or 10 years, reduce the debts exactly in a similar fashion. This means that the abolishment period of a fractional level does not affect the liquidation of the government debt, because banks are allowed to fill in the sufficient amount of cash shortage by borrowing from the PMA in the model.

It is shown in Figure 18 that the liquidation of government debt (line 4) is performed without triggering economic recession contrary to the case of debt money system (lines 2 and 3). To observe these comparisons in detail, let us illustrate GDP gap ratios and unemployment rates in Figure 19, in which the same line numbers apply as in the above figures. The liquidation of government debt under the public money system (line 4) can be said to be far better performed than the current debt system because of its accomplishment without recession and unemployment.

GDP (real)

"GDP (real)" : Equilibrium (Debt) ——1——1——1——1——1——1——1——1
"GDP (real)" : Primary Balance(=90%) —2——2——2——2——2——2——2
"GDP (real)" : Excise Tax (5+5%) —3——3——3——3——3——3——3
"GDP (real)" : Public Money (100% 5 Yr) —4——4——4——4——4——4

Figure 18: No Recessions Triggered by A Public Money System

Figure 19: GDP Gap and Unemployment

Figure 20: Wage Rate and Inflation

Moreover, Figure 20 illustrates that wage rate and inflation rates (lines 4) stay closer to the rates of mostly equilibria. Accordingly, the liquidation of debt under the public money system can be said to be attained without reducing

wage rate and setting off inflation.

Furthermore, the liquidation of debt under the public money system is not contagious to foreign countries as illustrated by lines 4 in Figure 21. That is, GDP gap and unemployment in a foreign country (lines 4) remain closer to their almost equilibria states (lines 1).

Figure 21: Foreign Recessions are Not Triggered

Debt Crises can be Subdued!

In sum, the pubic money system is, from the results of the above analyses, demonstrated as a superior alternative system for liquidating government debt in a sense that its implementation does not trigger recessions and unemployment both in domestic and foreign economies. In other words, looming debt crises caused by the accumulation of government debt under a current debt money system can be thoroughly subdued without causing recessions, unemployment, inflation, and contagious recessions in a foreign economy.

7 Public Money Policies

The role of a newly established public money administration under a public money system is to maintain a monetary value, similar to the role assigned to the central banks under the debt money system. Keynesian monetary policy under the debt money system controls money supply indirectly through the manipulation of required reserve ratio, discount ratio, and open market operations. Accordingly its effect is after all limited, as demonstrated by a failure of stimulating the prolonged recessions in Japan during 1990s through 2000s with the adjustment of the interest rates, specifically with zero interest rate policies.

Compared with these ineffective Keynesian monetary and fiscal policies, public money policies we have introduced here are simpler and more direct; that is, they are made up of the management of the amount of public money in circulation through governmental spending and tax policies. Interest rate is no longer used by the public money administration as a policy instrument and left to be determined in the market.

Figure 22: Public Money Policies

More specifically, our public money policies consist of three balancing feedback loops as shown in Figure 22. Anti-recession policy is taken in the case of economic recession to fill in a GDP gap; that is, government spends more than tax revenues by newly issuing public money. On the other hand, in the case of inflationary state, anti-inflation policy of managing public money is conducted such that public money in circulation is sucked back by raising taxes or cutting government spending. As a supplement to this policy in the case of an unusually higher inflation rate that is overshooting a maximum tolerable level, a step down policy of budgetary restructure will be carried out so that a head of the public monetary administration is forced to resign for his or her mismanagement of holding a value of public money.

Recession

Let us now examine in detail how anti-recession policy help restore the economy. For this purpose a recession or GDP gap is purposefully produced by changing the value of Normal Inventory Coverage from 0.1 to 0.5 months and Output Ratio Elasticity (Effect on Price) from 3 to 1, as illustrated in the left diagram of Figure 23.

To fill a GDP gap under such a recessionary situation, let us continue to newly issue public money by the amount of 5 annually for 20 years, starting at t=7. The right diagram of Figure 23 confirms that the GDP gap now gets completely filled in. More specifically, Figure 24 demonstrates how GDP gap ratio and unemployment rate caused by this recession (lines 1) are recovered by the public money policy as illustrated by lines 2.

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Figure 23: GDP Gap and Its Public Money Policy

Figure 24: GDP Gap and Unemployment Recovered

Inflation

As shown above, so long as a GDP gap exists, an increase in the government expenditure by newly issuing public money can restore the equilibrium by stimulating the economic growth. Yet, this money policy does not trigger a price hike and inflation as illustrated by lines 2 in Figure 25 in comparison with lines 1 of GDP gap.

Yet, inflation could occur if government happens to mismanage the amount of public money. To examine the case, let us take a benchmark equilibrium state attained by the public money policy as above (lines 2), then assume that the government overly increases public money to 15 instead of 5 at t=7 for 25 years in the above case. This corresponds to a continual inflow of money into circulation. Under such situations, Figure 25 shows how price goes up and inflation rate jumps to 1.3% (line 3) from the level of 0.3% attained by the public money policy (line 2), 4 times hike, at the year 9.

