Analysis on the effectiveness of China's macroeconomic policy based on the modified Mundell-Fleming model during the post-financial crisis period

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Abstract

This paper proposed the hypotheses of Mundell-Fleming model applicable to current Chinese economic environment, modified the traditional Mundell-Fleming model and analysed the effectiveness of fiscal and monetary policies under different exchange rate systems. Under a fixed exchange rate system, the monetary policy causes economic instability and aggravates economic inequality, thus increasing the difficulty in policy intervention, in which case the fiscal policy has significant results only with the positive coordination of monetary policy; under a floating exchange rate system, the fiscal policy has remarkable effects and the monetary policy has effects which are not uncertain. Finally, the paper analyzes the effectiveness of China's macroeconomic policy using the modified Mundell-Fleming model and proposes the orientation for China's macroeconomic policy in post-crisis period.

Keywords: Mundell-Fleming Model, Sub-prime Mortgage Crisis, Financial Crisis, Fiscal Policy, Monetary Policy

1 Introduction

In 2007, the financial crisis caused by American sub-prime mortgage crisis brought a great impact on Chinese economy through different channels. Many domestic and foreign scholars have made much research on the financial crisis's effects on Chinese economy and Chinese economic policy orientation in post-crisis era. Yiping H [1], Ping L [2] and Sanlin J [3] qualitatively analysed the impact of financial crisis on China's economy in post-crisis period, and proposed Chinese economic policy orientation to deal with the impact of financial crisis in post-crisis period; Rui C [4] analysed the effectiveness of China's fiscal and monetary policy using the Mundell-Fleming model (hereafter referred as M-F model) and proposed the short term, mid-term and long-term adjustment directions for the stable development of Chinese macro-economy under different foreign exchange system levels in the post-crisis period.

In the literatures above, there are some shortcomings in their analyses on the effects of financial crisis on Chinese economy. Most scholars analysed from the qualitative angle, but failed to make scientific judgments on Chinese economic policy orientation and the adjustment policy of macro-economy in post-crisis period. Rui C [4] added the fourth curve of full employment into M-F model based on the traditional M-F model and then analysed the effectiveness of Chinese fiscal & monetary policies. However, it is controversial

about whether the hypothetic conditions based on traditional M-F model are suitable for current situation of China. Boke J [5] believed the hypothesis that "the balance of international payments line (BP line) is a straight line with a positive slope" in M-F model did not conform to the reality of the country with asymmetric capital controls (such as China), so he modified the BP line of traditional M-F model. The modified M-F model hypothesis is under the asymmetric capital control, BP curve shows as a broken line and its slope relates to the control degree of capital inflow. Xiaohui L [6] studied the policy effectiveness and RMB exchange rate policy under FDI flows and assumed the net capital inflows K(i) formed by FDI was a linear function, which was different from the basic hypothesis of M-F model. The author believed that as to the equilibrium of foreign exchange market, M-F model mainly explored short-term capital flows, thus for the short-term capital, the interest rate is the measurement of returns on investment, so for short-term capital, interest rate is the measurement on the return on investment; while for FDI policy under the modified M-F model; the fourth part analyzes the orientation of China's macroeconomic policy in post-crisis period under different exchange rate systems; the third part is the analysis on the effectiveness of China's macroeconomic. This paper is structured as follows: the second part refers to the modification of M-F model and the analysis on the effectiveness of the fiscal and monetary policies.

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Capital utilizing domestic savings, domestic interest rate forms the capital cost of FDI. Jun Wu [7] modified M-F model using the dynamic purchasing power parity theory and examined the modified M-F model.

He pointed out the traditional M-F model's the hypothesis for BP curve didn't conform to Chinese reality; as the modified BP curve had a negative slope, the modified M-F model met Chinese reality. Delei Y [8] et al. believed that in modern economic society, the financial asset price fluctuation has become the most important factor affecting international capital flows in many cases. The price tendency of securities market and real estate market always changed in the direction opposite to that of interest rate, demonstrating the BP curve with a negative slope, thus extending & enriching the form of M-F model. Then they made an empirical test using the economic data of two groups amounting to 28 countries or regions.

This paper believes that the application of any economic theory and model has preconditions suitable for national situation. According to Keynes' foreign trade multiplier theory, the import volume of a country mainly depends on its national income. It means import is the increasing function of national income; while export is mainly decided by foreign income and independent of national income. Therefore, the increase in income may lead to the deterioration of current account. The paper considers the actual economic situation in China currently. Since American financial crisis, the import tariff of China has been decreasing continuously. From the start time of American financial crisis in 2007, Chinese economy in 2008 experienced a great decline comparing with that in 2007. From 2008, Chinese economy entered into a slowdown period, but the current account surplus continued and foreign exchange reserve increased greatly. These phenomenons obviously went against M-F model. Basing on the M-F model modified by the scholars mentioned above and considering that national export depends on not only foreign income but also domestic income, the paper adds the fourth curve of full employment in the modified M-F model to derive eight kinds of internal-external dual-imbalance of macro-economy which are used tools to analyse the internal & external imbalance state of China in post-crisis period. The paper studies the effectiveness of China's macroeconomic policy under the modified M-F model and proposes China's macroeconomics policy orientation in post-crisis period.

