Chapter 6

Interest and Equity

This chapter analyzes how money supply is affected by the introduction of interest. It is assumed that bank loans, deposits and discount loans are no longer interest-free, and different interest rates are applied to them. As a result, money supplies turn out to be increased due to a change in currency ratio. More importantly, it is found that equity tends to be distributed in favor of commercial banks and the central bank. Then the analysis of interest is applied to the monetary Goodwin model to demonstrates how the monetary economy triggers business cycles into economic recessions.

6.1 What is Interest?

In the previous chapter, it is argued that money is created as debt by non-financial sectors such as public and government, and commercial banks under a fractional reserve banking system. If money is created this way to meet the growing demand for economic transactions as a medium of exchange, the banking system becomes essential sector for economic activities.

Debt is, however, not free in our economy. When non-financial sector borrows money from commercial banks, they have to pay interest. In other words, commercial banks charge interest to make loans. What is interest, then? According to a typical macroeconomic textbook, "Interest is the price for the use of money. It is the price that borrowers need to pay lenders for transferring purchasing power to the future (259 page in [48]).

If extra money is sitting idle at hand without a specific plan to be used in the near future, why can't we let someone in need of medium of exchange use it free of charge? As a matter of fact, usury has been historically prohibited. Yet greedy bankers began to charge interest when loan were made. Eventually, to secure more fund for loans from those who have extra money in non-financial sector, bankers began to attract those extra money at interest. And in a capitalist market economy, as the above quotation of the textbook justifies, no one now doubts that "interest is the price for the use of money."

Since system dynamics is a method for designing a better system, it's worth while to consider whether it's possible to design an economy free of interest charge. To examine this question, let us expand our models of money creation in the previous chapter one by one.

6.2 Money and Interest under Gold Standard

For the expansion of the models [Companion model: 1 Money-Interest(Gold).vpm], let us introduce two types of interest rates. When commercial banks get deposits, they pay an *interest rate* per dollar deposit to non-financial sector. On the other hand, when they make loans to non-financial sector, they charge a higher interest rate called *prime rate* per dollar loan. The difference becomes a major source of income by the commercial banks. In this way, two different prices of interest rates begin to be introduced upon the introduction of commercial banks. Interest rate and prime rate are set here to be 2% and 3%, respectively

The receipts of interest become interest incomes and treated as inflows to the equity, while its payments become interest expenses and booked as outflows from the equity. Figure 6.1 reflects these transactions and becomes a revised model of money and interest under gold standard.

Under the introduction of interest, monetary base is not affected since gold held by the central bank does not change, Currency in circulation drops from \$133 to \$114, and non-financial sector's deposits increases from \$665.8 to \$764, resulting in the decrease in actual currency ratio from 0.2 to 0.15. Actual reserve ratio remains at 0.1. Accordingly, money multiplier increases from 4 to 4.6. and money supply increases from \$799 to \$878 at the period 24 as illustrated in the left-hand diagram of Figure 6.2, though high-powered money decreases slightly from \$200 to \$190. In this way, an introduction of interest has a positive effect to increase money supply through the decrease in actual currency ratio.

A more drastic change under the introduction of interest is observed in the distribution of equity between non-financial sector and commercial banks. The amount of equity in the non-financial sector begins to decline from \$200 to \$84.65, while that of the commercial banks increases from zero to \$115.35 as illustrated in the right-hand diagram of Figure 6.2.

Since no production is assumed in this simple economy of gold standard, its only equity or net assets is the \$200 dollars's gold held by the non-financial sector, which remains the same through the process of money creation. The introduction of interest causes the economy's equity to be redistributed between non-financial sector and commercial banks. In other words, the commercial banks can exploit non-financial sector's equity, no matter how positive interest payments please depositors in the non-financial sector. This is the essence of the introduction of interest to the monetary economy.

