

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(14), 2014 [7655-7661]

Monetary policy adjustment and macro-economy stability analysis based on new-Keynesianism monopolistic competition model

Fan Wang, Mingyu Yu

Changchun University of Science and Technology, Changchun 130022, (CHINA)

ABSTRACT

Monetary policy adjustment is functioning as a positive driving force for the stable development of our national macro economy. Currency market development has gone through 3 stages, the dual economy system to unification of exchange rates then to exploration of constructing rmb exchange rate management mechanism, which all had positive effects on the promulgation of our country's monetary policies. However, the reformation on foreign exchange management system, which has gradually stifled the initiative of monetary policies, is correspondingly playing an obstructive role in the fast development of our country's financial market. Thus, it is significant to do a test on the stability of currency market data. And this paper will produce a more convincing analysis process by means of the casual relationship study on the transition mechanism between different monetary interest rate systems and constructing the mathematical model of the short-term or long-term targets of policy tools.

KEYWORDS

Monetary policy; Macro economy; Model construction; Stability analysis.



INTRODUCTION

Through the development course of the monetary market in our country, it is easy to see the positive effects the monetary policy adjustment had on the macro economy in our country and the construction of the transition mechanism between different monetary interest rate systems, which further laid the foundation for the test on the stability of monetary interest rate data and also provided the firm theoretical basis for constructing the mathematical model of the short-term or long-term targets of policy tools. Study in the paper covered multiple aspects, the limitations on the initiative of china's monetary policy from the foreign exchange management system, data stability test, the granger casual relationship of the transition mechanism between interest rate systems, the construction of the mathematical model of the short-term or long-term targets of policy tools, to make sure the internal connections between monetary policy adjustment and stable macro-economy development are clearly expressed and meanwhile lay strong theory and data foundation for the scientific formulation of domestic exchange rate management system.

FOREIGN EXCHANGE MANAGEMENT SYSTEM STIFLED THE INITIATIVE OF CHINA'S MONETARY POLICY

The promulgation of our country's monetary policy has gone through the long-time reformations and development stages. With the accelerating pace of the reform and opening up, the reformation on economic system has gradually become an external factor for driving the economic growth in our country. And monetary policy adjustment has gradually become focused on foreign exchange management system, which has made foreign economic and trade gradually become the primary means to stimulate the economy. There are several significant stages in the development of domestic foreign exchange management system. First is dual economy period, 1981~1993; second is exchange rate unification period, 1994~2005; last is the period of exploration of constructing rmb exchange rate management mechanism, starting in 2005. Construction of the exchange rate mechanism determines direction of the reform and development of monetary policy. There are close connections between two of them. From the perspective of monetary policy, the important effects the macroeconomic regulations produced can be reflected in the increase and decrease of currency exchange rate, while the corresponding changes in currency exchange rates in turn influence the macroeconomic regulations^[1]. Therefore, recently the development pattern transformation and the development speed acceleration of China's market economy has gradually brought the negative effects out of monetary policy promulgation.

As the first economic mechanism of our country, the central bank which possesses the central economic management authority plays a vital role in the process of the economic management in our country. The corresponding national administrative organs have promulgated a serial of laws and institutions for the central bank to further engender the objectives of the monetary policy adjustment in early period, mainly between 1981 and 1993. However, during the reform of monetary policy and the unification of exchange rates, the major objective has become tended to maintain stable social economy development, keep the price steadiness, enhance employment, stimulate economic growth, finally achieve the economy balance. In addition, with the reform in domestic financial policies and institutions as a minor objective, a lot of challenges has been brought to the consistent increase in the mobility of macroeconomic regulation. For example, whether the monetary policy can have positive effects on our national macroeconomic regulation, whether it can produce positive influences on the monetary development goals of different stages, and meanwhile whether it can drive the perfection of monetary policy. Moreover, from the perspective of the development of bank system, the consistent increase in the mobility of macroeconomic regulation has gradually become the main content in monetary policy and meanwhile the managing on the financial enterprise liquidity has achieved a higher standard.

