Capital Controls and Macroeconomic Policies After the Asian Currency Crisis in China

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Abstract

The Asian currency crisis led to a hit on China's export growth and the economic growth. This paper provides a small open economy with both a fixed exchange rate and capital controls to analyze what kind of macroeconomic policy can contribute to China's export growth and the economic growth. We find that, an unanticipated permanent devaluation in the nominal exchange rate and reduction in the nominal money supply under the capital controls can make chinese economic growth and export growth compatible. However, the latter will be better than the former since the former may trigger competitive depreciations of exchange rates in the near neighbor countries. On the other hand, fiscal policies cannot bring the compatible growths.

Keywords: capital controls, monetary and fiscal policies, the terms of trade.
JEL classification: E63; F32; F41

1. Introduction

The depreciation in Thailand baht in July 1997 triggered competitive devaluations in other Asian currencies, Korean won and Taiwan dollar against U.S. dollar. Even though the currencies of these Asian countries or regions have held relatively stable since November 1998, Thailand baht, Philippines peso, Singapore dollar, Malaysia ringgit, Korean won and Taiwan dollar devalued 46.6%, 53.9%, 16.2%, 51.9%, 90.4% and 22.6% compared to pre-crisis, respectively. There were many literatures to analyze why the Asian currency crisis happened.[1] A common conclusion in those literatures is that, although massive and rapid foreign short capital flows are not an essential cause of the Asian currency crisis, it attributed to the Asian currency crisis since the sudden emergence and rapid diffusion of the currency devaluation in these Asian

countries or regions were possible after the liberalization of their capital markets. Compared to these Asian countries or regions, China has avoided the Asian currency crisis due to its capital controls. The capital controls conducted in China have two features. First, Chinese renminbi is inconvertible and is pegged to U.S. dollar. Second, China government prohibits and restricts the private sector to borrow and lend in the world capital market. However, the big depreciation in currencies in these Asian countries or regions led to a hit on China's export growth and economic growth after the Asian currency crisis. In China, the growth rate of GDP fell from 8.5% in 1997 to 7.8% in 1998 and to 7.1% in 1999; the growth rate of export fell from 21% in 1997 to 0.5% in 1998 and to 6.1% in 1999. In these circumstances, some analysts wonder if the China government would be forced to devaluate its currency. On the other hand, some analysts argue that keeping Chinese renminbi stable is desirable for the rapid recovery of the Asian economy. The purpose of this paper is to analyze whether the devaluation in Chinese renminbi is effective for making economic growth and export growth compatible under the capital controls or not, and to discuss whether there are other policies that can bring economic growth and export growth compatible.

Yashiv (1998) discussed capital controls policy from an intertemporal perspective. He argued that significant real effects are generated by the interaction between controls policy and traditional policy tools, since capital controls affect agent's intratemporal asset allocation and intertemporal consumption patterns. In this paper, we consider the significant real effects of capital controls in China. China's capital controls, however, are different from that Yashiv (1998) discussed. China government dose not issue the foreign-currency-linked domestic debt that can be held by domestic private sector. Therefore, even though the capital controls conducted in China yielded some similar non-traditional results of monetary and financial policies discussed by Yashiv (1998), the monetary and fiscal policies under the capital controls conducted in China have different effects on the economy, because the capital controls conducted in China have different effects on intratemporal asset allocation and intertemporal consumption patterns.

Based on the features of China's capital market, this paper provides a small open economy with a fixed exchange rate and the controls of borrowing and lending to analyze the effects of monetary and fiscal policies on the economy. We find that, an unanticipated permanent reduction in the nominal money supply and devaluation in the

nominal exchange rate under the capital controls are effective under the capital controls and they can make economic growth and export growth compatible. On the other hand, fiscal policy cannot bring the compatible growths. Alba (1999), however, used daily data to show China's currency devaluation may directly or indirectly trigger competitive depreciations in exchange rates of Southeast Asian countries. Therefore, an unanticipated permanent reduction in money supply seems to be better than an unanticipated permanent devaluation in the nominal exchange rate, since it can avoid the currency competition. However, this monetary policy will lead to an undesirable reduction in the consumption of the domestic private sector in the long run.

This paper is organized as follows. Section 2 sets up a model with the capital controls. Section 3 derives its dynamic structure. Section 4 analyzes long-run and initial effects of monetary and fiscal policies on the economy. Finally, section 5 provides conclusions.

