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Macroeconomic Policies

Monetary and fiscal policies are discussed in general and in the institutional setting of the Chinese economy. Monetary policy is discussed in terms of the supply of money rather than the control of the interest rate. Section 7.3 contains a statistical model to explain the rate of inflation in China.

7.1 Introduction

There are three sets of forces driving the macroeconomy. The first set affects economic growth, including the state of technology as summarized by the production function, the savings rate, and the rate of population growth, as we saw in chapter 5. The second set affects short-run changes, such as the acceleration principle and people's expectations. These two are sometimes considered separately as a way of organizing our thoughts about macroeconomic changes. There are some factors affecting both the long and the short run, such as the demand conditions for a country's exports and political movements like the Great Leap and the Cultural Revolution. The third set is government policies. We have studied economic forces affecting growth and fluctuations, and will study the effects of political movements in the next chapter. We turn to government policies in this chapter.

Chinese economic institutions have been evolving. The evolutionary process is considered gradual by those who advocate shock therapy as a means of institutional reform, but is in fact very rapid judged by the great adjustments which the Chinese people and institutions have had to make. The study of the Chinese economy has emphasized institutional reform more than economic policy. As the institutional changes have slowed down, the study of economic policy in China is receiving more attention. From the viewpoints of the Chinese government and observers of China's long-term development, economic reform is still an important topic and affects the formulation of economic policies.

During the period of planning in the late 1970s, economic policy was embedded in the Five Year Plans. The plans covered output targets for different sectors and industries. The targets were then allocated to individual state enterprises. In the mid-1980s, the concept of compulsory planning was changed to guidance planning. Macroeconomic control mechanisms began to be used to control aggregate economic activities. Today, we can understand China's macroeconomic policy in terms of monetary policy and fiscal policy. The former has taken the form mainly of controlling the supply of currency and bank credits, but also of controlling the banks' deposit and lending interest rates. The latter takes the form of the level of government expenditures. We will study these policies in turn.

Before we begin, perhaps it is useful to review the development of the roles of fiscal and monetary policy in economics. Keynes' *General Theory*, which I referred to in section 6.1, provided the economic justification for fiscal policies. According to Keynes' formulation of the consumption function, aggregate consumption expenditure as a fraction of national output decreases as aggregate output increases. This relationship leads to a declining rate of growth as the economy grows. It was used to explain the US depression in the early 1930s. If this hypothesis is valid, an economy requires additional sources of aggregate demand, other than aggregate consumption expenditures, to sustain its growth. Government expenditure was considered such an additional source. The expenditures of the New Deal under President Franklin Roosevelt were justified by the Keynesian theory of aggregate demand. The US economy did not recover substantially from the depression until the Second World War, when expenditure on the war provided a stimulus to the economy. At the end of the war, there was serious concern that, when the high level of government expenditure was reduced, the US economy was heading towards another depression. This concern led to the enactment of the Full Employment Act of 1945. The Act gave responsibility to the President to maintain full employment in the economy and created the Council of Economic Advisers to provide him with advice.

A depression did not occur right after the war. In fact, postwar economic development was rapid. In the early 1950s, Milton Friedman, at the University of Chicago, began to challenge two basic ideas underlying the Keynesian theory of national income determination. One idea is the consumption function, which we looked at in section 6.1. The second is the notion that aggregate "autonomous expenditure" A , defined by $Y = C + A$, is a good predictor of national income Y . This notion is related to the stability of the Keynesian consumption function explaining C by Y . If C can be explained by Y very closely, then we can solve for C using this consumption function to express Y as a function of A . Since Friedman challenged the Keynesian consumption function, he also challenged the relation between Y and A by proposing an alternative theory to explain Y . The alternative theory is the quantity theory of money, based on the quantity equation $Mv = PY$. M is the quantity of money; P is the price index for real output Y , so the product PY is nominal output. The symbol v denotes velocity of circulation. If $PY = 100$ billion and $M = 20$ billion, $v = 5$, meaning that on average the 20 billion of money is being circulated 5 times in one year to pay for the annual output of \$100 billion. By comparing the correlation between Y and A and the correlation between Y and M . Milton Friedman and David Meiselman (1963) found that the latter correlation was higher for most of the historical episodes that they examined. This was the beginning of the rise of

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monetarism, the notion that monetary policy is important, in the 1960s and 1970s.