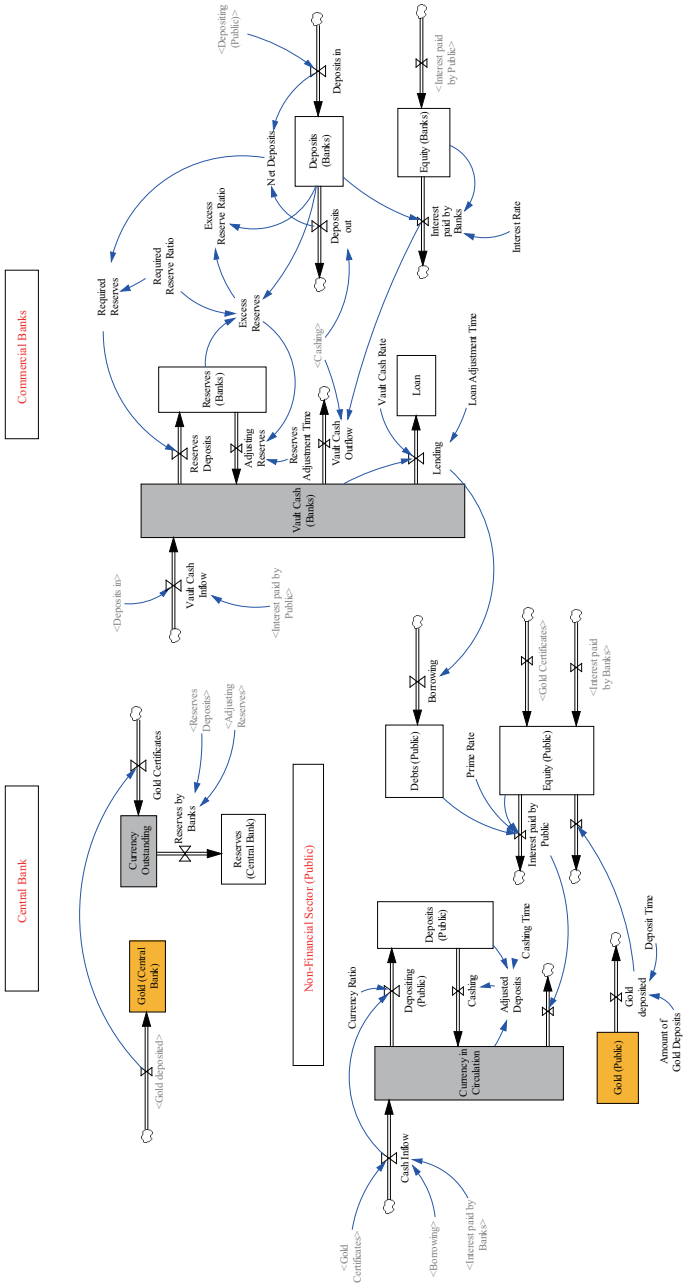

Figure 6.1: Money and Interest under Gold Standard

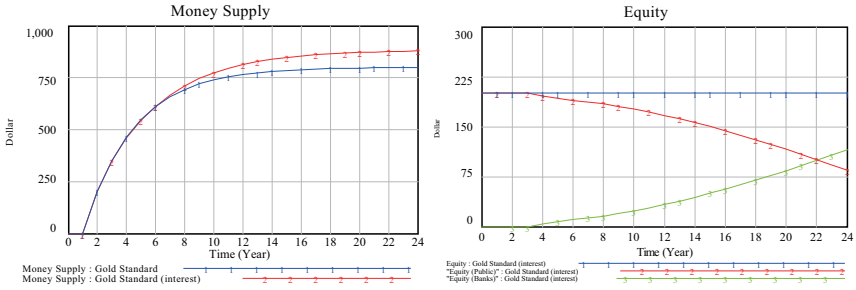

Figure 6.2: Money Supply and Equity under Gold Standard

6.3 Money and Interest under Bank Debt

What happens if the central bank makes a discount loan of $50 to commercial banks, as in the previous chapter? To examine this effect, let us assume that the discount rate charged by the central bank is 0.01 [Companion model: 2 Money-Interest(Loan).vpm]. In this case, money multiplier remains almost the same, yet high-powered money increases from $190 to $230. Accordingly, money supply increases from the above $878 to $1,068 (in the previous chapter it was $1,000) as illustrated in the left-hand diagram of Figure 6.3.

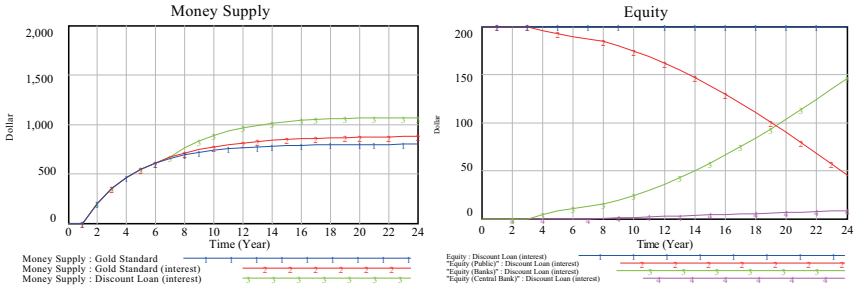

Figure 6.3: Money Supply and Equity under Banks Debt

The amount of equity in the non-financial sector begins to decline from the above $84.65 to $45.2 while that of the commercial banks increases from the above $115.35 to $146. Moreover, the equity of the central bank increases to $8.5 as illustrated in the right-hand diagram of Figure 6.3.