2. The model

Suppose that there is a small open economy, where a single good is produced and another good is imported from abroad. Since the economy is small, the price of the imported good measured in terms of foreign currency is given and assumed to be constant. For convenience, the price of the imported good can be represented by the fixed nominal exchange rate. On the other hand, we assume that the economy is large enough to influence the terms of trade that is defined as the nominal exchange rate relative to the price of the home good. We also assume that the currency money in the economy is inconvertible and the government in the economy can borrow and lend foreign assets in the world capital market but the private sector is prohibited to do so.

Households

Assume that households supply labor and consume home and imported goods. The intertemporal problem for a representative household is to maximize the following discounted lifetime utility:

$$\max \int_0^{\infty} [u(c_H,\ c_I)+\nu(m)+z(\bar{l}-L)]\exp(-\rho t)dt, \qquad (1)$$

where ρ denotes the constant rate of time preference, c_H the home good consumption,

c_I the imported good consumption, m the real money balance measured in terms of the home good, $\bar{l}$ the total time held by the representative household, L the labor supplied by the representative household. Therefore, $\bar{l}-L$ is the leisure held by the representative household. For convenience, we assume that $u(\cdot)$ is the loglinear version, $\nu(\cdot)$ and $z(\cdot)$ are increasing and strictly concave functions, i.e.

$$u(c_H,\ c_I) = \alpha \ln c_H + (1-\alpha)\ln c_I,\ 0 < \alpha < 1.$$

$$\nu'(\cdot) > 0,\ \nu''(\cdot) < 0,\ z'(\cdot) > 0,\ z''(\cdot) < 0,$$

The flow budget constraint of the representative household is given by

$$\dot{b} + \dot{m} = bi - a\pi + \chi + wL - c_H - ec_I - \tau, \qquad (2)$$

where b is the real holdings of the government bonds, χ the real net flow distributed from a representative firm, e the terms of trade, π the inflation rate, w the real wage, i the home nominal interest rate and τ the real values of lump-sum taxes. In addition, b, χ, π, and τ are variables measured in terms of the home good.

The representative household seeks to maximize Eq. (1) with respect to variables c_H, c_I, L, b and m subject to Eq. (2). The first-order conditions for the maximization are

$$\frac{1-\alpha}{\alpha}\frac{c_H}{c_I} = e, \qquad (3)$$

$$\nu'(m)\Big/\frac{\alpha}{c_H} = i, \qquad (4)$$

$$z'(\bar{l}-L)\Big/\frac{\alpha}{c_H} = w, \qquad (5)$$

$$\frac{\dot{c}_H}{c_H} = i - \pi - \rho = r - \rho, \qquad (6)$$

$$\lim_{t\to\infty} a(t)\exp(-\rho t) = 0, \qquad (7)$$

where r is the real interest rate measured in terms of the home good. Eq. (3) shows that the marginal rate of substitution between home and imported goods consumption is equal to the terms of trade. Eq. (4) shows that the marginal rate of substitution between the real money balance measured in terms of the home good and the home good consumption, that is, the opportunity cost of holding money, is equal to the home nominal interest rate. Eq. (5) shows that the marginal rate of substitution between the labor supply and the home good consumption is equal to the real wage rate measured in terms of home good. Eq. (6) implies that a rise in the home good consumption of the representative household depends on whether the home real interest rate measured in

terms of the home good exceeds the rate of time preference. Eq. (7) is the transversality condition for the representative household.

Firms

Assume that firms employ capital and labor to produce a single good. The production function of a representative firm is given by

$$y = f(K, L), \tag{8}$$

$$f_K > 0,\ f_{KK} < 0,\ f_L > 0,\ f_{LL} < 0,\ f_{KK}f_{LL} - f_{KL}^2 = 0,$$

where y is the output of the home good and K the capital stock.

The net flow of the representative firm is given by

$$\chi = f(K, L), -wL - I\left[1 + T\left(\frac{I}{K}\right)\right], \tag{9}$$

where I is investment and $T(\cdot)$ is the installation costs needed for the growth of per capita capital stock. We assume that $T(\cdot)$ satisfies $T'(\cdot) > 0$ and $2T'(\cdot) + (\cdot)T''(\cdot) > 0$.

