New Evidence on the PBoC's Reaction Function

Makram EL-SHAGI – Yishuo MA***

Abstract

While policy reaction functions of most major central banks are routinely approximated by fitting Taylor (type) rules to their policy rate, there is no such consensus for the People's Bank of China (PBoC). What makes it hard to get a clear impression of the "true" reaction function is that most papers in the extensive literature focus on a single aspect of the reaction function typically mostly comparing it to one (or a few) widely used baseline models. Contrarily, we assess a broad range of questions regarding the reaction function in a unified approach, estimating several hundred reaction functions. While we find that no single policy measure fully captures all aspects of the PBoC's policy, our paper provides clear evidence for asymmetric behavior, support for an important role of monetary aggregates. There is robust evidence that the PBoC includes objectives beyond price and business cycle stabilization; more specifically, there is robust evidence that it responds to financial stability, considers its own macroprudential policy by flanking it with cushioning monetary policies, and stabilizes the exchange rate.

Keywords: *China, monetary policy, reaction function, Taylor rule*

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Introduction

Since the seminal paper by Taylor (1993), policy reaction functions of most major central banks are routinely approximated by fitting Taylor (type) rules to their policy rate, see Clarida et al. (2000), Hayat and Mishra (2010), and Consolo

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and Favero (2009) for some of the most prominent applications. However, there is no such consensus for the People's Bank of China (PBoC). Given that the PBoC is in charge of the world's second largest financial and monetary system, this gap in the literature is surprising. There is no lack of literature on the subject per se; however, different papers use a wide array of estimation methods, measurements of monetary policy, and objectives considered in their reaction function. Most of the literature deals with the question whether the PBoC is – and should be – focused on controlling interest rates or money supply. Zhang (2009) explores the money supply rule and interest rate rule, the results show that the price is likely to be more effective in managing the macroeconomy than the quantity rule. Sun et al. (2012) investigate the McCallum rule as a policy framework for China, concluding that its implementation could notably diminish the volatility of China's nominal GDP. Li and Liu (2017) find evidence that rules based on money growth describe Chinese policy better than interest-based Taylor-type rules, while Kim and Chen (2022) emphasize the movement away from monetary targeting towards interest rate-based policies. Zhang and Dang (2018) compare monetary supply rule and interest rate rule to explore Chinese monetary policy, incorporating survey-based expectations for inflation and real output. They find that expectations only play a significant role after 2008, and that the central bank of China promotes economic growth in a procyclical manner while maintaining a countercyclical policy for inflation.

Especially in recent years, quite a few papers have addressed asymmetries and regime dependency of the PBoC's behavior. Chen et al. (2016) utilize M2 growth to estimate a McCallum-rule, accounting for asymmetrical reactions to GDP growth depending on whether growth is above or below the target set by the central government. Jawadi et al. (2014) explore nonlinear Taylor-type and McCallum rules, finding asymmetry in the PBoC's policy response. They conclude that inflation drives the nonlinear adjustments of the central bank rate, while the central bank adjusts the monetary aggregate based on GDP growth, interest rates, and commodity prices. Zheng et al. (2012) employ a regime switching forward-looking Taylor rule, finding that China's monetary policy responses are well described by a two-regime forward-looking Taylor rule. Shen et al. (2016) define regimes based on inflation and real estate prices, and find that the PBoC responds rather hawkish in the high inflation regime, but focuses more on output in the low inflation (and low house price inflation) regime.

Other papers have focused on the broader set of objectives that the PBoC has traditionally considered compared to its Western counterparts. Unlike the focus on inflation stated in the ECB's mandate or the Fed's dual mandate (on employment and price stability), the PBoC "considers short-run and long goals, economic growth and price stability, and internal and external balance" according to its own

publications. The vague phrasing is deliberate, as the PBoC is not independent but a government agency (and indeed its governor is considered part of the cabinet). The PBoC is thus meant to support the current macroeconomic goals of the government that are evolving over time. Many papers have assessed some of the potential additional targets (beyond those included in Taylor and McCallum rules) that the PBoC might have pursued. Lu et al. (2022), among others, suggest that the PBoC has been intervening in the exchange market. Yan (2009) and Tan et al. (2022) have shown the importance of the real estate market to the People's Bank. Long et al. (2023) consider an (asymmetric) multitarget rule that adds the exchange rate gap, housing prices, and economic uncertainty.

The complexity of the PBoC's policy both in terms of objectives and instruments, has led some authors to doubt the feasibility of either interest rates or money supply as indicators of the PBoC's policy. One line of literature sees interest rates and monetary aggregates as independent aspects of monetary policy (rather than treating them different measures of one policy) and compare the effects of those policies, such as Wang et al. (2022) and Sui et al. (2022). In a similar vein, some papers argue that the PBoC uses different tools to meet different objectives. E.g., He and Wang (2012) and El-Shagi and Jiang (2023) differentiate between regulation based and market-based policy measures. Others focus on developing alternative (single) measures of Chinese monetary policy. He and Pauwels (2008) consider the monetary policy stance as a latent variable and analyze changes in China's monetary policy stance using the reserve ratio, policy interest rate, and open market operations as indicators. They conclude that inflation and money growth are the primary factors explaining changes in the monetary policy stance. Xiong (2012) adopts a method similar to He and Pauwels (2008), constructing a policy index based on the PBoC's monetary policy tools. By analyzing quarterly data from 2001 to 2010 using an ordered probit model, he finds that forward-looking inflation plays a crucial role in the determination of China's monetary policy stance. Similarly, Chen et al. (2017) construct a composite index that distinguishes monetary tightening, expansion, and neutral policy based on the PBoC's main policy instruments (which they consider to be the required reserve ratio, as well as the loan and deposit benchmark rates). In recent years, an increasing number of scholars have used the narrative based index developed by Sun (2015) to study China's monetary policy. Klingelhöfer and Sun (2018) use the Sun monetary policy index to show that since 2000, the PBoC's policy responses are asymmetric and switch between three regimes. The PBC tightens policies during high inflation, eases them during economic slowdowns, and shows minimal reaction to low inflation and economic overheating. This highlights the importance of considering regime changes in modeling central bank policies in emerging countries like China.

What makes it hard to get a clear impression of the "true" reaction function (or at least a good empirical approximation of the PBoC's behavior) is that most papers dealing with Chinese macroeconomic dynamics simply include one of the most common proxies in their model (typically a short-term interest rate or M2) and even papers on the reaction function, typically focus on a single aspect, mostly comparing it to one (or a few) widely used baseline models. This makes it hard to distinguish robust findings.

The lack of an intermediate target that the PBoC is committed to, the multitude of tools that are to some degree used to achieve different objectives, and the much larger degree of discretionary policy make it unlikely to find a policy rule that is as close an approximation to the true reaction function as the Taylor rule has been for the Fed before the zero lower bound period. Yet, an approximation that works reasonably well to capture policy (and in consequence, also policy surprises) is a fundamental building block for macroeconomic models that help us understand the Chinese economy.

Our contribution to this endeavor is to assess a broad range of questions regarding the reaction function in a unified approach. We estimate several hundred reaction functions, covering different policy measures, comparing backward- and forward-looking reaction functions, considering possible asymmetries, and including a wide range of possible objectives that the PBoC might follow. This allows us to gauge which features of a potential policy rule are robust across different potential measures of policy and which proxies of policy respond to macroeconomic fluctuations in an expected manner and thus plausibly reflect policy rather than endogenous, market driven responses. We deliberately focus on this one aspect of a macro model rather than comparing full-fledged models to allow us to consider this one facet in much more depth. With this approach, we are part of a recently emerging literature that is aiming to structure the vast and extremely heterogeneous literature on China.

Our approach is closely related to the model selection literature, such as Bayesian model selection done by Raftery (1995) or extreme bounds testing by Leamer (2018) and Sala-i Martin (2016). Yet, we cannot follow the approaches developed in this literature, since we are not only interested in which variables explain changes in monetary policy but also in what measures monetary policy. Thus, we do not only exchange the explanatory variables but also the dependent variable.

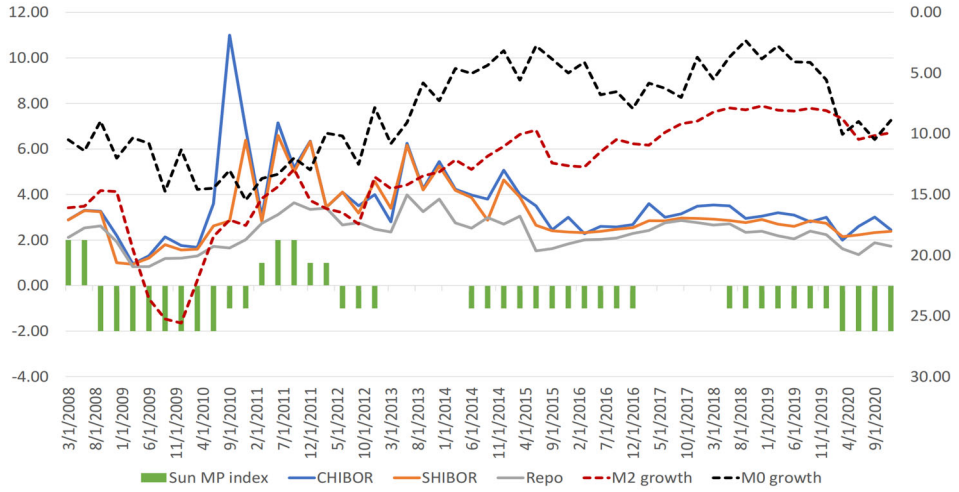
The rest of the paper is structured as follows. In Section 1, we present the data we use. In Sections 2 to 4, we estimate different monetary reaction functions, starting with Taylor and McCallum rules in 2, overrules utilizing narrative indices in 3 to asymmetric Taylor and McCallum rules in 4. Last section concludes.

1. Data

For our main specification, we employ quarterly data from 2005Q1 to 2020Q4. For the most simple specifications, where there are the least data availability issues, we also report results for an extended sample starting in 2001Q1 in the appendix. We consider three interest rates as possible instruments of the PBoC, the one-day Repo rate (R1dR) and two overnight interbank rates, namely 7-day SHIBOR and CHIBOR (Shanghai and China interbank overnight rates). While interbank rates have been widespread in the literature to proxy the PBoC's policy, Lien et al. (2019), Kerry (2019), and Ma et al. (2016) – where the main author is now in a leading position at the PBoC – discuss the PBoC's reforms aiming to make the repo rate the main policy instrument in the long-run.

F i g u r e 1

Different Measures of Monetary Policy



Note: Interest rates and the Sun MP index use the left-hand scale; money growth uses the right-hand scale. The right-hand scale is reversed so an upward movement reflects contractionary policy for all measures.

Source: Authors' computations.

Additionally, we use two money growth rates, M2 and M0 growth, to capture the possibility that the PBoC is still more focused on controlling monetary aggregates, as it has been traditionally (Li, 2019; Chen et al., 2018; Chen et al., 2016; Su et al., 2018). Yet, several papers argue that there is no such thing as a single measure of the PBoC's policy.[1] Therefore, we also use a narrative index developed by Sun (2015), that is based on an analysis of the PBoC's monetary policy implementation reports rather than looking at a single market outcome of monetary policy.

[1] See, e.g., El-Shagi and Jiang (2021) for a detailed discussion.

Figure 1 summarizes all 6 measures of monetary policy we include in our study. It is worth noting that money growth declined on average, and so did interest rate. The reduction in money growth is mostly driven by the "new normal" lower real growth path after the Global Financial Crisis. With lower economic growth, lower money growth is required as well.

For our backward-looking specifications, we use year-on-year CPI inflation and an estimate of the (real) output gap, based on the Hamilton filter (Hamilton, 2018).[2] As an alternative to the output gap, we also consider the gap between GDP growth target ($g^{*}_{X,t} = X_t - X_{t-1}$), where the superscript star denotes the targeted GDP, following the seminal work by Chen et al. (2018). Like for the US, the argument has been made that the PBoC is possibly following a forward-looking reaction function. Zhang and Dang (2018), Zheng et al. (2012), Fan et al. (2011), and El-Shagi and Ma (2025) find that shocks based on forward-looking models typically produce economically more plausible results.