2 Modifications of M-F Model and the Analysis on the Effectiveness of Fiscal and Monetary Policies under Different Exchange Rate Systems

2.1 HYPOTHESES OF M-F MODEL UNDER CURRENT CHINA'S ECONOMIC ENVIRONMENT

2.1.1 China is in an incomplete open economic state now

In 2007, American sub-prime mortgage crisis became a global financial crisis soon, seriously impacting developing countries with comparatively low financial development levels. At the same time, the United States put pressure on Chinese RMB appreciation with the excuse of the huge trade surplus of China and China carried out the "double-surplus" open economic policy for a long time. The reason for all of these is trend of global economic integration around the world. As one of developing countries, China is in an incomplete economic situation more or less, so the financial crisis caused by American subprime mortgage crisis influenced Chinese economy to a certain extent.

2.1.2 Under current open economic conditions, the price elasticity is greater than the interest rate plasticity of capital flows in securities market (or real estate market) with capital flows [8]

The traditional M-F model assumes that the net capital outflow is in direct proportion to the differential between international interest rate and domestic interest rate. If not considering the factor of exchange rate, the higher the international interest rate is, the more capitals flow to foreign countries for benefit pursuit, the more the net capitals outflow is, the higher the domestic interest rate is, and the less the capital outflow is. According to the modified M-F model, in a country, when its domestic interest rate falls, its securities market price rises; when its domestic interest rate rises, its securities market price falls. In this case, the fluctuation of financial asset price has become the major factor affecting international capital flows, but interest rate changes are in the direction opposite to the price tendencies in securities market and real estate market [8].

2.1.3 National export depends on not only the foreign income level but also the national income level

According to Mundell, the import volume of a country mainly depends on its national income. To be specific, the import is an increasing function of national income; the export is mainly decided by the foreign in-come and independent of the national income, so income increase may cause the deterioration of current account. The paper believes that Chinese import & export volume has been among the top in the world for a long time. In the more than 30 years since reform and opening, especially the 10 years since entering into WTO, China has realized the best and fastest development. Over the past 10 years, China has become the second biggest economic entity and first export country in the world with a 30% growth in trades and a 10% growth rate of economy. Meanwhile, Chinese GNP was also in the front rank in the world. Under such background, Chinese economic growth contributed to the improvement of production technology and the reduction of production cost per unit, thus

causing the price falling of export commodities and the increase in gross volume of export. Therefore, national export is decided by not only foreign income but also national income.

2.2 DERIVATION OF MODIFIED M-F MODEL

Basing on the hypotheses above, we build models of product market equilibrium, money market equilibrium and external market equilibrium respectively for one country in an open economy.

2.2.1 Product Market Equilibrium Model

In an open economy, the condition for product market equilibrium is AE=Y. AE is the effective demand or total willingness expenditure on domestic products and services. It equals to the total expenditure of all domestic sectors, namely C+I+G, adds the domestic products and services purchased by foreign people, namely the export, and then subtracts the foreign products and services purchased by domestic people, namely the import M. The equation is as follows:

$$AE = C + I + G + NX = C + I + G + (X - M), \qquad (1)$$

where, AE can be expressed by the national income, Y, G means governmental purchase expenditure, I is private investment, X-M is net export, and C is the consumption depending on disposable income Y_d and is expressed as:

$$C = \alpha + \beta Y_d = \alpha + \beta(Y - t_0 + T_r), \qquad (2)$$

$$I = e - dr, \qquad (3)$$

where t_0 and T_r represent taxation and transfer payment respectively and are the exogenous variables of model. e is autonomous investment. d is the sensitivity of investment to interest rate. r is national interest rate level.

According to traditional M-F model, net export NX equals to export minus input, which depends on the national income and real exchange rate. Then the NX linear function of traditional M-F model is:

$$NX = NX(Y, R) = q - \gamma Y + \frac{nEP_f}{P}, \qquad (4)$$

where, Y is national income, Y_w is foreign income exclusive of national income, R is real exchange rate, q is autonomous net export, γ is the marginal propensity to import, EP_f/P is real exchange rate, and n is the net export change ratio caused by real exchange rate change.

The IS curve of traditional M-F model in open economic conditions can be derived from Equations (1), (2), (3) and (4) as:

$$r = \frac{1}{d}\left(\alpha + e + G + q - \beta t_0 + \beta Tr + n\frac{EP_f}{P}\right) - \frac{1}{d}(1 + \gamma - \beta)Y. \quad (5)$$

Considering the real macro-economy environment currently and basing on the third hypothesis above, the net export function can be modified as:

$$NX = NX(Y, Y_w, R) = q - \gamma Y + \frac{nEP_f}{P} + w(Y + Y_w), \qquad (6)$$

where Y, Y_w, R, q, γ, EP_f/P and n have the same meanings as above and w (>0) is the marginal propensity to export.

The expression of modified IS curve in open economic conditions can be derived from Equation (1), (2), (3) and (5) as:

$$r = \frac{1}{d}\left(\alpha + e + q + G - \beta t_0 + \beta Tr + n\frac{EP_f}{P} + wY_w\right) - \frac{1}{d}(1 - \beta + \gamma - w)Y \qquad (7)$$

Comparing the absolute values of slope of IS curve before and after modification, the slope after modification is less than the one before modification, indicating the IS curve becomes smoother after modification.

