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China's regime-switching monetary policy☆

Jan Klingelhöfer[a], Rongrong Sun[b,*]

[a] School of Business and Economics, RWTH Aachen University
[b] School of Economics, University of Nottingham Ningbo China

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ABSTRACT

To understand Chinese monetary policy, we estimate a forward-looking Taylor-type monetary policy reaction function. The novelty of our paper lies in two aspects. The first is to use a composite overall indicator (the Sun-MP index) to tackle the measurement uncertainty and hence the model selection problem (i.e., a Taylor versus McCallum rule). The second is to capture nonlinearities in the PBC's policy responses with the multiple-regime threshold regression model. We find strong evidence that the PBC's policy reaction function is asymmetric during the post-2000 period and switches across three different regimes. When expecting high inflation, the PBC tightens by adjusting various policy tools; while facing an expected economic slowdown, it eases. However, it is tolerant to low inflation and economic overheating; it barely reacts to them. These findings highlight the importance of allowing for regime switches in modelling the policy response function of a "young" and fast evolving central bank in emerging countries like China.

1. Introduction

To understand Chinese monetary policy, this paper aims to find a policy response function that fits the data well. Quite often, the monetary-policy-making process is modelled with either a McCallum rule or a Taylor-type rule.[1] The general idea underlying these policy reaction rules is to describe how the central bank adjusts its policy in response to economic conditions measured with the reference to the policy targets.[2] Appropriate modelling of the central bank's response function has significant implications in two ways. First, these rules are widely used as a benchmark to understand and assess past policy-making, while without implying or requesting that the central bank mechanically follows these rules in formulating policies. Quite often, these rules, in spite of simplicity, work well; the estimates are a good match with the central bank's policy setting behavior (see, e.g., Taylor, 1993). They help to better understand the central bank policymaking process and hence toward a more transparent and effective monetary policy, as pointed out by Orphanides (2001). Second, appropriate specification of the central bank's reaction function captures its systematic response to economic conditions, hence the estimated error term in the response function can be interpreted as exogenous monetary policy shocks. Then, the estimation of their impact on the macroeconomy can solve the simultaneity problem inherent in the macroeconomic model, leading to unbiased estimates. It is the standard approach widely applied in the vector autoregression (VAR) literature (see, e.g., Sims, 1972; Bernanke and Blinder, 1992; Christiano et al., 1999).

The McCallum rule (McCallum, 2000) specifies the growth rate of the monetary base in a feedback rule for nominal GDP, while the Taylor-type rule is a simple interest rate rule, proposed by John Taylor (1993), which states that the central bank should set the short-term interest rate considering the variability of inflation and output. There are two main differences between them. First, they differ in what policy objectives to model. The former focuses on nominal GDP and the latter on output and inflation. Second, they differ in what instruments to model. The McCallum rule treats a monetary aggregate (say, base money or M1, M2) as the monetary policy instrument, while the Taylor-type rule treats an interest rate (say, the Federal Funds rate in the case of the Federal Reserve) as a policy instrument. These two feedback rules hence provide two alternatives to model the central

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* Corresponding author.
E-mail addresses: klingelhoefer@vwl1.rwth-aachen.de (J. Klingelhöfer), Rongrong.Sun@nottingham.edu.cn (R. Sun).

[1] Another simple monetary policy rule, the *k*-percent rule, is known as the Friedman rule, proposed by Milton Friedman (1960). That is, the stock of money increases at a fixed rate. However, the implementation of this rule heavily relies on a stable relationship between the money stock and final policy objectives such as output and inflation. Such a relationship does not hold stable since the 1980s due to deregulation of financial markets.

[2] For example, in the McCallum rule they are measured with deviation of nominal GDP growth from its target while in the Taylor rule they are gauged with deviations of inflation/real output from the target/potential.

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bank's policy decision process. The choice depends on which rule better describes operating procedures of the central bank of interest.

In the monetary history of advanced economies or in the current monetary operations of developing countries, central banks rely heavily on quantitative instruments (money supply) in implementing monetary policy. Hence, the McCallum rule is widely used to model their policy reaction (see, among others, Kapur and Patra, 2012; Damette and Parent, 2016). In contrast, it is widely believed that modern central banks in advanced economies adopt the standard one-instrument short-term interest rate operating procedure (at least, at normal times).[3] This also explains why the Taylor-type rule has attracted much more attention and has been widely used in empirical research to assess different central banks' polices as well as in theoretical research as an equation to model the systematic reaction of monetary policy to economic conditions (see, among others, Taylor, 1993; Clarida et al., 1997; Clarida and Gertler, 1997; Taylor, 1999; Clarida et al., 2000; Eleftheriou, 2009; Hayat and Mishra, 2010; Sánchez-Fung, 2011; Belke and Klose, 2013; Sznajderska, 2014; Ahmad, 2016).

