The McCallum Rule for Chinese Monetary Policy

Li Baoli

School of Management, Anhui Science and Technology University, Anhui, P.R.China, 233100
(E-mail: libao_li@yeah.net)

Abstract   With the development of market-oriented economic reforms, Chinese monetary policy plays an important role in the world. The objective of this paper is to review the recent conduct of Chinese monetary policy and the central bank's rule-based behavior in period 1999-2009 by estimating the monetary policy rules (monetary policy reaction function). This paper focuses on the McCallum rule, conducts the empirical study with Chinese data. The findings are that rule can describe Chinese monetary policy stance in some degree. This study includes five sections. Section 1 is the introduction.Section 2 is the short description of China's monetary policy. Section 3 indicates specifications of McCallum rule. Section 4 evaluates Chinese monetary policy performance utilizing models mentioned in Section 3. Section 5 provides conclusion.

Key words   McCallum rule; Monetary rule; Monetary policy; China

1 Introduction

The literature on monetary policy rules is related to the formal analysis of rules versus discretion by (Kydland and Prescott 1977), and there is now an ample literature on evaluating monetary policy by estimating simple policy rules. The literature on estimating monetary policy rules has focused predominantly on advanced economies, especially via the estimation of Taylor-type interest-rate feedback rules (see Taylor, 1993). In contrast, little such work has been done on developing or emerging economies. In this paper, we analyze the usefulness of the McCallum rule for the biggest emerging economy─China. As interest rates have not yet assumed a key role in the monetary transmission mechanism, the modeling of policy using a Taylor rule emphasizing short-term interest rates would hardly seem appropriate for China. In contrast, a monetary policy rule based on control of money supply, such as the one proposed by McCallum (e.g. McCallum 1988, 2003), would seem a viable alternative.

2 A Short Description of China's Monetary Policy

The stated objective of PBC (People's Bank of China) monetary policy is "to maintain stability of the value of the currency and thereby promote economic growth". Many studies note the absence of a major role for interest rates in the Chinese economy, as compared to the advanced economies. Even though the authorities actually set several interest rates (central bank lending rate, rediscount rate and benchmark rates for different maturities of deposits and loans), the interest rate channel has been ineffective for various reasons. For example, the liberalization of interest rates has advanced rather slowly, the banking sector has traditionally not been profit-oriented, and companies generally relegate interest costs to a minor role in their investment decisions.

Many studies note the absence of a major role for interest rates in the Chinese economy, as compared to the advanced economies. Even though the authorities actually set several interest rates (central bank lending rate, rediscount rate and benchmark rates for different maturities of deposits and loans), the interest rate channel has been ineffective for various reasons. For example, the liberalization of interest rates has advanced rather slowly, the banking sector has traditionally not been profit-oriented, and companies generally relegate interest costs to a minor role in their investment decisions.

Chinese authorities have generally been reluctant to use interest rates as a policy tool. Instead, they set annual intermediate targets for money supply growth (M1 and M2) and in recent years, the central bank has also announced a target for credit growth. The authorities have then controlled the money supply by setting the reserve requirement ratio and deciding on central bank lending, which used to be a significant part of commercial banks' financing. The PBC has also controlled market liquidity via open-market operations in treasury bonds, and since 2003 by selling central bank bills to commercial banks.

The authorities have also used administrative policy tools to guide financial sector developments in China. Until the start of 1998, credit plans formed the basis of bank lending. Even after the abolishment of credit plans, the authorities have continued to issue lending guidelines for commercial banks (window guidance policy). This policy, which includes the issuance of direct guidelines and orders to the

commercial banks, was intensified due to rapid credit growth in 2003 and again in 2007.

3 The McCallum Rule

Let us begin by discussing rule proposed in (McCallum 1988, 1993, 2000). This rule specifies the growth rate of the monetary base that the central bank should provide, rather than the value of the interest rate. It would be possible for the central bank to control growth of the monetary base, however, if it chose to do so. In any event, we can use this rule as an indicator of monetary policy ease or restrictiveness, even if the central bank is not operating so as to control the base growth rate.