2.2.2 Money Market Equilibrium Model

LM curve represents the combination of interest rate and national income under the equilibrium of money market. M is nominal money supply, and h & k are both parameters representing the sensitivity of money demand to income and interest rate respectively.

$$\frac{M}{P} = M_s = M_d = L_1 + L_2 = kY - hr, \qquad (8)$$

$$r = \frac{k}{h}Y - \frac{1}{h}\left(\frac{M}{P}\right). \qquad (9)$$

2.2.3 External Market Equilibrium Model

According to the external market equilibrium principles in an open economy, the external equilibrium of a country means the BP account of the country keeps balanced, namely $BP = X - M - F = 0$. In the traditional M-F model, net capital outflow is $F = \sigma(r_w - r)$, where r is domestic interest rate, r_w is the international interest rate, and σ is the parameter representing the sensitivity of capital flows to interest rate. According to the second hypothesis above, the net capital outflow can be expressed as:

$$F = \sigma(R_w - R), \qquad (10)$$

where, σ is an parameter, R_w and R are the average rates of return of international and domestic securities markets or real estate markets respectively, and $\frac{\partial F}{\partial R} < 0$. When $R > R_w$, F is negative and represents the net capital inflow. Because the market is not always the same, generally $R_w \neq R$. In general, the domestic interest rate is a decreasing function of average rate of return of securities market or real estate market, namely $\frac{\partial R}{\partial r} < 0$. The functional expression is:

$$R = K - \mu r, \tag{11}$$

where, K and μ are parameters. Generally, $\mu > 1$. Put (11) into (10), we get:

$$F = \sigma\left(R_w - K + \mu r\right). \tag{12}$$

According to external market equilibrium principles, $BP = NX - F = 0$. The following equation can be derived from (6) and (12):

$$r = -\frac{1}{\sigma u}(w - \gamma)Y + \frac{1}{\sigma u}\left(q + n\frac{ER_f}{P} - \sigma R_w + \sigma K + wY_w\right). \tag{13}$$

Because $\sigma > 0$ and $u > 1$, $w - \gamma$ depends on the size of marginal propensity to export and marginal propensity to import of China in recent years. Through an empirical study on America and China from 1979 to 2002, Huaimin W [10] concluded that in China the marginal propensity to import was much greater than the marginal propensity to export. Xin Chen [10] drew the same conclusion through his empirical study on America and China from 1994 to 2007. Such is the fact. Chinese economic ranks in the world in recent years indicate the contribution of Chinese economic growth to world economic growth is much greater than the contribution of world economy to Chinese economy. Therefore, $w - \gamma > 0$, namely the slope of BP curve is negative. In the traditional M-F model, BP curve slop γ/σ is positive, while the slope of modified BP curve is negative, which is $-\frac{1}{\sigma u}(w - \gamma)$ with $w - \gamma < \gamma$. It means the BP curve of modified M-F model is smoother than the one of traditional M-F model, and the absolute value of the slope of BP curve of modified M-F model is less than that of traditional M-F model. w and γ are stable in a given period. Therefore, the slope of modified BP curve also depends on the product of capital flow degree (σ) and the sensitivity of domestic securities market or real estate market to interest rate u.

As shown in Figure 1, if a country is in the cross point of curves IS, LM and BP, it reaches a state with the

equilibriums of product market, money market and external market at the same time.

2.3 EIGHT TYPES OF MACROECOECONOMIC IMBALANCE IN MODIFIED M-F MODEL AFTER ADDING THE FULL EMPLOYMENT

In the open economy, macroeconomic control has two goals: full employment and international payment balance, regarded as internal balance and external balance respectively. To realize internal balance, output level should reach the one of full employment; while to realize external balance, the combination of output and interest rate should be in BP curve. As shown in Figure 1, the ideal case is that the economy is at point F, namely the internal balance of full employment and the external balance of balance of international payment are both achieved at the same time. Away from the equilibrium point, the imbalance, internal imbalance, external imbalance, or internal external double imbalance will be caused. There are two forms of external imbalance, balance of payments surplus and balance of payments deficit; there are also two forms of internal imbalance, economic depression and economic overheating. Considering the single imbalance and double imbalance together, there are eight types of imbalance for a country's macro-economy (as shown in Figure （3-10).
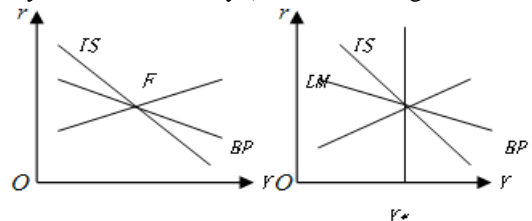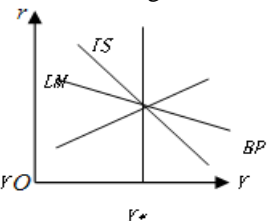

FIGURE 1 Internal-External   FIGURE 2 Double Equilibrium
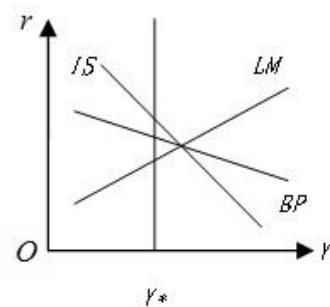Double Equilibrium   under Full Employment

