Chapter 8

Integration of Real and Monetary Economies

In the previous three chapters, monetary and real parts of macroeconomies are built separately. In this chapter[1], these three separate models are integrated to present a complete macroeconomic dynamic model consisting of real and monetary parts of macroeconomies. The integrated model is aimed to be generic, out of which diverse macroeconomic behaviors are shown to emerge. Specifically equilibrium growth path, business cycles and government debt issues are discussed in this chapter.

8.1 Macroeconomic System Overview

This chapter tries to integrate real and monetary parts of the macroeconomy that have been so far analyzed separately in the previous chapters [Companion model: Nominal GDP.vpm]. For this purpose, at least five sectors of the macroeconomy have to play macroeconomic activities simultaneously; that is, producers, consumers, banks, government and central bank. Figure 8.1 illustrates the overview of a macroeconomic system in this chapter, and shows how these macroeconomic sectors interact with one another and exchange goods and services for money. Foreign sector is still excluded from the current analysis.

The reader will be reminded that the integrated model to be developed in this chapter is a generic one by its nature, and does not intend to deal with some specific issues our macroeconomy is currently facing. Once such a generic macroeconomic model is built, we believe, any specific macroeconomic issue could be challenged by bringing real data in concern to this generic model without major structural changes in this integrated model.

[1]This chapter is partly based on the paper: Integration of Real and Monetary Sectors with Labor Market – SD Macroeconomic Modeling (3) – in "Proceedings of the 24th International Conference of the System Dynamics Society", Nijmegen, The Netherlands, July 23 - 27, 2006. (ISBN 978-0-9745329-5-0)

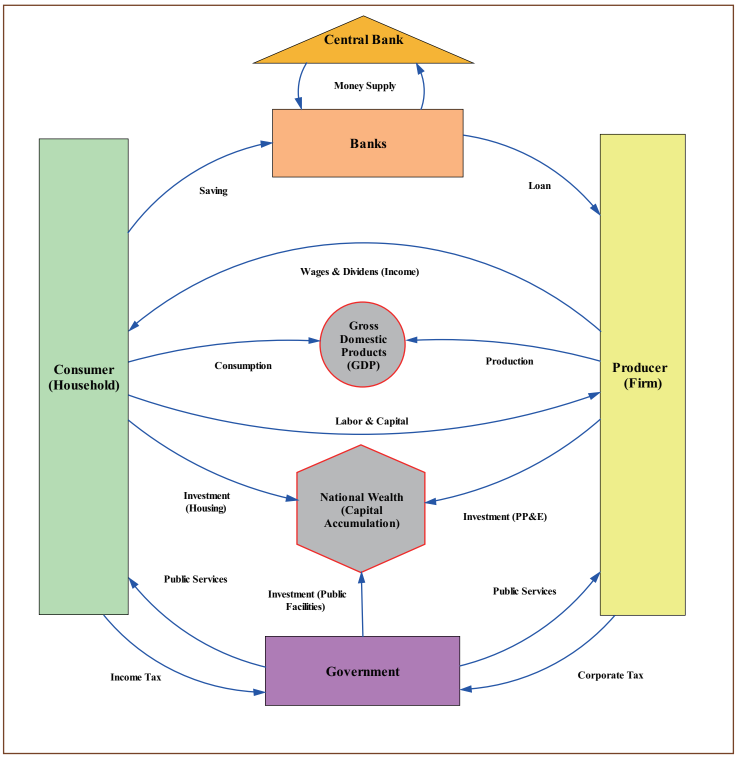

Figure 8.1: Macroeconomic System Overview

8.2 Changes for Integration

Let us now start by explaining some major changes made to the previous models in order to integrate them.

Nominal and Real Units

In the previous models, all macroeconomic variables are assumed to have a dollar unit without specifically distinguishing nominal and real terms. In other words, GDP and other variables in the real sector of the previous model are implicitly interpreted as having real value of dollar.

In the integrated model of real and monetary sectors, variables in real production sector such as output and capital stock must have physical unit (which is specified as DollarReal in this chapter), while all market transactions among all sectors are made in terms of nominal unit of money; that is, Dollar. To convert a physical unit to a monetary unit for transactions between real and monetary sectors, price P is used that has a unit of Dollar/DollarReal.

Nominal and Real Interest Rates

With the introduction of real and nominal terms, interest rate introduced in the previous chapter has also to be reinterpreted as a real interest rate, meanwhile interest rate used for market transactions has to be nominal. The relationship between these two interest rates are shown by the following relation[2].

$$\text{Nominal interest rate} = \text{Real interest rate} + \text{Inflation rate} \tag{8.1}$$

Investment Order Placement and Delay

To reflect the fact that investment process takes time, a capital stock under construction is newly added to the capital accumulation process. That is, new investment is accumulated to the capital stock under construction, out of which capital stock (property, plant & equipment) is accumulated after a completion of capital under construction. This revision is illustrated in Figure 8.2.

Investment Function

The amount of desired investment is obtained as the difference between desired and actual capital stock plus depreciation such that

$$I(i) = \frac{K^*(i) - K}{\textit{Time to Adjust Capital}} + \delta K \tag{8.2}$$

where δ is a depreciation rate. Desired capital stock could be approximated by

$$K^* = \frac{\alpha(1-t)Y^*}{i+\delta} \tag{8.3}$$

where α is exponent on capital, and t is excise tax rate[3]. Furthermore, desired output Y^* is represented by the variable: Aggregate Demand Forecasting (Long-run) as illustrated in Figure 8.2.

The new investment function obtained above replaces our previous investment function that is determined by the interest rate:

$$I(i) = \frac{I_0}{i} - ai \tag{8.4}$$

where a was defined there as an interest sensitivity of investment. Surely, our model is open to any type of investment function which the reader considers to be more appropriate.

[2]This formulation is the so-called Fisher effect; to be precise, nominal rate of interest is the sum of real interest, inflation rate and their cross product. See [78, pp. 320-323] for the detailed discussion on the real rate of interest in relation with the uniform rate of profit.

[3]For the derivation of this equation, see the section of production function in the next chapter.