Rather than using future realizations as expectation (implying rational expectations) and then using past values as instruments in a GMM approach, we use actual forecasts for our forward-looking versions of the policy rule. As first mentioned in Orphanides (2003) and discussed in more depth by Jung (2018), this allows us to omit GMM (which would be problematic in a sample of our size). Even though this would technically allow the inclusion of forward and backward-looking values simultaneously (which is impossible in the previously mentioned GMM frameworks), the multicollinearity problems are so pronounced that this is, in practice, not feasible, especially in a limited sample such as ours.

Our primary indicator for inflation expectations is survey implied expectations (based on the People's Bank of China's inflation expectation survey). Around 20,000 Chinese households across 50 different cities are surveyed in each quarter of a year (in February, May, August, and November). To make sure that they use the same scale as the other policy functions (and the coefficients are thus comparable), we generate rolling window (one-year-ahead) forecasts of our inflation measures on the corresponding surveys following Qingyuan et al. (2015). As a robustness check, we also consider professional one-year-ahead forecasts (obtained from Bloomberg), which are available for a shorter sample.[3]

[2] As a robustness test, we also run our estimations the more commonly used HP filter, which has been subject to increasing criticism in recent years. The results are qualitatively similar and available on request. Previous versions of this paper used a recursive filter only using information up to *t* to estimate the output gap in *t*. However, given the low growth volatility in China and our relatively small sample the end of sample bias essentially removes too much information in the current economic situation, that is most likely available to the central bank.

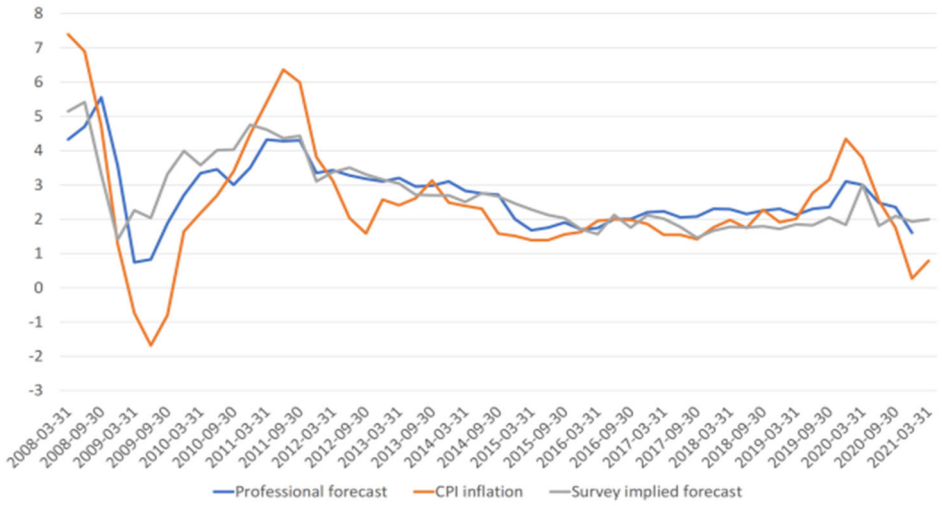
[3] We also experimented with forward-looking output gaps. However, forecasts and surveys typically expect a return to trend, yielding forward-looking output gap estimates with extremely low volatility and barely correlated to the actual output gap.

Figure 2 shows all three measures for inflation (expectations) in the left panel and the output gap in the right panel. Inflation forecasts are not leading inflation most of the time, but typically co-move with inflation and are slightly less volatile.[4]

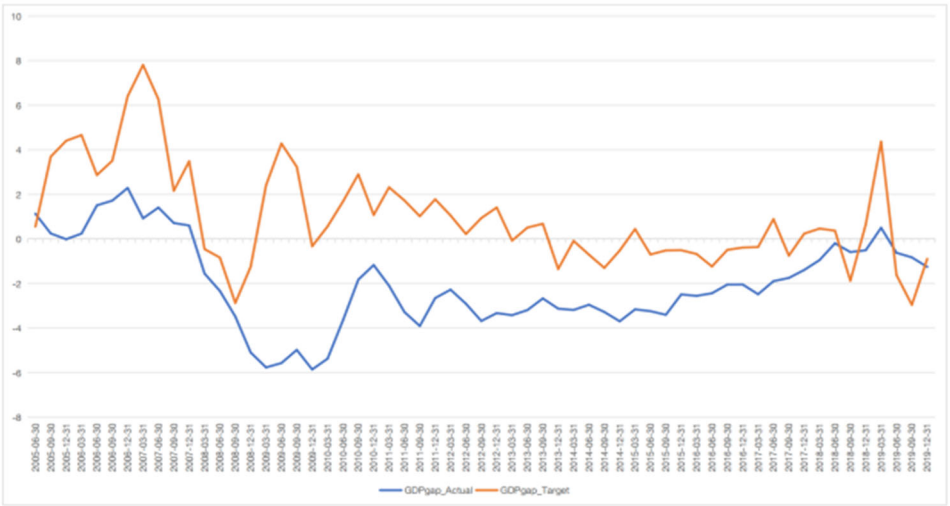
F i g u r e 2

Key Drivers of Monetary Policy

(a) Inflation Measures



(b) Output Gap Measures



Source: Authors' computations.

[4] Previous versions of this paper also included a forward-looking output gap. However, since growth forecasts typically predict a shrinking output gap, the resulting forward-looking gap exhibited an implausibly low variance.

We include four additional variables to capture potential further objectives of the PBoC. Three of these are measures of financial stability based on the housing price, non-performing loans, and shadow banking. While bad loans are possibly the most general indicator of financial stability, the PBoC is known to have focused on combating both exuberances on the real estate market and shadow banking (which was growing fast in China) in recent years, making those indicators particularly interesting. Finally, we include the growth rate of foreign reserves to proxy for exchange rate pressure. The variables described above are summarized in Table 1.

T a b l e 1
Summary of Variables

Types	Meaning of variables	Symbol	Available from
Monetary policy	one-day Repo rate	R1dR	before 2001
	7-day SHIBOR	SHIBOR	2006
	7-day CHIBOR	CHIBOR	before 2001
	M2 growth rate	M2gr	before 2001
	M0 growth rate	M0gr	before 2001
	sun-index	sun-index	
Price level indicator	year-on-year CPI inflation	πa	2005
	professional forecasts (Bloomberg)	πB	2007
	survey implied forecast (PBoC)	πP	2001
Business cycle indicator	real output gap	*	before 2001
	GDP growth target gap		before 2001
Financial market indicator	foreign reserve growth rate	FRgr	2005
	non-performing loans	FSSN	2005
	shadow banking	FSSS	2005
	housing price	FS	2005

Source: Authors' computations.

2. Taylor and McCallum Rules

2.1. Taylor Type Rules

The Model

Our starting point is a set of Taylor type rules with interest rate smoothing and – for some versions – additional objectives beyond maintaining price stability and mitigating business cycle fluctuations.

$$r_t = \alpha r_{t-1} + (1-\alpha)(\beta_1 \pi_t + \beta_2 y_t + BX_t) + \varepsilon_t \tag{1}$$

where r is an interest rate, π and y are indicators of inflation and output gap, X is a vector of additional explanatory variables, and t is the time index. α is the interest rate persistence (or smoothing parameter), and the βi and B are the long-run responses. Due to the previously discussed debate about the adequate interest rate to reflect the PBoC's monetary policy, we consider all three standard choices in the

recent literature. Our main analysis focuses on the Repo rate and the CHIBOR. Robustness tests using the SHIBOR, which is only available for a shorter sample, are found in the appendix. While a direct comparison of likelihood between models with different dependent variables is, of course, futile, this allows us to assess (a) the robustness of the objective function across different measures of the policy stance and (b) the economic plausibility of reaction functions using different policy variables.

Similarly, we use different indicators of π and y. For the inflation, we use year-over-year CPI inflation (as a backward-looking measure) and survey-based inflation expectations reported by the PBoC (as forward-looking measure).[5] For our robustness test, we also add the professional inflation forecasts reported by Bloomberg, which are available for a shorter sample period as alternative forward-looking measure. Since the professional forecasts are not reported at a consistent four-quarter ahead horizon but for "this year" and "next year", we form weighted averages to combine implicit four-quarter ahead forecasts.

As output indicators, we use the output gap, estimated with the Hamilton filter, and the growth gap, i.e., the difference between economic growth and the growth target set by the central government, as suggested in the seminal work by Chen et al. (2018). Note that we refrain from using forward-looking measures for the output (or growth) gap. Output is extremely stable in China, and output expectations thus are too close to potential output to have meaningful variation. For the same reason, we do not use pseudo-real-time estimates of the output gap. The already low volatility of Chinese output combined with the end of sample bias of typical filters essentially removes most information.

For all combinations of r and the vector $[\pi\ y]$, we consider seven different reaction functions. In addition to the baseline model with merely the smoothing parameter, inflation and output, we add one of three different (lagged) financial stability indices (reflecting house prices, bad loans, and shadow banking), or – to proxy the role of exchange rate stabilization which is often considered to be relevant for China – the lagged growth of foreign reserves. For the interest rate models discussed in this section, we also alternatively add lagged money growth to see if the interest rate adjustments serve to adjust an underlying money growth target. In a final model, we add all five indicators simultaneously. Note that all additional indicators are considered in lagged form. With all of them being financial market indicators, the exogeneity assumption that we use with regard to current inflation and output gap seems inappropriate.

[5] The survey indicator is rescaled to match inflation by using a regression of CPI inflation (four quarters ahead) on the survey and then using the predicted values (i.e., linear predictions only produced from the information of the survey) instead of the index itself.

Again, this is following the standard assumptions of monetary VARs, in particular, the block recursive identification pioneered by Christiano et al. (1999), where monetary policy is wedged between the slower responding macroeconomy and the faster financial sector.

Results

The baseline results for our full sample are summarized in Table A1. Compared to the U.S., where the literature typically finds a persistence parameter α that is close to 1 (and indeed, the claim has been made that interest rates are not stationary), we find α to be around 0.4 for CHIBOR and around 0.7 for the Repo rate. This bears witness to the fact that, unlike the Federal Funds rate in the U.S., China does not have an official intermediate target. While that does not necessarily imply that there is no interest rate that is a valid measure of policy, it generally makes interest rates much more volatile. However, even if a central bank is not de facto fixing a specific rate (as the Fed does with the Fed Funds rate), even the mere fact that a central bank considers a specific interest rate in its policy-making should give some persistence to that interest rate. While not being conclusive evidence, this points to a comparatively more important role of the Repo in the PBoC's deliberations.

All measures of inflation (or inflation expectation) have a significant positive impact on the interest rate, as is to be expected when interpreting our regression as reaction function.

However, we always find $\beta \leq 1$. Those coefficients indicate an extremely "dovish" monetary policy, as it does not create an increase of the real interest rate in response to inflationary pressure. Yet, China does not have exploding prices by any means. An alternative explanation to reconcile those seemingly contradictory observations is the high degree of regulation of the Chinese financial market. The PBoC has relatively tight control over the banks particularly over state-owned banks that make up the lion's share of the market. That means that it is well possible that there is no single interest rate to look at. While the interest rates we look at are the main short-term interest rates to describe the financial market, they are not the interest rates that directly determine the investment costs. If the central bank simultaneously addresses liquidity in the banking sector and imposes additional restrictions on the credit market, the interest rates that entrepreneurs are exposed to might satisfy the Taylor condition. Yet, unlike financial market rates, those interest rates, which are partly based on over-the-counter business with individual companies, are not easily observable in the short-run. In other words, if the PBoC is considering "the" interest rate in its policy-making, more likely than not, it is a financial market rate like the ones we included in our model.

We find no robust evidence that the output gap matters for the interest rate. While surprising, it should be kept in mind that this does not necessarily indicate that the PBoC is indeed ignoring the business cycle, but is probably merely due to the short sample.