At a macroeconomic level, to accelerate the pace of the financial development in our country fundamentally lies in strengthening the open operation in financial market to make deposit reserve become an important tool dealing the financial problems and our national foreign exchange reserve capacity increase continuously and also to reduce the excess liquidity in financial industry, which, however, cannot solve the basic problem of excess liquidity in our national macroeconomic fundamentally^[2]. The so-called excess macroeconomic liquidity mainly refers to the currency quantity in circulation is too big, with an oversupply to market demand. The primary measure of excess liquidity is to compare growth rates of GDP and consumer price index with money supply. When money supply is over the sum of growth rates, the excess liquidity in our country's economic development will spontaneously emerge. Based on the national economic development data, China's GDP growth rates were systematically investigated, at the same time the corresponding statistics on China's consumer price index was also done. From the data, it is easy to see that only in 2 particular year money supply is less than the sum of growth rates of GDP and consumer price index, and in all other years money supply is over the growth rates sum, which reveals the long-term existence of excess economic liquidity, as shown in TABLE 1:

TABLE 1 : Economic Liquidity Status in China from 1994-2009

year	GDP million)	(100 GDP (%)	growth rate	CPI of last year	M_0 million)	(100 M_2 (%)	growth rate	Liquidity
1994	48197.9	13.1		124.1	46923.5	34.5		-2.7
1995	60793.7	10.9		117.1	60750.5	29.5		1.5
1996	71176.6	10.0		108.3	76094.9	25.3		7.0
1997	78973.0	9.3		102.8	90995.3	17.3		5.2
1998	84402.3	7.8		99.2	104498.5	14.8		7.8
1999	89677.1	7.6		98.6	119897.9	14.7		8.5
2000	99214.6	8.4		100.4	134610.3	12.3		3.5
2001	109655.2	8.3		100.7	158301.9	14.4		5.4
2002	120332.7	9.1		99.2	185007.0	16.8		8.5
2003	135822.8	10.0		101.2	221222.8	19.6		8.4
2004	159878.3	10.1		103.9	254107.0	17.6		4.5
2005	184937.4	11.3		101.8	298755.7	17.6		4.5
2006	216314.4	12.7		101.5	345603.6	17.0		2.8
2007	265810.3	14.2		104.8	403442.2	16.4		-2.3
2008	314045.4	9.6		105.9	475166.6	17.8		2.3
2009	340506.9	9.1		99.3	606225.0	27.7		19.3

DATA STABILITY TEST

Under the general condition of financial market development in our country, the monetary policy transmission ways are from several aspects. First is the interest rate effect of money; second is the exchange rate effect of money; third is the relative price effect of financial assets; last is the conduction effect of credit loan. However, in the financial development process in the contemporary society of our country, the development of interest rate market is slow and cannot form the market development. Besides, the construction of its benchmark interest rate system is still not perfect, which produced certain blocking factors to the conduction process of monetary policy in China. Back to 1996, the formulation and implementation of related monetary policy for interest rate market development had made the money market interest rate system have achieved its initial formation which covered commercial bank deposit, loan interest rates and short-term debt by interest rate. In this initial formation, there were still some incoordinations in the construction of its benchmark interest rate system, which weakened the scientificity and rationality of the transmission mechanism between each interest rate system^[3]. Throughout all the economic development theories in our country, in the continuous improvement process for China's financial market, the structure of interest rates for monetary contains certain difference, which is mainly reflected in the period of interest rate of money. The relevant adjustments on short-term interest rates have the influence to a certain extent on being long-time beneficial to development. Part of the influence is negative and part of it is also positive. As for different kinds of interest rates, the related adjustment on the benchmark interest rate can produce the corresponding effects on the fixation of other interest rates. Thus, commercial bank currency interest rate selection should be combined with the loan interest rate and recovery rate for a scientific selection, which makes the establishment of conduction mechanism can consistently be improved, at the same time can provide powerful support for carrying on the further exploration of it to lay the corresponding foundation for optimizing China's money market financial environment. The precondition of causality test is that data series should be stationary. The test results on the stationarity of each group of data are shown in TABLE 2.

GRANGER CAUSALITY RELATIONSHIP OF TRANSMISSION MECHANISM BETWEEN DIFFERENT INTEREST RATE SYSTEMS

The paper carries out the causality test on the transmission mechanism between different interest rate systems to provide the corresponding argument for the existence of specific causal relationship. The test based on daily data and monthly is able to engender further study on different interest rate systems of our national currency market. Through the specific statistics of 2 groups of data, it is revealed that bond market recovery rates, commercial loan rates and interbank offer rates can influence each other and also have interaction with the construction of different interest rate systems. The different changes, which had been seen in 3 interest rate systems from January 2002 to October 2010, have a direct relationship with their respectively different system constructions, which illustrates the causal cycle between 2 of them. This conclusion can be fully modified through the data in TABLE 3.