Therefore, the optimization problem of the representative firm is to maximize

$$\max \int_0^\infty \chi(t)\exp\left[-\int_0^t r(s)ds\right]dt. \tag{10}$$

The budget constraint of the representative firm is given by

$$\dot{K} = I. \tag{11}$$

Therefore, the optimal conditions for the representative firm can be given by[2)]

$$\dot{K} = K\varphi(q), \tag{12}$$

$$\varphi'(q) > 0,\ \varphi(1) = 0.$$

$$f_L(K, L) = w, \tag{13}$$

$$\dot{q} = -f_K(K, L) - \varphi^2(q)T'(\varphi(q)) + qr, \tag{14}$$

$$\lim_{t\to\infty} q(t)k(t)\exp\left[-\int_0^t r(s)ds\right] = 0, \tag{15}$$

where q is the Lagrange variable. Eq. (12) implies that q is the shadow price of investment, that is, Tobin's q. Eq. (13) shows that the marginal product of labor is equal to the real wage rate measured in terms of the home good. Eq. (15) is the transversality condition for the representative firm.

Government

The government consumes home and imported goods. The government expenditures

on the two goods are financed by the foreign assets (or debt), the issue of nominal money supply, and the issue of the government bonds. Therefore, the budget constraint of the government can be given by

$$\dot{m}+m\pi+\dot{b}+eB^*r^*+\tau = br+e\dot{B}^*+g_H+eg_I, \tag{16}$$

where r^* is the world interest rate, g_H and g_I the government expenditure on home and imported goods consumption respectively, and B^* the foreign assets (or debt) held by the government.

The real money balance measured in terms of the home good is given by

$$m = \frac{M}{p_H}, \tag{17}$$

where M is the nominal money supply, E the nominal exchange rate and p_H the price of the home good. Therefore $p_H = E/e$ and $\pi = -\dot{e}/e$.

The non-Ponzi game conditions for the government are given by

$$\lim_{t\to\infty} B^*(t)\exp(-r^*t) = 0, \tag{18}$$

$$\lim_{t\to\infty} b(t)\exp\left(-\int_0^t r(s)ds\right) = 0. \tag{19}$$

Market-clearing conditions

The macroeconomic equilibriums in the home good market, the labor market and the money market is required to keep clear at all points of time. The equilibrium condition for the home good market is given by

$$f(K, L) = c_H+g_H+K\varphi(q)[1+T(\varphi(q))]+x(e), \tag{20}$$

where $x(\cdot)$ denotes export and satisfies $x'(\cdot) > 0$.

The supply of labor is given by Eq. (5) and the demand for labor is given by Eq. (13). Substituting Eq. (13) into Eq. (5), we can obtain the equilibrium condition for the labor market as follows:

$$z'(\bar{l}-L)\Big/\frac{\alpha}{c_H} = f_L(K, L). \tag{21}$$

The demand for money is given by Eq. (4). Eq. (4) means that the nominal interest rate is an increasing function of the private home good consumption and a decreasing function of the real money balance. The supply of money is given by Eq. (17). Substituting Eq. (17) into Eq. (4), the equilibrium condition for the money market is given by

$$\nu'\left(\frac{M}{E}e\right)\Big/\frac{\alpha}{c_H}=i. \tag{22}$$

3. Dynamic structure

In order to examine the effects of monetary and fiscal policies, we assume that the nominal money supply and the government expenditures on home and imported goods are given, namely

$$M=\bar{M},\ g_H=\bar{g}_H,\ g_I=\bar{g}_I. \tag{23}$$

Substituting Eq. (9) into Eq. (2) yields

$$\dot{b}=br+f(K,L)-K\varphi(q)[1+T(\varphi(q))]-c_H-ec_I-\tau. \tag{24}$$

Substituting Eqs. (17), (23) and (24) into Eq. (16) yields

$$\dot{B}^*=B^*r^*+\frac{x(e)}{e}-c_I-\bar{g}_I. \tag{25}$$

Eqs. (3), (6), (12), (14), (20), (21), (22), (24) and (25) describe an evolution of the economy along a perfect foresight equilibrium path. These equations can be summarized as follows:

$$\frac{1-\alpha}{\alpha}\frac{c_H}{c_I}=e, \tag{26}$$

$$\nu'\left(\frac{M}{E}e\right)\Big/\frac{\alpha}{c_H}=i, \tag{27}$$

$$z'(\bar{l}-L)\Big/\frac{\alpha}{c_H}=f_L(K,L), \tag{28}$$

$$f(K,L)=c_H+\bar{g}_H+K\varphi(q)[1+T(\varphi(q))]+x(e), \tag{29}$$

$$\frac{\dot{c}_H}{c_H}=i+\frac{\dot{e}}{e}-\rho=r-\rho, \tag{30}$$

$$\dot{K}=K\varphi(q), \tag{31}$$

$$\dot{q}=q\left(i+\frac{\dot{e}}{e}\right)-f_K(K,L)-\varphi^2(q)T'(\varphi(q)), \tag{32}$$

$$\dot{B}^*=B^*r^*+\frac{x(e)}{e}-c_I-\bar{g}_I, \tag{33}$$

$$\dot{b}=b\left(i+\frac{\dot{e}}{e}\right)+f(K,L)-K\varphi(q)[1+T(\varphi(q))]-c_H-ec_I-\tau. \tag{34}$$

Setting Eqs. (30)～(34) to zero can yield steady state values of the above variables as

follows:

$$\bar{i} = \bar{r} = \rho, \tag{35}$$

$$\bar{q} = 1, \tag{36}$$

$$f_K(\bar{K}, \bar{L}) = \rho, \tag{37}$$

$$z'(\bar{l}-L)\Big/\frac{\alpha}{\bar{c}_H} = f_L(\bar{K}, \bar{L}), \tag{38}$$

$$f(\bar{K}, \bar{L}) = \bar{c}_H + \bar{g}_H + ex(\bar{e}), \tag{39}$$

$$\frac{1-\alpha}{\alpha}\frac{\bar{c}_H}{\bar{c}_I} = \bar{e}, \tag{40}$$

$$\nu'\left(\frac{\bar{M}}{E}\bar{e}\right)\Big/\frac{\alpha}{\bar{c}_H} = \rho, \tag{41}$$

$$\bar{B}^* = \frac{1}{r^*}\left[\bar{c}_I + \bar{g}_I - \frac{x(\bar{e})}{\bar{e}}\right], \tag{42}$$

$$\bar{b} = \frac{1}{\rho}[\bar{c}_H - \bar{e}\bar{c}_I + \tau - f(\bar{K}, \bar{L})]. \tag{43}$$

Eq. (35) shows that the nominal interest rate and the real interest rate measured in terms of the home good are identical in the steady state, since the inflation rate measured in terms of the home good is equal to zero. Eq. (37) implies that growth rates of capital stock and labor are identical or that the capital-labor ratio is constant. Eq. (42) shows that the government holdings of the foreign assets (or debt) are equal to a negative constant proportion of the current account. Eq. (43) shows that the stock of the government bonds is equal to a constant proportion of the differences between the private expenditures (the sum of the private consumption and the real values of lump-sum taxes) and the output of the home good.

In order to analyze the dynamic form of the model, we must study the relationships among the variables in Eqs. (26)～(34) around the steady state represented by Eqs. (35)～(43). Eq. (27) implies that the nominal interest rate is a decreasing function of the terms of trade and an increasing function of the private home good consumption, namely

$$i = i(e, c_H),\ i_e < 0,\ i_{c_H} > 0. \tag{44}$$

c_I, L and e in Eqs. (26), (28) and (29) are a function of c_H, q and K respectively. As shown in Appendix A, c_I, L and e can be represented by c_H, q and K respectively as follows:

$$c_I = c(c_H, q, K),\ c_{c_H} > 0,\ c_q > 0,\ c_K < 0, \tag{45}$$

$$L = L(c_H, q, K),\ L_{c_H} < 0,\ L_q = 0,\ L_K > 0, \tag{46}$$

$$e = e(c_H, q, K),\ e_{c_H} < 0,\ e_q < 0,\ e_K > 0. \tag{47}$$

In turn, We also find that B^* and b in Eqs. (33) and (34) can be reduced to an autonomous differential equation after substituting solutions for c_H, q and K, respectively. Therefore, the dynamic form of the model can be reduced to a system involving three variables: the private home good consumption, c_H, Tobin's q and the capital stock, K. Linearizing Eqs. (30), (31) and (32) around the steady state, we can have

$$\begin{bmatrix} \dot{c}_H \\ \dot{q} \\ \dot{K} \end{bmatrix} = \begin{bmatrix} C_{c_H} & C_q & C_k \\ Q_{c_H} & Q_q & Q_k \\ K_{c_H} & K_q & K_k \end{bmatrix} \begin{bmatrix} c_H - \bar{c}_H \\ q-1 \\ K-\bar{K} \end{bmatrix}. \tag{48}$$