The fit of the Taylor rules does not change much depending on whether we use a forward-looking version or not. However, the fact that professional forecasts yield long-run coefficients on inflation that are considerably higher (and closer to 1) provides some evidence for forward-looking rules.

The results all hold in the shorter sample starting 2005, both for the baseline model and the extended versions of the model, as can be seen in Tables 2 and 3.

In this sample, where financial market indicators are available, we find a fairly robust reaction to shadow banking and – to a slightly lesser degree – to bad loans. The PBoC seems to aim to stabilize the credit market by reducing interest rates if the number of bad loans increases (which is a reduction in the corresponding stability index). Contrarily, a reduction in shadow banking (i.e., an increase in the corresponding stability index) causes lower interest rates. This is possibly driven by the fact that the fluctuations in shadow banking are largely driven by the PBoC's regulation itself and are often accompanied by monetary policy that compensates the effects on liquidity provision. I.e., macroprudential policy, targeted at eliminating shadow banking, was typically flanked by expansionary traditional policy.

SHIBOR results (in a sample starting 2006) by and large match CHIBOR results at least qualitatively (see Table A3) and results using Bloomberg inflation forecasts (in a sample starting 2007) roughly match the results using the PBoC inflation forecasts (see Table A4).

For reference, the baseline results for Taylor rules without smoothing are reported in Tables A6 in the appendix. Compared to the smoothed model, the output gap becomes significant in the regression results using CHIBOR and SHIBOR, but the fit of the regression model decreases. This is mainly due to the fact that the effect of the output gap is magnified in this case, which makes the output gap become more significant in the results. This suggests that the smoothing response function is more reasonable.

2.2. McCallum Rules

The Model

We set up our extended McCallum rules matching the general design of our estimated Taylor rules, i.e., we include smoothing (and thus estimate long-run coefficients), inflation, and output gap as main objectives and a set of additional potential objectives, yielding the following equations:

$$\Delta m_t = \alpha \Delta m_{t-1} + (1-\alpha)(\beta_1 \pi_t + \beta_2 y_t + BX_t) + \varepsilon_t \quad (2)$$

where the definitions match those given for Equation 1, and Δm is the first difference of log money stock. We use two monetary aggregates. First, and in line with the literature, we use broad money, M2. Additionally, we consider base money M0. While there is little reason to believe that a central bank targets M0 rather than broader monetary aggregates, control over base money is much tighter, and thus it might be a valid intermediate instrument.

We use the same sets of indicators for inflation and output gap and the same additional indicators – with the obvious exception of lagged money growth, which is now simply the lagged endogenous – i.e., financial stability and reserve growth.

Results

The results of the basic models estimating McCallum type rules based on M2 and M0 from 2000 are summarized in Table A2. Interestingly, while we find plausible reaction functions for M2,[6] we do not find the same for M0. In particular, M0 neither responds to inflation nor inflation forecasts, and we only find a significant response to the growth gap but not output gap itself. This is noteworthy because, typically, central banks should have closer control over the money base. One factor that might play a role here is that the PBoC – unlike the Fed or ECB – still has a binding reserve ratio that it regularly adjusts as part of its policy. Given the mismatch between M0 and M2 based results, it seems that the PBoC is more actively controlling the money multiplier than base money, even though conducting policy that is focused on monetary aggregates. Another potentially relevant factor is the increasing relevance of digital payment systems, that rendered cash largely obsolete and thus increase the "distance" between the monetary base and the assets actually used as money.

For M2 growth, the results are largely aligned with what we find for Taylor rules. All measures of inflation consistently lead to contractionary policy. We consistently find a negative but insignificant impact of the output gap on money growth. Since the demand side effect of income on money growth should be positive, this indicates money supply (or rather the monetary policy function) dominates the correlation between output gap and money, supporting the idea that the PBoC indeed focuses on controlling M2 supply, even in the most recent decade. Similarly, we find a coefficient of the growth gap that is significantly lower than 1, i.e., not fully accommodating the increase in money demand and thus being contractionary.

[6] Note that a coefficient of less than 1 on GDP growth is sufficient to make the response of policy to growth contractionary, as this implies that money supply is growing slower than money demand.

Table 2

CHIBOR Based Taylor-rules (starting in 2005)

Policy variable	**CHIBOR**																												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
Constant	1.362***	1.480**	1.341***	2.207***	1.908***	1.526***	2.211***	0.824*	1.611**	0.577	1.521***	1.163***	0.825**	2.035***	1.526***	1.449**	1.176***	1.620***	1.655***	1.589***	2.407***	1.047**	1.499**	0.513	1.064***	0.922**	0.958**	2.127***
	(5.333)	(2.222)	(5.312)	(5.643)	(5.795)	(5.607)	(2.948)	(1.965)	(2.555)	(1.449)	(5.026)	(3.328)	(2.065)	(3.140)	(4.897)	(2.308)	(3.032)	(4.527)	(4.660)	(5.237)	(3.186)	(2.582)	(2.451)	(1.025)	(2.677)	(2.395)	(2.337)	(3.447)
$CHIBOR_{t-1}$	0.419***	0.413***	0.397***	0.219*	0.273**	0.385***	0.024	0.403***	0.306***	0.328***	0.167	0.145	0.335***	0.007	0.437***	0.438***	0.402***	0.213*	0.204	0.402***	0.028	0.392***	0.361***	0.332***	0.213	0.130	0.344***	0.030
	(5.167)	(4.644)	(4.759)	(1.974)	(2.505)	(4.662)	(0.158)	(4.277)	(3.095)	(3.420)	(1.273)	(1.253)	(3.161)	(0.050)	(5.396)	(5.216)	(4.682)	(1.835)	(1.532)	(4.950)	(0.178)	(4.096)	(3.687)	(3.393)	(1.661)	(1.069)	(3.340)	(0.224)
π_a	0.178*	0.182*	0.154	0.250**	0.221**	0.229**	0.257*								0.155	0.154	0.138	0.314**	0.300***	0.245*	0.474**							
	(1.733)	(1.849)	(1.455)	(2.531)	(2.304)	(2.239)	(1.732)								(1.535)	(1.555)	(1.472)	(2.547)	(2.704)	(1.999)	(2.288)							
π_p								0.408*	0.647***	0.468**	0.602**	0.701***	0.619**	0.470**								0.418*	0.505**	0.452**	0.571**	0.708***	0.605**	0.701***
								(1.796)	(2.904)	(2.035)	(2.322)	(2.769)	(2.267)	(2.319)								(1.970)	(2.428)	(2.079)	(2.341)	(2.842)	(2.283)	(2.686)
$\tilde{y}$	-0.078	-0.085	-0.040	0.127*	0.012	-0.069	0.353**	-0.074	-0.154*	-0.014	0.160*	0.053	-0.057	0.314*														
	(-1.132)	(-1.077)	(-0.536)	(1.691)	(0.232)	(-1.081)	(2.457)	(-0.982)	(-1.975)	(-0.207)	(1.722)	(0.943)	(-0.822)	(1.843)														
$\widetilde{y^*}$															-0.002	-0.006	0.076	0.174	0.243**	0.075	0.232**	-0.059	-0.041	0.039	0.066	0.160*	0.004	0.142*
															(-0.028)	(-0.095)	(0.922)	(1.480)	(2.076)	(0.749)	(2.355)	(-1.017)	(-0.743)	(0.530)	(0.765)	(1.747)	(0.051)	(1.859)
$M2gr_{t-1}$		-0.009					0.089		-0.090**					0.031		0.006					0.019		-0.043					-0.060
		(-0.183)					(1.299)		(-2.037)					(0.470)		(0.150)					(0.380)		(-1.216)					(-1.652)
FS_{t-1}			-0.077				0.237			-0.152**				0.127			-0.139**				0.364*			-0.179**				0.153
			(-1.118)				(1.252)			(-2.447)				(1.009)			(-2.032)				(1.700)			(-2.349)				(1.141)
$FSSN_{t-1}$				0.855***			1.247**				0.970***			1.095*				0.947***			0.794*				0.803**			0.626
				(3.267)			(2.214)				(3.100)			(1.981)				(2.696)			(1.784)				(2.544)			(1.595)
$FSSS_{t-1}$					-0.535***		-1.254***					-0.816***		-1.175***					-0.971***		-1.430***					-1.035***		-1.171***
					(-3.690)		(-3.228)					(-4.570)		(-3.171)					(-3.503)		(-3.331)					(-3.679)		(-3.211)
FRgrt−1						-0.014*	0.044**						-0.024**	0.051***						-0.022*	0.016						-0.025**	0.035**
						(-1.972)	(2.449)						(-2.522)	(2.773)						(-1.914)	(0.795)						(-2.060)	(2.146)
Long-run																												
π	0.306	0.309	0.255	0.320	0.305	0.372	0.264	0.684	0.932	0.696	0.723	0.821	0.931	0.473	0.275	0.273	0.231	0.398	0.376	0.409	0.488	0.688	0.791	0.676	0.726	0.813	0.923	0.722
$\tilde{y}$	-0.135	-0.144	-0.066	0.162	0.017	-0.113	0.362	-0.124	-0.222	-0.021	0.192	0.061	-0.086	0.316	-0.004	-0.010	0.128	0.221	0.305	0.126	0.239	-0.097	-0.064	0.058	0.084	0.184	0.006	0.147
Adj R^2	0.244	0.231	0.239	0.335	0.295	0.244	0.414	0.265	0.281	0.285	0.38	0.377	0.287	0.419	0.236	0.222	0.244	0.361	0.355	0.245	0.416	0.263	0.258	0.287	0.364	0.403	0.282	0.401
Observations 60																												

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

Table 3

Repo Based Taylor-rules (starting in 2005)