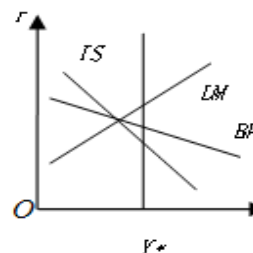FIGURE 3 Internal Overheating and External Equilibrium

FIGURE 4 Internal Depression   FIGURE 5 Internal Equilibrium
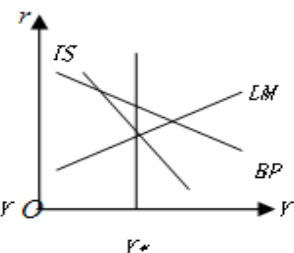and Equilibrium   and External Surplus
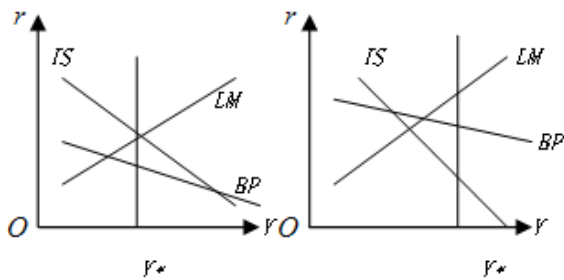
Operation research and decision making

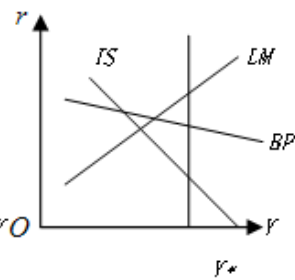FIGURE 6 Internal Equilibrium and External Deficit
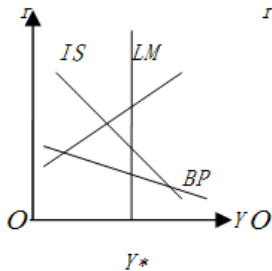

FIGURE 7 Internal and External Surplus

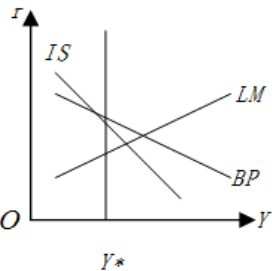FIGURE 8 Internal Depression and External Deficit

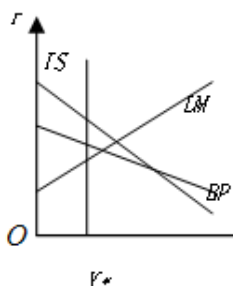FIGURE 9 Internal Overheating and External Surplus

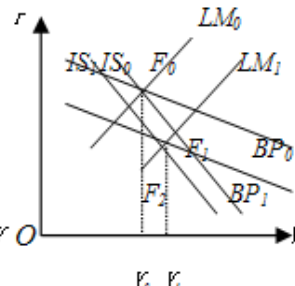FIGURE 10 Internal Overheating Monetary Policy and External Deficit Rate

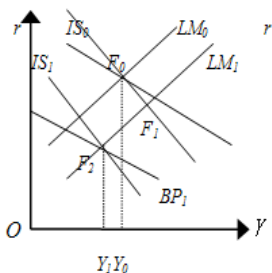FIGURE 11 Effect of Policy under Floating Exchange System I

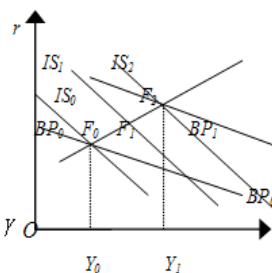FIGURE 12 Effect of Monetary Policy Floating Exchange Rate System II

FIGURE 13 Effect of Fiscal under Policy under Floating Exchange Rate System

2.4 ANALYSIS ON THE EFFECTIVENESS OF FISCAL AND MONETARY POLICIES UNDER DIFFERENT EXCHANGE RATE SYSTEMS

The M-F model provides an analysis platform for the effectiveness of macroeconomic policy under different exchange rate systems in open economic conditions. Under the floating international exchange rate system in current open economy, countries can choose the degree of floating when establishing the exchange rate system.

Whether a partial-floating or partial-fixed exchange rate sys-tem, it will impact the effectiveness of fiscal and monetary policies to different extents.

2.4.1 Fiscal and Monetary Policy Effect under the Floating Exchange Rate System

In the open economy, when a country executes a floating exchange rate system, the exchange rate is decided by the foreign exchange demand curve and foreign exchange supply curve jointly. The demand on foreign exchange is rooted in the import and capital transfer to foreign countries, while the supply is rooted in the export and capital transfer into the country. Therefore, when there is a surplus of external balance, namely BP>0, the supply exceeds the demand in the foreign exchange mar-ket and exchange rate decreases which indicates a pressure on currency appreciation. On the contrary, when there is a deficit of external balance, the exchange rate increases which indicates the currency depreciation.