Left-hand diagram of Figure 6.4 shows how the original equity of $200 in the non-financial sector has been further reduced (line 3) when discount loan is made to commercial banks, compared with the case under gold standard (line 2). Right-hand diagram indicates how commercial banks, as well as the central bank, benefits (line 3) compared with the case under gold standard (line 2). In other words, the central bank can not only obtain a portion of the economy's equity through the discount loan, but also help commercial banks to exploit

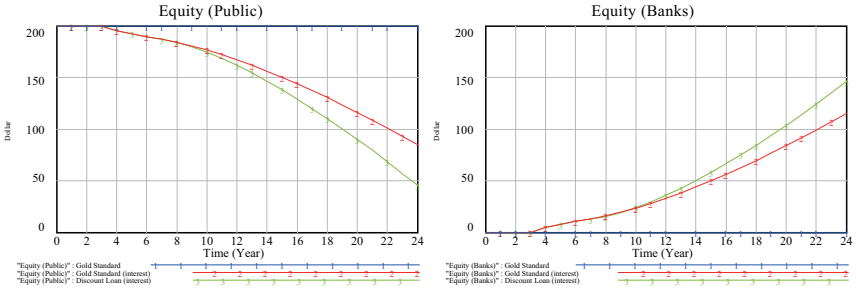

Figure 6.4: Equity Distribution between non-financial sector and Banks

non-financial sector's equity furthermore!

6.4 Money and Interest under Government Debt

Let us now expand the above model to the economy where government is allowed to borrow by newly issuing its securities [Companion model: 3 Money-Interest(Fiat).vpm]. Security interest is assumed to be the same as the interest rate of 2% non-financial sector (public) receives for its deposits. Under this new environment, the same activities are assumed as in the section of "Open Market Operations" of the previous chapter. To repeat, government issues securities (and borrow money) of 100 dollars at the period t = 3, 30% of which are assumed to be purchased by the public (consumers and producers) and 70% by commercial banks. At the period t = 10 central bank purchases 50% of government securities held by the public and commercial banks through open market purchase operation. At the period t = 20 the central bank sells 50% of the government securities it holds, and monetary base decreases to 225 dollars.

Under such situation, money supply is illustrated as line 4 in the left-hand diagram of Figure 6.5. Lines 2 and 3 are money supplies under gold standard and bank debt as discussed above for comparison. Right-hand diagram shows the new distribution of equity among non-financial sectors (public and government), commercial banks and central bank.

Let us take a closer look at the equity distribution of non-financial sectors (public and government). Left-hand diagram of Figure 6.6 illustrates the changes of public sector's equity. Compared with the previous cases (lines 2 and 3), government borrowing jumps the public equity as illustrated in line 4, which is caused by the government spending in the non-financial sector (public). This seems that government borrowing increases the public equity. It is, however, balanced by the decrease in the government equity of -$100 as shown in the right-hand diagram. (Only government is allowed to suffer from negative equity!) To be worse, this increased public equity continues to decline as line 4 of the left-hand diagram indicates.