Policy variable	**R1dR**																												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
Constant	0.512***	0.682**	0.570***	0.835***	1.004***	0.665***	0.983**	0.211	0.656**	0.271	0.478**	0.618***	0.261	0.797*	0.547***	0.693***	0.529***	0.598***	0.800***	0.614***	1.1259***	0.249	0.638**	0.221	0.275	0.388**	0.231	0.855*
	(3.748)	(2.519)	(4.208)	(4.826)	(5.004)	(4.396)	(2.350)	(1.131)	(2.516)	(1.563)	(2.491)	(3.066)	(1.467)	(1.920)	(4.112)	(2.701)	(3.790)	(4.244)	(4.793)	(4.636)	(2.7046)	(1.355)	(2.554)	(1.197)	(1.458)	(2.142)	(1.277)	(1.922)
$R1dR_{t-1}$	0.706***	0.671***	0.656***	0.587***	0.493***	0.647***	0.475***	0.768***	0.666***	0.682***	0.677***	0.573***	0.729***	0.509***	0.685***	0.662***	0.663***	0.623***	0.493***	0.647***	0.4524***	0.730***	0.661***	0.698***	0.705***	0.617***	0.717***	0.521***
	(9.624)	(7.270)	(8.671)	(7.144)	(5.322)	(8.633)	(4.267)	(11.314)	(7.942)	(9.948)	(9.109)	(6.590)	(11.047)	(4.522)	(9.396)	(7.485)	(8.942)	(7.709)	(5.007)	(8.649)	(3.7789)	(10.328)	(8.061)	(9.958)	(9.375)	(7.457)	(10.153)	(4.284)
π_a	0.076**	0.082**	0.069**	0.093***	0.102***	0.105***	0.109**								0.078**	0.082**	0.077**	0.100***	0.122***	0.113***	0.1603***							
	(2.438)	(2.550)	(2.116)	(3.220)	(3.441)	(3.113)	(2.191)								(2.395)	(2.428)	(2.348)	(3.110)	(3.736)	(2.989)	(3.1502)							
π_P								0.142***	0.206***	0.148***	0.154***	0.187***	0.201***	0.143*								0.159***	0.202***	0.160***	0.164***	0.187***	0.203***	0.214***
								(2.827)	(3.460)	(3.044)	(2.880)	(3.424)	(3.374)	(2.007)								(2.947)	(3.299)	(3.010)	(2.938)	(3.306)	(3.213)	(3.095)
$\tilde{y}$	0.010	0.002	0.026	0.066**	0.051**	0.014	0.086**	0.016	-0.010	0.038	0.068**	0.060***	0.024	0.086**														
	(0.403)	(0.072)	(0.843)	(2.291)	(2.208)	(0.598)	(2.422)	(0.698)	(-0.427)	(1.436)	(2.380)	(2.916)	(1.115)	(2.204)														
$\widetilde{y^*}$															-0.014	-0.011	-0.005	0.011	0.046*	0.013	0.0440*	-0.030*	-0.024	-0.017	-0.017	0.009	-0.012	0.012
															(-0.890)	(-0.648)	(-0.207)	(0.543)	(1.860)	(0.555)	(1.8841)	(-1.891)	(-1.554)	(-0.793)	(-0.964)	(0.442)	(-0.696)	(0.583)
$M2gr_{t-1}$		-0.009					0.017		-0.031**					0.003		-0.008					-0.0029		-0.025**					-0.022
		(-0.813)					(0.814)		(-2.548)					(0.126)		(-0.727)					(-0.1670)		(-2.075)					(-1.129)
FS_{t-1}			-0.035				0.062			-0.054*				0.007			-0.020				0.0951			-0.028				0.023
			(-1.054)				(0.975)			(-1.800)				(0.162)			(-0.599)				(1.5696)			(-0.875)				(0.507)
$FSSN_{t-1}$				0.229***			0.080				0.200***			0.032				0.145**			-0.0222				0.077			-0.081
				(3.459)			(0.616)				(2.986)			(0.237)				(2.246)			(-0.1569)				(1.378)			(-0.558)
$FSSS_{t-1}$					-0.251***		-0.456**					-0.255***		-0.407**					-0.282**		-0.4952**					-0.197**		-0.367*
					(-3.419)		(-2.669)					(-3.464)		(-2.334)					(-2.863)		(-2.5820)					(-2.345)		(-1.965)
$FRgr_{t-1}$						-0.007**	0.006						-0.008**	0.009						-0.008*	-0.0001						-0.007*	0.005
						(-2.243)	(0.970)						(-2.617)	(1.397)						(-1.975)	(-0.0218)						(-2.004)	(0.649)
Long-run																												
π	0.258	0.251	0.200	0.226	0.201	0.297	0.207	0.614	0.617	0.466	0.477	0.439	0.741	0.292	0.249	0.243	0.228	0.264	0.240	0.320	0.2928	0.591	0.595	0.529	0.557	0.489	0.717	0.447
$\tilde{y}$	0.033	0.006	0.075	0.160	0.100	0.039	0.163	0.070	-0.031	0.120	0.211	0.142	0.088	0.175	-0.046	-0.033	-0.014	0.029	0.091	0.036	0.0803	-0.112	-0.070	-0.055	-0.059	0.024	-0.041	0.025
Adj R2	0.631	0.626	0.632	0.667	0.682	0.644	0.688	0.638	0.646	0.65	0.665	0.691	0.656	0.675	0.633	0.627	0.628	0.646	0.678	0.644	0.68	0.645	0.65	0.642	0.645	0.668	0.653	0.659
Observations	60																											

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

The results are largely but not entirely robust in the shorter sample that allows including financial market indicators, see Tables 4 and 5. M2 still responds significantly to current inflation but no longer to inflation expectations (although the coefficients remain negative). However, this might merely reflect the smaller sample size. The previously insignificant results for the output gap become significantly negative in this period, reinforcing our previous interpretation that the relationship between GDP (or rather the output gap) and money growth is largely driven by countercyclical policy.

Individually, all the financial market factors are significant (in most specifications). However, only shadow banking is robustly affecting money growth once all factors are considered simultaneously. Declines in shadow banking are again found to be compensated by additional money supply. Interestingly, the effect of bad loans not only becomes insignificant once controlling for other factors, but the point estimate turns positive (making it quite unlikely that the true value is meaningfully negative). Yet, that result is plausible. Interest changes targeted at bad loans are less driven by the need to add liquidity to the market and more by the need to make the extension of existing credit lines feasible (thus creating financial stability, but not increasing money supply and rather preventing a collapse of liquidity in the future).

The results for M2, including the Bloomberg forecast, are reported in Table A5 in the appendix. While the PBoC and Bloomberg forecasts perform similarly well when explaining interest rates, the Bloomberg forecast performs far better for money growth. This is interesting as it might indicate that the PBoC responds more strongly to the public perception than its own forecasts (which might already be conditional on its own planned policy path which is unknown to external observers).

For reference, the baseline results for McCallum rules without smoothing are reported in Table A6 in the appendix. Compared to the model with interest rate or money growth smoothing, inflation is no longer significant in the regression results for M2 without smoothing and the fit of the regression model is substantially lower.

3. Reaction Functions Based on a Narrative Index

3.1. Data and Estimation

Even though China is slowly starting to focus more on interest rates in its conduct of monetary policy, the PBoC never committed to an interest rate target for a specific interest rate. While there is little doubt that many interest rates respond to the PBoC's monetary policy, this renders the use of any interest rate in estimating a policy reaction function problematic.

Table 4

M2 Based McCallum-rules (starting in 2005)

Policy variable												**M2gr**												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Constant	1.060	3.195***	1.720**	3.010***	2.421***	3.595***	0.757	3.312***	1.222*	2.627***	1.516*	3.714***	1.254*	2.062**	1.473**	2.143***	2.235***	2.890***	1.100	2.084**	1.179	1.677**	1.482*	2.888***
	(1.599)	(3.070)	(2.473)	(3.769)	(3.102)	(4.246)	(1.213)	(3.232)	(1.723)	(3.160)	(1.766)	(4.130)	(1.883)	(2.516)	(2.202)	(2.956)	(2.913)	(3.356)	(1.603)	(2.368)	(1.645)	(2.200)	(1.744)	(2.854)
$M2_{t-1}$	0.966***	0.820***	0.875***	0.759***	0.821***	0.726***	0.995***	0.793***	0.887***	0.744***	0.910***	0.689***	0.942***	0.918***	0.938***	0.897***	0.870***	0.815***	0.968***	0.935***	0.966***	0.934***	0.941***	0.868***
	(19.963)	(11.224)	(13.898)	(10.936)	(12.436)	(10.759)	(13.969)	(9.703)	(9.884)	(8.438)	(10.875)	(8.041)	(17.838)	(16.554)	(18.181)	(16.863)	(14.862)	(13.242)	(13.010)	(12.154)	(12.731)	(12.141)	(11.661)	(12.403)
π_a	-0.278**	-0.083	-0.265***	-0.225***	-0.415***	-0.222*							-0.261**	-0.227*	-0.291***	-0.303***	-0.413***	-0.421***						
	(-2.576)	(-0.831)	(-2.894)	(-3.266)	(-3.784)	(-1.909)							(-2.232)	(-1.935)	(-2.673)	(-2.825)	(-3.246)	(-3.160)						
π_P							-0.324	0.035	-0.156	-0.049	-0.414	0.165							-0.351	-0.294	-0.355	-0.348	-0.431	-0.339
							(-1.232)	(0.185)	(-0.588)	(-0.229)	(-1.497)	(0.714)							(-1.269)	(-1.099)	(-1.272)	(-1.278)	(-1.470)	(-1.289)
$\tilde{y}$	-0.016	-0.335**	-0.321*	-0.415***	-0.167*	-0.411***	-0.030	-0.397***	-0.347*	-0.479***	-0.132	-0.585***												
	(-0.180)	(-2.269)	(-1.997)	(-3.112)	(-1.720)	(-2.741)	(-0.364)	(-2.902)	(-1.985)	(-3.140)	(-1.295)	(-3.558)												
$\widetilde{y^*}$													0.125**	0.048	0.060	-0.015	0.009	-0.042	0.162**	0.064	0.132	0.064	0.121*	0.028
													(2.073)	(0.889)	(0.974)	(-0.270)	(0.165)	(-0.763)	(2.305)	(1.016)	(1.672)	(0.937)	(1.832)	(0.464)
FSt−1		0.412***				0.120		0.470***				0.308***		0.159**				-0.052		0.189**				0.171*
		(3.155)				(0.956)		(3.883)				(3.461)		(2.018)				(-0.449)		(2.375)				(1.893)
FSSNt−1			-0.896***			0.259			-0.866**			0.102			-0.310*			0.698			-0.152			0.820
			(-2.769)			(0.662)			(-2.293)			(0.228)			(-1.699)			(1.582)			(-0.733)			(1.556)
FSSSt−1				1.259***		1.084***				1.332***		1.159***				0.606***		0.963**				0.441**		0.776*
				(4.265)		(3.243)				(3.853)		(2.884)				(3.184)		(2.392)				(2.470)		(1.863)
FRgrt−1					0.057***	0.018					0.036**	-0.014					0.044***	0.044**					0.020	0.016
					(3.487)	(1.043)					(2.011)	(-0.787)					(2.999)	(2.250)					(1.381)	(0.809)
Long-run																								
π	-8.183	-0.460	-2.127	-0.933	-2.324	-0.809	-61.374	0.170	-1.380	-0.191	-4.602	0.530	-4.487	-2.770	-4.721	-2.945	-3.174	-2.277	-10.834	-4.534	-10.336	-5.255	-7.358	-2.568
$\tilde{y}$	-0.477	-1.856	-2.577	-1.719	-0.936	-1.501	-5.683	-1.914	-3.069	-1.874	-1.472	-1.882	2.157	0.581	0.973	-0.150	0.069	-0.228	5.018	0.987	3.859	0.966	2.055	0.214
Adj R2	0.914	0.931	0.928	0.942	0.932	0.941	0.904	0.93	0.916	0.933	0.911	0.938	0.918	0.921	0.919	0.925	0.927	0.929	0.911	0.915	0.91	0.914	0.912	0.917
Observations 60																								

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

Table 5

M0 Based McCallum-rules (starting in 2005)

Policy variable	**M0gr**																							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Constant	1.373*	2.461**	1.367*	1.798**	1.621*	2.649**	0.568	1.555	0.416	0.887	0.816	1.312	1.314*	2.151**	1.382*	1.846**	1.502*	2.592**	0.613	1.380	0.689	1.136	0.788	1.498
	(1.707)	(2.375)	(1.743)	(2.269)	(1.875)	(2.557)	(0.654)	(1.637)	(0.502)	(1.099)	(0.891)	(1.249)	(1.866)	(2.096)	(1.791)	(2.312)	(1.820)	(2.484)	(0.817)	(1.389)	(0.874)	(1.445)	(0.927)	(1.474)
$M0_{t-1}$	0.891***	0.757***	0.850***	0.734***	0.807***	0.683***	0.795***	0.688***	0.723***	0.612***	0.712***	0.624***	0.787***	0.755***	0.789***	0.750***	0.755***	0.662***	0.707***	0.689***	0.704***	0.659***	0.678***	0.623***
	(11.593)	(6.410)	(8.571)	(6.719)	(6.875)	(5.821)	(8.127)	(6.077)	(6.094)	(5.199)	(5.516)	(5.496)	(8.821)	(7.762)	(9.139)	(8.164)	(6.767)	(6.023)	(7.102)	(6.961)	(7.086)	(6.452)	(5.716)	(5.764)
πa	-0.093	0.208	-0.051	0.089	-0.096	0.301							0.086	0.164	0.070	0.076	0.052	0.294						
	(-0.633)	(0.981)	(-0.349)	(0.581)	(-0.690)	(1.321)							(0.576)	(1.014)	(0.444)	(0.548)	(0.339)	(1.506)						
πP							0.499	0.757**	0.657*	0.799**	0.495	0.858**							0.626**	0.677**	0.626**	0.664**	0.600**	0.740**
							(1.535)	(2.596)	(1.982)	(2.624)	(1.619)	(2.499)							(2.113)	(2.523)	(2.142)	(2.404)	(2.091)	(2.563)
$\tilde{y}$	0.114	-0.132	-0.032	-0.147	0.057	-0.112	0.054	-0.137	-0.159	-0.225*	-0.002	-0.160												
	(1.043)	(-0.836)	(-0.195)	(-1.070)	(0.531)	(-0.601)	(0.464)	(-1.066)	(-0.900)	(-1.828)	(-0.020)	(-0.830)												
$\widetilde{y^*}$													0.291**	0.192	0.258*	0.136	0.246*	0.161	0.293**	0.178	0.259*	0.132	0.263**	0.109
													(2.159)	(1.344)	(1.712)	(0.901)	(1.744)	(1.130)	(2.429)	(1.339)	(1.967)	(0.963)	(2.140)	(0.796)
FS_{t-1}		0.383*				0.240		0.355**				0.108		0.213				0.184		0.201				0.060
		(1.896)				(1.032)		(2.282)				(0.590)		(1.356)				(0.849)		(1.344)				(0.331)
$FSSN_{t-1}$			-0.486			1.106			-0.710			0.696			-0.140			1.341**			-0.173			1.046**
			(-1.045)			(1.549)			(-1.452)			(0.952)			(-0.392)			(2.174)			(-0.494)			(2.170)
$FSSS_{t-1}$				1.029**		1.700**				1.175***		1.693***				0.655*		1.555**				0.706*		1.606**
				(2.466)		(2.647)				(2.990)		(2.724)				(1.680)		(2.389)				(1.807)		(2.501)
$FRgr_{t-1}$					0.033	-0.016					0.032	-0.021					0.019	-0.005					0.016	-0.007
					(1.361)	(-0.472)					(1.379)	(-0.602)					(0.789)	(-0.167)					(0.687)	(-0.222)
Long-run																								
π	-0.858	0.858	-0.338	0.336	-0.498	0.950	2.435	2.427	2.372	2.059	1.721	2.281	0.404	0.669	0.330	0.304	0.214	0.871	2.141	2.179	2.117	1.945	1.860	1.963
$\tilde{y}$	1.044	-0.543	-0.212	-0.552	0.296	-0.353	0.261	-0.439	-0.573	-0.579	-0.008	-0.426	1.362	0.783	1.221	0.545	1.003	0.477	1.000	0.574	0.876	0.386	0.816	0.288
Adj R2	0.736	0.751	0.737	0.759	0.739	0.76	0.743	0.765	0.75	0.779	0.746	0.775	0.751	0.755	0.747	0.759	0.749	0.763	0.764	0.767	0.761	0.774	0.761	0.775
Observations 60																								