First, we analyse the monetary policy under a floating exchange rate system. Set point F_0 in Figure 11 as the initial equilibrium point. The government implements an expansionary monetary policy. LM_0 moves to LM_1 and F_1 is in the area under BP curve. The balance of international payments surplus leads to the appreciation of domestic currency and thus reduces net export, in which case IS curve shifts to the left from IS_0 to IS_1 and BP curve also shifts to the left from BP_0 to BP_1, producing a new equilibrium point F_2. Comparing with point F_0 before government intervention, point F_2's interest rate decreases and the national income increases. However, if the appreciation of local currency leads to a significant decrease in net export, namely a high elasticity of exchange rate of net export, curves IS and BP may shift to left greatly, and the nation-al income may decrease after the implementation of policy, which is shown by F_2 in Figure 12. We can draw the same conclusion in the case that BP curve is steeper than IS. According to analysis above, under the BP curve with negative slope and the floating exchange system, the government's monetary policy has effects, but such effects are uncertain. Therefore, when adopting the monetary policy, the government should adjust the policy slightly and make further decisions according to practical effects.

Second, we analyse the fiscal policy under a floating exchange rate system. As shown in Figure 13, if the government adopts an expansionary fiscal policy to make IS_0 shift to IS_1, then the internal equilibrium point moves from F_0 to F_1. F_1 is above BP_0 curve, in which case the deficit of the balance of international payments and the depreciation of local currency exist to increase the net export, making IS curve move from IS_1 to IS_2, BP curve move from BP_0 to BP_1 and F_2 become the effective equilibrium point of fiscal policy under floating exchange rate system. It is obvious that under BP curve with negative slope and floating exchange system, the fiscal

policy has the significant effects. We can draw the same conclusion in the case that BP curve is steeper than IS curve.

2.4.2 Fiscal and Monetary Policies under Pegged Exchange Rate System

Under the fixed exchange rate system, the central bank establishes the exchange rate and promises to take measures to stabilize the exchange rate, which is generally achieved by buying and selling foreign exchange. When supply exceeds demand in the foreign exchange market, namely the tendency of increase in exchange rate, the central bank will sell the foreign exchange. Therefore, the nominal exchange rate will stay unchanged. Due to the assumption of fixed price, the real exchange rate stays unchanged, and IS curve & BP curve will not move because of the rise or decline of exchange rate.

We first analyse the monetary policy under the fixed exchange rate system.

Adopting the expansionary monetary policy as shown in Figure 14, LM_0 moves to LM_1, the interest rate falls, and then the securities market quotation rises and attracts international capital inflow. In this case, the balance of international payments equilibrium point moves from F_0 to F_1, causing the balance of international payments surplus and the appreciation of local currency. To maintain a fixed exchange rate, if continue to increase money supply, it will aggravate economic disequilibrium. According to the figure, if money supply decreases now, LM will return to LM_0, thus maintaining the fixed exchange rate and restoring economic equilibrium. But, if money supply decreases, it may cause the increase in interest rate and then restrain the price from rising in the securities market, and thus result in some international capital outflow and even part of domestic funds may flow into the international securities market to seek a higher rate of return. In this case, LM curve may move to LM_2, forming the balance of international payments deficit which will challenge the fixed exchange rate and government's policies again.

So we can see under the open fixed exchange rate system in the securities market, the effects of monetary policy always place the government into a dilemmatic situation. It is also the challenge faced by many emerging market economy countries after opening the securities market. Similarly, the tight monetary policy will lead to the same policy effect under the fixed exchange rate system, aggravating the instable and imbalanced situation of economy and increasing the difficulty of policy intervention.

Next is the analysis on the fiscal policy under the fixed exchange rate system.
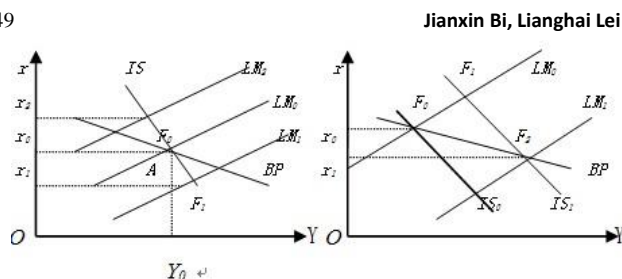

FIGURE 14 Effect of Monetary Policy Fixed Interest Rate

FIGURE 15 Effect of Fiscal under Policy under Fixed Exchange Rate

Adopting the expansionary fiscal policy as shown in Figure 15, IS_0 moves to IS_1 and the internal equilibrium point is F_1. The increase in income leads to the aggravation of current account, when interest rate rises and obstructs the securities market quotation causing international capital outflow, the aggravation of capital account and the balance of international payments deficit. According to the figure, to maintain the fixed exchange rate, the money supply should be enlarged to make LM_0 move to LM_1. The three curves intersect at point F_2, realizing the internal and external economic equilibriums at the same time. Due to monetary ease and interest rate decline, the environment of securities market is improved and then the capital account is improved, making the balance of international payments get better and even return to equilibrium. It indicates that, when the securities market becomes the major channels for the inflows and out-flows of international capital, the fiscal policy has significant effects with the positive coordination of monetary policy.

3 Analyses on the Effectiveness of Chinese Macroeconomic Policy with the Modified M-F Model

3.1 ANALYSIS ON INTERNAL AND EXTERNAL IMBALANCE OF CHINESE MACROECONOMIC SITUATION

The cyclical changes of Chinese economy have objective laws, which is also the inevitable result of the massive accumulation of contradictions during rapid economic growth. In addition, the financial crisis initiated by American sub-prime mortgage crisis further exposed the contradictions aggravated these imbalances among which the internal external economic imbalance is the most obvious.