(1)Based on the test results of data in Tab.3, it is conclude that there is a causality relationship between the repo rates of 3 months, the mortgage rates of 6 months and the interbank offer rates of 1 month^[4]. Specifically, the changes on the

interbank rates of 1 month is due to the changes on the repo rates of 3 months. Samely, the changes on the repo rates of 3 months is due to the changes on the loan rates of 6 months. On the basis of the results above, it can be seen that the establishment of reverse transmission mechanism has remained some unreasonableness in the process of discussion on the transmission mechanism mentioned above. Consulting the test results of TABLE.3, it can be proved that the constructions of interest rate systems in our national currency market are not perfect and the transmission mechanism can not smoothly function.

TABLE 2 : Data series stationarity test table

	Test form <C T D>	Statistic T	Test conclusion	
Repo rate	R07D	<C 0 0>	-3.6895*	steady
	R14D	<C 0 0>	-3.2790*	steady
	R21D	<C 0 0>	-2.6735***	steady
	R01M	<C 0 0>	-3.1064**	steady
	R02M	<C 0 0>	-2.6749***	steady
	R03M	<0 0 1>	-11.9360*	steady
Interbank offer rate	C01D	<C 0 0>	-3.3550*	steady
	C07D	<0 0 1>	-15.4870*	steady
	C20D	<C 0 0>	-3.2945*	steady
	C01M	<0 0 1>	-14.4481*	steady
	C02M	<0 0 1>	-14.6068*	steady
	C03M	<C 0 0>	-3.6142*	steady
	B0ND	<C 0 0>	-3.4479*	steady
	B07D	<0 0 1>	-11.0691*	steady
	B14D	<0 0 1>	-14.8446*	steady
	B01M	<0 0 1>	-15.0762*	steady
Central ticket rate SHIBOR	B02M	<0 0 1>	-14.8664*	steady
	B03M	<0 0 1>	-40.8153*	steady
	B06M	<0 0 1>	-14.1423*	steady
	B09M	<0 0 1>	-13.3173*	steady
	B01Y	<0 0 1>	-14.5143*	steady
	S0ND	<C T 0>	-6.4845*	steady
	S01W	<C T 0>	-7.3147*	steady
	S02W	<0 0 1>	-6.9254*	steady
	S01M	<0 0 1>	-7.6691*	steady
	S03M	<0 0 1>	-8.6350*	steady
	S06M	<0 0 1>	-8.0060*	steady
	S09M	<0 0 1>	-9.4015*	steady
	S01Y	<0 0 1>	-9.6672*	steady
	Loan rate	L06M	<0 0 1>	-4.7663*
L01Y		<0 0 1>	-6.5780*	steady

TABLE 3 : Test table for causality relationship of monthly data

Original assumption	F statistics	P value
DR03M is not the Granger reason of DC01M	3.3206	0.0402
DC01M is not the Granger reason of DR03M	1.9639	0.1458
DL06M is not the Granger reason of DC01M	10.0708	0.0001
DC01M is not the Granger reason of DL06M	0.1775	0.8377
DL06M is not the Granger reason of DR03M	9.5990	0.0002
DR03M is not the Granger reason of DL06M	0.7891	0.4570

(2)As for the granger causality test on daily data, the causality relationship between 3-months central ticket rates and SHIBOR rate (TABLE 4) indicates that the transmission relationship between the two of them is not evident, which also shows that the SHIBOR interest rate is still a big gap away from money market benchmark interest rate.

TABLE 4 : Test table for causality relationship of daily data

Original assumption	F statistics	P value
DS03M is not the Granger reason of DB03M	1.6152	0.1995
DB03M is not the Granger reason of DS03M	1.2778	0.2792

In the constructions of different interest rate systems, it is easily seen that the transmission mechanisms between every interest rate systems, which has had some positive effects on great development of China's money market though, are not fully unobstructed. However, the urged improve is unignorable. The consistent increase in liquidity of monetary policies can no longer produce significant influences, which brought some of the obstacles between the monetary policies of our country and the national macroeconomic regulation.