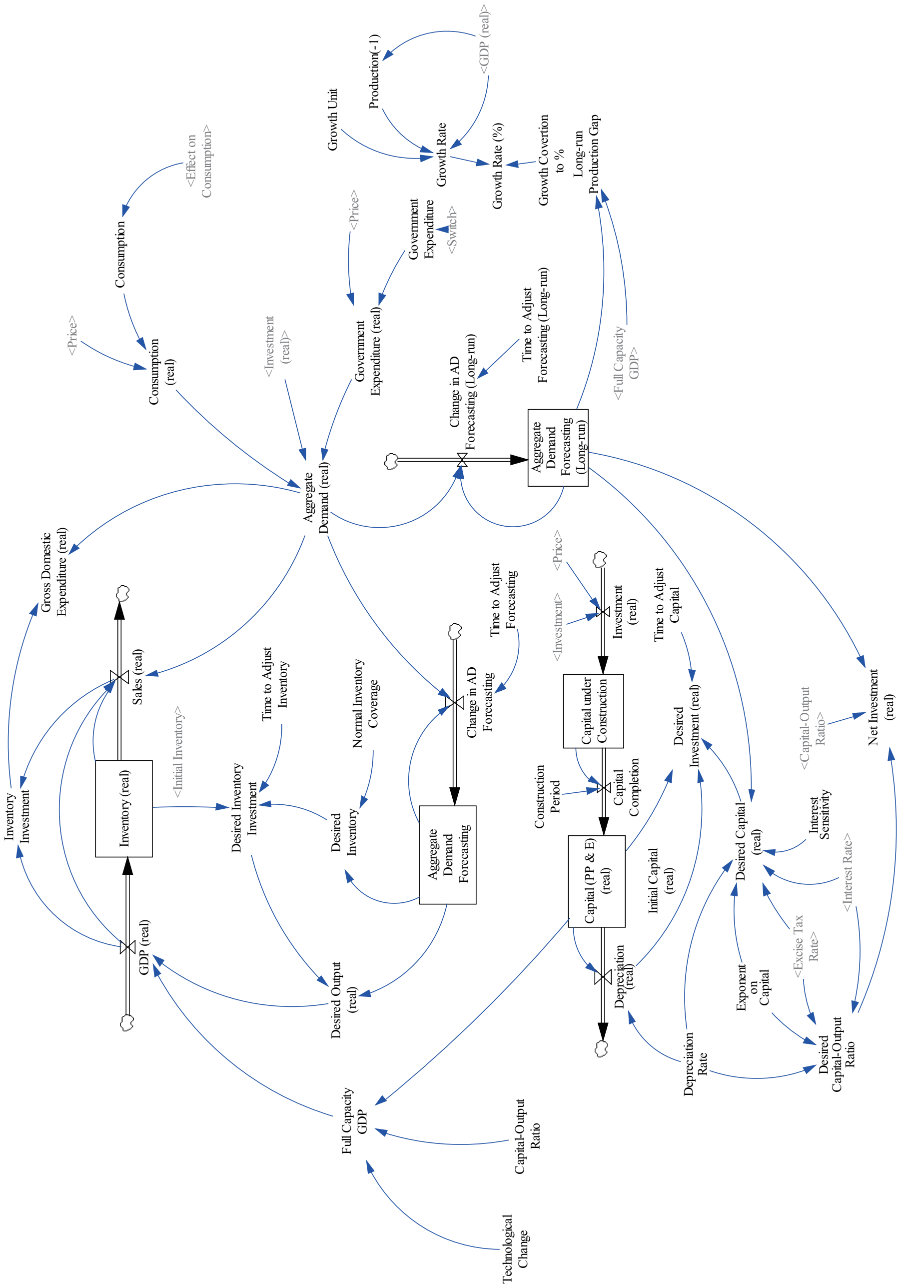

Figure 8.2: Real Production of GDP

Consumption Function

In the previous model, consumption is assumed to be determined by a constant marginal propensity to consume as expressed in equation (7.3). Now that nominal price is explicitly used in the integrated model, it's appropriate to consider that consumers respond to a price level. Specifically, marginal propensity to consume is now assumed to be dependent on a relative price elasticity of consumption such that

$$c(P) = \frac{c}{\left(\frac{P}{P_0}\right)^e} \tag{8.5}$$

where P_0 is an initial price level and e is a relative price elasticity of consumption. As a relative price level goes up, marginal propensity to consume gets smaller. In this way, consumption is affected by the relative size of prices and its elasticity.

Accordingly, the revised consumption function becomes

$$C(P) = C_0 + c(P)Y_d \tag{8.6}$$

The consumption function thus defined has a feature of a downward-sloping demand function, similar to a demand curve of consumers at a microeconomic level.

Money Supply and Demand for Money

The integrated model here intends to be a complete system of macroeconomy, and money supply and demand for money have to be sought *within the system itself.* This revision is partly made in the previous chapter under the section of "A Comprehensive IS-LM Model".

Let us consider money supply first. In the previous model it is treated as exogenously fixed parameter, because there exists no mechanism to change money supply within the system. With the introduction of the central bank, money supply is now created within the system. It is here defined as follows[4]:

$$\text{Money Supply} = \text{Currency in Circulation} + \text{Deposits} \tag{8.7}$$

Currency in circulation may be represented by the sum of cash stocks held by consumers, producers, government and banks, while deposits are the amount of money consumers deposit with banks. For instance, whenever consumers purchase consumption goods from producers, the ownership of money changes hands from consumers to producers, and in the model this movement is represented as a decrease in consumers' stock of cash and a simultaneous increase in producers' stock of cash. In this way currency in circulation keeps moving among the cash stocks of consumers, producers, government and banks, decreasing one cash stock and increasing another cash stock simultaneously.

[4]In our simple model, it may not be needed to classify monetary aggregates further into M1, M2 and M3.

On the other hand, demand for money consists of three motives: transaction, precautionary and speculative motives, according to the standard textbooks such as [34]. In our previous IS-LM model (equation (7.32)), real demand for money is formalized as consisting of transaction motives and speculative motives. Money demanded for market transactions in our integrated model is nothing but cash outflows by consumers, producers, government and banks. Consumers need cash to buy consumption goods, and producers need cash to make investment. And these needs for transaction have to be met out of their cash stocks.

As to a speculative motive, demand for cash is assumed to move back and forth freely between deposits and cash stocks of consumers to maintain a certain level of currency ratio (= Cash / Deposits).

$$\text{Cash Demand} = \frac{\text{Currency Ratio * Deposits - Cash}}{\text{Cashing Time}} \tag{8.8}$$

Currency ratio in turn is assumed to be determined by nominal interest rate. Specifically, whenever nominal interest rate drops, currency ratio tends to rise so that consumers increase their demand for cash. As an extreme case if nominal interest rate drops to the level of a so-called liquidity trap (almost close to zero per cent in late 1990s in Japan), currency ratio is assumed to become one so that no deposits are made. In this way, speculative demand for cash is made dependent on the nominal interest rate in the model.

Demand for money (nominal) thus interpreted has a unit of dollar/year, while money supply as a stock of cash has a unit of dollar. Therefore, money supply has to be multiplied by its velocity that has a unit 1/year, to secure unit equivalence in SD model as already formalized in the equation (7.22)[5].

Figure 8.3 illustrates our revised model of money supply and demand for money. It also shows adjustment processes of real interest rate and price level, which is already discussed in the section of a comprehensive IS-LM model in the previous chapter.

Discount Loans by the Central Bank

In this integrated model, 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 or currency has to be created within the system. Under the current financial system, only the central bank is endowed with a power to create currency within the system, and make loans to the

[5] This part of treatment for demand and supply of money corresponds to the Quantity Equation:

$$\text{Money (M) * Velocity (V) = Price (P) * Transaction (T),}$$

where V is called transaction velocity of money in [47, p. 82].

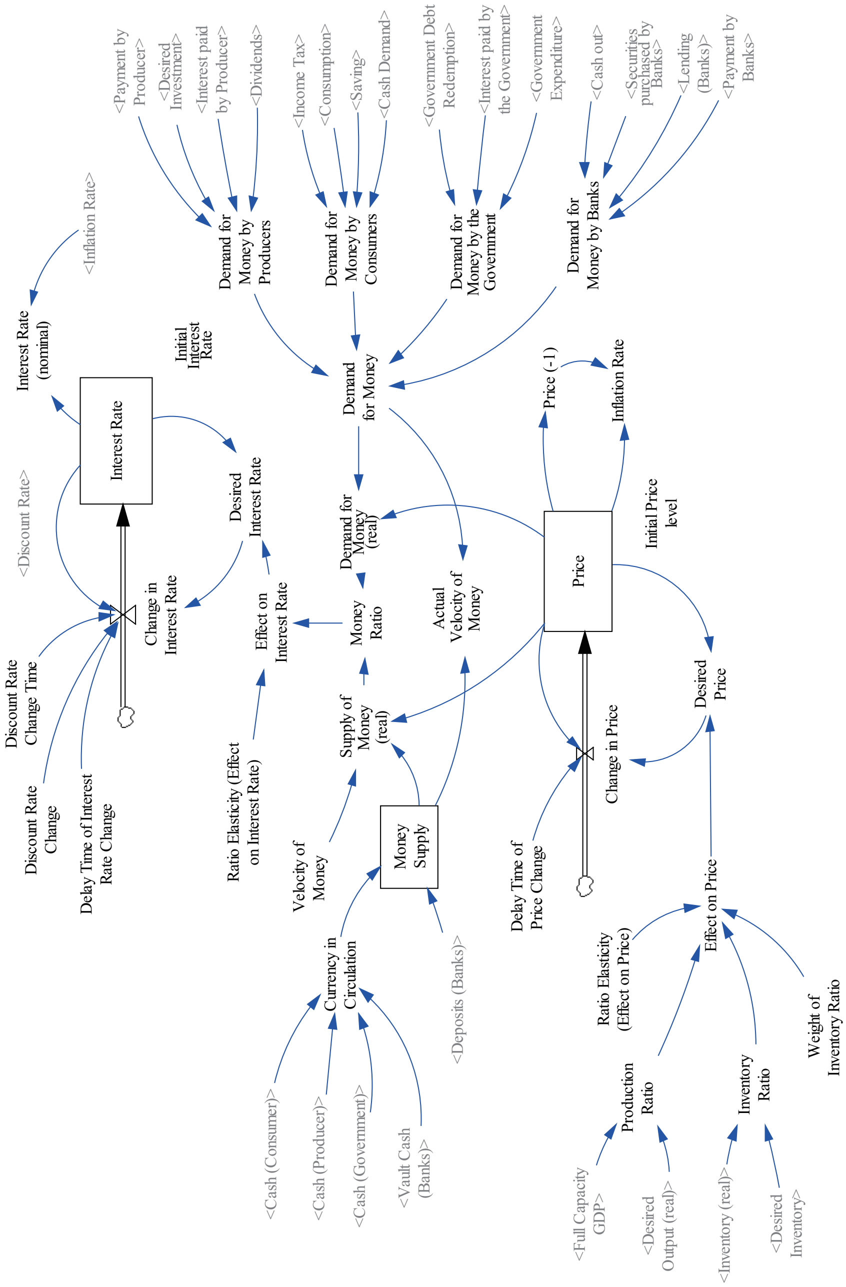

Figure 8.3: Interest Rate and Price Adjustments

commercial banks as a last resort of currency provider to avoid bankruptcies of the whole economic system. This process of lending money by creating (or printing) currency is known as *money out of nothing*.

