On the choice of monetary policy rules for China: A Bayesian DSGE approach

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\section*{ABSTRACT}

Motivated by the institutional features of China's monetary policy, this paper aims at identifying the most data favored monetary policy rule for China within a dynamic stochastic general equilibrium (DSGE) model framework. In a canonical New-Keynesian DSGE model, we carry out a positive analysis by employing Bayesian methods to estimate three main categories of monetary policy rules, namely a Taylor-type interest rate rule, a money growth rule and an expanded Taylor rule with money. Based on China's quarterly data from 1996Q2 to 2015Q4, our estimation shows that the expanded Taylor rule obtains the best empirical fit to the data. Moreover, impulse responses and forecast error variance decompositions demonstrate that monetary policy rules with or without money provide very different implications for the policy behavior. Our results ultimately suggest that money has so far been more closely targeted than nominal interest rate and still plays an important role as a monetary policy target in China. Furthermore, a conventional Taylor-type interest rate rule is not good enough yet to describe China's monetary policy behavior.

\section*{1. Introduction}

Ever since Taylor's (1993, 1999) seminal work, the Taylor-type interest rate rule has been recognized as a good way to characterize monetary policy behavior for the advanced economies such as the U.S. and Europe for the period from the post-World War II till the recent financial crisis. In almost the same period, New-Keynesian dynamic stochastic general equilibrium (DSGE) models have become the standard framework for monetary policy analysis and economic forecasting in both academia and policy institutions, see, e.g., Christiano, Eichenbaum, and Evans (2005), and Smets and Wouters (2007) among many others for the advanced economies. Within the DSGE framework, sophisticated monetary policy behavior is usually captured by simple rules such as the Taylor-type interest rate rule or the money growth rule\textsuperscript{1}. Both types of rules are reaction functions of intermediate targets of monetary policy, e.g., nominal interest rate or money growth rate, to the states of the economy and random policy shocks. However, whether such a rule-based DSGE framework can be simply used to analyze the developing countries, especially the largest developing country China where the financial system and the monetary policy are not fully market-oriented, is still unclear\textsuperscript{2}.

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\textsuperscript{1} We also refer to the Taylor-type interest rate rule and the money growth rule as price rule and quantity rule, respectively.
\textsuperscript{2} There exists a growing literature applying the rule-based DSGE framework to developing countries. For example, Ravenna and Natalucci (2008) explore the welfare implications of alternative monetary policy rules within a DSGE model built for emerging market economies, Ayşun and Honig (2011) study the vulnerability of developing countries such as Argentina to sudden stops of capital inflows and Mandelman (2013) analyzes the role of monetary policy subject to sizable remittance fluctuations using data for the Philippines.
Obviously, China as the largest developing country has its own unique features. Regarding the institutions for monetary policy, there exist huge differences between China and the advanced economies. The differences are not less obvious even compared with most developing countries. First, China’s central bank, i.e., the People’s Bank of China (PBoC), tries to realize more ultimate objectives than the advanced economies. Its multiple objectives include maintaining price stability, maximizing employment, promoting economic growth and achieving balance of payments equilibrium. Among these objectives, promoting economic growth has been widely recognized as the foremost objective of the PBoC under the leadership of the central government, as documented in Chen, Higgins, Waggoner, and Zha (2016). While for the industrialized country such as the U.S., price stability and full employment are most important. Second, although the PBoC adopted the growth rates of monetary aggregate as its intermediate targets in 1996, there exist ongoing debates on the intermediate targets of China’s monetary policy. The arguments mainly focus on whether the growth rates of monetary aggregate are still acceptable as intermediate targets given the unstable velocity of money during the past several decades, and which are the more suitable intermediate targets between the growth rates of monetary aggregate and the interest rates, see Xia and Liao (2001); Xie and Luo (2002), and Liu (2006) for more discussions. Third, as for monetary policy instruments, most advanced economies focus on the use of indirect tools such as short-term nominal interest rates, while China employs not only indirect tools but also direct tools such as specific central bank lending schemes and window guidance. For a more detailed review on the PBoC’s institutions, see Shu and Ng (2010), and Sun (2013).