Policy-makers in China since 1949 have always believed in the quantity theory. The quantity equation $Mv = PY$ can be found in economics textbooks in the period of economic planning before 1978 because it can be found in the writing of Karl Marx. By the quantity theory, which assumes that v is approximately constant, if M increases proportionally more than real output Y , the price level P will increase. But a greater influence than Marx on the economic officials of the PRC was the high level of inflation in China during the period 1946–9, which they attributed correctly to the rapid increase in money supply under the Nationalist government. They did not forget that inflation experience, which is a testimony to the quantity theory of money. Current Chinese economic officials also believe in the use of government expenditure as a stimulus to real GDP, as we will see later in this chapter.

7.2 Monetary Policy

Ever since the founding of the People's Republic of China in 1949, the Chinese government has paid attention to the supply of money. Government officials in 1949 realized that printing too much money, like the previous government of the Republic of China, led to serious inflation and was a major cause of their predecessors' unpopularity and downfall. Within months after the new government took power, it was able to set up a stable monetary system. It issued a new currency, the renminbai (RMB), or "People's currency," in exchange for the old currency at rates fairly favorable to the population holding the old currency. Since the supply of the new currency was limited and the quantity was not increasing rapidly, the price level soon stabilized. The government succeeded in maintaining price stability, in the sense of having an inflation rate of less than 3 percent for most years, until the early 1980s. The only exception was in 1961–2, when the supply of goods decreased by some 30 percent as a result of the Great Leap, leading to higher prices.

To review the history of inflation in China, we provide in table 7.1 four sets of data: the general retail price index (column 1), the ratio of the price index in the current year to the index in the preceding year as a measure of inflation (column 2), an index of real GDP (column 3), which is proportional to the real GDP in constant prices (given in table 5.1 of chapter 5), and the amount of currency in circulation (column 4). The most important variable that can explain the inflation rate is the ratio of currency in circulation to real GDP. If GDP is constant, a larger amount of currency in circulation will result in a higher inflation rate. Table 7.1 shows an inflation rate of 16.2 percent in 1961. During this year of the Great Leap there was a large increase in money supply from RMB96.1 (100 million yuan) to 125.67. More importantly, the real output index was concurrently reduced from 43.9 in the previous year to 30.9. Thus the ratio of money supply to real output increased a great deal in 1961, causing a high level of inflation.

In the era of economic reform there have been several episodes of inflation, all associated with a rapid increase in money supply, as we can see in table 7.1. Money supply can be measured by the amount of currency in circulation, since checking accounts were and still are uncommon in China. The episodes include 1985, 1988, and 1993. In all three cases there was a rapid increase in money supply at an annual

Table 7.1 Data on inflation and its determinants

<i>Year</i>	<i>General retail price index</i>	<i>Price index preceding year = 100</i>	<i>GDP index 1978 = 100</i>	<i>Currency in circulation (100 millions), year end</i>
1952	0.8227	99.6	22.0	38.55
1953	0.8506	103.4	25.1	39.60
1954	0.8705	102.3	26.6	41.19
1955	0.8793	101.0	28.3	40.13
1956	0.8793	100.0	32.3	57.03
1957	0.8926	101.5	33.7	52.80
1958	0.8947	100.2	41.2	67.59
1959	0.9028	100.9	44.6	74.98
1960	0.9308	103.1	43.9	96.10
1961	1.0820	116.2	30.9	125.67
1962	1.1229	103.8	28.9	106.66
1963	1.0567	94.1	32.0	89.76
1964	1.0177	96.3	37.2	80.26
1965	0.9904	97.3	43.5	90.82
1966	0.9875	99.7	50.9	108.25
1967	0.9801	99.3	44.5	121.97
1968	0.9809	100.1	44.2	134.12
1969	0.9698	98.9	52.7	137.29
1970	0.9676	99.8	65.0	123.56
1971	0.9603	99.2	69.5	136.23
1972	0.9581	99.8	71.5	151.02
1973	0.9639	100.6	77.5	166.33
1974	0.9691	100.5	78.3	176.36
1975	0.9706	100.2	84.9	182.70
1976	0.9735	100.3	82.6	203.82
1977	0.9934	102.0	89.0	195.37
1978	1.000	100.7	100.0	212.27
1979	1.020	102.0	107.6	267.71
1980	1.081	106.0	116.0	346.20
1981	1.107	102.4	122.1	396.34
1982	1.128	101.9	133.1	439.12
1983	1.145	101.5	147.6	529.78
1984	1.177	102.8	170.0	792.11
1985	1.281	108.8	192.9	987.83
1986	1.358	106.0	210.0	1,218.36
1987	1.457	107.3	234.3	1,454.48
1988	1.727	118.5	260.7	2,134.03
1989	2.034	117.8	271.3	2,344.02
1990	2.077	102.1	281.7	2,644.37
1991	2.137	102.9	307.6	3,177.80
1992	2.252	105.4	351.4	4,336.00
1993	2.549	113.2	398.8	5,864.70
1994	3.102	121.7	449.3	7,288.60
1995	3.561	114.8	496.5	7,885.30
1996	3.778	106.1	544.1	8,802.00
1997	3.808	100.8	592.0	10,177.60
1998	3.709	97.4	638.2	11,204.20