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

Therefore, we estimate an alternative monetary policy reaction function using a narrative indicator of monetary policy, namely the Sun-MP index, that aggregates over different dimensions of monetary policy based on evaluating the set of policy actions listed in the PBoC's monetary policy implementation reports. The Sun-MP index is an ordinal measure ranging from −2 (highly expansionary) to +2 (highly contractionary) in unit steps. To account for its ordinal nature, we estimate our monetary policy reaction functions using an ordered logit model.

For the simplified reaction function (with contemporary inflation and output gap), this yields:

$$r_t^* = \sum_{k=-2}^{2} \alpha_{2+k} \mathbb{I}(mp_{t-1} = k) + \beta_1 \pi_t + \beta_2 y_t + BX_t + \varepsilon_t \quad (3)$$

and for the forward-looking policy rule:

$$r_t^* = \sum_{k=-2}^{2} \alpha_{2+k} \mathbb{I}(mp_{t-1} = k) + \beta_1 E\pi_{t+4|t} + \beta_2 Ey_t + BX_t + \varepsilon_{t+4|t} \quad (4)$$

where the latent variable *r** in either equation is linked to the observable monetary policy index through:

$$\begin{aligned} mb_t &= -2 \, if \; r_t^* \le \tau_{-2|1} \\ mb_t &= -1 if \; \tau_{-2|1} < r_t^* \le \tau_{-1|0} \\ mb_t &= 0 if \; \tau_{-1|0} < r_t^* \le \tau_{0|1} \\ mb_t &= 1 if \; \tau_{0|1} < r_t^* \le \tau_{1|2} \\ mb_t &= 2 if \; r_t^* > \tau_{1|2} \end{aligned} \quad (5)$$

Rather than treating the lagged MP index as if it were continuous, we control for persistence using a set of dummy variables reflecting the monetary policy stance in the previous quarter.

3.2. Results

The results of the reaction functions based on the narrative index are summarized in Table 6.

The results largely match what we find for continuous measures. We find significant results (with the expected sign) for both inflation and inflation expectations. Like in the interest rate regressions, we find the output gap is overall insignificant. The growth gap performs slightly better, but is only significant when paired with current inflation.

This is, however, the best model in terms of AIC. The additional variables do not seem to matter. This is not necessarily proof of their irrelevance, but might be

due to the additional uncertainty introduced by the ordered probit, where the true (continuous) policy stance is treated as unobservable.

Because Equations 3 and 4 have the latent variable governing monetary policy on the left-hand side and the actual lagged monetary policy indicator (as a set of dummies) on the right-hand side it is impossible to merely solve the equation for a long-term policy associated with a specific combination of macroeconomic indicators, as we did for Taylor and McCallum-rules. What we do instead is to simulate the sequence of policies for constant macroeconomic conditions over 50,000 periods to obtain a probability distribution of policies associated with those conditions.

Figure 3 shows the long-run distributions implied by the baseline version of the model with actual inflation and GDP growth target gap (i.e., Equation 4, where X is empty). Despite using 50,000 periods in our simulation (i.e., we are basically looking at monetary policy over more than 10 millennia), we see ragged edges between highly expansionary and expansionary policy (dark green and green). The reason is the extremely high persistence of highly expansionary policy, which we will discuss in detail below.

We see an interesting asymmetry in the response to the growth gap (see Figure 3a). When GDP growth is two percentage points below the target, policy is almost unequivocally highly expansionary. Contrarily, output growth exceeding the target in the same order of magnitude are typically not associated with ultra-tight monetary policy, but neutral or only mildly contractionary policy instead. When inflation is at its long-run average, it is still accompanied by loose monetary policy, below-average inflation quickly leads to strong monetary expansion, while even when inflation exceeds 5% we would typically only find mild contractions. Like with the output gap, we find that neutral policy is associated with inflation expectations above their long-term mean (2.7% compared to 2.56%).

For both inflation and output gap, the change between strong expansion and expansion is much more abrupt than the change between strong tightening and tightening. While the PBoC quickly moves to strong countermeasures when faced with a negative outlook, it is much more hesitant before adopting strongly contractionary measures.

Again, this is very well in line with the established finding that central banks typically are very reluctant to create economic trouble by adopting too harsh countermeasures against economic overheating too quickly. All those observations align closely with an asymmetric loss function – well-established among many central banks – where recessions are regarded as more harmful than economic overheating.

Table 6

Monetary Policy Rules Based on a Narrative Index

Policy variable	**Sun − index**																												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
Sun. $index_{t-1} = -1$	4.805***	6.232***	4.419**	5.191***	5.343**	5.207***	5.771**	5.207***	5.784***	3.968**	5.18***	4.829**	5.371***	5.881**	6.127***	6.725***	5.88***	6.158***	6.189***	6.187***	5.862**	6.101***	6.263***	5.73***	6.094***	6.065***	6.262***	6.547**	
	(2.983)	(3.068)	(2.463)	(3.054)	(2.564)	(2.827)	(2.406)	(3.198)	(2.719)	(2.22)	(3.105)	(2.376)	(2.963)	(2.187)	(3.496)	(3.204)	(3.249)	(3.561)	(3.403)	(3.253)	(2.574)	(3.721)	(2.877)	(3.399)	(3.719)	(3.535)	(3.502)	(2.387)	
Sun. $index_{t-1} = 0$	7.318***	8.784***	6.946***	7.747***	7.997***	7.63***	8.445***	7.636***	8.199***	6.562***	7.605***	7.18***	7.747***	8.538***	8.75***	9.359***	8.506***	8.824***	8.846***	8.791***	8.563***	8.546***	8.706***	8.286***	8.542***	8.496***	8.649***	9.393***	
	(4.056)	(3.948)	(3.56)	(4.063)	(3.244)	(3.934)	(2.967)	(4.184)	(3.611)	(3.413)	(4.069)	(3.071)	(4.069)	(2.787)	(4.346)	(4.002)	(4.139)	(4.421)	(4.099)	(4.224)	(3.159)	(4.593)	(3.714)	(4.346)	(4.598)	(4.287)	(4.513)	(3.034)	
Sun. $index_{t-1} = 1$	10.043***	10.677***	10.066***	9.769***	10.164***	9.927***	10.271***	9.968***	10.234***	10.057***	9.998***	9.866***	9.904***	10.458***	10.296***	10.702***	10.563***	9.687***	10.24***	10.267***	9.883***	10.423***	10.532***	11.149***	10.312***	10.449***	10.341***	10.717***	
	(4.683)	(4.755)	(4.653)	(4.545)	(4.707)	(4.636)	(3.975)	(4.612)	(4.498)	(4.558)	(4.549)	(4.523)	(4.546)	(3.744)	(4.942)	(4.815)	(4.831)	(4.424)	(4.83)	(4.871)	(3.937)	(5.382)	(4.853)	(5.362)	(4.876)	(5.308)	(5.271)	(3.841)	
Sun. $index_{t-1} = 2$	9.062***	10.152***	8.797***	8.773***	9.239***	9.018***	8.694***	11.394***	11.861***	10.002***	11.406***	11.22***	11.345***	9.851***	9.952***	10.448***	9.86***	9.438***	9.927***	9.933***	8.604***	12.213***	12.348***	11.782***	12.148***	12.215***	12.15***	10.372***	
	(3.949)	(4.032)	(3.723)	(3.801)	(3.949)	(3.949)	(2.901)	(5.25)	(4.838)	(4.3)	(5.231)	(5.01)	(5.214)	(3.189)	(4.16)	(4.042)	(4.086)	(3.831)	(4.147)	(4.139)	(2.936)	(5.528)	(4.91)	(5.161)	(5.373)	(5.523)	(5.474)	(3.408)	
π_a	0.967***	0.91***	0.949***	1.052***	0.98***	0.931***	0.899**								1.112***	1.068***	1.1***	1.169***	1.112***	1.103***	1.288***									
	(3.087)	(2.957)	(2.987)	(3.083)	(3.127)	(2.918)	(2.097)								(3.457)	(3.259)	(3.385)	(3.461)	(3.463)	(3.248)	(2.738)									
π_P								0.866**	0.764*	1.099**	0.863**	0.876**	0.829*	0.814*								0.818**	0.79*	0.924**	0.825**	0.818**	0.779*	1.038*	
								(2.248)	(1.687)	(2.565)	(2.228)	(2.258)	(1.955)	(1.384)								(2.164)	(1.762)	(2.387)	(2.158)	(2.164)	(1.879)	(1.764)	
$\tilde{y}$	0.211	0.29	0.28	0.086	0.109	0.202	0.545	0.192	0.223	0.48	0.204	0.258	0.186	0.734															
	(0.897)	(1.179)	(1.012)	(0.3)	(0.319)	(0.856)	(1.219)	(0.833)	(0.913)	(1.662)	(0.721)	(0.815)	(0.801)	(1.664)															
$\widetilde{y^*}$															0.493**	0.473**	0.52**	0.464**	0.483**	0.489**	0.547**	0.245	0.244	0.33	0.238	0.25	0.241	0.306	
															(2.276)	(2.15)	(2.323)	(2.118)	(2.092)	(2.214)	(2.061)	(1.239)	(1.233)	(1.577)	(1.17)	(1.186)	(1.22)	(1.343)	
M2grt-1		0.166					0.286		0.068					0.256		0.071					0.131		0.017					0.051	
		(1.242)					(1.668)		(0.434)					(1.259)		(0.528)					(0.836)		(0.114)					(0.304)	
FSt-1			-0.121				-0.635			-0.447*				-0.935			-0.123				-0.423			-0.3				-0.804**	
			(-0.485)				(-1.686)			(-1.765)				(-2.561)			(-0.521)				(-1.141)			(-1.428)				(-2.306)	
FSSNt-1				-0.533			-1.187				0.049			-0.683				-0.413			-1.893				-0.072			-1.05	
				(-0.748)			(-0.867)				(0.074)			(-0.517)				(-0.704)			(-1.317)				(-0.131)			(-0.786)	
FSSSt-1					0.366		-0.344					-0.242		-0.061					0.081		-0.775					-0.045		0.457	
					(0.411)		(-0.216)					(-0.306)		(-0.041)					(0.122)		(-0.467)					(-0.074)		(0.322)	
FRgrt-1						0.018	0.014						0.009	0.046						0.003	-0.014						0.01	0.033	
						(0.455)	(0.241)						(0.207)	(0.845)						(0.077)	(-0.251)						(0.224)	(0.623)	
-2|-1	3.104*	6.098**	3.055*	3.669*	3.631*	3.409*	8.635**	3.516*	4.557	4.084**	3.483*	3.184	3.584*	9.23*	5.041***	6.343**	5.304***	4.976***	5.043***	5.073***	7.9**	4.599***	4.889	5.675***	4.575***	4.588***	4.648***	8.463**	
	(1.886)	(2.04)	(1.826)	(1.999)	(1.738)	(1.929)	(2.4)	(1.912)	(1.49)	(2.082)	(1.837)	(1.496)	(1.926)	(2.363)	(3.029)	(2.104)	(3.007)	(3.036)	(3.048)	(2.964)	(2.24)	(2.812)	(1.609)	(3.042)	(2.78)	(2.789)	(2.838)	(2.215)	
-1|0	8.267***	11.263***	8.204***	8.828***	8.856***	8.595***	13.896***	8.475***	9.506***	9.103***	8.442***	8.121***	8.554***	14.519***	10.425***	11.711***	10.657***	10.371***	10.446***	10.46***	13.282***	9.694***	9.986***	10.886***	9.663***	9.685***	9.752***	13.921***	
	(4.037)	(3.453)	(3.977)	(3.987)	(3.52)	(3.948)	(3.501)	(3.766)	(2.861)	(3.878)	(3.681)	(3.226)	(3.749)	(3.369)	(4.671)	(3.496)	(4.64)	(4.689)	(4.673)	(4.597)	(3.359)	(4.491)	(2.967)	(4.512)	(4.455)	(4.475)	(4.499)	(3.276)	
0|1	10.451***	13.588***	10.369***	11.04***	11.063***	10.803***	16.28***	10.63***	11.684***	11.234***	10.595***	10.266***	10.711***	16.815***	12.809***	14.167***	13.029***	12.771***	12.832***	12.849***	15.78***	11.888***	12.188***	13.076***	11.858***	11.878***	11.95***	16.203***	
	(4.815)	(3.919)	(4.751)	(4.705)	(4.171)	(4.66)	(3.905)	(4.483)	(3.384)	(4.583)	(4.386)	(3.891)	(4.457)	(3.743)	(5.328)	(3.951)	(5.297)	(5.353)	(5.328)	(5.226)	(3.783)	(5.194)	(3.476)	(5.17)	(5.161)	(5.176)	(5.194)	(3.669)	
1|2	14.297***	17.351***	14.378***	14.836***	14.849***	14.574***	20.52***	13.903***	14.95***	14.927***	13.868***	13.548***	13.986***	20.742***	17.101***	18.375***	17.564***	16.996***	17.091***	17.117***	20.685***	15.152***	15.446***	16.646***	15.128***	15.142***	15.219***	20.257***	
	(5.41)	(4.655)	(5.28)	(5.4)	(5.008)	(5.408)	(4.489)	(5.31)	(4.128)	(5.186)	(5.211)	(4.752)	(5.284)	(4.317)	(5.649)	(4.68)	(5.379)	(5.712)	(5.673)	(5.655)	(4.388)	(5.881)	(4.217)	(5.606)	(5.861)	(5.864)	(5.875)	(4.273)	
AIC	103.089	103.486	104.852	104.527	104.92	104.884	107.957	109.198	111.01	107.793	111.193	111.104	111.155	111.254	98.344	100.064	100.064	99.851	100.329	100.338	104.84	108.363	110.35	108.219	110.346	110.358	110.313	112.336	
Observations 60																													