The inflation thus caused by the excessive supply of money also triggers a GDP gap of 5% at the year 12 (or -3.1% of economic growth or recession), and an unemployment rate of 7.7% at the year 13 as illustrated by lines 3 in Figure 26.

Persistent objection to the public money system has been that government, once a free-hand power of issuing money is being endowed, tends to issue more money than necessary, which tends to bring about inflation eventually, though

Figure 25: Price and Inflation Rate

Figure 26: GDP Gap and Unemployment

history shows the opposite [17]. The above case could be unfortunately one such example. With the introduction of anti-inflationary policy, however, this type of inflation can be easily curbed by the decrease in public money. Let us define maximal inflation as a maximum tolerable inflation rate set by the government. For instance, it was set to be 8% in [16], as suggested by the American Monetary Act. Then, anti-inflationary policy works such that if an inflation rate approaches to the maximal level and a tolerable gap decreases to zero, the amount of public money will be reduced to curb the inflation through the decrease in government spendings and/or the increase in taxes.

Step Down

What will happen if the tolerable gap becomes negative; that is, current inflation rate becomes higher than the maximal inflation? This could occur, for instance, when the incumbent government tries to cling to the power by unnecessarily stimulating the economy in the years of election as history demonstrates. Business cycle thus spawned is called *political business cycle*. "There is some evidence that such a political business cycle exits in the United States, and the Federal Reserve under the control of Congress or the president might make the cycle even more pronounced [6, p.353]." Indeed Figure 27, obtained from the above analysis of inflation, shows how business cycles could be caused by the mismanagement of the increase in public money (line 3) when no GDP gap ex-

ists (line 2). This could be a serious moral hazard lying under the public money system.

Figure 27: Business Cycles caused by Inflation under No GDP Gap

Proponents of the central bank may take advantage of this cycle as an excuse for establishing the independence of the central bank from the intervention by the government. How can we avoid the political business cycle, then, without resorting to the independence of the central bank? As a system dynamics researcher, I suggest an introduction of the third balancing feedback loop of *Step Down* as illustrated in Figure 22. This loop forces, by law, a head of the Public Money Administration to step down in case a tolerable gap becomes negative; that is, an inflation rate gets higher than its maximum tolerable rate. Then a newly appointed head is obliged to restructure a budgetary spending policy to stabilize a monetary value. The stability of a public money system depends on the legalization of a forced step down of the head of the public money administration.

Conclusion

Money is, by Aristotle (384 - 322 BC), fiat money as legal tender and has been historically created either as public money or debt money. Current macroeconomies in many countries are built on a debt money system, which, however, failed to create enough amount of money to meet an increasing demand for growing transactions. Gold standard failed in 1930s and was replaced with gold-dollar standard after World War II, which alas failed in 1971. Then current dollar standard was established, allowing free hand of creating money by central banks, from which, unfortunately, current runaway government debt has

been derived. The accumulation of debt will sooner or later lead to impasses of defaults, financial meltdown or hyper-inflation; in other words current debt money system is facing its systemic failure.

Under such circumstances it is shown that it becomes very costly to save the current debt money system by reducing government debt and debt-GDP ratio; that is, a liquidation process of debt inevitably triggers economic recessions and unemployment of both domestic and foreign economies.

An alternative system, then, is presented as a public money system of open macroeconomies as proposed by the American Monetary Act in which only government can issue money with a full reserve banking system. It is shown that under the public money system government debt can be liquidated without triggering recession, unemployment and inflation.

Finally, in place of the current Keynesian monetary and fiscal policies, public money policies are introduced, consisting of three balancing feedback loops of anti-recession policy, anti-inflation policy and restructuring policy of step down of a head of PMA (Public Money Administration). Public money policies thus become simpler and can affect directly to the workings of the economy.

Accordingly, from a viewpoint of system design, a public money system of macroeconomies as proposed by the American Monetary Act seems to be worth being implemented if we wish to avoid impasses such as defaults, financial meltdown and hyper-inflation. [8].

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[8]This implementation might bring about fortunate by-products. A debt money system of the current macroeconomy has been pointed out to constitute a root cause of unfair income distribution between haves and haves-not, wars due to recessions, and environmental destruction due to a forced economic growth to pay interest on debt. Accordingly, a public money system remove the root cause of these problems and could be panacea for solving them. Due to the limited space, further examination will be left to the reader

Appendix: MacroDynamics 2.5 Illustrated[9]

Figure 28: Title Page of the MacroDynamics Model

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[9]In this illustrated section of the model, only domestic macroeconomy is presented. The model called MacroDynamics version 2.5 is available through the author.

Figure 29: Model Overview

Figure 30: Population and Labor Force

Figure 31: GDP Determination

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Figure 32: Interest Rate, Price and Wage Rate

Figure 33: Transactions of Producers

Figure 34: Transactions of Consumers

Figure 35: Transactions of Government

Figure 36: Transactions of Banks

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Figure 37: Transactions of Public Money Administration (Central Bank)

Figure 38: Foreign Exchange Market

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Figure 39: Balance of Payment

Figure 40: Simulation Panel of GDP

Figure 41: Simulation Panel of Trade and Investment Abroad

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