rate of about 50 percent, compared with some 20 to 25 percent in other years. The increase in money supply can be said to be a government policy but not necessarily an intended policy. In 1984, when enterprise autonomy was introduced for state enterprise reform, state enterprises went directly to the banks for credit. There was insufficient control of the extension of credit. In fact the banks were mistakenly given autonomy in much the same way as the state industrial enterprises. Credit was extended as a result of political pressure and willingness on the part of bank managers to extend loans to enterprises in their home province for the purpose of promoting local economic development or expansion of economic activities. When credit was extended by the local banks, which were branches of the People's Bank, the enterprises receiving the credit could convert it to cash for wage payment and other expenses. The People's Bank had to issue currency to honor the credit of its branch banks. The end result was an increase in currency in circulation of about 50 percent from January 1984 to January 1985. Inflation in 1985 was 8.8 percent: high compared with the low inflation rate achieved up to 1984.

The increase in money supply in 1988 was also unintentional and resulted from the reform process. Reform gave enterprises and consumers much freedom in the latter part of the 1980s. Aggregate demand and national output were expanding at a high rate. Unless the government made a serious effort to control the supply of credit, inflation would occur. The government failed to make such an effort. In 1988, the money supply again expanded by 48 percent. Furthermore, the government announced a policy to fix the prices of some important consumer goods at the level prevailing at the end of 1988. In response to the announcement, producers hastened to increase prices before the deadline. In the fall of 1988 the price index was increasing at an annual rate of over 30 percent. Inflation, together with corruption, contributed to discontent and student demonstrations in the spring of 1989.

In response to the serious inflation in the fall of 1988, the government tried to restrict the increase in money and credit creation by assigning credit quotas to the banks of different regions and provinces. In addition, interest rates on bank deposits were raised to attract deposits and to reduce the quantity of money in circulation, thus making the price level lower. Because of the absence of a properly functioning modern banking system, the government mainly applied administrative means to control the money supply, namely the assignment of credit quotas to banks in different regions, in addition to raising interest rates. Deposit rates were increased to over 11 percent per year to make the real rate of interest positive and attractive enough to depositors to increase their deposits. The policy worked, and inflation stopped in 1990.

After Deng announced the policy of speeding up reform and the further opening of China's door during his Southern Expedition to Shenzhen in 1992, people began to invest more and the economy started booming. The increase in aggregate demand led to serious inflation in late spring 1993. In 1992 the money supply increased by 36 percent. Inflation in terms of the official retail price index reached 13 percent in 1993 and 22 percent in 1994. Again the administrative and economic means of issuing credit quotas to regional banks and raising interest rates on deposits were applied. A strong and well respected administrator in the person of Zhu Rongji was appointed to head the People's Bank and solve the inflation problem. Zhu was determined and was feared by the heads of the bank's provincial branches. He told them

that they would lose their jobs if the credit quotas were exceeded. The expansion of credit was put under control. Inflation was slowed to 15 percent in 1995, 6 percent in 1996, 1 percent in 1997, and -2.5 percent in 1998. The rates in 1998 and 1999 were affected by the reduction in aggregate demand due to the Asian financial crisis which started in July 1997. The money supply in these years increased slowly also. Zhu Rongji became Prime Minister in March 1998, partly on account of his successful performance in controlling inflation in the mid-1990s.