Figure 8.4 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, currency 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 has to be in average equal to or slightly greater than the economic growth rate as suggested by the right hand diagram of Figure 8.4.

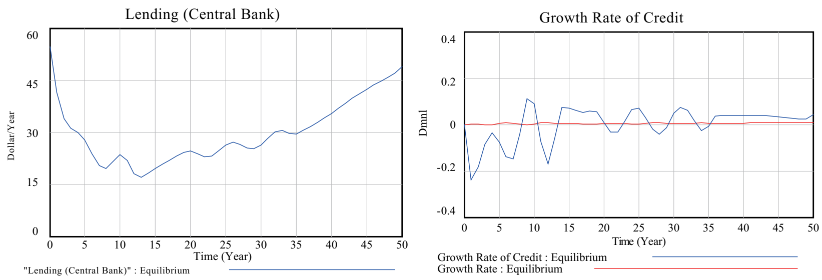

Figure 8.4: Lending by the Central Bank and its Growth Rate

In this way, the central bank begins to exert an enormous power over the economy through its credit control. What happens if the central bank fails to supply enough currency intentionally or unintentionally? An influential role of the central bank which caused economic bubbles and the following burst in Japan during 1990's was completely analyzed by Warner in [72, 73]. Our macroeconomic model might provide an analytical foundation to support his findings in the role of the central bank.

Four Types of Interest Rates

Due to the introduction of the central bank a fraction of bank deposits have to be reserved as required reserve with the central bank. This is called *a fractional reserve banking system*. Accordingly, the amount of loans banks can make to producers becomes less than that of deposits by consumers, and, if the same interest rate is applied as in the previous model, their interest income from loans becomes less than their interest payment against deposits. To avoid this negatively retained earnings of the banks, a higher interest rate has to be applied to the loans, which is already called *a prime rate* in Chapter 6.

$$\text{Prime rate} > \text{Nominal interest rate} \tag{8.9}$$

The difference between these two interest rates is made large enough to avoid negatively retained earnings of banks. Moreover, it is assumed here that positive earnings, if any, will be completely distributed among bank workers as consumers.

With the introduction of credit loan by the central bank, another type of interest rate needs to be applied to the transaction, which is called *a discount rate* in Chapter 6. The central bank is given a power to set its rate as a part of its monetary policies whenever making loans to commercial banks. It is set to be 0.8%, or 0.008 in our model.

Now the economy has four different types of interest rates; discount rate, real rate of interest, nominal rate of interest, and prime rate[6]. How are they related one another? It is assumed that the initial value of the real rate of interest (which is set to be 0.02 in our model) is increased by the amount of discount rate such that

$$\text{Initial interest value} = \text{initial interest rate} + \text{discount rate} \tag{8.10}$$

Nominal rate of interest and prime rate are assumed to be determined in our previous models as

$$\text{Interest rate (nominal)} = \text{real interest rate} + \text{inflation rate} \tag{8.11}$$

and

$$\text{Prime rate} = \text{interest rate (nominal)} + \text{prime rate premium}, \tag{8.12}$$

where prime rate premium is set to be 0.03 in our model to attain positive profits to the banks. Accordingly, discount rate affect all of the other three types of interest rate, giving a legitimacy of monetary policies to the central bank.

8.3 Transactions Among Five Sectors

Let us now describe some transactions by the central bank that is additionally brought to the model here. For the convenience to the reader, let us also repeat some of the transactions, with some revisions, by producers, consumers, government and banks that were already presented in the previous chapters.

Producers

Major transactions of producers are, as illustrated in Figure 8.5, 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.

[6] To be precise, an overnight rate needs to be added, which is called a federal fund rate in the United States, or a call rate in Japan. It is the interest rate applied to the loans of reserved fund at the central bank by commercial banks. Current monetary policy is said to use this rate as a target rate so that it could influence all the other interest rates. In this model, it is represented by the discount rate for simplicity.

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

Consumers

Transactions of consumers are illustrated in Figure 8.6, some of which are summarized as follows.

- Consumers receive income as wages and dividends from producers.
- Financial assets of consumers consist of bank deposits and government securities, against which they receive financial income of interests from banks and government. (In this chapter, no corporate shares are assumed to be held by consumers).
- 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 disposal income, they spend on consumption. The remaining amount are either saved or spent to purchase government securities.

Government

Transactions of the government are illustrated in Figure 8.7, some of which are summarized as follows.

- Government receives, as tax revenues, income taxes from consumers and corporate taxes from producers as well as excise tax on production.
- 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 banks and consumers by newly issuing government securities.