The base growth rule in question can be expressed as follows:

$$\Delta m_t = \Delta x_t^* - \Delta v_t + \lambda(\Delta x_t^* - \Delta x_{t-1}) \tag{1}$$

The symbols in this equation are as follows:

Δm_t : Rate of growth of the monetary base, percent per year

Δv_t : Rate of growth of base velocity, percent per year, averaged over previous four years

Δx_t : Rate of growth of nominal GDP, percent per year

Δx_t^* : Target rate of growth of nominal GDP, percent per year

Where Δm_t is growth rate of base money, $\Delta m_t = \ln m_t - \ln m_{t-1}$, Δx_t^* is the target of nominal GDP growth rate. Δx_t^* is a constant and equals to the sum of inflation rate target and long-run average real GDP growth rate. at Δv_t is the average base money velocity (McCallum used the average of lagged sixteen quarter) and it is calculated by dividing base money variable into nominal GDP . $\Delta x_t^* - \Delta x_{t-1}$ is the nominal GDP growth rate deviation.

In terms of inflation target framework, base-money-growth-rate rule can also be understood as a kind of inflation targeting framework. If $\Delta x_t^* - \Delta x_{t-1}$ is regarded as the pressure on the inflation, when nominal GDP growth rate is bigger than the target, that is, the economy is overheated, the growth rate of base money will reduce. Therefore, McCallum rule can provide an automatic stabilizer for the macro economy.

In McCallum rule, there is only one target variable – nominal GDP growth rate. In terms of target variables, the rule does not reflect that base money responds to inflation directly, although Fisher Equation and lots of empirical studies indicate that money supply and inflation have high correlation coefficient

In order to solve the problem that McCallum rule does not reflect price stability reaction directly we modify eq. (1) as follows:

$$\Delta m_t = \Delta x_t^* - \Delta v_t + \beta(\pi^* - \pi_{t-1}) + \lambda(\Delta x_t^* - \Delta x_{t-1}) \tag{2}$$

Equation (2) indicates that when nominal output growth rate is greater than nominal growth rate target, the base money should be decreased in order to reduce the overheat pressure. Similarly, when inflation rate is greater than inflation rate target, money supply should be decreased in order to adjust the overheated economy.

4 Estimation of McCallum Rule for China

There are two methods to estimate the reaction coefficients of the monetary policy rule. One is calibration, that is, choosing different figures and testing which figures are the best to fit the actual interest rate or money growth movements. The other is to use the econometric analysis methods such as GMM, OLS and so on to estimate the response parameters.

In this paper, we utilize the methods of OLS to estimate McCallum rule rules mentioned in section 2. The data period is 1999-2009. The reasons why we choose data from 1999 is data availability.

4.1 Data analysis

Base Money Growth Rate (Δm_t*)*. Base money growth rate takes the form of log difference. $\Delta m_t \approx \ln m_t - \ln m_{t-1}$. From 1994, China begins to compile the statistics of base money. According to the PBC, the reserve money is the same as the base money and the statistics is consistent.

Velocity of Money (Δv_t). Based on Fisher equation $MV = PT$, the calculation of velocity can be obtained, that is $V = PT / M$. Because PT can be replaced with nominal GDP, the formula of velocity of money can be changed into $V = no \min alGDP / M$. The velocity of money in this paper is the velocity money of base money.

Nominal GDP Growth Rate (Δx_t). Nominal GDP growth rate takes the form of nominal GDP log difference. $\Delta x_t = \ln x_t - \ln x_{t-1}$.

Nominal GDP Growth Rate Target (Δx_t^*). The nominal GDP growth target equals to the sum of inflation target and long-run average real GDP growth rate. Since quarterly data of real GDP growth rate is available in China, we use the real GDP growth rate as the long-run average real GDP growth rate. Therefore, the nominal GDP growth rate target can be obtained by summing up the quarterly inflation target and quarterly real GDP growth rate.

Inflation rate (π). The inflation rate is measured by consumer price index CPI .

Inflation Target (π^*). The data of inflation target is Published by Chinese Government.

4.2 Unit root test

In order to avoid spurious regression, we conduct the unit root test first. We conduct ADF test for three variables –base money growth rate (Δm_t) , nominal GDP growth rate (Δx_t),Velocity of Money (Δv_t) . The results indicate that at the 1% and 5% level. Table 1 is the empirical results of ADF test.