When he took office in 1998, Premier Zhu announced two macroeconomic policy objectives, fully recognizing the "formidable challenges due to the financial crisis in southeast Asia." The objectives were to maintain a real growth rate at 8 per cent or more in 1998 and an inflation rate of not more than 3 percent. As President of the People's Bank and later Vice-premier, Zhu Rongji deserved much credit for reducing the rate of inflation in China from 22 percent in 1994 to a negative figure in 1998 by reducing the rate of growth in the money supply. Realizing the need to stimulate the economy, he was prepared to raise the inflation rate target to 3 percent by adopting a more expansionary monetary policy. By September 1998, currency in circulation in China reached RMB10 trillion, an increase of only 16 percent from the previous year. Total credit also increased by 17 percent in the same period. Since inflation had slowed down, nominal interest rates also came down. In March 1998, the one-year deposit rate went down to 5.2 percent and the one-year official lending rate to 7.9 percent. Commercial banks were allowed to set their lending rates within a fairly narrow range, between 10 percent below and 20 percent above the official lending rate.

In the years 1998 and 1999, China was affected by the Asian financial crisis, although only to a moderate extent. Economic growth was slower. Perhaps at the time it would have been better for the People's Bank to exercise a more expansionary monetary policy by increasing credit and the money supply more rapidly. Some economists think that it is possible to restrict the expansion of credit, but not possible to increase money and credit when there is no demand for them. The impossibility of extending credit during times of slow growth because of lack of demand is known as a liquidity trap. In the Chinese case the government was trying to raise aggregate demand following the Asian financial crisis by increasing expenditure on the building of infrastructure. Instead of financing expenditure by issuing bonds, the government could and should have financed some of the projects by issuing more money, or non-interest-bearing government debt. It would have solved the problem of the liquidity trap, if such a phenomenon did indeed exist.

In the 1980s and 1990s, monetary policy in China was exercised mainly by the administrative means of assigning credit quotas and the economic means of setting interest rates. Credit creation and contraction through the commercial banks, by changing reserve requirements and by open-market operations, was not possible because commercial banks were not operating effectively. The use of more modern means of macroeconomic policy-making will require some time to develop in China, as there are problems in reforming the banking system (which will be discussed fully in chapter 13). One problem in monetary policy that has not yet been resolved is the practice of simultaneous control of interest rates on loans and on deposits, often leading to insufficient profit margins for the commercial banks. These rates should be market determined to a larger extent than at present in China. This problem is

recognized by the People's Bank, and the deregulation of interest rates is taking place gradually. As new commercial banks appear to compete with the four large state commercial banks at the turn of the century, there is a need for the People's Bank to monitor all commercial banks in order to prevent them from being financially irresponsible.

We have discussed monetary policy mainly in terms of controlling the quantity of money. Historically, economists have found a relation between the quantity of money and the rate of inflation. Inflation can be measured by the ratio p_t/p_{t-1} of a general price index for period t to the index for period $t-1$, less one, as we have done using data in column 2 of table 7.1. Alternatively, it can be measured by the natural logarithm of this ratio $\ln(p_t/p_{t-1}) = \ln p_t - \ln p_{t-1}$. For such a large proportional change in the price index, as from 0.9308 in 1960 to 1.0820 in 1961, the first measure of inflation gives 0.162, and the second measure gives 0.151, not very different from the first. For smaller proportional changes in the price index, the two measures are closer. To examine the relation between money supply and inflation, we use the data in table 7.1 on (1) the retail price index p , (2) China's gross domestic product in real terms Y , (3) the amount of currency in circulation as a measure of money supply M , (4) the ratio of money supply to real GDP M/Y , (5) the inflation rate as measured by $\ln p_t - \ln p_{t-1}$. The rate of increase in money supply, which can be measured by $\ln M_t - \ln M_{t-1}$, forms the basis of much of our discussion of monetary policy and its effect on the inflation rate. Note the three inflation episodes of 1985, 1988, and 1993-5.

It is a useful exercise to estimate a regression of the inflation rate $\ln p_t - \ln p_{t-1}$ on the rate of increase in money supply $\ln M_t - \ln M_{t-1}$ of the same year and/or of the preceding year.