Since c_H and q are two jumping variables and K is a predetermined variable, the saddle path is required in the model. As shown in Appendix, the saddle path condition is satisfied since there are one negative and two positive eigenvalues in the matrix of coefficients in Eq. (48). If we assume that λ_1 is the negative eigenvalue, we can obtain a solution to the system described by Eq. (48) as follows:

$$K = \bar{K} + (K_0 - \bar{K})\exp(\lambda_1 t), \tag{49}$$

$$c_H = \bar{c}_H + h_1(K-\bar{K}), \tag{50}$$

$$q = 1 + h_2(K-\bar{K}), \tag{51}$$

Where

$$h_1 = (h_2 C_q + C_K)/(\lambda_1 - C_{c_H}) = -[(Q_q - \lambda_1)h_2 + Q_K]/Q_{c_H} \gtreqless 0$$

$$h_2 = \lambda_1 / K\varphi'(1) < 0.$$

Eq. (50) describes the relationship between the private home good consumption and the capital stock. Since the sign of h_1 is ambiguous, the relationship is unclear. Eq. (51) describes the relationship between Tobin's q and the capital stock. $h_2 < 0$ means that q is a decreasing function of K.

Linearizing Eqs. (33) and (34) around the steady state, we can obtain

$$\dot{B}^* = (B^* - \bar{B}^*)r^* + \beta_1(K-\bar{K}), \tag{52}$$

$$\dot{b} = (b-\bar{b})r + \beta_2(K-\bar{K}), \tag{53}$$

Where

$$\beta_1 = [(\beta_3 e_{c_H} - c_{c_H})h_1 + (\beta_3 e_q - c_q)h_2 + (\beta_3 e_K - c_K)]/\bar{e},$$

$$\beta_2 = \{\bar{b}[i_{c_H} + i_m m_e e_{c_H} + (e_{c_H} C_{c_H} + e_q Q_{c_H})/\bar{e}] + f_L L_{c_H} - 1/\alpha\} h_1 +$$
$$\{\bar{b}[i_m m_e e_q + (e_{c_H} C_q + e_q Q_q + e_K K_q/\bar{e}]$$
$$-\bar{K}\varphi'(1)\} h_2 + \bar{b}[i_m m_e e_K + (e_{c_H} C_K + e_q Q_K)/\bar{e}] + \rho + f_L L_K,$$

$$\beta_3 = B^* r^* + e x'(e) - c_I - g_I = \frac{x(e)}{e}\left(\frac{dx(e)}{de}\Big/\frac{x(e)}{e} - 1\right).$$

We assume $\beta_3 > 0$. $\beta_3 > 0$ means that if and only if the elasticity of the home export exceeds one the foreign assets increase. Therefore, $\beta_3 > 0$ implies that the Marshall-Lerner condition is satisfied. However, the signs of β_1 and β_2 are unclear.

According to the non-Ponzi-game conditions for the government represented by Eqs. (18) and (19), we can obtain the intertemporal budget constraint conditions for the government as follows:

$$B_0^* = \bar{B}^* + h_3(K_0 - \bar{K}),$$
$$b_0 = \bar{b} + h_4(K_0 - \bar{K}),$$

where $h_3 = \beta_1/(\lambda_1 - r^*) \gtreqless 0$ and $h_4 = \beta_2/(\lambda_1 - \rho) \gtreqless 0$.

Therefore, the solutions of Eqs. (52) and (53) can be given by

$$B^* = \bar{B}^* + h_3(K - \bar{K}), \tag{54}$$
$$b = \bar{b} + h_4(K - \bar{K}), \tag{55}$$

respectively. Eq. (54) describes the relationship between the government holdings of the foreign assets and the capital stock. Eq. (55) describes the relationship between the government bonds and the capital stock. Since the signs of h_3 and h_4 are ambiguous, the two relationships are unclear.