To sum, nothing new has happened to the distribution of equity when gov-

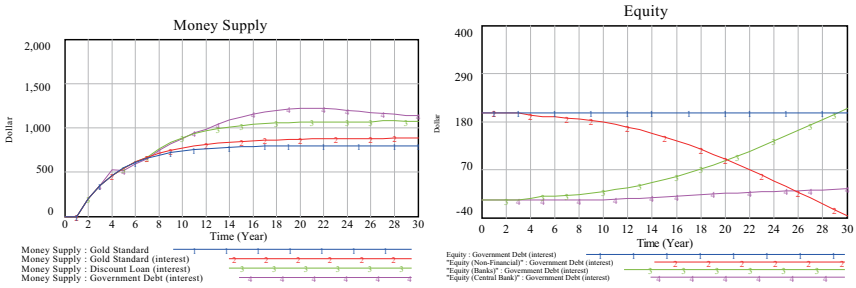

Figure 6.5: Money Supply and Equity under Government Debt

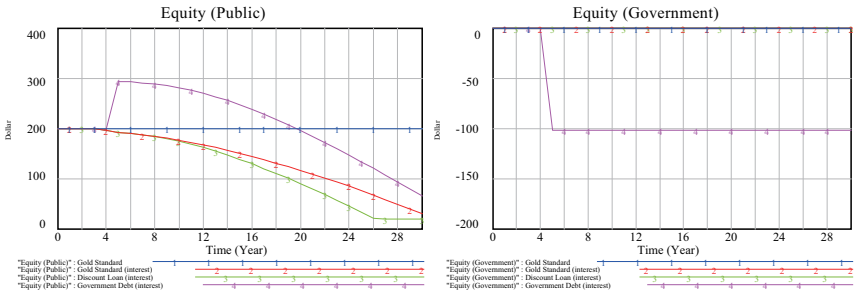

Figure 6.6: Public and Government Equities under Government Debt

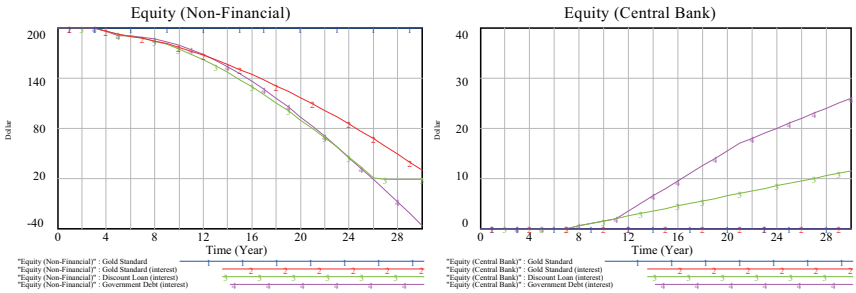

Figure 6.7: Non-Financial and Central Bank Equities under Government Debt

ernment borrows. To see this, let us combine public and government equities as non-financial equity. Left-hand diagram of Figure 6.7 illustrates that consolidated non-financial sector's equity distribution (line 4) behaves similar to the line 3 under discount loan, except that this time non-financial sector suffer from the negative equity because of the government debt. Meanwhile, the central bank's equity (line 4) continues to rise more than the case under discount loan (line 3) as the possession of government securities as its assets increases as shown in the right-hand diagram.

6.5 A Monetary Goodwin Model with Interest

The monetary Goodwin model or the integrated Goodwin model with a circulation of money presented in Chapter 4 is not still complete in the sense that interest payments are not considered. Having the nature of interest being analyzed above, it's now time to explore how the introduction of interest affects economic behaviors in the monetary Goodwin economy. In Chapter 4 only the possibilities of business cycles that collapse into economic recessions were shown by introducing liquidity constraint and credit crunch due to outside shocks or fears of bankruptcies. In this section, let us complete our monetary Goodwin model with the introduction of interest, and explore whether economic recessions could be triggered endogenously out of perpetual Goodwin-type business cycles.

The model is completed in the following fashion. First, consumers receive interest income against their deposits. The interest rate applied to the calculation of this income is set to be 2% by default. Secondly, producers pay interest and loan disbursement to banks for the debts out of their retained earnings. Interest thus paid becomes interest income for the banks. The interest rate applied to the calculation is called a prime rate which has to be higher than the interest rate in order for the banks to realize positive income. The difference between prime rate and interest rate is called a prime rate spread here, and set to be 2% by default. In this way, banks can accumulate their equity by the flow amount of their interest income paid by producers less interest paid by banks to consumers. Finally, producers' (gross) profits now need to be redefined as follows:

$$\text{Profits} = \text{Output - Wages - Interest Income (Banks)} \tag{6.1}$$

Figure 6.8 illustrates a balance sheet of the monetary Goodwin model with interest[Companion model: Goodwin(Interest).vpm].

Business Cycles into Economic Recessions!

The introduction of the interest into the monetary Goodwin model turns out to affect the perpetual business cycles caused in the Goodwin model in Chapter 4. Let us start with the same situation of labor supply; that is, $L^s = 110$ that causes perpetual business cycles[1]. Specifically, line 1 in the left-hand diagram of Figure 6.9 indicates the same output business cycles as the original one in the Goodwin model when there is no interest. Line 2 is our new output business cycle caused by the interest rate of 2% and prime rate spread of 2%; that is, 4% of prime rate. Line 3 is additionally produced for the interest rate of 2% and the prime rate of 5%. These three business cycle curves thus produced with or without the introduction of interest rate obviously demonstrates that the

[1]Analyses done under the subsection of "A Credit Crunch and Economic Recession" in Chapter 4 are not tried in this section. They are left to the reader as exercise.