As we have pointed out, a better explanation of inflation is to use the rate of change of the ratio M/Y instead of the rate of change of the money supply itself. This formulation is based on the quantity theory of money. The quantity theory states $Mv = pY$, or $p = v(M/Y)$, where v is the income velocity of circulation of money, measuring the ratio of money income pY to the stock of money M . Second, we need to specify the possible delayed effects on the inflation rate of the change in the ratio M/Y of the same year and of the preceding year, and of the inflation rate of the preceding year. Thus $(M/Y)_t$, $(M/Y)_{t-1}$ and $\ln(p_{t-1}/p_{t-2})$ are three variables that can affect the current inflation rate. Change in the ratio M/Y in the preceding year enters as an explanatory variable because of its delayed effect. The inflation rate of the preceding year enters because it can capture the effects of the changes in M/Y further back in time, as the dependent variable of the preceding year always captures the delayed effects of changes in M/Y of the previous years. Thus we have two more variables to explain the inflation rate in addition to the ratio M/Y . Both are used to capture the delayed effects of M/Y . These delayed effects are embedded in the formulation of a dynamic equation to be discussed in the next section. Chow (1987) estimated such an equation using data up to 1993. This equation is useful not only for our understanding of the effect of monetary policy on inflation, but also for the formulation of monetary policy. We can determine the right credit quotas to impose, once its effect on inflation is quantitatively ascertained.

7.3 Estimating a Dynamic Equation to Explain the Inflation Rate

Consider a general method for estimating the delayed effects of a variable x on a variable y . (Note the distinction between this lower-case y and real GDP, denoted by Y .) In the example of the explanation of the price level, y is the natural log of the price level p and x is the natural log of the ratio M/Y of money supply to real output. The relation between these two log variables can be justified by taking the logarithm of both sides of the equation $p = v(M/Y)$ without considering the delayed effects of $x = M/Y$. The natural logarithm is used also because a linear relation between $\log p$ and $\log(M/Y)$ is a better approximation to the data than a linear relation between p and M/Y . In the dynamic equation, y_t is affected not only by x_t but possibly by past values of both variables. In the long run, let us assume that there is an equilibrium relation between the two variables given by $y - \alpha_0 - \alpha_1 x = 0$. The dynamic equation has an error correction mechanism built into it. The correction mechanism specifies that a positive deviation $u_{t-1} = y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}$ from equilibrium in the last period will assert a negative effect on the change $\Delta y_t = y_t - y_{t-1}$ of the dependent variable in the current period. Thus the coefficient γ of this deviation u_{t-1} in the regression of Δy_t is negative. The dynamic equation proposed attempts to explain Δy_t by Δx_t , past changes of both x and y , and by this error-correction term, i.e.,

$$\Delta y_t = \beta_0 + \beta_1 \Delta x_t + \beta_2 \Delta x_{t-1} + \beta_3 \Delta y_{t-1} + \gamma u_{t-1} + \varepsilon_t \quad (7.1)$$

where $u_{t-1} = y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}$ and ε_t is a random residual.

Let $\ln p$ be the dependent variable y and $\ln(M/Y)$ be the explanatory variable x . Using the annual data from 1954 to 1993 exhibited in table 7.1 (except for the revision of official Chinese national income statistics in 1994), Chow (1987) applied the method suggested in Engle and Granger (1987) to estimate the following equation to explain the inflation rate $\Delta \ln p$ in China:

$$\Delta \ln p = 0.00422 + 0.1430 \Delta \ln(M/Y) + 0.2176 \Delta \ln p_{-1} - 0.3771 u_{-1} \quad R^2 = 0.7174$$

$$(0.00376) \quad (0.0201) \quad (0.1098) \quad (0.1209) \quad (7.2)$$

Note that $\Delta \ln(M/Y)_{-1}$ was omitted because its coefficient was found to be statistically insignificant. The deviation u from the long-run relation was the residual of a regression of $\ln p$ on $\ln(M/Y)$ which was first estimated. Since lagged values of the explanatory variables are not used as explanatory variables and the equilibrium relation is estimated using the levels of the variables and not their differences, there are two more observations for 1952 and 1953 available to estimate this regression. The equilibrium relation is estimated to be:

$$\ln p = 0.9445 + 0.2687 \ln(M/Y)$$

The lagged value of the residual u_{t-1} of this regression equation was used as an independent variable representing the error correction term in the estimation of equation (7.2). The above long-run equilibrium relation between $\ln p$ and $\ln(M/Y)$ is called a "cointegration" relation, as suggested by Engle and Granger (1987).