In the Chinese context, studies have applied both types of rules to model the People's Bank of China (PBC)'s policy response function. For example, Burdekin and Siklos (2008) estimate a McCallum policy rule over the 1990–2003 period. They find that monetary policy was typically too tight until around 2001, and later too loose in 2003–2004. Sun et al. (2012) try to evaluate the feasibility of the McCallum rule as a policy guideline for China. Their findings suggest that following the McCallum rule could significantly reduce China's nominal GDP fluctuations. Zheng et al. (2012) estimate a forward-looking interest-rate rule over the 1992–2010 period, allowing for regime switching (modelled with Markov switching). They characterize the PBC's policy in two regimes. Jawadi et al. (2014) estimate both a Taylor-type (the policy interest rate) and a McCallum (a monetary aggregate) rule for the period of 1990–2008, allowing for nonlinearity. They find evidence for asymmetry and nonlinearity in the PBC's policy reaction function, arguing that inflation is the major driver of such nonlinear adjustment of the central bank rate while the GDP growth, the interest rate and the commodity price explain the responses of the growth rate of the monetary aggregate. Chen et al. (2016) estimate a Taylor-type monetary policy response function with M2 growth as an instrument, allowing asymmetry in response to different states of the economy (measured with output growth relative to its target). They find that monetary policy is designed to support real GDP growth to meet its target.

All these studies contribute to a better understanding of the PBC's monetary policy. However, a quick comparison of these studies suggests that using different types of rules leads to divergent conclusions. Discrepancy remains on how to model the PBC's monetary policy responses. As indicated above, these two rules model the adjustment of different policy instruments as the response to economic conditions. In the Chinese framework, the PBC uses multiple instruments to achieve multiple objectives. These instruments are both price- and quantity-based. In certain sense, this justifies the use of either the McCallum rule or the Taylor-type rule. However, none of these instruments can be described as the dominant instrument so as to be able to represent all others (see, e.g., He and Pauwels, 2008; Shu and Ng, 2010; Xiong, 2012; Chen et al., 2013; Sun, 2013, 2015a, b). Hence, focusing on one instrument might miss a lot of policy responses when the PBC chooses to adjust other instruments instead. It might imply a poor fit of the estimated models.

In this paper, we take a close look at the PBC's monetary policy in the period 2000–2015. We begin with an overview of Chinese monetary policy and the measurement problem. We tackle the measurement uncertainty problem by using the Sun-monetary-policy (Sun-MP, hereafter) index (Sun, 2015a) in estimating the policy response function. This Sun-MP indicator is a narrative index (derived through reading the PBC's historic documents), which measures the PBC's overall policy stance. The shifts of the policy stance can be reflected in the adjustments of all different instruments. Hence, policy responses to economic conditions would be better captured in the changes of this index.

To understand the PBC's policy behavior, we employ a Taylor-type reaction function framework where the PBC's mandate is modelled with output and inflation targets. We start with a linear reaction function. Our review of the PBC's policy suggests the possibility that it may have grown increasingly concerned with output when output negatively deviates from its long-run trend, and about inflation when inflation positively deviates from the target. Therefore, we extend our Taylor-type reaction in various dimensions to allow for this nonlinearity. Our multiple-regime threshold regression (MRTR), using two threshold variables (both output gap and inflation deviation), enables us to carefully examine the PBC's nonlinear reaction.

The novelty of our paper lies in two aspects. The first is to use the Sun-MP composite overall index to tackle the measurement uncertainty and hence the model selection problem (i.e., a Taylor versus McCallum rule). The second is to capture nonlinearities in the PBC's policy responses with the multiple-regime threshold regression model. We identify three different states of the economy: high inflation, low output growth and a Goldilocks period with low inflation and steady economic growth.

We find strong evidence that the PBC's policy reaction function is asymmetric during the post-2000 period and it switches across three different regimes. The policy priority varies across regimes. When expecting high inflation, the PBC tightens by adjusting various policy tools; while facing an expected economic slowdown, it eases. However, it is tolerant to low inflation and economic overheating: it barely reacts to them. These findings highlight the importance of allowing for regime switches in modelling the policy response function of a "young" and fast evolving central bank in emerging countries like China.

Our paper is organized as follows. Section 2 presents an overview of the PBC's operating procedures. Section 3 present our estimation results. Section 4 concludes.

2. PBC's monetary policy

The current monetary policy in China can be described as a multiple-instrument and multiple-objective operating regime, with the excess reserve ratio and the money market interest rate as its operating targets; growth rates of M2 and the new total bank lending as its intermediate targets (see, e.g., Zhang and Ji, 2012; Bell and Feng, 2013; Sun, 2015a, b). The PBC's policy objectives are threefold: price stability, economic growth, and financial stability, as defined in the People's Bank of China Act (amended in 2003) "to maintain the stability of the value of the currency and thereby promote economic growth" (Article 3) and to "guard against and eliminate systemic financial risk and maintain financial stability" (Article 2). To achieve various policy objectives, the PBC uses a mix of quantity- and price-based monetary and credit policy instruments, together with administrative tools. They include the open market operations, central bank lending, the interest rate, the required reserve ratio and window guidance.[4]

For example, Fig. 1 presents three selective policy instruments over the period of 2000–2015, including the required reserve ratio (RRR) and two interest rates (the benchmark lending rate[5] and the central bank lending rate to financial institutions (CBLR)). Changes in them are discretionary though the adjustments in the required reserve ratio turn more often in the post-2006 period. They do not necessarily co-move with each other. As reported in the figure, the correlation

[3] That is, those central banks use open market operations with short-term money market rates as the operational target.

[4] For more details, see Sun (2013) and Klingelhöfer and Sun (2017).

[5] The PBC used to exert direct influences on private saving and bank lending by setting benchmark deposit rates and lending rates (of various maturities), while commercial banks are allowed to adjust interest rates around the benchmark within a limited band. This direct control was gradually fading out with the last ceiling lifted on October 24th 2015.