4. Capital controls and effects of monetary and fiscal policies

In this section we use the model in the preceding section to analyze long-run and initial effects of unanticipated permanent monetary and fiscal policies. As monetary policies, the government can devaluate or revaluate the nominal exchange rate and raise or reduce the issue of the nominal money supply. As fiscal policies, the government can raise or reduce government expenditures on home and imported goods.

Differentiating Eqs. (35)~(43) with respect to E, $\bar{M}$, $\bar{g}_H$ and $\bar{g}_I$ can obtain the long-run effects of monetary and fiscal policies as shown in Table 1:

Table 1 Long-run effects of monetary and fiscal policies

	$d\bar{e}$	$d\bar{p}_H$	$d\bar{c}_H$	$d\bar{c}_I$	$d\bar{K}$	$d\bar{L}$	$d\bar{b}$	$d\bar{B}^*$
dE	+	+	−	−	+	+	−	−
$d\bar{M}$	−	+	+	+	−	−	+	+
$d\bar{g}_H$	−	+	−	?	+	+	−	?
$d\bar{g}_I$	0	0	0	0	0	0	0	0

Differentiating Eqs. (49), (50), (.51), (54) and (55) with respect to E, $\bar{M}$, $\bar{g}_H$ and $\bar{g}_I$ can obtain the initial effects of monetary and fiscal policies as shown in Table 2:

Table 2 Initial effects of monetary and fiscal policies

	dK_0	dq_0	dc_{H0}	db_0	dB_0^*
dE	0	+	?	?	?
$d\bar{M}$	0	−	?	?	?
$d\bar{g}_H$	0	+	?	?	?
$d\bar{g}_I$	0	0	?	?	?

Proposition 1 In the fixed exchange rate regime, monetary policy under the capital controls has effect on the economy.

As shown in Table 1, an unanticipated permanent devaluation in the exchange rate and rise in the nominal money supply will lead to a rise in the price of the home good in the long run. Furthermore, the former will lead to rises in the capital accumulation and the labor supply, to an improvement in terms of trade, and to falls in home and imported goods consumption, the government holdings of the foreign assets and the stock of the government bonds in the long run. On the other hand, the latter will lead to opposite results except the rise in the price of the home good. As shown in Table 2, the monetary policies have no effects on the capital accumulation, but it will change the expectation of the investment at initial time, since the policies change a value of Tobin's q. However, the effects of the policies on the other variables are unclear at the initial time.

If capital mobility is perfect, the real interest rate in home and foreign countries will be equalized by perfect international capital mobility. When monetary policy causes a disparity in the real interest rate between home and foreign countries, the disparity will be restored immediately by perfect international capital mobility. However,

the disparity caused by monetary policies cannot be restored under the capital controls conducted in China. Therefore, monetary policy will have the significant real effects on the economy in the fixed exchange rate regime.

Proposition 2 Under the capital controls, an unanticipated permanent devaluation in the nominal exchange rate and reduction in the nominal money supply will bring economic growth and export growth compatible in the long run. However, the latter seems to be better than the former, since the former may trigger depreciations in exchange rates of Asian countries or regions.

Table 1 showed the long-run effects of an unanticipated permanent rise in the nominal money supply on the economy. Therefore, an unanticipated permanent reduction in the nominal money supply has opposite long-run effects on the economy. This means that an unanticipated permanent reduction in the nominal money supply and devaluation in the nominal exchange rate can make economic growth and export growth compatible in the long run. Alba (1999), however, used daily data to examine whether there is relationships among China's exchange rate and Southeast Asia's exchange rates or not. He pointed out that, China's exchange rate impacts Thailand baht and Philippines peso, which initially is affected by the Asian currency crisis; Thailand baht and Philippines peso then affected exchange rates of the rest of Southeast Asia. Since the devaluation in the nominal exchange rate may directly or indirectly trigger competitive depreciations of exchange rates in Asian countries or regions, the reduction in the nominal money supply will be better than the devaluation in the nominal exchange rate.

Proposition 3 An unanticipated permanent rise in the government expenditure on the home good consumption has crowding-in effect on investment but it decreases export in the long run. On the other hand, an unanticipated permanent rise in the government expenditure on the imported good consumption will only lead to a reduction in the government holdings of the foreign assets.