THE MATHEMATICAL MODELS FOR LONG-TERM AND SHORT-TERM OBJECTIVES OF POLICY TOOLS

Mathematical models for short-term objectives of policy tools

Assuming time as ‘t’, the commercial bank legal reserve as ‘ $W_2(t)$ ’, excess reserve as ‘ $W_1(t)$ ’, circulating cash as ‘ $W_3(t)$ ’, cash deposit proportion as ‘ $C(t)$ ’, within the time ‘t’, required reserve ratio is $U_1(t)$, discount rate is $U_4(t)$. During the time period from U to $U+1$, the proportions of each amounts of securities in each turnover of the central bank that bought from or sold to commercial banks in the total turnover are $U_2(t)$, $U_3(t)$ and $a(t)$. η represents the concrete influence coefficient engendered through the influences the changes on discount rate had on the excess reserve. However, the central bank’s securities transactions with the commercial banks in the open market has produced certain effects on reloan and excess reserves of the commercial banks. Through all mentioned above, the constructed model is as follow:

$$w_1(t+1) = w_1(t) + \alpha(t)u_2(t) + u_3(t) + \eta(u_1(t) - u_1(t+1))w_1(t) \tag{1}$$

Through the study on legal reserve within the time period ‘t+1’, the resource for legal reserves consists of 2 parts. This first part is resulted from changes on reserve ratio. Assuming the total amount of deposits within the time ‘t’ as $M_1(t)$, then $W_2(t) = u_1(t) \times M_1(t)$. When $time = t+1$, reserve ratio = $u_1(t+1)$, legal deposit reserve ratio = $u_1(t+1) \times M_1(t+1) = (\text{reserve ratio} \times \text{legal reserve}) / \text{legal reserve ratio}$ ^[5]. At the same time, the amount of deposits do not change though. While another part of the resource for legal reserve is resulted from the influence on commercial bank deposits by effects on cash in circulation through open market operations. From t to t+1, with the direct securities transactions between the central bank and the public, the amount of change on cash in circulation is $(1 - a(t))u_2(t)u_1(t+1) / [C(t)+1]$ which can be calculated the following formula.

$$w_2(t+1) = u_1(t+1)w_2(t) / u_1(t) + c(t)(1 - \alpha(t))u_2(t)u_1(t+1) / [c(t)+1] \tag{2}$$

According the changes of the cash in circulation, the specific formula is stated as follow.

$$w_3(t+1) = w_3(t) + (1 - \alpha(t))u_2(t) / [c(t)+1] \tag{3}$$

The model (1) and model (3) are the mathematical modes for short-term objectives of policy tools.

Mathematical models for long-term objectives of policy tools

Model (1) and model (3) have only described the first step in the central bank’s regulation on monetary base. The changes on cash in circulation, legal deposit reserve and excess reserve inevitably bring the changes on excess reserve of commercial bank. At the time $t+1$, excess reserve of commercial bank:

$$[w_1(t+1) + w_2(t+1) - w_2(t)] / [w_2(t+1) / u_1(t+1)] \tag{4}$$

China's commercial banks implement the asset liability ratio and risk management, among which excess reserve is covered. The central bank is at any time monitoring on excess reserve of commercial banks^[6]. Assuming that when $time=t$, commercial bank determines the average excess reserve ratio at the time $t+1$ as $\gamma(t+1)$, its amount of change on reserve is:

$$\Delta w(t+1) = \gamma(t+1)w_2(t+1) / u_2(t+1) - [w_1(t+1) + w_2(t+1) - w_2(t)] \tag{5}$$

When reserve is not enough, commercial bank will adjust it through the recovery of loans from the public and security trades to reduce the public's cash by $\Delta\omega$. If deposit-cash ratio is C , $\Delta\omega/(C+l)$ comes from the cash in circulation, $C\Delta\omega/(C+l)$ comes from shifting savings out of cash. Considering deposit multiplier, the deposits in commercial bank will shrink by $m_0c\Delta\omega/(C+l)$ and the deposit reserve by $m_0c\Delta\omega/(c+1)$. When this part of the excess reserves all put to the public, the public cash will increase by the same amount, which once again causes the changes on deposits and cash in circulation. While the reserve is surplus, situation is just reversed. Assuming that the reserve of commercial bank is surplus and $\Delta\omega$ is all converted into public cash, the cycle is:

Commercial bank deposits	Reserve	Public cash	Cash in circulation
-----	-----	$+\Delta w$	$+\frac{1}{c+1}\Delta w$
$+\frac{m_0c}{c+1}\Delta w$	$+\frac{m_0c}{c+1}u_1\Delta w$	$-\frac{m_0c}{c+1}u_1\Delta w$	$-\frac{m_0c}{(c+1)^2}u_1\Delta w$
$-\left(\frac{m_0c}{c+1}\right)^2 u_1\Delta w$	$-\left(\frac{m_0c}{c+1}\right)^2 u_1^2\Delta w$	$+\left(\frac{m_0cu_1}{c+1}\right)^2 \Delta w$	$+\frac{1}{c+1}\left(\frac{m_0cu_1}{c+1}\right)^2 \Delta w$