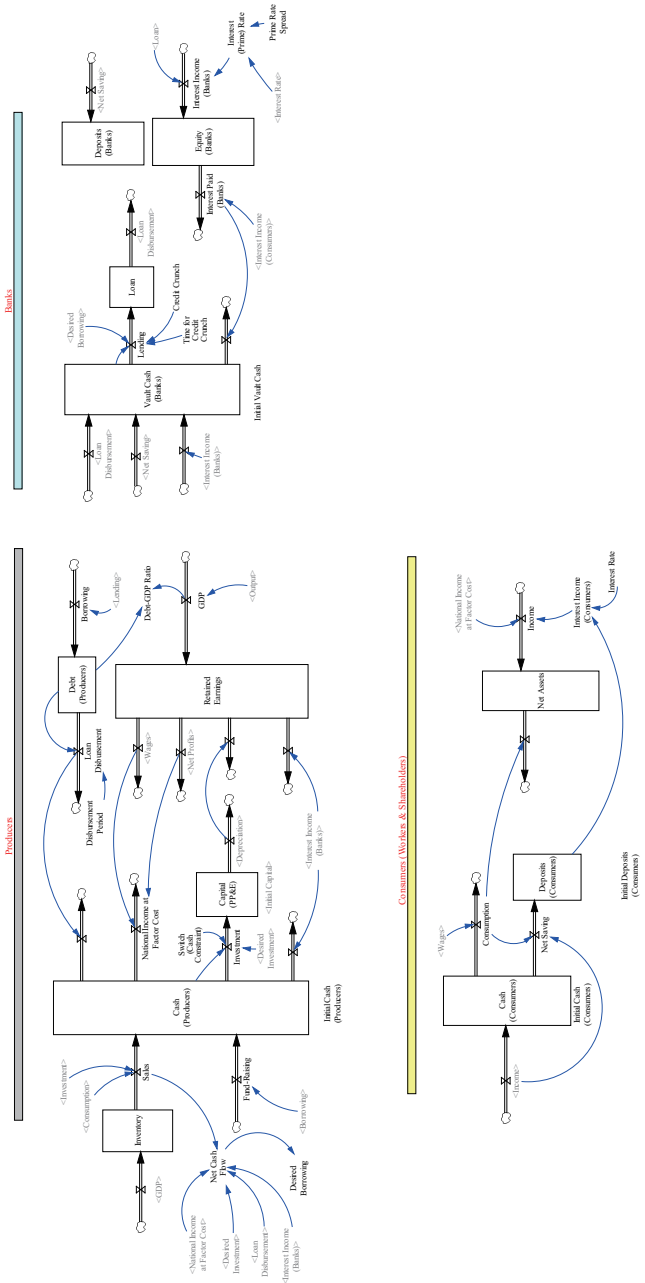

Figure 6.8: Balance Sheet of the Monetary Goodwin Model with Interest

nature of perpetual Goodwin business cycles remains unaffected over the first 30 years. The right-hand diagram also demonstrates similar unemployment business cycles over 30 years. That is to say, unemployment cycles seem to have not being affected by the introduction of interest.

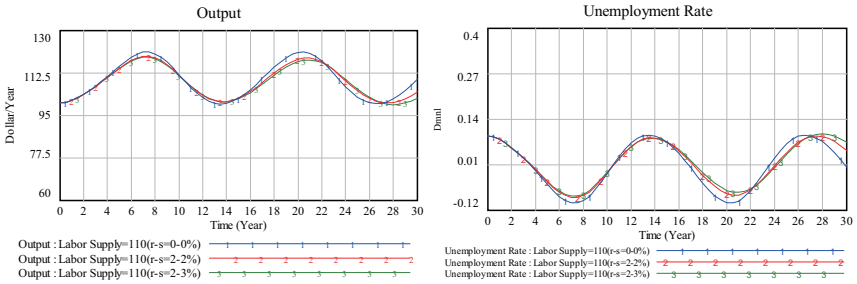

Figure 6.9: Output and Unemployment with Interest Rate: 0 - 30 years

These observation may suggest that money does NOT matter on the formation of business cycles, because they look alike with or without money and interest rate. To confirm this furthermore, I have extended the simulation period to the next 20 years. To my surprise, then, one of the perpetual business cycles begins to break and fall down as illustrated by line 3 in left-hand diagram of Fig 6.10. In other words, this breakdown seems to have occurred when a prime rate spread becomes larger than 3% in our model. Meanwhile, unemployment rate begins to rise out of its perpetual business cycle as illustrated by line 3 in the right-hand diagram.

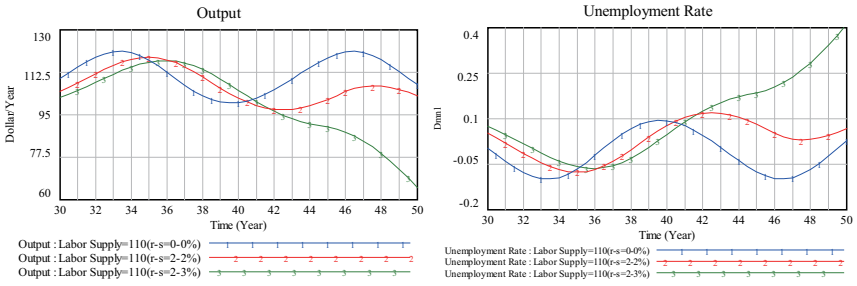

Figure 6.10: Output and Unemployment with Interest Rate: 30 - 50 years

Compared with these breakdowns of business cycles, lines 2 being produced at the prime rate spread of 2% seem to remain unaffected by the introduction of interest. The reader may easily confirm that this is not true when the simulation is further extended over 60 years[2]. In other words, it may be conjectured that

[2]Refer to lines 3 in Figures 6.15 and 6.16 below.

a capitalist monetary economy of Goodwin type eventually triggers economic recessions out of perpetual business cycles in 50 years, 60 years, or 100 years.