As shown in Table 1, an unanticipated permanent rise in the government expenditure on the home good consumption leads to rises in the investment and the labor

supply, and to falls in the private home good consumption and the stock of the government bonds in the long run. However, the effects of the policy on the private imported good consumption and the government holdings of the foreign assets are ambiguous. As shown in Table 2, the policy will lead to a rise in Tobin's q at the initial time. But the effects of the policy on the other variables at the initial time are unclear. On the other hand, an unanticipated permanent rise in the government expenditure on the imported good consumption will only lead to a reduction in the government holdings of the foreign assets immediately, but it has no effects on other variables in the long run and at the initial time.

Since a rise in the government expenditure on home good consumption will raise the price of the home good in the long run, the terms of trade will depreciate. Then the export will fall. Furthermore, a jump-up in q at the initial time means that the real interest rate measured in terms of the home good continues to return upward to ρ from initial shock in the long run, the investment therefore will increase. Since the growth of the labor supply and the capital accumulation change at the same rate, the labor supply will increase. Therefore, the output will increase.

5. Conclusions

This paper used a small open economy model to examine long-run and initial effects of monetary policies and fiscal policies under the capital controls conducted in China. We found that monetary policies under the capital controls have significant effects on the economy and they can bring economic growth and export growth compatible. On the other hand, an unanticipated permanent rise in the government expenditure on the home good consumption will reduce export, even though it has crowing-in effect on the investment in the long run. An unanticipated permanent rise in the government expenditure on the imported good consumption will only reduce the holdings of the foreign assets, but it has no effects on other variables in the long run and at the initial time.

Therefore, the difference between the monetary policies (an unanticipated permanent devaluation in the nominal exchange rate and rise in the nominal money supply) and the fiscal policy (an unanticipated permanent rise in government expenditure on home good consumption) is that, though they can raise the economic growth by increasing

both the capital accumulation and the labor supply, the monetary policies will increase export due to the improvement of the terms of trade, and the fiscal policy will decrease export due to the depreciation of the terms of trade. The difference is important for China. If the aims of the government are not only to raise economic growth but also to raise export growth, the monetary policies seem to be better than the fiscal policy. Furthermore, an unanticipated permanent reduction in money supply seems to be better than an unanticipated permanent devaluation in the nominal exchange rate, since the latter may trigger competitive depreciations in exchange rates of Asian countries or regions, but the former can avoid the competition. However, this monetary policy will lead to an undesirable reduction in the consumption of the private sector in the long run.

Notes

1) See, for examples, Bacchetta and van Wincoop (2000), Chinn et al (1999), Kaminsky and Schmikler (1999), Kim (1999), Krongkaew (1999), Mishkin (1999), Montiel and Reinbart (1999) and Sarno and Taylor (1999).
2) See Blanchard and Fischer (1989), p. 62.

Appendix

Differentiating Eq. (28) with respect to c_H, q and K, we can obtain

$$L_{c_H} = \frac{\alpha}{c_H^2} f_L \Big/ \left(z'' + \frac{\alpha}{c_H} f_{LL} \right) < 0, \; L_q = 0,$$

$$L_K = -\frac{\alpha}{c_H} f_{LK} \Big/ \left(z'' + \frac{\alpha}{c_H} f_{LL} \right) > 0.$$

Differentiating Eqs. (26) and (29) with respect to c_H, q and K in the steady state, we can have

$$c_{c_H} = \frac{1-\alpha}{\alpha \bar{e}^2} (\bar{e} - \bar{c}_H e_{c_H}) > 0, \quad c_q = -\frac{1-\alpha}{\alpha \bar{e}^2} \bar{c}_H e_q > 0,$$

$$c_K = -\frac{1-\alpha}{\alpha \bar{e}^2} \bar{c}_H e_K < 0, \quad e_{c_H} = \frac{f_L L_{c_H} - 1}{x'(\bar{e})} < 0,$$

$$e_q = \frac{K\varphi'(1)}{x'(\bar{e})} < 0, \quad e_K = \frac{f_L L_K + \rho}{x'(\bar{e})} > 0.$$