Considering:

$$m_0cu_1/(c+1) \leq m_0u_1 = u_1/(u_1 + d + er + nr) < 1$$

The amount of change on reserve of commercial bank in the above formula:

$$\Delta w_2 = \frac{m_0cu_1}{m_0cu_1 + c + 1} \Delta w \quad (6)$$

The amount of change on cash in circulation:

$$\Delta w_3 = \frac{1}{m_0cu_1 + c + 1} \Delta w \quad (7)$$

The excess reserve of commercial bank finally:

$$w_1'(t+1) = \gamma(t+1)w_2'(t+1)/u_1(t+1) \quad (8)$$

The broad money supply M_2 :

$$M(t+1) = w_2'(t+1)/u_1(t+1) + w_3'(t+1) = w_1'(t+1)/\gamma(t+1) + w_3'(t+1) \quad (9)$$

For consistency in formulas, $w_3'(t+1)$, $w_2'(t+1)$, $w_1'(t+1)$ are still written as $w_i(t+l)$, $w_2(t+l)$, $w_3(t+l)$, through which (8),(9) can be described as a standard cybernetic model.

$$W(t+1) = f_1(W(t), V(t)) \quad (10)$$

$$M(t+1) = g_1(W(t), V(t)) \quad (11)$$

$W(t) = [w_1(t), w_1(t), w_3(t)]$ and $V(t) = [u_1(t), u_1(t+1), u_2(t), u_3(t), u_4(t), u_4(t+l)]$ (10) are state equations, and (11) is output equation. In the actual economic system, the above control variables must satisfy certain conditions which are listed as follow.

$$\begin{cases} u_1^0(t) < u_1(t) < u_1^1(t), 0 \leq u_2(t) < u_2^0(t), (0 < u_1^0(t) < u_1^1(t) < 1) \\ 0 \leq u_3(t) < u_3^0(t), u_4^0(t) < u_4(t) < u_4^1(t), (0 < u_4^0(t) < u_4^1(t) < 1) \end{cases} \quad (12)$$

The above variable parameters was determined according to the financial and economic situation at that time^[7]. The system formed by (10), (11) and (12) is a discrete-time nonlinear system with variable constraints, also as the model for long-term objectives of policy tools.

CONCLUSION

The above is the specific analysis in the paper on interrelation and interaction between the monetary policy adjustments and the stable development of macroeconomic in our country, which explored the influences on money exchange rate generated by the foreign exchange management system's limits on the initiative of Chinese monetary policy. Besides, the paper has carried out the scientific tests on currency data stationary, conducted relevant research on the granger causality relationship of the transmission mechanism between different interest rate systems and established the mathematical models for long-term and short-term objectives of policy tools, which has embodied the comprehensiveness of the study process of the paper.

REFERENCES

- [1] Zhang Huaping; Optimization Operations of Inflation Expectations, Policy Game and Monetary Policy, *Modern Economic Research*, **7**, 14-18 (2014).
- [2] Li Yi; Research On the Liquidity of the Transmission Mechanism of Monetary Policy in China and its Effectiveness, *Inner Mongolia Social Sciences*, **4**, 115-119 (2014).
- [3] Zhu Jun; Research on China's Fiscal Policy and Monetary Policy Rules Selection and Collocation, *Journal of Guangdong University of Business Studies*, **29(4)**, 4-13 (2014).
- [4] Xiao Qiang; Monetary Policy Tool Selection in Asset Price Regulation Based on MS-FAVAR Model, *Journal of Central University of Finance & Economics*, **7**, 23-30 (2014).
- [5] Liao Wei; Liberalization of Monetary Policy and Interest Rate in China. *International Economic Review*, **4**, 160-161 (2014).
- [6] Wang Dongming; Feasibility Analysis of the Regional Differences of Monetary Policy Operation in Our Country, *Wuhan Finance Monthly*, **5**, 9-12 (2014).
- [7] Wu Jiayu; Study On the Transmission Mechanism of Monetary Policy Through Real Estate Price, *Prices Monthly*, **7**, 15-18 (2014).