Chinese economy has kept a double-figure growth in the five years from 2003 to 2007 and also has accumulated a lot of contradictions and problems, showing as the following four major imbalances.

First, economic growth excessively relied on export and the domestic demand is insufficient. The second imbalance is between the overheated investment and the inadequate consumption. The proportion of final consumption, especially household consumption, was too low. Third, the pressure of resource and environment are bigger and bigger. Resource and environment have

become the major "bottle-neck" for the sustainable growth of Chinese economy. Fourth, Chinese capital account and current account began to have double surplus since 1994. The great increase in foreign exchange reserves has brought pressure on the appreciation of RMB till now. The foreign trade surplus of China stayed at a high level from 2007 to 2010 after the sub-prime mortgage crisis. Such situation is different from those of general developing countries obviously. The high domestic savings led to the high domestic investment, and the high investment brought excess capacity which would find a way out abroad when facing the deficiency of domestic market demand, finally causing the expansion of general trade surplus [11].

Among the four imbalances, the imbalance of internal and external demands, the imbalance of investment and consumption, and the imbalance of long-term and continuous double surplus and high foreign exchange reserves are particularly significant, directly constraining the implementation of sustainable economic development strategy in China.

From the angle of unemployment rate, according to the data from the National Bureau of Statistics of China, the unemployment rate remained in the range of 3.6-4.3% from 2001 to 2010. It is the registered urban unemployment rate exclusive of the surplus labour in rural areas and the unregistered unemployment in urban areas. Therefore, the data cannot reflect the unemployment status in China accurately. If including these data, Chinese unemployment rate would be much higher than 4%.

In particular, affected by American financial crisis in 2007, Chinese export-oriented enterprises' ability to absorb employees declined significantly. Industrial restructuring and upgrading also affected small and medium-sized labour-intensive enterprises with a large employment capacity. The backward development of tertiary industry was weak in pushing employment, thus causing a severe employment status in China. According to the Blue Paper issued by the Chinese Academy of Social Sciences on December 16, 2008, the urban unemployment rate in China has rose to 9.4% and reached 14.2% in 2009.

According to the comprehensive analysis on Chinese macro-economy, from 2001 to 2003, Chinese economy experienced the external balance of international payments surplus and internal depression (as shown in Figure 7); from 2004 to 2006, Chinese economy experienced the external balance of international payments surplus and kept a growth state with full employment (as shown in Figure 5); in 2007, Chinese economy experienced the external surplus and its economic growth rate rose to a level higher than the growth of full employment (as shown in Figure 9); from 2008 to 2012, Chinese economy experienced external surplus and its economic growth declined to a level lower than the growth of full employment (as shown in Figure 7).

3.2 IS-LM-BP MODEL FOR CURRENT CHINA

3.2.1 Current Exchange Rate System of China

After the market-oriented reform of exchange rate system in 1994, China began to implement a single and supervisory floating exchange rate system based on market supply & demand. Due to the outbreak of Asian financial crisis in 1997, China declared that RMB would not depreciated against foreign currencies and made RMB tightly pegged to US dollar to fix the exchange. At this time, the International Monetary Fund (IMF) included Chinese exchange rate system into those to be strictly pegged. In July 2005, Chinese monetary authority adjusted the nominal anchor of exchange rate from pegging to US dollar to referring to currency basket, and implemented a managed floating exchange rate system. In July 2008, RMB began bilateral fluctuations and was trans-formed into the floating exchange rate system gradually. Therefore, it can be considered that the system implemented by China currently is a half-floating exchange rate system with some characteristic of partial fixed exchange rate system.

3.2.2 Slope Characteristics of Curves BP, IS and LM in the Post-crisis Period

Before 2005, China adopted a fixed exchange rate system that RMB was pegged to US dollar. Thereafter, RMB exchange rate system began to change, but the government still applied intensive intervention to the foreign exchange market and the annual fluctuation of RMB-dollar exchange rate is extremely small. It is regarded that the RMB exchange rate is actually a fixed exchange rate system "softly pegging to US dollar". Consequently, BP curve of international payment balance basically remains unchanged.

In the first half of 2005, the pilot reform of the foreign exchange administration of overseas investment was promoted to the whole country, greatly increasing the foreign exchange quota for overseas investment and further delegating the power of approval. On July 1, 2006, the State Administration of Foreign Exchange made great adjustments to the foreign exchange management of overseas investment. All of these show that the international payment balance curve (BP curve) of China will become smoother and smoother in the future. The analysis on modified model has shown that the modified BP curve is smoother than the traditional one.

The absolute value of unmodified IS curve's slope is $(1-\beta+\gamma)/d$, where β is the marginal propensity to consume, d is the sensitivity of investment demand to interest rate. Affected by American financial crisis in 2007, the Chinese resident's marginal propensity to consumption and investment demand's sensitivity to interest rate both became smaller, which decides that the slope of curve IS curve increases and IS curve becomes steeper. According

to model above, IS curve in the modified M-F model has a smaller slope than that of the unmodified IS curve, so the modified IS curve becomes a bit smoother after it becomes steeper under the influence of financial crisis.