Why cannot the perpetual business cycles be sustained, then? Left-hand diagram of Figure 6.11 shows how banks keep accumulating their equity due to the incessant flows of interest income. What do the banks do with the increasing amount of equity? In the model it is assumed to be sitting idle, without being productively used as investment, because banks have no incentives to do so. Instead, they may become "Ponzi financier" [40, p.328] and engage in unproductive financial gambles. This implies in our model a substantial decline in profits and investment as indicated by line 1 in Figure 6.12.

Moreover, right-hand diagram of Figure 6.11 shows how producers are forced to borrow from banks and, as a result, keep accumulating their debt (and debt-GDP ratio).

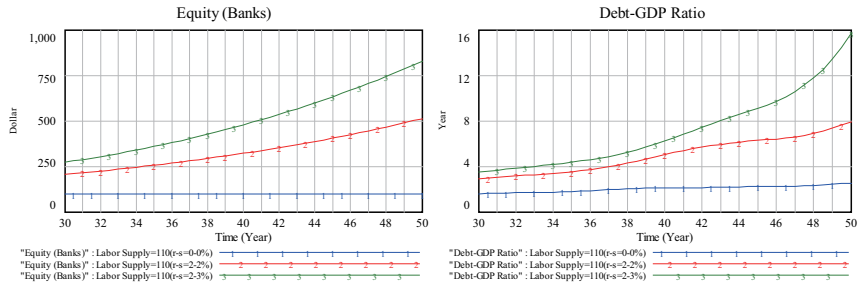

Figure 6.11: Increasing Bank Equity and Debt-GDP ratio: 30 - 50 years

Surely, due to the higher prime rate payments, the desired borrowing of producers begins to sky-rocket as illustrated in line 3 in Figure 6.12, yet lending amount of banks cannot meet the demand of producers from the year 40 as indicated by line 4. In this way, the actual investment (line 2) begins to be constrained from the year 45. The reduced investment, then, collapses capital accumulation and eventually output, triggering economic recessions. To be worse, an economic recession thus provoked may turn into a great depression in 50 to 100 years of time span.

Figure 6.13 gives another view of the collapse of perpetual business cycles into economic recessions. Left-hand diagram shows a perpetual cycle of workers' share and labor-employment ratio, while the right-hand diagram indicates a cyclical decline in workers' share and a cyclical increase in the labor-employment ratio; that is, an increase in unemployment.

Figure 6.14 illustrates a skyrocketing increase in debt-GDP ratio from 1.8 in the year 20 to 15.7 in the year 50 (line 1). Line 2 shows its change rate; for instance, 8.5% in the year 20 and 14.8% in the year 50. In relation with the recent financial crisis in 2008, Steve Keen pointed out an interesting correlation between the change in debt-GDP ratio and unemployment in [40, Chapter 13]. To examine the correlation in our model, unemployment rate is drawn as line 3. A closer look at the lines 2 and 3 suggests that cycles of unemployment rate fol-