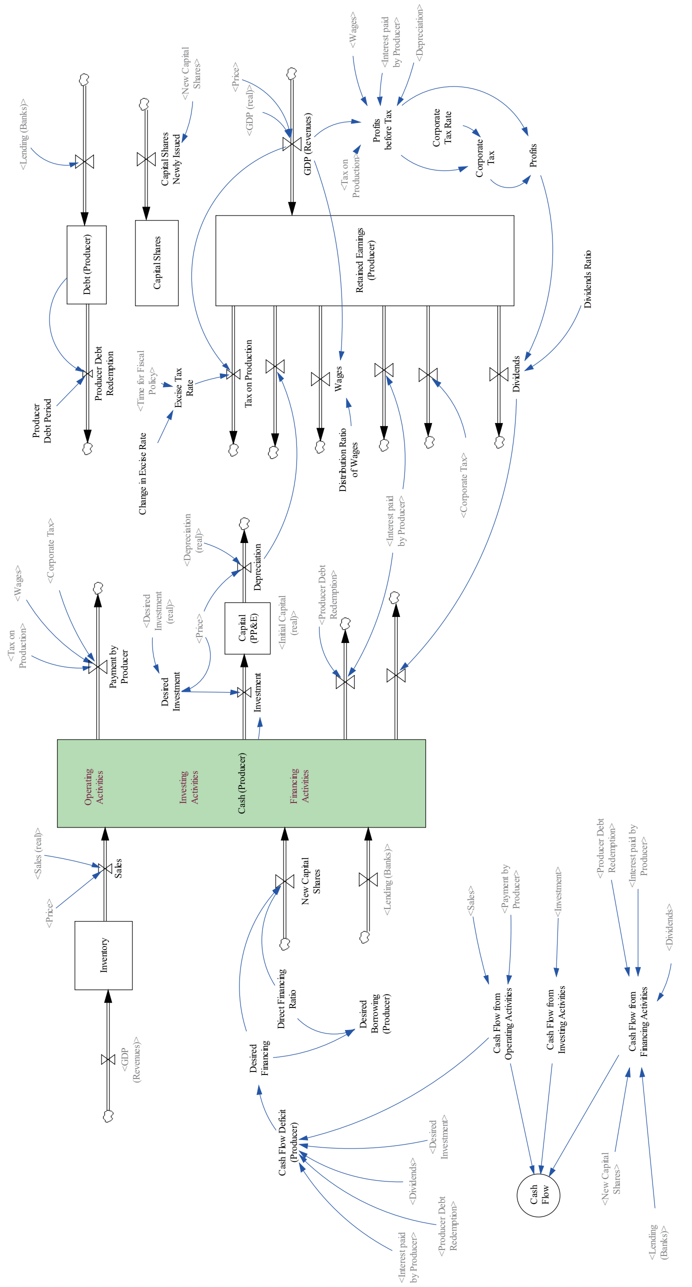

Figure 8.5: Transactions of Producers

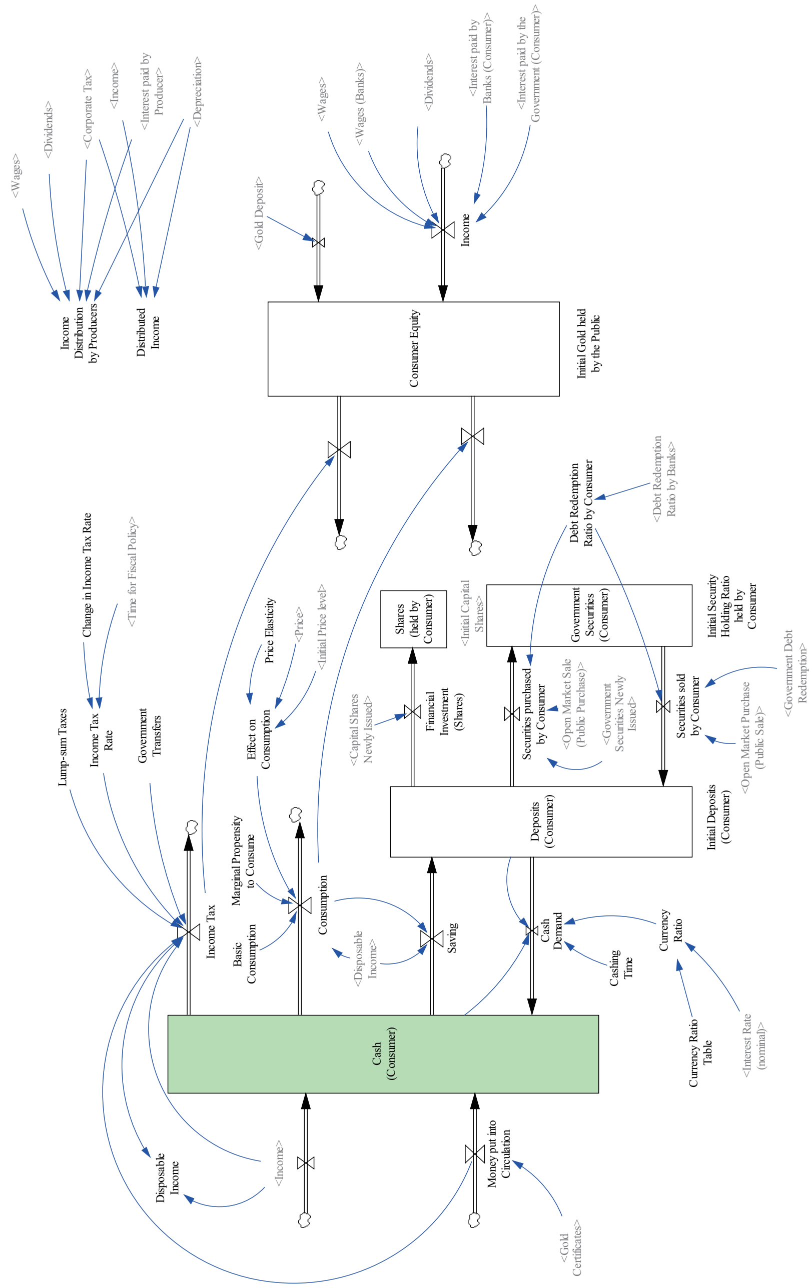

Figure 8.6: Transactions of Consumer

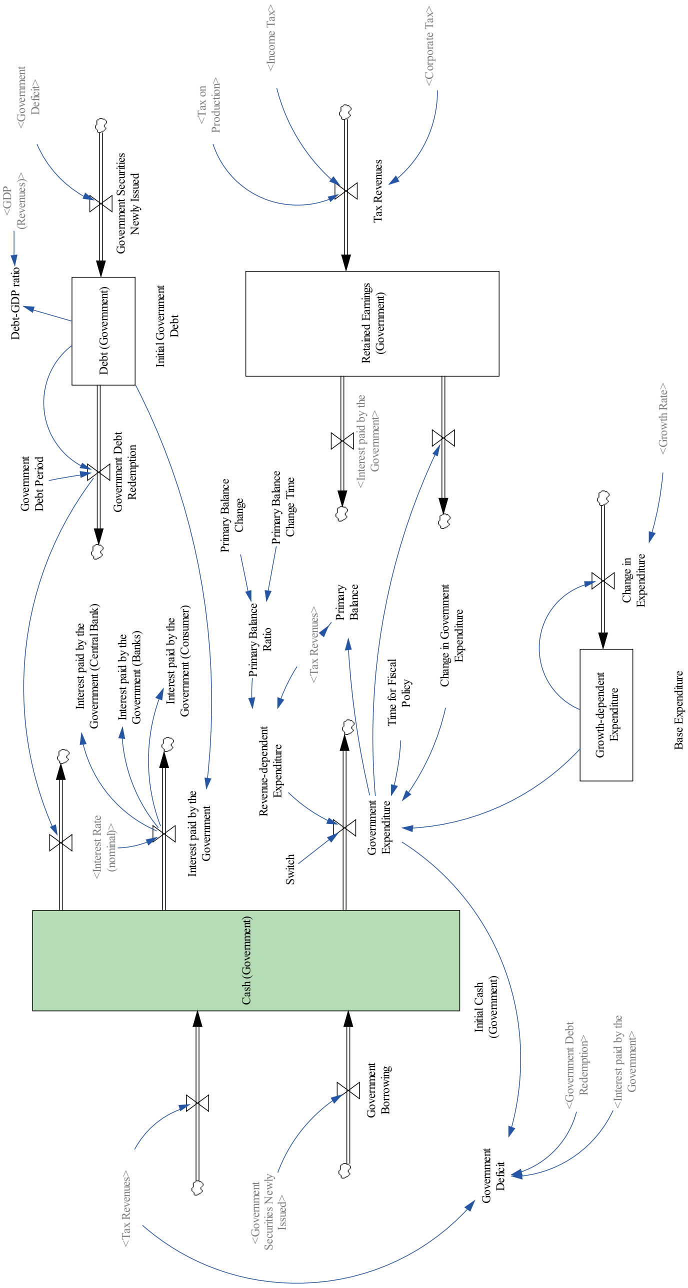

Figure 8.7: Transactions of Government

Banks

Transactions of banks are illustrated in Figure 8.8, some of which are summarized as follows.

- Banks receive deposits from consumers, against which they pay interests.
- They are obliged to deposit a fraction of the deposits as the required reserves with the central bank (which is called *a fractionalreserve banking system*).
- Out of the remaining deposits they purchase government securities, against which interests are paid from the government.
- Then, loans are made to producers and they receive interests for which a prime rate is applied.
- Their retained earnings thus become interest receipts from producers and government less interest payment to consumers. Positive earning will be distributed among bank workers as consumers.

Central Bank

In this integrated model, the central bank plays a very important role of providing a means of transactions and store of value; that is, currency. To make a story simple, its sources of assets against which currency is issued are confined to gold, discount loans and government securities. The central bank can control the amount of money supply through the amount of monetary base consisting of currency outstanding and reserves over which it has a direct power of control. This is done through monetary policies such as a manipulation of required reserve ratio and open market operations as well as direct lending control.

Transactions of the central bank are illustrated in Figure 8.9, some of which are summarized as follows.

- The central bank issues currency or money (historically gold certificates) 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 discount loans to commercial banks. (These activities are sometimes called *money out of nothing*.)
- It can similarly withdraw currency 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 fraction of deposits with the central bank. By controlling this required reserve ratio, the central

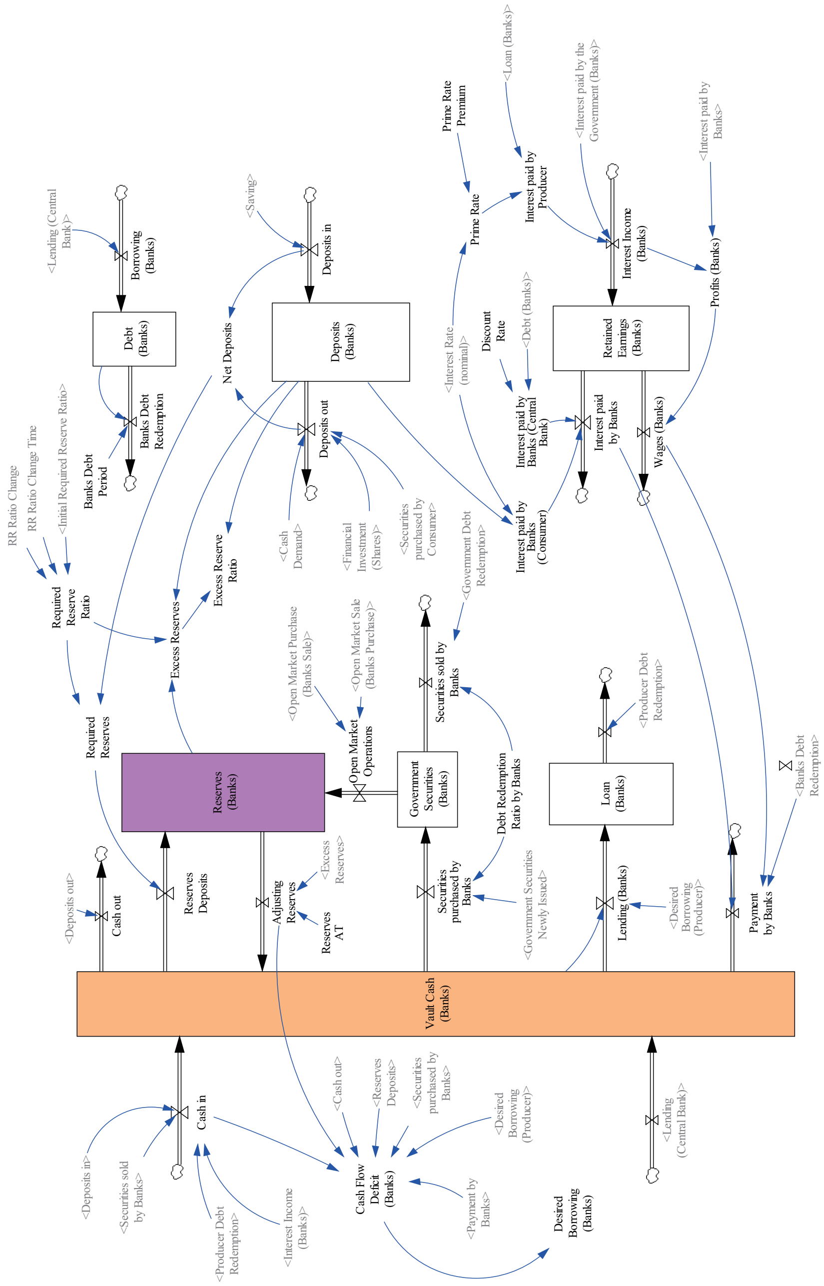

Figure 8.8: Transactions of Banks

bank can control the monetary base directly. The central bank can, thus, control the amount of money supply through monetary policies such as open market operations, reserve ratio and discount rate.