Given equation (7.2) and given a model to forecast real output Y , government policy-makers can assess the effects of increasing the money supply M on inflation one or two years in advance. In fact I estimated an early version of equation (7.2) in response to a request from the office of Premier Zhao Ziyang in June 1985 to project the inflation rate in 1985, as he was concerned about the effect of the rapid increase in the money supply in 1984 by nearly 50 percent in one year.

7.4 Basic Facts about Government Revenue and Expenditures

In 1998, the total revenue of the Chinese government amounted to 987.595 billion yuan, with 489.2 billion or almost half belonging to the central government and the remainder to local governments of various levels; total expenditures amounted to 1,079.818 billion yuan (see the *Statistical Yearbook of China, 1999*, table 8-10). Total government revenue was 12.4 percent of GDP.

The historical trends of government revenue as a percent of GDP show that it declined from 28.4 percent in 1979 to 10.7 percent in 1995 and recovered slightly to 12.4 percent in 1998 (*Yearbook, 1999*, table 8-2). In 1979, the central government's revenue was only 23.134 billion yuan, as compared with 91.504 billion for the local governments; the ratio dramatically changed in favor of the central government in 1994 (see *ibid.*, table 8-10). In 1977 and 1978 China had budget surpluses, but since 1979 it has had budget deficits every year, except for 1985 (*ibid.*, table 8-1). In 1998, the deficit of 92.223 billion was 8.54 percent of total government revenue or 1.06 percent of GDP. China has maintained a conservative stand on managing its budget by not allowing government deficits to increase beyond its ability to finance them.

The sources of government revenue have changed drastically since economic reform started in 1978. In 1978, of the total government revenue of 113.226 billion, 57.199 billion was from state enterprises and 51.928 billion was from taxes (*ibid.*, table 8-3). Since 1985, state enterprises have had to pay taxes instead of having their income counted as government revenue, and some of them have had to be subsidized also. In 1998, of the total revenue of 987.595 billion, 926.280 billion was tax revenue. The taxes consisted mainly (in the order of over 75 percent) of industrial and commercial taxes in the form of turnover and income taxes collected from enterprises. Income taxes on individuals are insignificant, although foreign residents earning high incomes by Chinese standards have to pay income tax.

Of total government expenditures of 923.356 billion yuan in 1997, 364.733 billion was spent on economic construction, 246.938 billion on social, cultural, and educational development, 81.257 billion on national defense, and 135.885 billion on government administration (*ibid.*, table 8-6). The recorded defense expenditure amounted to only 1.1 percent of GDP, but possibly not all expenditure items related to defense are included in the above figure. Even after being corrected for possible underestimation, China's defense expenditure is a small fraction of GDP. Economic construction made up 4.9 percent of GDP. It is an item which can be expanded to increase aggregate demand when the economic conditions call for such an increase. We will turn to government expenditures as an instrument of fiscal policy in the next section.

7.5 Fiscal Policy

Fiscal policy consists mainly of setting the amount of government expenditure given the level of government revenue, which is determined by the tax structure and the economic conditions. During the period of planning, aggregate output could be controlled by the government through the setting of output targets for state enterprises. There was no need for fiscal policy to stimulate aggregate demand. Such a need has arisen since economic planning became less important and market forces were allowed to determine aggregate output. Chinese government economic officials believe in the use of fiscal stimuli when aggregate demand is insufficient, as advocated by Keynes.

A notable example occurred in 1998 during the Asian financial crisis and a period of slower growth in China. Premier Zhu Rongji stated at a press conference on March 19, 1998, that to achieve an 8 percent growth rate in 1998, the main policy would be to increase domestic demand. He said, "To stimulate domestic demand, we will increase investment in construction of infrastructure, such as railways, highways, agricultural land and water conservancy facilities, municipal facilities, and environmental protection facilities. We will also increase investment in high-tech industries and in the technical renovation of existing enterprises." A figure quoted in the Western press is a total of US\$1.2 trillion of investment in the three years 1998 to 2000. If the figure were converted to Chinese RMB by an 8 to 1 ratio, the average of \$400 billion per year would become 3,200 billion yuan of investment each year from 1998 to 2000. In 1997, investment in fixed assets increased by 9 percent in real terms to reach 2,350 billion yuan. If one allowed for an inflation rate of 3 percent and projected the 2,350 figure forward using an annual growth rate of 13 percent in money terms for three years, the amounts of fixed investment in 1998, 1999, and 2000 would be 2,656, 3,000, and 3,391 billion yuan respectively. Therefore, the average of 3,200 billion yuan represented an achievable stimulation program.