Given the fact that China’s monetary policy is institutionally unique at least in the above-mentioned ways, to analyze it in the standard rule-based DSGE framework becomes a challenging task. Even so, the rule-based DSGE framework still becomes more and more popular in China’s monetary policy analysis during the past decade. However, there is no consensus until now on which type of simple rule can characterize China’s monetary policy better in the context of DSGE framework and the choices of which rule to use are rather arbitrary. For instance, Li and Meng (2006), G.Xu (2008), and Tong (2010) choose quantity rules while Xi and He (2010); W.Xu and Chen (2009), and Y.Ma (2015) choose price rules in their respective works. Meanwhile, given the fact that the PBoC has been undergoing a gradual transition from a quantity-based monetary policy framework to a price-based one, another line of literature has explored a hybrid monetary policy framework that contains both nominal interest rate and money growth as policy targets, e.g., Liu (2008), Liu and Zhang (2010), and Wu and Lian (2016).

As is known that the DSGE models with different policy rules may have qualitatively different implications, so if monetary policy analysis is based on an inappropriate rule, the corresponding results might be biased and misleading. Therefore, even though the results from the existing literature on China’s monetary policy analysis are interesting and illuminating in many different ways, without solid statistical justifications on the choice of policy rules, those results and implications cannot stand convincingly.

In this paper, we aim at starting from the unique institutional background of China’s monetary policy and identifying the most data favored monetary policy rule for China within the DSGE framework. In a canonical New-Keynesian DSGE model that most people are currently using, we employ Bayesian methods to estimate a Taylor-type interest rate rule and a money growth rule, respectively. In addition, we also estimate an expanded Taylor rule that includes money growth rate. Unlike Liu and Zhang (2010), Wu and Lian (2016), and etc., where separate rules are specified for nominal interest rate and money growth, we take a theoretically more sensible approach by specifying a unified single rule so that the central bank acts by adjusting a linear combination of the dual targets to achieve its policy goals. Under such rule, monetary policy behavior rests critically on the weight that the central bank assigns to each policy target. We then apply model comparisons to identify the monetary policy rule for China as the one with which the DSGE model obtains the best empirical fit to the data.

Based on China’s quarterly data from 1996Q2 to 2015Q4, the empirical results are threefold. First, the expanded Taylor rule is very strongly favored by the data relative to the price rule and the quantity rule. In the Bayesian framework, we refer to the Bayes factor as the indicator of empirical fit of a model. Our results show that the Bayes factors of the best fitting model versus the models under the quantity rule and the price rule are exp(23) and exp(76), respectively, both of which are very strong signals for the expanded Taylor rule being favored by the data. This captures the features of the ongoing reform of PBoC’s monetary policy as money and interest rate are both important policy targets during the transition period. Second, monetary policy rules with or without money provide very different implications for the policy behavior. For example, if the model is estimated with a price rule, the monetary policy shock turns out to be very ineffective in affecting output and inflation according to impulse responses. This finding echoes the argument in Li and Meng (2006). However, if the model is estimated with an expanded Taylor rule that is empirically more plausible, the monetary policy shock turns out to be more effective for output and inflation stabilization. From forecast error variance decompositions, the monetary policy shock turns out to contribute the most to the variation of output growth forecasts under a price rule. While under an expanded Taylor rule, the monetary policy shock becomes much less important for the variation of output growth forecasts. Meanwhile, the other shocks gain importance, especially the technology shock. Third, as long as money is targeted in the policy rule, our results demonstrate that the models under the expanded Taylor rule and the quantity rule are nearly indistinguishable qualitatively, especially when the inferences on output is the major concern, because their parameter estimates, impulse responses and forecast error variance decompositions are very similar to each other. This to some extent reflects that money has so far been more closely targeted by the PBoC than nominal interest rate.

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3 Similar monetary policy rules for the advanced economies have been estimated in the literature, e.g., Ireland (2001), Christiano, Motto, and Rostagno (2008) Polly (2010) Canova and Menz (2011), Li and Liu (2017). For China, Liu (2008) estimates a similar rule but the aim of that paper is not to identify the most data favored monetary policy rule for China by Bayesian model comparison technique as we do in this paper.

4 In general, a Bayes factor $B_{10}$ signals the evidence of the model $M_1$ against the model $M_0$. According to Kass and Raftery (1995), $B_{10} \in (1, 3)$ implies "not worth more than a bare mention" of $M_1$, $B_{10} \in (3, 20)$ implies "positive" evidence of $M_1$, $B_{10} \in (20, 150)$ implies "strong" evidence of $M_1$ and $B_{10} > 150$ implies "very strong" evidence of $M_1$. 

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