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

8.4 Behaviors of the Integrated Model

Mostly Equilibria in the Real Sector

The integrated model is now complete. It is a generic model, out of which diverse macroeconomic behaviors will be produced. Let us start with an equilibrium growth path of the macroeconomy. In the previous IS-LM model, Keynesian aggregate demand equilibrium is defined as an equilibrium state where aggregate demand is equal to production. Moreover, it is also emphasized that the Keynesian aggregate demand equilibrium is not a full capacity equilibrium.

Let us call an equilibrium state *a full capacity aggregate demand equilibrium* if the following two output and demand levels are met:

$$\text{Full Capacity GDP} = \text{Desired Output} = \text{Aggregate Demand} \tag{8.13}$$

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

$$\text{GDP} = \text{MIN (Full Capacity GDP, Desired Output)} \tag{8.14}$$

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.

Does the equilibrium state, then, exist in the sense of full capacity GDP? By trial and error, mostly equilibrium states are acquired in the integrated model when a ratio elasticity of the effect on price e is 1, and a weight of inventory ratio ω is 0.1, as illustrated in Figure 8.10.

The reader may wonder why this is a state of mostly equilibria, because growth rates and inflation rates still fluctuate as shown in Figure 8.11. Specifically, growth rates fluctuates between 0.8% and - 0.2%, and inflation rates between 0.2% and - 0.2%. Our heart pulse rate, even that of a healthy person, fluctuates between 60 and 70 per minute. This is a normal state. In a similar fashion, it is reasonable to consider these fluctuations as normal equilibrium states.

In what follows, these equilibrium states are used as benchmarking states of comparative analysis, and illustrated by line 2 or red lines in the Figures below.

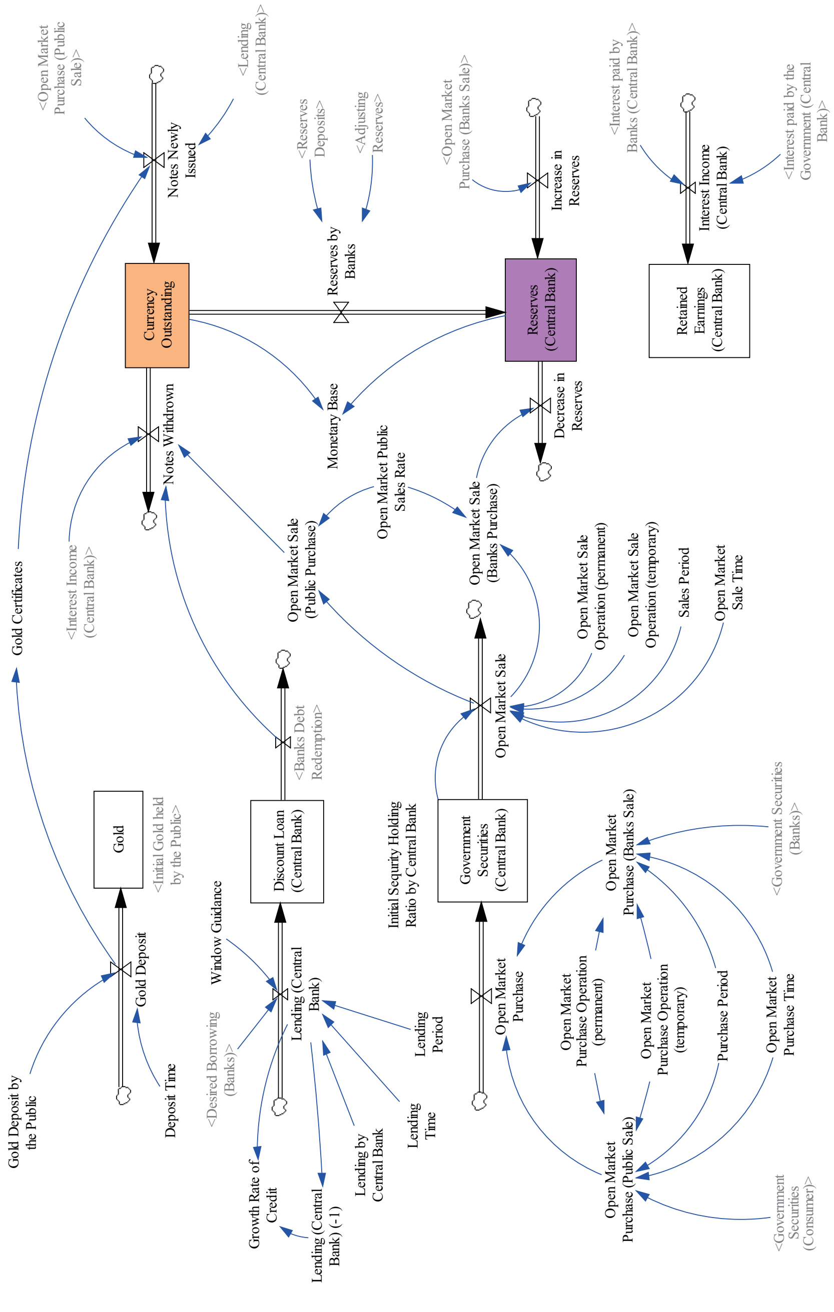

Figure 8.9: Transactions of Central Bank

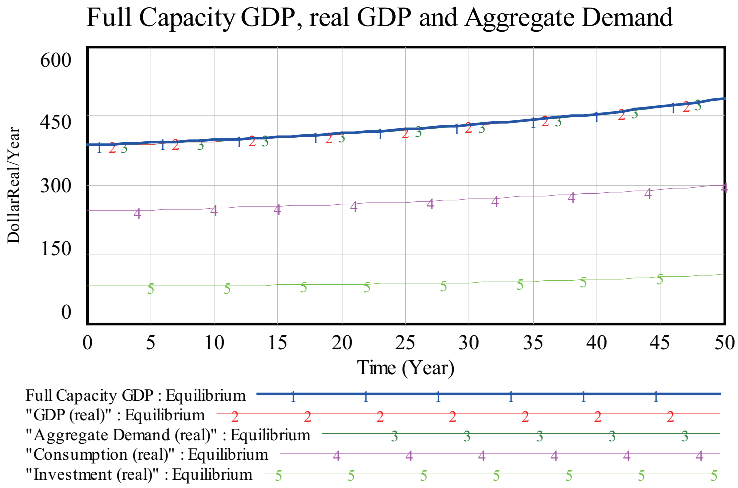

Figure 8.10: Mostly Equilibrium States

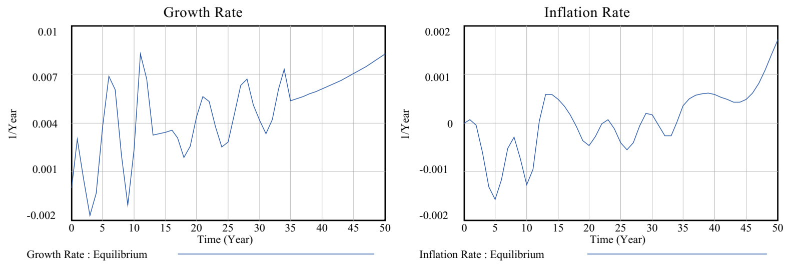

Figure 8.11: Growth and Inflation Rates of Mostly Equilibrium States

Fixprice Disequilibria

We are now in a position to make some analytical simulations for the model. First, let us show that without price flexibility it's hard to attain mostly equilibrium states. When price is fixed; that is, ratio elasticity of the effect on price is set to be zero, disequilibria begin to appear all over the period. Figure 8.12 illustrates how fixprice causes disequilibria everywhere. The economy seems to stagger; that is, economic growth rates become lower than the equilibrium ones over many periods.