Note: t-values are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively. The Sun index (sun.index) is a narrative, ordinal index scaled from –2 to 2. The model is estimated using ordered probit regression.

Source: Authors' computations.

T a b l e 7

Transition Table for a Simple Backward-looking MP Rule, Πt = 2.56

	$mp_t = -2$	$mp_t = -1$	$mp_t = \pm 0$	$mp_t = +1$	$mp_t = +2$
$mp_{t-1} = -2$	0.985	0.015	0.000	0.000	0.000
$mp_{t-1} = -1$	0.000	0.925	0.075	0.000	0.000
$mp_{t-1} = \pm 0$	0.000	0.118	0.767	0.115	0.000
$mp_{t-1} = +1$	0.000	0.003	0.362	0.634	0.000
$mp_{t-1} = +2$	0.000	0.009	0.492	0.499	0.000

Source: Authors' computations.

Since we include lagged monetary policy in the form of a set of dummies rather than as a single index, the ordered probit estimated MP rules inherently account for possibly asymmetric persistence. A look at the raw coefficients reveals that there is considerable persistence for expansionary policy, where the lag coefficients are fairly low (including the baseline group "highly contractionary" that implicitly has a coefficient of 0), i.e., predicting expansionary policy for the next period.

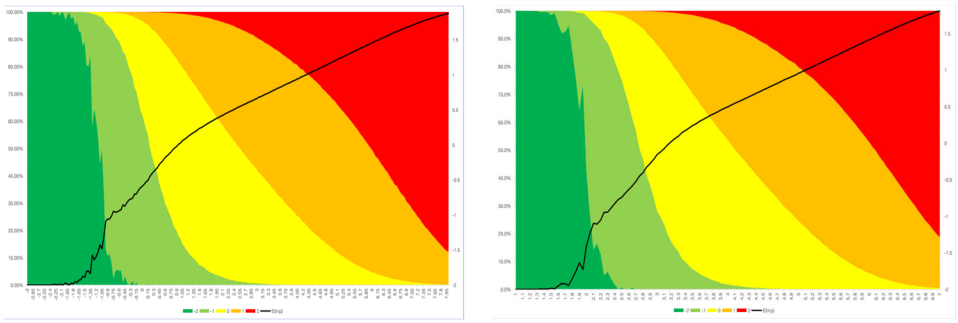
However, the coefficients for highly contractionary and mildly contractionary policy are hardly distinguishable (and even slightly reversed in several of our regressions). That is, the expected future monetary policy is identical for highly contractionary and contractionary policy. Unlike in a simple Taylor rule, the coefficients in an ordered probit model do not lend themselves to a more detailed direct interpretation. To make persistence more accessible, Table 7 presents a transition matrix for a situation where we set inflation to its long-run equilibrium (2.56) and the output gap to 0.

The results confirm the initial impression of highly persistent expansionary policy. Once the economy is in a regime of highly expansionary policy, the probability of maintaining there – in a situation usually associated with neutral policy – is over 98%. While the estimated probability of entering neutral of contractionary policy in this situation is de facto zero. This implies that highly expansionary policy typically persists long after the original problems that called for the policy have been overcome. This matches recent experiences in Western economies, where both the Fed and the ECB faced substantial difficulties in exiting the very loose monetary policy initiated after the GFC (for the Fed) and the debt crisis in the European periphery (for the ECB). On the other extreme of the spectrum, we find much lower persistence. Highly contractionary policy has a close to zero probability to persist (if the situation no longer calls for it, as in our equilibrium scenario).

Figure 3

Model Implied Long-run Distribution of the Sun-MP

(a) MP Distribution by GDP Growth Target Gap ***(b) MP Distribution by Inflation***



Note: The figure shows the long-run distribution of the Sun-MP index implied by the forward-looking policy rule. The solid line represents the expected value (which should be taken with a grain of salt given the ordinal nature of the index). The abscissa gives the growth gap (a) and inflation (b) in percentage points. For the inflation simulation, growth is assumed to be on target, for the growth simulation inflation is assumed to have its sample average.

Source: Authors' computations.

4. Robustness: Asymmetry in Taylor and McCallum Rules

4.1. Estimation

While narrative measures are generally preferable in the absence of an actual policy interest rate, there are some pitfalls. The Sun-MP index technically does not measure monetary policy but the central bank's communication about its policy. It seems very unlikely that the central bank misrepresents the direction of its policy. However, there might be situations when it is important to emphasize policy more strongly (e.g., to manage expectations), although the actual intensity of the policy is the same. Theoretically, the asymmetry found in Section 4.2 might be a consequence of such measurement issues. If contractionary and highly contractionary policy are just an artifact of the measurement method and not actually different, this would lead to the exact type of non-persistence we find.

Therefore, as a robustness test, we return to direct and continuous measures of monetary policy (namely the interest rate and M2 growth), and extend the respective Taylor and McCallum rules to allow for the same type of asymmetry. We estimate a threshold model, where we assume there exists a long-run objective associated with specific macro conditions, but the adjustment speed towards that objective – i.e., α from Equation 1 – differs between a high interest (low money growth) and a low interest (high money growth) regime. At the same time, we

conducted a regression for the output target gap to explore the asymmetric response to the positive and negative output target gap.

This yields the equation:

$$mp_t = \alpha_1 \mathbb{I}(mp_{t-1} < \tau) mp_{t-1} + \alpha_2 \mathbb{I}(mp_{t-1} \geq \tau) mp_{t-1} + (1 - \alpha_1 \mathbb{I}(mp_{t-1} < \tau) - \alpha_2 \mathbb{I}(mp_{t-1} \geq \tau))(\beta_0 + \beta_1 \pi_t + \beta_2 \tilde{y}_t + BX_t) + \varepsilon_t \quad (6)$$

where *mp* is the indicator of monetary policy, and τ is the threshold separating the regimes, and other variables and coefficient definitions match previous equations. The model is estimated using a maximum likelihood. Due to the relatively small sample size, we set τ to the mean of *mp* to guarantee that both regimes have a sufficient number of observations to allow identification. We restrict α_1 and α_2 to be in the interval from 0 to (not including) 1 to guarantee that Equation 7 that distinguishes between persistence and the adjustment to the long-run equilibrium can be meaningfully estimated. Standard errors are obtained through bootstrapping.

In a final exercise, we consider an alternative view on asymmetry and, following Chen et al. (2018), treat the growth target as minimum rather than actual target, implying very different responses to growth falling short of the target and growth exceeding the target.

We estimate:

$$\delta mp_t = \alpha \delta mp_{t-1} + (1-\alpha)\left(\beta_1 \pi_t + \beta_2 \tilde{y}_t^+ + \beta_3 \tilde{y}_t^- + BX_t\right) + \varepsilon_t \quad (7)$$

where $\tilde{y}_t^+ = \tilde{y}_t$ if $\tilde{y}_t > 0$ and 0 otherwise, and $\tilde{y}_t^- = \tilde{y}_t$ if $\tilde{y}_t < 0$ and 0 otherwise.

4.2. Results

Our results are extremely mixed. By and large, the Taylor rule estimations (Table 8) confirm the asymmetry found when looking at the Sun-MP index. I.e., the persistence of the interest rates in periods of expansionary policy (i.e., lagged interest rates below the mean) is typically higher than for periods of contractionary policy, where the reversion to the long-run equilibrium happens faster. However, the difference between the symmetric and the asymmetric model is only significant in about one-third of the models we estimate. Additionally, for monetary models (Table 9), the result reverts. Persistence is typically higher when money growth is low. However, the share of bootstrap iterations that coincide with the upper boundary is extremely high, indicating that the low money growth regime might indeed be explosive, making Equation 7 problematic to interpret.[7]

[7] The results are available from the authors on request.

The growth gap results are largely inconclusive. Unlike Chen et al. (2018), we do not find significant results in our (shorter) sample, see Table 10. There is mild evidence pointing to the right direction in the basic (unaugmented) McCallum rules, that indicate an increase in M2 when there is high growth (i.e., monetary policy accomodates the expansion to some degree), whereas the correlation disappears for low growth, indicating that the PBoC leaves excess liquidity in the market.