According to the above model, the slope of LM curve is k/h, and k and h are decided by the money demand function of $M_d=Ky-hr$, where Ky is money transaction demand and $-hr$ is money speculative demand. After 2008, affected by American financial crisis, economic structures were adjusted all over the world. Under such a background, Chinese growth speed has slowed down compared with those in former years. People were willing to hold any amount of currency, in which case h becomes larger and LM curve thus becomes smoother.

From the analysis above, we know that BP curve and LM curve in the modified M-F model for China during 2008 and 2012 are both smooth and IS curve is steeper than BP curve and LM curve. See Figure 1.

3.3 ANALYSIS ON THE EFFECTIVENESS OF FISCAL AND MONETARY POLICIES OF CHINESE MACRO-ECONOMY IN POST-CRISIS PERIOD

3.3.1 Analysis on Fiscal Policy

A series of fiscal policies implemented in China these years can be illustrated by Figure 13.which shows the good effects of the fiscal policy. Before the outbreak of sub-prime mortgage crisis in 2007, China was in an overheated economic growth period with foreign trade surplus. The imbalance at that time is shown in Figure 9. To control the overheated economy, China continued to implement the moderate fiscal policy. From 2008 to now, due to American sub-prime mortgage crisis, Chinese economic growth declined greatly with continuous surplus of foreign trade. The imbalance state is shown in Figure 7. To achieve economic equilibrium, IS curve moves to the right, namely implementing the positive fiscal policy, in which case there is the balance of payment deficit, the domestic currency depreciates, and the net export increases to make IS curve shift to the right continually, then BP curve also shifts to the right and reaches a new equilibrium point. The specific analysis is shown in Figure 15. It is effective to implement the positive fiscal policy in the face of such an imbalanced state. The fact was also like this. China has implemented the positive fiscal policy since 2008. Especially, after the global financial crisis caused by American sub-prime mortgage crisis, China rapidly launched a series of measures to enlarge domestic demand and implemented the positive fiscal policy, which effectively curbed the tendency of economic decline. Similarly, from 2009 to now, China has been in the imbalanced economic state shown in Figure 7 and has adopted the positive fiscal policy. These fiscal policies push the economy shifting from the former imbalanced state to a new equilibrium point to effectively increase investment, promote industrial structure upgrading, stimulate the economic growth, change economic development mode, increase employment, and maintain the stable and rapid development of national economy.

3.3.2 Analysis on Monetary Policy

The analysis on the effect of Chinese monetary policy in recent years can made combing Figure 11, Figure 12and Figure 14. Because before 2002, China implemented a fixed exchange rate system under the partial-closed economic conditions and the implementation of Chinese monetary policy is relatively effective, the paper does not make a detailed analysis. Since 2003, Chinese economy has been in an incomplete open situation, but as Chinese entry into WTO, the economic openness has become bigger and bigger. According to previous analysis, China is implementing an incomplete floating exchange rate system, which is partial to the characteristics of fixed exchange rate system. Under such macroeconomic conditions, according to annual macroeconomic conditions at home and abroad, the central bank adopted a series of monetary policies according to the direction of monetary policy. The effect of monetary policy showed a decrease tendency, indicating the effect of monetary policy is characterized by disequilibrium in different economic environments. For instance, the imbalance state in 2007 due to the overheated economy and continuous surplus of trades is shown in Figure 9. According to the analyses above, to make the economy reach a new equilibrium and LM curve shift to the left, which means implementing the tight monetary policy to increase the interest rate, the securities market will meet with obstruction. In the meantime, there is international flight and the equilibrium point of international payments balance shifts to the left, in which case the international payment balance deficit leads to the depreciation of local currency. To maintain a fixed exchange rate, if keeping decreasing money supply, economic disequilibrium will be aggravated; if increasing money supply, LM will return to the position of LM_0, maintaining a fixed exchange rate and restore economic equilibrium. However, if increasing money supply, which causes the rise in price of securities market and some international capital inflows, the trade surplus will be further enlarged. Therefore, the effect of monetary policy may be implicit or ineffective, or even uncertain. Practice has proved that the tight monetary policy was adopted in 2007, including 10 times of the increase in deposit re-serve ratio successively, the 14.5% required reserves by the end of year, 6 times of increase in interest rate, and other series of tight monetary policies, but the successive adjustment of deposit reserve ratio and the increase in interest rate had no obvious effect. The increase in interest rate can restrain the overheated investment by increasing enterprise's financing cost and the outflow cost of deposit. However, the price rising at that time was mainly promoted by the cost of agricultural products, so the

action of interest rate increase alone could not add the supply of agricultural products, but might add other production costs and become the factor to push prices higher. Therefore, the monetary policy such as interest rate rise cannot achieve the ideal effect of money deflation.

To sum up the analysis combining the modified M-F model and the reality, the inefficacy of monetary policy is mainly shown in the following aspects: the easy monetary policy fails to avoid price falling; the effect of money supply on economic growth weakens; continuous interest rate decline has little effect on simulating consumption; the monetary policy has limited effects in promoting investment. There is limited space for the operation of monetary policy, especially under the background of global financial crisis. In addition, Chinese economy is facing internal economic structure imbalance and fierce external impact, thus having the risk of continuous decline in economic growth rate, and the central bank lacks the operation tools for an open market, so central bank's operation of monetary policy becomes more difficult.