Business Cycles by Inventory Coverage

From now on, let us assume the mostly equilibrium path. One of the interesting questions is to find out a macroeconomic structure that may produce economic fluctuations or business cycles. How can the above equilibrium growth path be

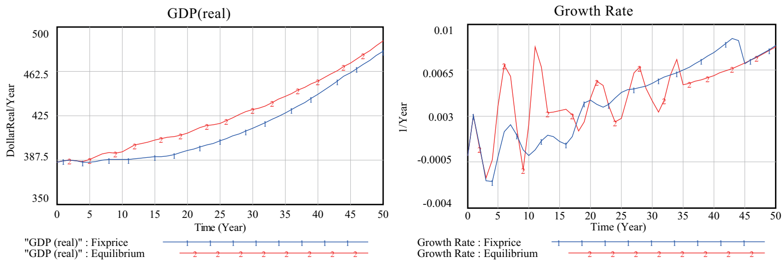

Figure 8.12: Fixprice and Mostly Equilibrium States

broken and business cycles will be triggered?

Our integrated model can successfully produce at least two ways of causing macroeconomic fluctuations. First, they can be caused by increasing normal inventory coverage period, Specifically, suppose the normal inventory coverage period increases from 0.25 or 3 months to 0.42 or about 5 months. The economy, then, begins to be troubled with short business cycles of about 9 years as Figure 8.13 portrays.

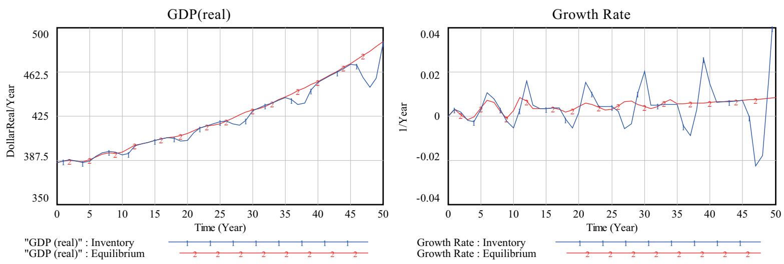

Figure 8.13: Business Cycles by Inventory Coverage

Business Cycles by Elastic Price Fluctuation

Secondly, the equilibrium growth path can also be broken and business cycle is triggered, though, in a totally different fashion. This time let us assume that a price response to the excess demand for products and inventory gap becomes more sensitive so that ratio elasticity now becomes elastic with a value of 1.3 from 1, and a weight of inventory ratio to production ratio becomes 0.6 from 0.1. Again, the economy is thrown into business cycle of between 5 and 8 years as depicted in Figure 8.14.

In this way, two similar business cycles are triggered, out of the same equilibrium growth path, by two different causes; one by an increase in inventory coverage period, and the other by the elasticity of price changes. The ability to produce these different behaviors of business cycles and economic fluctuations indicates a richness of our integrated generic model.

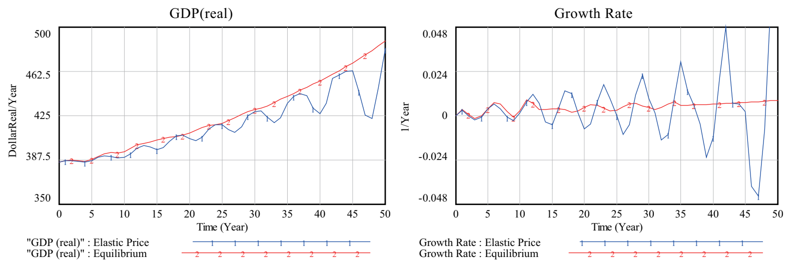

Figure 8.14: Business Cycles by Elastic Price Fluctuation

Recessions by Credit Crunch (Window Guidance)

With the introduction of discount credit loans to banks, the central bank seems to have acquired an almighty power to control credit. This hidden exerting power has been known in Japan as “window guidance”.

To demonstrate how influential the power is, let us suppose that the central bank reduces the amount of credit loans by 10%; that is, window guidance value is reduced to 0.9 from 1. In other words, banks can borrow only 90% of the desired amount of borrowing from the central bank.

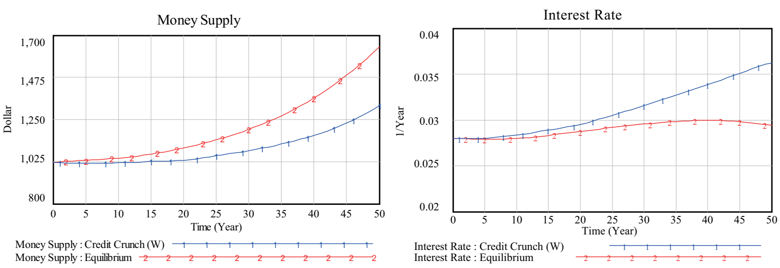

Figure 8.15: Money Supply and Interest Rate by Credit Crunch

Figure 8.15 illustrates how money supply shrinks and, accordingly, interest rate increases by the credit crunch caused by the central bank. Figure 8.16 illustrates the economy is now deeply triggered into recession in the sense that the GDP under credit crunch is always below the equilibrium GDP, and its economic growth rates seem to be lower in average than those of equilibrium with dwindling short-period business cycles. It is unexpected to see that the economic recession is provoked by the credit crunch rather than the business cycles as shown above. Economic recessions caused by the credit crunch can be said to be worse than the recessions caused by other business cycles.

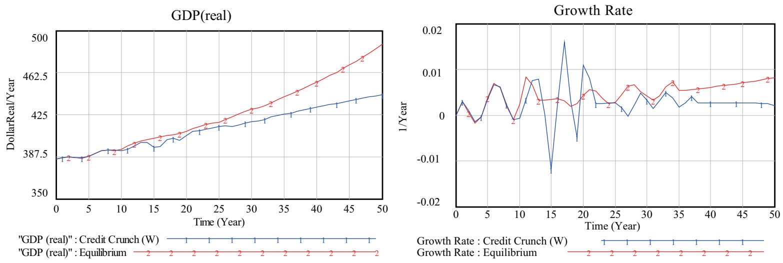

Figure 8.16: Economic Recession by Credit Crunch

Depressions by Credit Crunch (Window Guidance & Currency Ratio)

Credit crunch can be alternatively caused if the public rush to the banks to withdraw their deposits, a so-called *bank run*. In our model this can be confirmed if a change in currency ratio is increased by 0.15 at the year 1, whose simulation is left to the reader. A more interesting case is when this bank run is triggered by the above economic recessions.

To see this impact, let us consider the above economic recessions triggered by the above credit crunch of window guidance (=0.9), in which economic growth rate plunges to - 1.18% at the year 15. Under such a recession, let us further assume that bunk runs arise all over. In our model this can be simulated by increasing a currency ratio by 0.15 at the year 15. Figure 8.17 illustrates how currency in circulation jumps (line 3) and deposits plummets (line 3), compared with equlibrium states (lines 2) and credit crunch (lines 1).

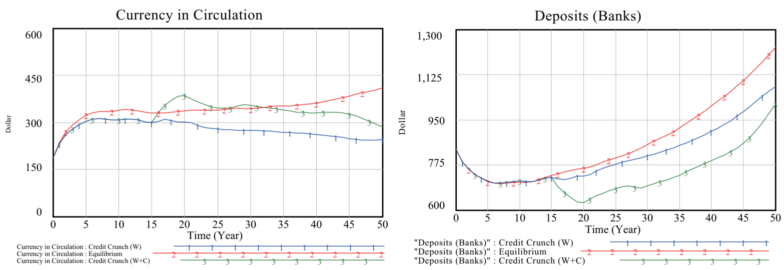

Figure 8.17: Currency in Circulation and Deposits by Bank Run

These changes affect overall behavior of money supply, specifically it is decreased as indicated by the left diagram of Figure 8.18 (line 3), which in turn worsens the GDP growth and causes depressions as shown by the right diagram of Figure 8.18 (line 3).