Table 1   Empirical Results of Unit Root Test

Variable	ADF test value	1% Critical Value	5% Critical Value	Stationarity
Δm_t	-3.52	-4.420595	-3.259808	Yes
Δx_t	-4.06	-4.420595	-3.259808	Yes
Δv_t	-5.01	-4.420595	-3.259808	Yes

Through the table 3 reports the results of ADF test, we knew that the regression conducted by these three variables is not spurious.

4.3 The estimation of McCallum rule with Chinese data

$$\Delta m_t = \Delta x_t^* - \Delta v_t + \lambda(\Delta x_t^* - \Delta x_{t-1}) \tag{3}$$

We utilizes OLS method to estimate eq. (1). The regression result is as follows,

$$\Delta m_t = 0.95\Delta x_t^* - 0.107\Delta v_t + 0.098(\Delta x_t^* - \Delta x_{t-1})$$

$$(2.34) \qquad (1.38) \qquad (-2.35)$$

$$\bar{R}^2 = 0.35 \qquad\qquad DW=1.5$$

The regression result presents that the reaction coefficient of base money growth rate to nominal GDP growth rate deviation is positive (0.098) and statistically significant It seems that this is accorded with the principle that the reaction coefficient of McCallum rule should be positive. The positive coefficient means that when nominal GDP growth rate is bigger than GDP growth rate target, ceteris paribus, the growth rate of base money will decrease and this will hamper the increase of nominal GDP growth rate. In this sense, McCallum rule is determinate in China.

4.4 The estimation of the extended form of the McCallum rule

$$\Delta m_t = \Delta x_t^* - \Delta v_t + \beta(\pi^* - \pi_{t-1}) + \lambda(\Delta x_t^* - \Delta x_{t-1}) \tag{4}$$

Utilizing the OLS method, the regression results can be obtained.

$$\Delta m_t = -0.53\Delta x_t^* - 0.76\Delta v_t + 0.31(\pi^* - \pi_{t-1}) + 0.25(\Delta x_t^* - \Delta x_{t-1})$$

$$(-2.53) \qquad (2.28) \qquad (1.88) \qquad (5.24)$$

$$\overline{R}^2 = 0.95 \qquad\qquad DW = 1.8$$

The regression results indicate that reaction coefficient of base money growth rate to the nominal GDP growth rate deviation is positive (0.25). The reaction coefficient of base money growth rate to the inflation is also positive (0.31). Similar to the unmodified McCallum rule, we also can conclude that the extended form of The McCallum rule tends to be stabilizing in China.

5 Conclusion

In this paper, we have examined the usefulness of the McCallum rule for modeling the implementation of monetary policy for Mainland China. While earlier studies have emphasized the modest role of interest rates in the Chinese economy, monetary policy can plausibly be analyzed in the framework of a quantity-based McCallum rule. Moreover, the quantitative targets set by the People's Bank of China for money supply growth support the argument that monetary policy can be modeled by using money-based rules.

According to our analysis, the simulated McCallum rule accords quite well with actual growth of the base money since 1999, the extended form of The McCallum rule also tends to be stabilizing in China. Our results suggest that the McCallum rule could be a useful tool for analyzing the monetary policy stance and for providing information about inflationary pressures in the Chinese economy. The results could also be seen to lend support for the PBC's focus on monetary aggregates as intermediate policy targets. Both major targets of China's monetary policy-stability of the value of the currency and fast economic growth-have been simultaneously achieved since the mid-1990s. In the coming years, however, China will face new challenges as economic reforms are pushed forward. Partial privatization of the financial sector, a more flexible exchange rate and gradual liberalization of capital flows may reduce the effectiveness of quantitative monetary policy tools in the economy. Interest rates are likely to assume a bigger role as major operating targets for the implementation of policy - as is the case in advanced economies.

Reference

[1] McCallum B.T. Robustness Properties of a Rule for Monetary Policy[J]. Carnegie-Rochester Conference Series on Public Policy, 1988,29:173-203
[2] McCallum B.T. Japanese Monetary Policy: 1991-2001[J]. Federal Reserve Bank of Richmond Economic Quarterly, 2003,89(1):1-31
[3] Kydland F.E., Prescott E.C. Rules Rather than Discretion: The Inconsistency of Optimal Plans[J]. Journal of Political Economy, 1977,85:473-491
[4] Song Yuhua, Li Zexiang. The Empirical Study of Effectiveness of McCallum Rule[J]. Finance Research, 2007(5):49-61(In Chinese)