Conclusions

The reason for the variety of empirical specifications to approximate the policy reaction function of the PBoC in the literature simply seems to be that there is no single "perfect" specification among the traditional approaches. Most specifications we consider reveal some facet of the PBoC's behavior while obfuscating others.

Interest rate-based specifications perform well overall, but give the wrong impression of a dovish central bank. While simple McCallum rules yield very plausible results, their asymmetric results are instable and do not match anecdotal evidence of the PBoC's behavior, despite otherwise clear empirical support for asymmetric behavior. Narrative measures seem to yield the best results but come at the cost of high granularity, corresponding difficulties in using them to identify shocks and miss the importance of policies that are not documented well in the PBoC's publications (such as exchange rate stabilization). Overall, this points to the importance of using multi-indicator approaches, or refining narrative indicators, to cover more available information and thus allow a more detailed view similar to continuous indicators.

Yet, we can identify some features of the PBoC's reaction function. First, money does indeed play a major role in the PBoC's behavior, even in the most recent decade (where a shift towards interest rates has been documented). Second, the PBoC clearly shares the asymmetric behavior of other central banks; more specifically, it is very reluctant to abandon expansionary policy, whereas contractionary policies are typically short-lived. Third, the PBoC includes objectives beyond price and business cycle stabilization; more specifically, there is robust evidence that it responds to financial stability, considers its own macro-prudential policy by flanking it with cushioning monetary policies, and stabilizes the exchange rate. Specifically, in the face of an increase in non-performing loans, the central bank to maintains financial stability by extends credit lines rather (interest reduction) than injecting liquidity into the market, which serves to prevent future liquidity crises. In response to a decline in shadow banking, the central bank implements an expansionary monetary policy by lowering interest rates and increasing the money supply.

Table 8

Repo Based Asymmetric Taylor-rules

Policy variable	**R1dR**																												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
LowRegime	0.784***	0.732***	0.658*	0.734***	0.726***	0.688**	0.785***	0.851***	0.793***	0.754***	0.79***	0.712***	0.819***	0.819***	0.755***	0.791***	0.803***	0.804***	0.738***	0.695***	0.779***	0.85***	0.779***	0.847***	0.807***	0.751***	0.827***	0.826***
	(5.112)	(2.534)	(1.997)	(3.512)	(4.27)	(2.558)	(5.908)	(9.703)	(4.581)	(3.741)	(6.184)	(5.836)	(6.935)	(5.023)	(4.397)	(4.337)	(5.049)	(7.893)	(7.158)	(2.87)	(6.831)	(13.864)	(4.585)	(10.19)	(10.091)	(8.688)	(9.386)	(5.388)
HighRegime	0.408	0.429	0.413	0.235	0.167	0.417	0.169	0.425	0.438	0.453*	0.341	0.298	0.409	0.232	0.462*	0.416	0.405*	0.173	0.111	0.452*	0.128	0.39	0.425*	0.36*	0.264	0.295	0.405*	0.18
	(1.455)	(1.457)	(1.384)	(0.864)	(0.801)	(1.421)	(0.85)	(1.435)	(1.628)	(1.74)	(1.266)	(1.381)	(1.457)	(0.908)	(1.903)	(1.593)	(1.936)	(0.782)	(0.759)	(1.787)	(0.859)	(1.591)	(1.766)	(1.716)	(1.022)	(1.417)	(1.687)	(0.769)
Threshold	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322	2.322
Const	2.041***	1.509	1.985***	1.937***	1.809***	1.958***	0.7	0.371	0.772	0.934	1.59***	1.48***	1.471**	0.598	2.002***	1.786***	2.091***	1.84***	1.696***	1.948***	1.67**	0.914	0.785	1.677*	1.637***	1.338***	1.492**	1.281
	(5.465)	(1.382)	(3.324)	(10.002)	(7.083)	(6.371)	(0.391)	(0.05)	(0.125)	(0.195)	(2.694)	(4.13)	(2.023)	(0.253)	(4.632)	(2.944)	(3.023)	(6.516)	(6.552)	(4.232)	(2.353)	(0.15)	(0.103)	(1.714)	(3.359)	(3.057)	(2.224)	(0.205)
$\bar{y}$	-0.01	0.157	-0.005	0.039	0.046	-0.031	0.253	0.038	0.152	0.095	0.112	0.109	-0.004	0.336														
	(-0.097)	(0.519)	(-0.036)	(0.346)	(0.636)	(-0.269)	(0.883)	(0.127)	(0.21)	(0.191)	(0.751)	(1.213)	(-0.031)	(0.636)														
$\widetilde{y^*}$															-0.014	0.01	0.006	-0.004	0.054	0.013	0.092	-0.042	-0.068	-0.011	-0.026	0.024	-0.022	0.076
															(-0.149)	(0.089)	(0.059)	(-0.072)	(0.575)	(0.113)	(1.337)	(-0.275)	(-0.175)	(-0.097)	(-0.275)	(0.371)	(-0.21)	(0.438)
π_a	0.19	0.094	0.124	0.202*	0.247***	0.25*	0.352								0.21**	0.148	0.161	0.218***	0.251***	0.285	0.404**							
	(1.76)	(0.523)	(1.168)	(2.638)	(3.218)	(1.756)	(1.435)								(2.035)	(0.917)	(1.285)	(3.05)	(5.436)	(1.692)	(2.349)							
π_P								0.947	0.778	0.581	0.426	0.461**	0.513	0.07								0.694	0.745	0.376*	0.346**	0.426***	0.518*	0.327
								(0.324)	(0.318)	(0.331)	(1.338)	(2.557)	(1.452)	(0.126)								(0.3)	(0.306)	(1.712)	(2.094)	(2.865)	(1.795)	(0.233)
$M2gr_{t-1}$		0.101					0.154		0.01					0.229		0.038					0.041		0.014					0.066
		(0.527)					(0.785)		(0.054)					(0.508)		(0.526)					(0.683)		(0.043)					(0.212)
FS_{t-1}			-0.055				0.125			-0.122				0.069			-0.023				0.216			-0.023				0.08
			(-0.353)				(0.937)			(-0.211)				(0.203)			(-0.14)				(1.396)			(-0.138)				(0.176)
$FSSN_{t-1}$				0.57**			0.051				0.548*			0.297				0.595			-0.178				0.352			-0.12
				(1.952)			(0.064)				(1.859)			(0.251)				(1.797)			(-0.376)				(1.167)			(-0.047)
$FSSS_{t-1}$					-0.605***		-0.942					-0.531**		-0.493					-0.605**		-1.022**					-0.46***		-0.603
					(-2.845)		(-1.589)					(-2.65)		(-0.861)					(-2.129)		(-2.057)					(-2.791)		(-0.435)
$FRgr_{t-1}$						-0.016	-0.021						-0.015	-0.005						-0.018	-0.02						-0.013	-0.005
						(-0.868)	(-0.549)						(-0.635)	(-0.133)						(-0.856)	(-0.819)						(-0.63)	(-0.039)
LR.test	2.474	2.44	1.363	5.501	6.938	1.742	13.235	4.251	2.231	1.475	5.082	4.001	1.722	6.274	2.146	2.258	1.925	8.966	8.68	1.524	14.818	3.561	1.996	3.266	8.782	6.806	2.828	6.319
Asym.test	0.29	0.295	0.506	0.064	0.031	0.418	0.001	0.119	0.328	0.478	0.079	0.135	0.423	0.043	0.342	0.323	0.382	0.011	0.013	0.467	0.001	0.169	0.369	0.195	0.012	0.033	0.243	0.042
Observations	60																											

Note: t-values and p-values for the LR-test in parentheses. High Regime and Low Regime denote the lagged policy indicator in either regime. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively. We use bootstrapped standard errors.

Source: Authors' computations.

Table 9

M2 Based Asymmetric McCallum Rules

Policy variable	**M2**																							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
LowRegime	0.988***	0.937***	0.98***	0.967***	0.964***	0.974***	0.981***	0.924***	0.946***	0.941***	0.975***	0.94***	0.988***	0.984***	0.988***	0.987***	0.977***	0.985***	0.99	0.981***	0.987***	0.988***	0.984***	0.985***
	(64.824)	(18.761)	(40.928)	(18.931)	(25.522)	(28.525)	(21.394)	(14.415)	(8.695)	(16.317)	(17.475)	(10.677)	(76.895)	(61.352)	(133.318)	(100.755)	(40.318)	(65.54)	(384.643)	(40.15)	(90.376)	(127.214)	(57.492)	(74.013)
HighRegime	0.814***	0.77***	0.795***	0.642***	0.768***	0.476***	0.851***	0.749***	0.853***	0.689***	0.853***	0.443***	0.817***	0.818***	0.825***	0.765***	0.805***	0.398***	0.851***	0.855***	0.882***	0.844***	0.859	0.445
	(7.768)	(8.133)	(8.083)	(6.386)	(8.005)	(2.822)	(8.302)	(6.977)	(9.196)	(5.167)	(7.263)	(2.547)	(7.692)	(8.357)	(8.293)	(8.167)	(7.634)	(2.456)	(7.587)	(8.339)	(9.535)	(7.683)	(8.413)	(2.23)
Threshold	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055	13.055
Const	23.87***	18.533***	16.941***	14.272***	13.434	14.556***	30.918**	14.354***	17.016	10.923***	23.059	12.969***	22.376***	24.344**	24.051***	21.729***	18.613**	16.48***	31.371*	33.615	27.905	29.636	30.145	18.561***
	(3.421)	(6.149)	(3.542)	(10.067)	(1.57)	(8.617)	(2.129)	(3.138)	(1.321)	(3.061)	(1.586)	(4.294)	(3.338)	(2.639)	(3.268)	(3.714)	(2.329)	(9.258)	(1.86)	(1.492)	(1.552)	(1.392)	(1.423)	(3.153)
$\tilde{y}$	-0.236	-1.846	-2.199	-1.192*	-1.111	-0.651	-0.185	-2.256	-4.059	-1.864	-2.192	-1.07**												
	(-0.124)	(-1.123)	(-1.208)	(-2)	(-0.859)	(-1.656)	(-0.108)	(-1.447)	(-0.734)	(-1.148)	(-0.668)	(-2.071)												
$\overline{\tilde{y}^x}$													0.773	0.303	0.291	-0.494	-0.119	-0.407**	1.886	0.791	2.113	0.443	1.972	-0.492
													(0.515)	(0.256)	(0.2)	(-0.77)	(-0.156)	(-2.307)	(1.009)	(0.438)	(0.89)	(0.275)	(0.752)	(-0.68)
πa	-3.061	-0.556	-2.444	-0.842*	-2.867	-0.316							-2.827	-2.532	-3.33	-2.318	-4.002	-0.743						
	(-1.062)	(-0.599)	(-1.004)	(-1.76)	(-0.909)	(-0.615)							(-1.095)	(-0.966)	(-1.114)	(-1.032)	(-0.926)	(-1.455)						
π_P							-5.551	0.858	-4.092	-0.557	-8.359	0.588							-6.515	-4.834	-5.749	-5.93	-7.928	-0.913
							(-0.972)	(0.606)	(-0.614)	(-0.272)	(-0.824)	(0.719)							(-1.121)	(-0.722)	(-0.9)	(-0.778)	(-0.829)	(-0.306)
FS_{t-1}		2.444				0.115		2.871				0.454		1.118				-0.404		2.323				0.167
		(1.255)				(0.138)		(1.654)				(1.078)		(0.54)				(-0.667)		(0.827)				(0.254)
$FSSN_{t-1}$			-6.149			3.289			-9.477			2.315			-2.97			4.336**			-2.515			5.844
			(-0.997)			(1.606)			(-0.813)			(0.887)			(-0.736)			(2.545)			(-0.446)			(1.242)
$FSSS_{t-1}$				4.002***		5.951***				6.179		5.542***				4.14		7.112***				7.218		8.629
				(3.053)		(4.001)				(1.206)		(2.844)				(0.859)		(5.012)				(0.882)		(1.417)
$FRgr_{t-1}$					0.408	-0.016					0.601	-0.091					0.422	0					0.263	-0.034
					(1.254)	(-0.119)					(0.954)	(-0.745)					(1.002)	(0.004)					(0.553)	(-0.167)
LR.test	8.897	2.05	5.067	6.428	5.418	15.938	5.588	3.563	1.328	4.45	2.408	18.398	6.573	4.093	5.979	8.151	4.815	28.707	4.664	2.69	4.252	5.26	3.603	30.262
Asym.test	0.012	0.359	0.079	0.04	0.067	0	0.061	0.168	0.515	0.108	0.3	0	0.037	0.129	0.05	0.017	0.09	0	0.097	0.261	0.119	0.072	0.165	0
Observations	60																							

Note: t-values and p-values for the LR-test in parentheses. High Regime and Low Regime denote the lagged policy indicator in either regime. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively. We use bootstrapped standard errors.