During the Great Depression in 1930s, currency in circulation continued to increase from 4.52 $ billion in 1930 to 5.72 $ billion in 1933, while demand

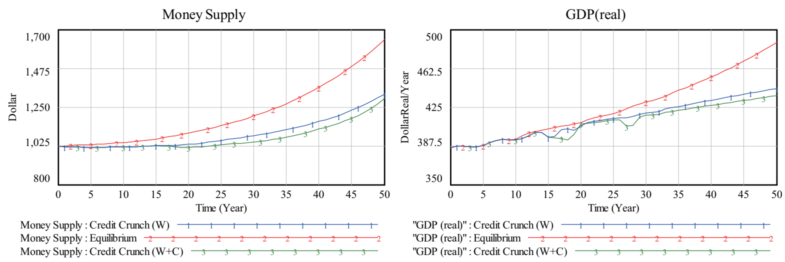

Figure 8.18: Money Supply and Depression by Bank Run

deposits continued to decline from 22.0 $ billion to 14.8 $ billion during the same period. As a result, money supply of M1 (about the sum of currency in circulation and demand deposits) also continued to decline from 25.8 $ billion to 19.9 $ billion. Our simulation results may support these monetary behaviors of the Great Depression.

Growing economy needs new currencies to be incessantly put into circulation. If the central bank, instead of the government, is historically endowed with this important role, savvy control of credits by the central bank with the avoidance of bank run becomes crucial for the stability and growth of macroeconomy as demonstrated here by the integrated model.

Monetary and Fiscal Policies for Equilibrium

So far, we have examined several states of disequilibria caused by fixprice, business cycles by inventory coverage and elastic price fluctuation, and credit crunch. Can we restore equilibrium, then ? According to the Keynesian theory, the answer is affirmative if monetary and fiscal policies are appropriately applied.

Let us consider the case of fixprice disequilibria and apply monetary policy, first. Suppose the central bank increases the purchase of government securities by 12% for 5 years starting at the year 6 (see the top left diagram of Figure 8.19). Then, money supply continues to grow gradually, and interest rate eventually starts to decrease (see top right and bottom left diagrams.). These changes in the monetary sector will eventually restore full capacity aggregate demand equilibrium (GDP=420.08) at the year 24 through the year 38 for 15 years (see the bottom right diagram). It takes 18 years for this open market operation to take its effect. Moreover, it is interesting to observe that during this period of sustained equilibrium due to the increased money supply, desired output (line 2 of the bottom right diagram) is higher than the real GDP. This does not cause inflation here due to the assumption of fixprice. Once this assumption is dropped, surely inflation arises. In this sense, monetary policy of open market purchase can be said to be inflationary by its nature.

Second scenario of restoring the equilibrium is to apply fiscal policy. In our model quite a few tools are available for fiscal policy such as changes in income tax rate, lump-sum taxes, excise rate, corporate tax rates and government ex-

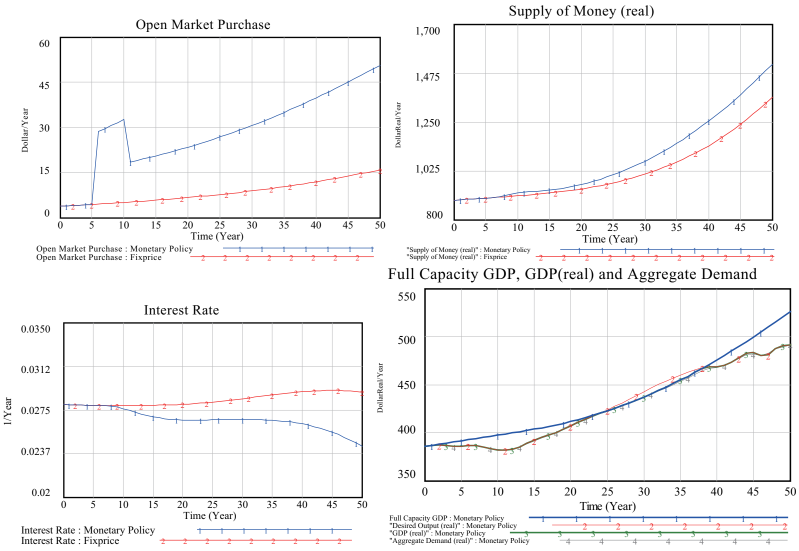

Figure 8.19: Monetary Policy: Open Market Purchase and GDP

penditures. We employ here income tax rate. The reader can try other policy tools by running the model.

Facing the fixprice disequilibria, the government now decides to introduce an increase in income tax rate by 3%; that is, from the original 10% to 13 %, at the year 6 (see top left hand diagram in Figure 8.20). Under the assumption of balanced budget, or a unitary primary balanced ratio, an increase in income tax also becomes the same amount of increase in government expenditure (see top right diagram). This causes the increase in interest rate, which crowds out investment. Even so, aggregate demand is spontaneously stimulated to restore the equilibrium (GDP = 393.89) at the year 7 through the year 26 for 20 years (see the bottom right diagram). This equilibrium is attained by a slightly higher desired output (line 2), which,however, does not trigger inflation due to the assumption of fixprice recession. Compared with the monetary policy, the effect of fiscal policy appears quickly from the next year.

In this way, our integrated generic model can provide effective scenarios of sustaining full capacity aggregate demand equilibrium growth path through monetary and fiscal policies.

Government Debt

So long as the equilibrium path in the real sector is attained by fiscal policy, no macroeconomic problem seems to exist. Yet behind the full capacity aggregate demand growth path attained in Figure 8.20, government debt continues to accumulate as the left diagram of Figure 8.21 illustrates. Primary balance ratio

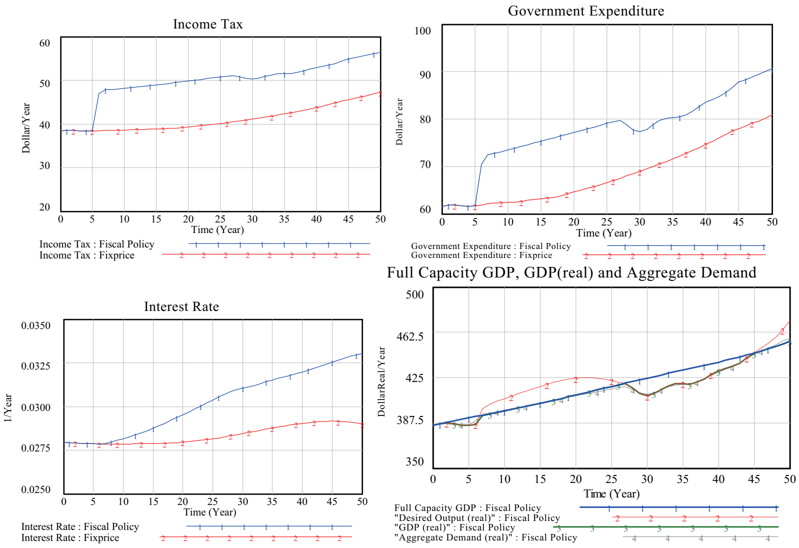

Figure 8.20: Fiscal Policy: Change in Income Tax Rate and Interest Rate

is initially set to one and balanced budget is assumed in our model; that is, government expenditure is set to be equal to tax revenues, as lines 1 and 2 overlap in the diagram. Why, then, does the government continue to suffer from the current deficit?

In the model government deficit is defined as

$$\text{Deficit} = \text{Tax Revenues - Expenditure - Debt Redemption - Interest} \quad (8.15)$$

Therefore, even if balanced budget is maintained, the government still has to keep paying its debt redemption and interest. This is why it has to keep borrowing and accumulating its debt. Initial GDP in the model is obtained to be 386, while government debt is initially set to be 200. Hence, the initial debt-GDP ratio is around 0.52 year (similar to the current ratios among EU countries). The ratio continues to increase to 1.98 years at the year 50 in the model as illustrated in the right diagram of Figure 8.21. This implies the government debt becomes 1.98 years as high as the annual level of GDP (which is comparable to the Japanese debt ratio of 1.97 in 2010).

Can such a high debt be sustained? Absolutely no. Eventually this runaway accumulation of government debt may cause nominal interest rate to increase, because the government may be forced to pay higher and higher interest rate in order to keep borrowing, which may in turn launch a hyper inflation[7].

On the other hand, a higher interest rate may trigger a sudden drop of government security price, deteriorating the value of financial assets of banks,

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

producers and consumers. The devaluation of financial assets may force some banks and producers to go bankrupt eventually. In this way, under such a hyper inflationary circumstance, financial crisis becomes inevitable and government is destined to collapse. This is one of the hotly debated scenarios about the consequences of the abnormally accumulated debt in Japan, whose current debt-GDP ratio is about 1.97 years; the highest among OECD countries!