Total differentiation of Eq. (47) yields

$$\dot{e} = e_{c_H}\dot{c}_H + e_q\dot{q} + e_K\dot{K} \tag{A1}$$

Substituting Eq. (A1) into Eqs. (30) and (32), we can have

$$\dot{c}_H = \frac{1}{\theta}i(e, c_H) - \frac{\rho}{\theta}\left(1 - \frac{q}{e}e_q\right) + \frac{e_K}{e\theta}K\varphi(q) - \frac{e_q}{e\theta}[f_K(K, L) + \varphi^2(q)T'(\varphi(q))], \tag{A2}$$

$$\dot{q} = \frac{q}{c_H\theta}i(e, c_H) - \frac{q\rho}{e\theta}e_{c_H} + \frac{qe_K}{ec_H\theta}K\varphi(q) - \left[\frac{1}{c_H\theta} - \frac{e_{c_H}}{e\theta}\right][f_K(K, L) + \varphi^2(q)T'(\varphi(q))], \tag{A3}$$

where $\theta = \dfrac{1}{c_H} - \dfrac{e_{c_H}}{e} - \dfrac{qe_q}{ec_H} > 0.$

Linearizing Eqs. (A2), (A3) and (31) around the steady state represented by Eqs. (35)~(43), we can obtain the coefficients in Eq. (48) as follows:

$$C_{c_H} = \frac{1}{\bar{\theta}}\left[i_e e_{c_H} + i_{c_H} - \frac{1}{\bar{e}}e_q f_{KL}L_{c_H}\right] \gtreqless 0,$$

$$C_q = \frac{1}{\bar{\theta}}\left[i_e e_q - \frac{1}{\bar{e}}e_q f_L L_K\right] > 0,$$

$$C_K = \frac{1}{\bar{\theta}}\left[i_e e_K - \frac{e_q z'' f_{KK}}{\bar{e}(z'' + \alpha f_{LL}/\bar{c}_H)}\right] < 0,$$

$$Q_{c_H} = \frac{1}{\bar{\theta}}\left[\frac{1}{\bar{c}_H}(i_e e_{c_H} + i_{c_H}) - \left(\frac{1}{\bar{c}_H}\frac{e_{c_H}}{\bar{e}}\right)f_{KL}L_{c_H}\right] > 0,$$

$$Q_q = \frac{1}{\bar{\theta}}\left[\frac{1}{\bar{c}_H}(i_e e_q + \rho) - \frac{e_{c_H}\rho}{\bar{e}} + \frac{e_K}{\bar{e}\bar{c}_H}K\varphi'(1)\right] > 0,$$

$$Q_K = \frac{1}{\bar{\theta}}\left[\frac{1}{\bar{c}_H}i_e e_K - \left(\frac{1}{\bar{c}_H}\frac{e_{c_H}}{\bar{e}}\right)\frac{z'' f_{KK}}{z'' + \alpha f_{LL}/\bar{c}_H}\right] \gtreqless 0,$$

$$K_{c_H} = 0,$$

$$K_q = \bar{K}\varphi'(1) > 0,\ K_K = 0,$$

where $\bar{\theta} = \dfrac{1}{\bar{c}_H} - \dfrac{e_{c_H}}{\bar{e}} - \dfrac{e_q}{\bar{e}\bar{c}_H} > 0.$

We denote three eigenvalues of the matrix of the coefficients in Eq. (48) as λ_1, λ_2 and λ_3. We can therefore obtain

$$\lambda_1+\lambda_2+\lambda_3 = C_{c_H}+Q_q+K_K$$
$$= \frac{1}{\bar{\theta}}\left[i_e e_{c_H}+i_{c_H}+\frac{1}{\bar{c}_H}(i_e e_q+\rho)-\frac{e_{c_H}\rho}{\bar{e}}+\frac{\rho\bar{K}\varphi'(1)}{\bar{e}\bar{c}_H e x'(\bar{e})}\right] > 0,$$

$$\lambda_1\lambda_2\lambda_3 = \begin{vmatrix} C_{c_H} & C_q & C_K \\ Q_{c_H} & Q_q & Q_K \\ K_{c_H} & K_q & K_K \end{vmatrix}$$
$$= \frac{1}{\bar{\theta}}\bar{K}\varphi'(1)\left[f_{KL}L_{c_H}i_e e_K-(i_e e_{c_H}+i_{c_H})\frac{z''f_{KK}}{z''+\alpha f_{LL}/\bar{c}_H}\right] < 0.$$

Therefore, there are one negative and two positive eigenvalues in the dynamic system described by Eq. (48). In other words, there exists unique perfect foresight equilibrium in the dynamic system.

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