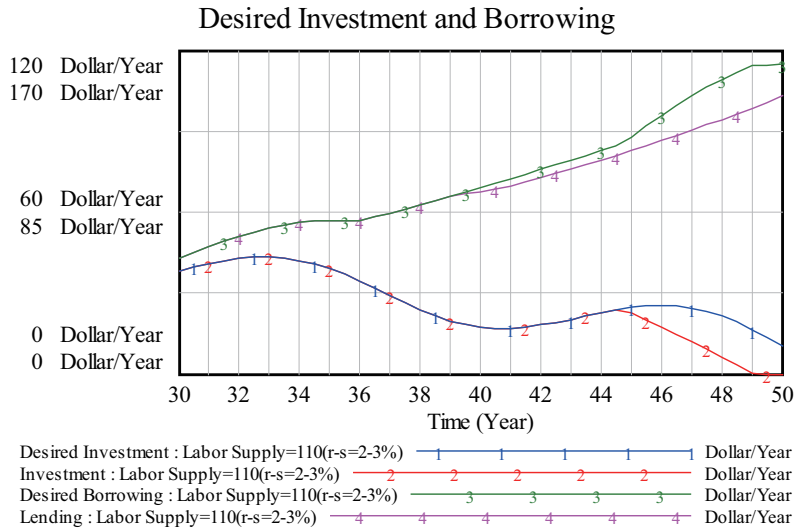

Figure 6.12: Desired Investment and Borrowing at a Prime Rate Spread=3%

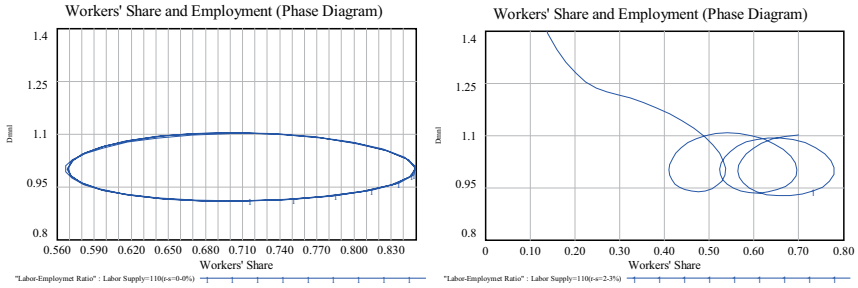

Figure 6.13: Breaking Phase Diagram of Labor-Employment Ratio and Workers' Share

low those of the change in debt-GDP ratio with a delay. In other words, change in debt-GDP ratio could be an appropriate indicator of economic recessions in a capitalist monetary economy.

Economic Recovery

How can we avoid the collapse of perpetual business cycles into economic recessions? In Figure 6.12 that desired investment begins to be constrained around the year 45. Accordingly, it can be easily conjectured that additional cash being put into circulation may remove the monetary constraint and lead the economy once again to recovery.

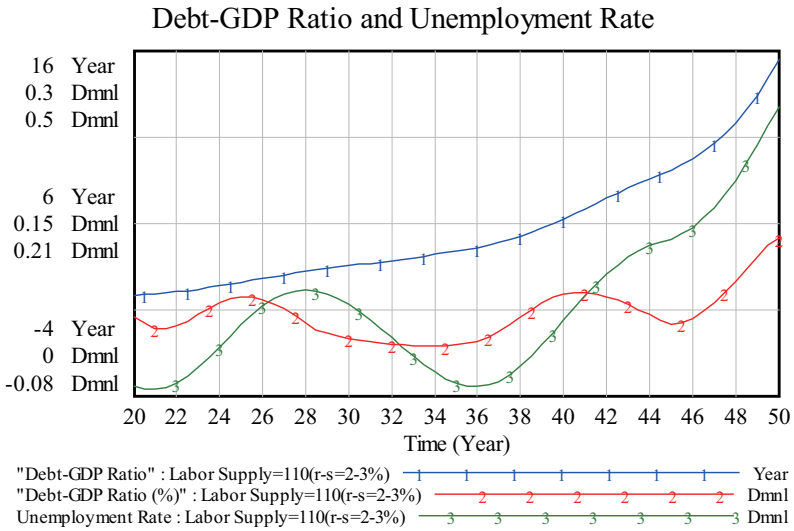

Figure 6.14: Debt-GDP Ratio and Unemployment Rate: 20 - 50 years

To examine this conjecture, let us put a new amount of 60 cash at the year 45 into circulation (without asking where it comes from!). Our simulation this time is extended to the year 55 to explore its effect. Figures 6.15 and 6.16 thus obtained are the same as the left-hand and right-hand diagrams of Figure 6.10 in the case of lines 1 through 3. In addition, effects of the input of new cash on the output and unemployment are illustrated by lines 4.

Output now seems to stop plummeting for a while, and unemployment rate seems to stop rising temporarily. The reader may easily predict that output sooner or later begin to decline, and unemployment rate begins to rise if simulations are extended beyond the year 55. To avoid this, the reader may also predict that another additional input of cash into circulation might improve the situation. Additional simulation has proved that no such effect is attained. The reason is that the increasing interest income for banks continues to squeeze the profits of producers, and accordingly their desired investment. Surely, declines of capital accumulation and output are to follow.

From these reasoning it is now clear that to regain economic recoveries, interest income of banks has to be restricted. To do so, let us reduce the primary rate spread to be zero at the year 45, together with the input of cash. Lines 5 in Figures 6.15 and 6.16 are thus obtained. They indicate the recovery of perpetual output cycles as well as that of perpetual unemployment cycles.