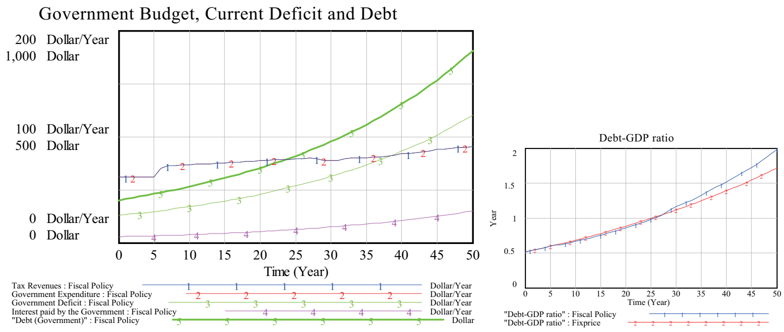

Figure 8.21: Accumulation of Government Debt

Let us now consider how to avoid such a financial crisis and collapse. At the year 6 when fiscal policy is introduced to restore a full capacity aggregate demand equilibrium in the model, the economy seems to have gotten back to the right track of sustained growth path. And most macroeconomic textbooks emphasize this positive side of fiscal policy. A negative side of fiscal policy is the accumulation of debt for financing the government expenditure. Yet most macroeconomic textbooks neglect or less emphasize this negative side, partly because their macroeconomic framework cannot handle this negative side effect properly as our integrated model does here. In our example the debt-GDP ratio is 0.61 years at the introduction year of fiscal policy.

At the face of financial crisis as discussed above, suppose that the government is forced to reduce its debt-GDP ratio to around 0.6 by the year 50, To attain this goal, a primary balance ratio has to be 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 percent of its tax revenues. Let us assume that this reduction is put into action around the same time when fiscal policy is introduced; that is, the year 6. Under such a radical financial reform, as illustrated in Figure 8.22, debt-GDP ratio will be reduced to around 0.64 (line 1 in the right diagram) and the accumulation of debt will be eventually curved (left diagram).

Even so, this radical financial reform becomes very costly to the government and its people as well. At the year of the implementation of 10 % reduction of a primary balance ratio, growth rate is forced to drop to minus 4.1 %, and the economy fails to sustain a full capacity aggregate demand equilibrium as illustrated in the left diagram of Figure 8.23. In other words, the reduction of

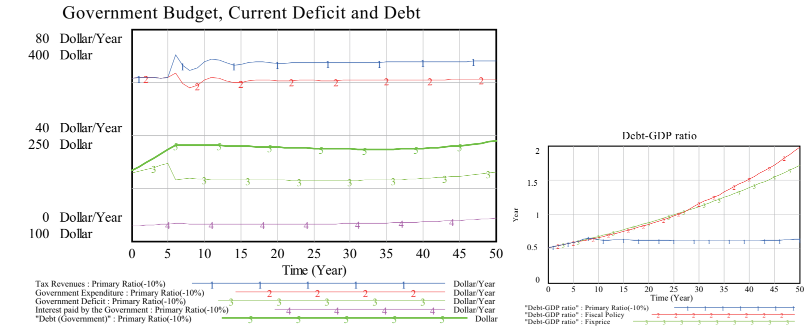

Figure 8.22: Government Debt Deduction

the primary balance ratio by 10% nullifies the attained full capacity aggregate demand equilibrium by fiscal policy. The right diagram compares three states of GDP; line 3 is when price is fixed, line 2 is when fiscal policy is applied, and line 1 is when primary balance ratio is reduced by 10 %.

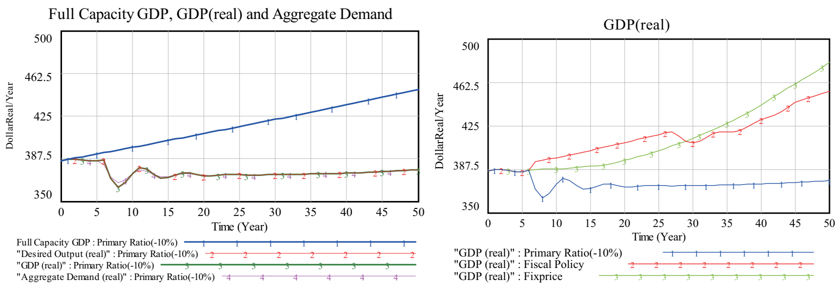

Figure 8.23: Effect of Government Debt Deduction

Price Flexibility

Is there a way to reduce government debt without sacrificing equilibrium? Monetary and fiscal policies above are applied to the disequilibria caused by fixprice. Let us make price flexible again by setting price elasticity to be 0.7 under the above fiscal situation of primary balance deduction. Left diagram of Figure 8.24 shows that equilibrium is attained at the peaks of business cycle, while right diagram shows that government debt is reduced by 10 % deduction of primary balance ratio.

In this way, the reduction of the government debt by diminishing a primary balance ratio is shown to be possible without causing a sustained recession by introducing flexible price. Yet, a financial reform of this radical type seems to allude to the only soft-landing solution path for a country with a serious

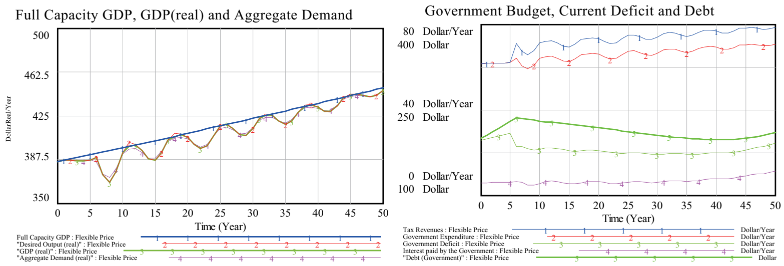

Figure 8.24: Price Flexibility, Business Cycles and Debt Reduction

debt problem such as Japan, so long as our SD simulation suggests, if a sudden collapse of the government and macroeconomy is absolutely to be avoided. Its success depends on how people can endure getting *worse before better*.

Figure 8.25 compares growth paths of the economy under five different situations such as almost equilibrium, fixprice, fiscal policy, fiscal policy with debt deduction, and fiscal policy with flexible price. Compared with the almost equilibrium path (line 1), debt-reducing path with flexible price causes a business cycle. Yet, compared with another debt-deduction path (line 4), this seems a better path.

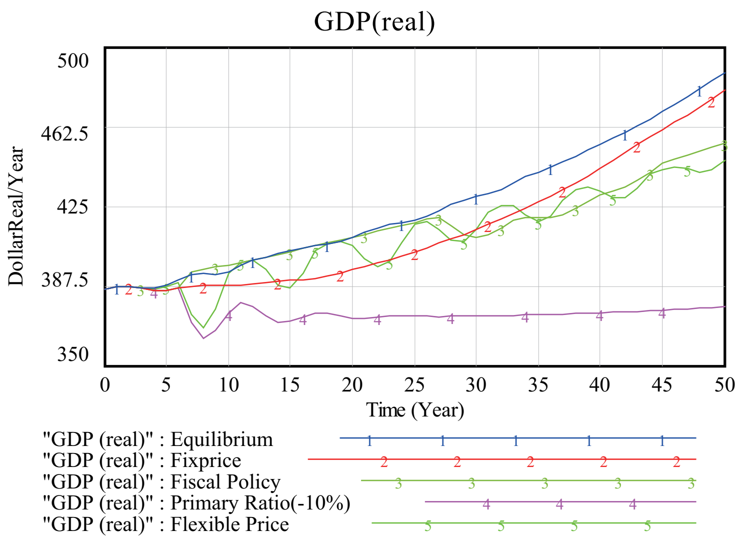

Figure 8.25: Comparison of GDP paths

Remember in our model labor market is not introduced. In other words, economic equilibrium and government debt reduction are shown to be possible under market price flexibility. This gives us an important clue for the working of market economy without labor market (or capitalist economy). Our society needs an economic production system for its survival. Market economy needs not be a capitalist market economy with labor market. Market economy without labor market here is shown to be an efficient system, which I called *MuRatopian Economy*([78]). Now is time to analyze a capitalist market economy with labor market in the next chapter.

8.5 Conclusion

The integration of the real and monetary sectors in macroeconomy is attained from the previously developed macroeconomic models. For this integration, five macroeconomic sectors are brought to the model such as producers, consumers, government, banks and the central bank. Moreover, several major changes are made to the previous models, among which distinction between nominal and real outputs and interest rates are the most crucial one.

The integrated macroeconomic model could be generic in the sense that diverse macroeconomic behaviors will be produced within the same model structure. To show such a capability, some macroeconomic behaviors are discussed. First, the existence of mostly equilibria is shown. And disequilibria are triggered by fixprice and business cycles by two different causes; inventory coverage period and price sensitivity.

Then, Keynesian monetary and fiscal policies are applied to the disequilibria caused by fixprice. Finally accumulating government debt issue is explored. As shown by these, the integrated generic model presented here, we believe, will provide a foundation for the analysis of diverse macroeconomic behaviors.

To make the model furthermore complete, however, at least the following fine-tuning revision has to be incorporated to the model: a feedback loop of the accumulating government debt to the interest rate.