Economic trends at the time suggested that China's economy continued to grow in 1997, but the rate of growth slowed down in 1998. Industrial output grew by 11.2 percent in real terms in 1997, with the state sector growing at only 5.5 percent but the collective and privately-owned sectors growing at 11 and 14 percent respectively. In the first three months of 1998, industrial output in constant prices still increased by 9.7 percent over the same period in 1997, whereas the growth of real GDP during these three months was 7.2 percent, smaller than the target rate of 8 percent for 1998. In the third quarter of 1998, real GDP grew at 7.6 percent, compared with 6.8 percent in the second quarter. Many infrastructure projects were underway, including the introduction of state-of-the-art technology to agriculture, and a new railway linking the northeastern and southern regions as a part of a planned 245-billion-yuan railway construction project over five years, among others.

Thus China adopted the Keynesian way of stimulating aggregate demand by increasing government expenditure, especially in infrastructure-building. Another component of the increase in government expenditure was caused by severe floods in the summer of 1998 in the central and northeastern regions, in response to which the government took decisive action. Retail sales as a component of aggregate demand grew at an annual rate of 7 percent in the third quarter of 1998. As of early Novem-

ber the government was still expecting to achieve the target growth rate of 8 percent, or something close to it. The growth of over 7 percent during the first three quarters was already a remarkable achievement. The actual growth in real GDP in 1998 turned out to be 7.8 percent. Some observers believe that the high figure in 1998, when other Asian countries suffered a negative growth rate, was partly the consequence of false statistical reporting. Overestimation might have resulted from over-reporting by provincial government sources which were under pressure to achieve the output targets assigned to them by central government. To what extent such over-reporting existed and was not corrected by the State Statistics Bureau is an open question.

To study the quantitative effect of government expenditure, one can use a simple Keynesian model consisting of the following equations, with Y denoting real net domestic product, C denoting real consumption expenditure, I denoting real net investment expenditure, G denoting real government expenditure, and X denoting net exports (exports minus imports).

$$\begin{aligned} Y &= C + I + G + X \\ C &= a_0 + a_1 Y + a_2 C_{-1} \\ I &= b_0 + b_1(Y - Y_{-1}) + b_1 L_1 \end{aligned}$$

If Y denotes gross domestic product instead of net domestic product, I will be gross investment and the coefficient of Y_{-1} in the investment equation will be $-(1 - d)$ instead of -1 . We can treat government expenditure G and net exports X as exogenous variables. Then the above three equations can be used to determine the three endogenous variables Y , C , and I . Each of these three variables can be explained by a reduced-form equation, obtained by solving the above three structural equations for the endogenous variables. Each reduced-form equation has C_{t-1} , I_{t-1} , G_t , G_{t-1} , X_t , and X_{t-1} as explanatory variables. The lagged values of G and X enter because lagged Y in the equation for I is a function of these variables. Thus the effects of fiscal policy, of the manipulation of government expenditure G , on the macroeconomy can be evaluated by the use of these reduced-form equations. (See question 4 at the end of this chapter.)

In section 6.4 we estimated a model with one variable, "accumulation," replacing the sum $I + G + X$ in the above model. One can also use the method presented in that section to estimate the coefficients of the consumption and investment equations in the above model. Once these coefficients are estimated, we can solve the structural equations to obtain the reduced-form equations. As an exercise, the reader might wish to estimate this model using Chinese data. Such a model has shortcomings, but it may suffice to provide a first approximation to evaluate the effects of government expenditure on real GDP.

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1. Using the data in table 7.1, estimate a regression of the change in the log of the price index on the change in the log of the ratio of money supply to real GDP.
2. Using the data in table 7.1, estimate equation (7.1) to explain the rate of inflation in China. Comment on the difference between your estimated equation and equation (7.2).
3. Estimate the model suggested at the end of section 7. 5. Comment on the effect of government expenditure on real GDP in China. What is the value of the coefficient of government expenditure G in the reduced-form equation explaining real GDP? The coefficient is termed the "government expenditure multiplier."
4. Assume that the structural equations (6.6) of chapter 6 remain valid, and $Y = C + I + G$, where G stands for government expenditure. Solve these equations to obtain the reduced-form equations for C and I by substituting out Y and Y_{t-1} . By how much will Y_t and Y_{t+1} change when G_t increases by 1 billion yuan?