Can the perpetual recoveries thus attained, then, be sustained? When simulation period is further extended beyond 65 years, they turned out to collapse again. Only when interest rate is additionally set to be 1% from the beginning in our model, perpetual business cycles are shown to be sustained without col-

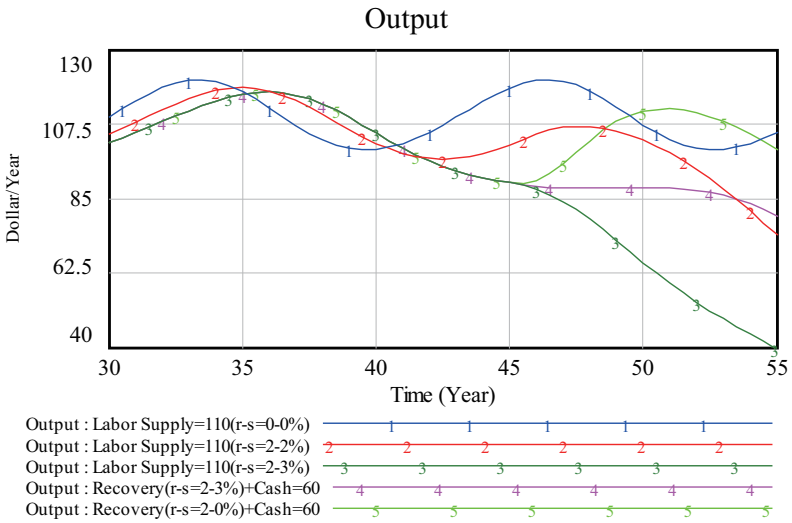

Figure 6.15: Recovering Output with Interest Rate: 30 - 55 years

Figure 6.16: Recovering Unemployment with Interest Rate: 30 - 55 years

lapsing into economic recessions. This may indicate, as a final conclusion of this chapter, that banking services with interest is an obstacle to the sustainability of the economic activities.

6.6 Interest and Sustainability

The introduction of interest always plays in favor of commercial banks and the central bank in terms of the equity distribution. This is a negative side of the coin. The positive side is that through the banking system with interest, non-financial sector obtains enough money for productive investment that enables economic growth and eventually an increase in non-financial sector's equity.

The fundamental question is whether this increase in the non-financial sector's equity is large enough to compensate the exploitation of its equity by banking system. In system dynamics, this financial (interest) system of deposits and debts can be described by a simple model illustrated in Figure 6.17. That is, this financial system guarantees the infinite inflow of interest to the owner of deposits and lenders.

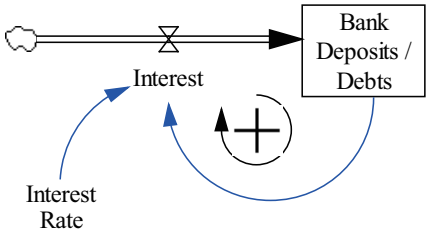

Figure 6.17: Financial (Interest) System of Deposits/ Debts

This is nothing but the example of exponential growth explained in Chapter 1. And the reader can remember its power with a built-in doubling time. In other words, this financial system makes the haves richer and richer. Once we are enslaved with debt, we are forced to work indefinitely to attain endless economic growth for the payments of interest if we want to avoid the decline in our equity values. Otherwise, as we have seen above, our equity eventually will be totally exploited by bankers. In other words, considering the power of exponential growth, this financial system of distorted equity distribution does not work consistently, and its resetting eventually needs be enforced by financial and economic crises and wars as our economic history indicates.

This may lead to our ultimate question: Can the resetting together with indefinitely forced economic growth work well for attaining a sustainable economy under a finite world of resources? The answer seems to be negative. Accordingly it is always expedient to think about the option of designing an interest-free economy as a system designer. We'll challenge this in Part IV. Until we arrive there, let us continue to model our capitalist market macroeconomy by focusing on the production side in the chapters to follow.

Conclusion

To create money supply out of a limited monetary base, banking system of deposits and debts play a crucial role. We have examined how positive interest rate affect money supply under the systems of gold standard, discount loan and government debts. In all cases money supplies are shown to be further increased.

It is also shown that in this process of money creation equity distribution is made in favor of the commercial banks and the central bank. In other words, non-financial sector's equity will be completely exploited unless economic growth is attained with debts as investment.

To explore a role of interest thus analyzed in a capitalist monetary economy, the monetary Goodwin model developed in Chapter 4 is further revised for its completion with the introduction of interest payments. Under the monetary economy with interest, it is shown that perpetual business cycles could collapse into economic recessions so long as the simulation period is extended far enough. In our example, with the interest rate of 2% and a primary rate of 4%, economic recessions are shown to be triggered between the year 40 and 50. Economic recoveries from these recessions can be shown to be attained only when additional cash is put into circulation and interest income by banks are decisively restricted. In this way, money is shown to matter on the formation of business cycles and economic recessions. Moreover, it is shown that banking system with interest may be an obstacle to the economic recoveries. Finally, it is posed that interest and sustainability may not be compatible.

Questions for Deeper Understanding

1. In the companion model: 1 Money(Gold).vpm in Chapter 5, money supply is increased to 800 from the original gold of 200 as monetary base. However, in the model: 1 Money-Interest(Gold).vpm in this chapter, money supply is further increased to around 878 at t=24 due to the introduction of interest rate and prime rate. Discuss why money supply is increased by 78 without a change in monetary base.