Therefore, through the analysis in the paper with the principles of modified M-F model, the reasons for the unstable effect of Chinese monetary policy in recent years include: first, China is in a transitional period from the fixed exchange rate system to the floating exchange rate system. If we analyse the effectiveness of the monetary policy simply from the perspective of fixed exchange rate, we can see from the modified M-F model, the monetary policy may always aggravate the unstable and imbalanced situation of economy, thus increasing the difficulty in policy intervention. Analysing the effectiveness of the monetary policy simply from the perspective of floating exchange rate, the monetary policy has some effects, but with an uncertainty. Analysing the effect of the monetary policy of Chinese exchange rate system during the transitional period, we find economic intervention becomes more and more difficult, which is quite obvious in Chinese economic practice in recent years. Second, since Chinese entry into WTO, because of the trend of global integration of finance and economy, the open degree of Chinese economy has been increased constantly and the capital market such as securities and real estate began to show more and more characteristics of international capital market behaviours. On the other hand, the securities market and real estate market play more and more important roles in international capital flows and international payment balance. Therefore, implementing economic intervention in line with the market rules in the two markets should be an important part of the inter-national payment balance policy, and the effect on securities market should be taken into account when making the interest rate policy.

4 Chinese Macroeconomic Policy Orientations in the Post-crisis Period

Considering current macroeconomic background of China and basing on traditional M-F model, the paper modifies M-F model in the case that the traditional M-F model hypothesis are not suitable for Chinese macroeconomic conditions, to make the model applicable for the analysis on Chinese macroeconomic policy. The following conclusions are drawn through the analysis on the effectiveness of Chinese economic policy with the modified M-F model: under the floating exchange rate system, when the BP curve has a negative slope, the fiscal policy has significant effects and the monetary policy has effects which are uncertain to some extent; under the fixed exchange rate system, the monetary policy may aggravate the uncertainty and imbalance of economy and the increase the difficulty in policy intervention. When adopting the fiscal policy, the policy has more effects only with the positive cooperation of the monetary policy.

In conclusion, Chinese economy is experiencing the economic growth decline with a high unemployment rate and trade surplus. The economy is in an unbalanced status shown in Figure 7. Because China is in a transitional period from the fixed exchange rate to the floating ex-change rate under incomplete open economic conditions, the country should adopt the macroeconomic policy orientation dominated by the positive fiscal policy and supplemented by the monetary policy, adjust the monetary policy during implementation little by little and make further decisions considering practical effects. The adjustment process is shown in Figure 16. First to adopt the proactive fiscal policy, such as increasing government's fiscal investment in the projects under construction, the construction of indemnificatory housing, social security, employment and medical treatment, to make IS curve move to the right from IS_0 to IS_1 and the equilibrium point move from F_0 to F_1 of international payment balance deficit. Meanwhile, to keep Chinese exchange rate unchanged (based on current exchange rate system, rather than immutable), properly easy monetary policy, such as the interest reduction, the reduction of deposit reserve ratio and should be implemented for coordination to increase money supply. In this case, LM curve moves to the right from LM_0 to LM_1 and the intersection of IS_1 and LM_1 forms a new equilibrium point F_2, very close to the intersection of BP curve and employment curve. If the adjustment is proper and the internal and external equilibriums can be reached at the same time. It can be seen that the active fiscal policy has more effects with positive coordination of monetary policy.
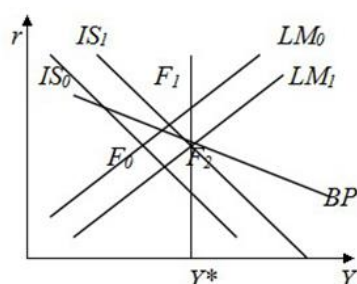
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FIGURE 16 Adjustment Process from Internal and External Imbalance
to Internal and External Balance

5 Conclusions

The sub-prime mortgage crisis occurred in America in 2007 caused a widespread financial crisis and profound economic crisis there and in developed economic entities. Because of its great impact on Chinese economy, China launched many fiscal and monetary policies to relieve the influence of financial crisis on economy. This paper proposed the hypotheses of M-F model applicable to current Chinese economic environment, modified the traditional M-F model and analysed the effectiveness of fiscal and monetary policies under different exchange rate systems. Conclusions are as follows: first, under the fixed exchange rate system, the monetary policy may aggravate the unstable and imbalanced situation of economy and thus increases the difficulty in policy intervention. The effects will be significant by implementing the fiscal policy with the positive coordination of monetary policy. Second, under the floating exchange rate system, the fiscal policy has significant effects, but the effects of the monetary policy are uncertain. Third, the paper uses the modified M-F to analyse the effectiveness of Chinese macro-economic policy and puts forward the policy orientation in the post-crisis period. Currently, China is in a transitional period from the fixed exchange rate to the floating exchange rate in incomplete open economic conditions and is experiencing growth rate decline, high unemployment rate and trade surplus. China should adopt the macroeconomic policy orientation dominated by the

positive fiscal policy and supplemented by the monetary policy. Furthermore, China should gradually adjust the monetary policy during implementation little by little and make further decisions considering practical effects.

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