Source: Authors' computations.

Table 10

Taylor and McCallum-rules Using a Growth-to-Target Gap (Chen et al.; 2018)

	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	R1dR	M2	M2	M2	M2	M2	M2	M2	M2	M2	M2	M2
Const	0.618***	0.593***	0.592***	0.7634***	0.651***	1.0335***	0.278	0.226	0.253	0.317	0.212	0.4311*	1.143*	2.092**	1.510**	2.531***	2.337***	3.205***	1.035	2.269**	1.194	2.028**	1.534*	3.171***
	(3.687)	(3.173)	(3.514)	(4.2523)	(3.932)	(3.8730)	(1.309)	(0.990)	(1.182)	(1.626)	(1.000)	(1.7629)	(1.807)	(2.346)	(2.111)	(3.076)	(2.853)	(3.540)	(1.569)	(2.350)	(1.573)	(2.372)	(1.685)	(2.941)
$Money_{t-1}$	0.672***	0.658***	0.623***	0.4876***	0.642***	0.4548***	0.726***	0.698***	0.707***	0.610***	0.719***	0.5784***	0.943***	0.918***	0.938***	0.886***	0.866***	0.806***	0.968***	0.932***	0.966***	0.924***	0.940***	0.861***
	(8.618)	(8.418)	(7.687)	(5.0279)	(8.141)	(4.2568)	(10.087)	(9.923)	(9.453)	(7.506)	(10.155)	(6.0830)	(18.326)	(16.409)	(17.989)	(16.124)	(14.472)	(13.069)	(13.155)	(12.020)	(12.656)	(11.835)	(11.628)	(12.135)
π_a	0.081**	0.079**	0.100***	0.1235***	0.113***	0.1614***							-0.263**	-0.226*	-0.292***	-0.307***	-0.417***	-0.426***						
	(2.407)	(2.342)	(3.126)	(3.8354)	(2.963)	(3.1768)							(-2.249)	(-1.884)	(-2.717)	(-2.900)	(-3.285)	(-3.272)						
π_a							0.158***	0.160***	0.165***	0.195***	0.205***	0.2042***							-0.348	-0.294	-0.355	-0.356	-0.436	-0.345
							(2.916)	(2.995)	(2.928)	(3.422)	(3.208)	(3.1728)							(-1.259)	(-1.098)	(-1.284)	(-1.300)	(-1.460)	(-1.308)
$\tilde{y}^*$_pos	-0.031	-0.021	0.013	0.0654*	0.002	0.0629*	-0.036	-0.018	-0.011	0.037	-0.007	0.0325	0.158*	0.042	0.049	-0.104	-0.015	-0.119	0.180*	0.028	0.128	-0.016	0.109	-0.039
	(-1.310)	(-0.635)	(0.412)	(1.8321)	(0.075)	(1.9968)	(-1.551)	(-0.545)	(-0.425)	(1.282)	(-0.285)	(1.1852)	(1.827)	(0.439)	(0.434)	(-0.978)	(-0.170)	(-1.243)	(1.835)	(0.285)	(0.975)	(-0.133)	(1.050)	(-0.368)
$\tilde{y}^*$_neg	0.047	0.044	0.006	-0.0001	0.047	-0.0046	-0.007	-0.013	-0.036	-0.061	-0.026	-0.0473	-0.018	0.066	0.092	0.209	0.087	0.153	0.087	0.176	0.146	0.270	0.161	0.204
	(0.603)	(0.557)	(0.081)	(-0.0017)	(0.602)	(-0.0682)	(-0.098)	(-0.181)	(-0.517)	(-0.945)	(-0.363)	(-0.7467)	(-0.153)	(0.490)	(0.598)	(1.372)	(0.638)	(1.004)	(0.673)	(1.296)	(0.942)	(1.610)	(1.005)	(1.336)
FS_{t-1}		-0.015				0.0955		-0.028				0.0199		0.162*				-0.053		0.205**				0.171*
		(-0.413)				(1.5725)		(-0.804)				(0.4354)		(1.764)				(-0.470)		(2.272)				(1.904)
$FSSN_{t-1}$			0.147**			-0.0189			0.085			-0.1334			-0.324			0.674			-0.158			0.800
			(2.178)			(-0.1711)			(1.525)			(-1.2230)			(-1.407)			(1.538)			(-0.627)			(1.527)
$FSSS_{t-1}$				-0.3068***		-0.5190***				-0.234**		-0.4022**				0.735***		1.058**				0.557**		0.858*
				(-2.9333)		(-2.7700)				(-2.640)		(-2.2388)				(2.995)		(2.616)				(2.386)		(1.999)
$FRgr_{t-1}$					-0.008*	-0.0003					-0.007**	0.0009					0.046***	0.044**					0.020	0.015
					(-1.889)	(-0.0527)					(-2.023)	(0.1720)					(2.885)	(2.248)					(1.286)	(0.798)
longrun																								
	0.247	0.232	0.265	0.2410	0.314	0.2961	0.579	0.529	0.563	0.500	0.729	0.4843	-4.632	-2.738	-4.698	-2.680	-3.123	-2.198	-10.861	-4.314	-10.315	-4.672	-7.283	-2.477
$\tilde{y}^*$_pos	-0.094	-0.062	0.034	0.1277	0.006	0.1153	-0.133	-0.059	-0.037	0.094	-0.025	0.0772	2.784	0.506	0.791	-0.907	-0.109	-0.612	5.613	0.412	3.714	-0.207	1.817	-0.282
$\tilde{y}^*$_neg	0.145	0.129	0.016	-0.0002	0.131	-0.0084	-0.026	-0.043	-0.122	-0.155	-0.091	-0.1122	-0.322	0.801	1.475	1.830	0.652	0.793	2.725	2.582	4.229	3.548	2.694	1.465
Adj R2	0.629	0.623	0.64	0.674	0.638	0.682	0.638	0.636	0.638	0.666	0.646	0.655	0.917	0.919	0.918	0.925	0.926	0.929	0.909	0.914	0.908	0.913	0.91	0.916

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

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A p p e n d i x

T a b l e A1

Sample Taylor-rules (starting in 2000)

Policy variable	**CHIBOR**				**R1dR**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.200***	0.972***	1.338***	1.111***	0.4741***	0.302*	0.491***	0.326*
	(5.857)	(3.973)	(4.785)	(3.563)	(3.3024)	(1.832)	(3.478)	(1.928)
$Interest_{t-1}$	0.444***	0.433***	0.480***	0.442***	0.7218***	0.773***	0.717***	0.760***
	(5.743)	(5.137)	(6.148)	(5.217)	(10.2181)	(11.273)	(10.036)	(10.639)
π_a	0.159**		0.136*		0.0634***		0.063***	
	(2.043)		(1.717)		(2.8221)		(2.680)	
π_P		0.294**		0.300**		0.097***		0.096***
		(2.094)		(2.172)		(3.149)		(3.100)
$\tilde{y}$	-0.113*	-0.086			0.0005	0.013		
	(-1.753)	(-1.321)			(0.0191)	(0.514)		
$\tilde{y}^*$			-0.012	-0.034			-0.004	-0.008
			(-0.223)	(-0.695)			(-0.273)	(-0.495)
Long-run								
π	0.286	0.518	0.261	0.537	0.2279	0.430	0.223	0.399
$\tilde{y}$	-0.202	-0.151	-0.023	-0.060	0.0017	0.056	-0.015	-0.032
Adj R2	0.308	0.322	0.288	0.313	0.617	0.62	0.617	0.619
Observations	84							

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.
Source: Authors' computations.

T a b l e A2

Simple McCallum-rules (starting in 2000)

Policy variable	**M2gr**				**M0gr**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.080*	0.811	1.220**	1.017	1.578**	1.417*	1.529**	1.314**
	(1.769)	(1.267)	(2.083)	(1.614)	(2.245)	(1.961)	(2.430)	(2.019)
Moneyt−1	0.965***	0.985***	0.946***	0.960***	0.862***	0.824***	0.762***	0.739***
	(22.564)	(19.058)	(20.121)	(16.868)	(11.580)	(9.967)	(9.863)	(9.123)
πa	-0.302***		-0.282***			-0.075		0.083
	(-3.498)	(-3.095)		(-0.594)		(0.670)		
πP		-0.335**		-0.300**		0.148		0.267
		(-2.455)		(-2.349)		(0.691)		(1.368)
$\tilde{y}$	-0.024	-0.060			0.110	0.116		
	(-0.281)	(-0.599)			(1.096)	(1.171)		
$\tilde{y}^*$			0.100**	0.127**			0.318***	0.323***
			(2.161)	(2.401)			(3.135)	(3.383)
Long-run								
π	-8.744	-22.786	-5.209	-7.500	-0.540	0.838	0.349	1.023
$\tilde{y}$	-0.689	-4.065	1.848	3.175	0.796	0.659	1.335	1.236
Adj R2	0.914	0.903	0.917	0.907	0.704	0.705	0.729	0.734
Observations	84							

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.
Source: Authors' computations.

Table A3

Taylor-rules Based on CHIBOR vs. SHIBOR (starting in 2006)

	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR	CHIBOR	SHIBOR
Constant	1.615***	1.288***	1.854**	2.174***	1.150***	0.647	1.846**	2.040***	1.652***	1.373***	1.846**	2.170***	1.145***	0.657	1.901***	2.008***
	(4.335)	(3.660)	(2.231)	(3.310)	(2.969)	(1.538)	(2.497)	(3.696)	(5.047)	(3.731)	(2.186)	(3.415)	(2.879)	(1.558)	(2.718)	(3.763)
Interestt−1	0.407***	0.423***	-0.001	-0.126	0.359***	0.434***	-0.019	-0.105	0.418***	0.430***	-0.017	-0.195	0.360***	0.414***	-0.009	-0.125
	(5.000)	(3.480)	(-0.006)	(-0.800)	(3.440)	(3.558)	(-0.131)	(-0.749)	(5.030)	(3.489)	(-0.105)	(-1.312)	(3.437)	(3.172)	(-0.064)	(-0.891)
πa	0.154	0.173*	0.333**	0.324***					0.142	0.160*	0.569**	0.460***				
	(1.438)	(1.717)	(2.157)	(2.905)					(1.420)	(1.833)	(2.523)	(3.951)				
πP					0.438*	0.452**	0.548**	0.648***					0.436*	0.478***	0.775***	0.700***
					(1.772)	(2.558)	(2.679)	(4.277)					(1.876)	(2.699)	(2.755)	(4.727)
$\tilde{y}$	-0.032	-0.031	0.340*	0.153	0.001	0.007	0.309	0.071								
	(-0.343)	(-0.359)	(1.950)	(1.506)	(0.015)	(0.091)	(1.505)	(0.773)								
$\tilde{y}^*$									0.056	0.002	0.256**	0.186***	0.004	-0.050	0.158*	0.101*
									(0.565)	(0.048)	(2.355)	(2.856)	(0.050)	(-1.022)	(1.911)	(1.832)
M2grt−1			0.094	-0.003			0.019	-0.094**			0.026	-0.035			-0.076*	-0.117***
			(1.140)	(-0.072)			(0.242)	(-2.176)			(0.469)	(-0.976)			(-2.007)	(-3.784)
FSt−1			0.207	0.050			0.081	-0.056			0.298	0.082			0.080	-0.071
			(0.947)	(0.395)			(0.470)	(-0.467)			(1.248)	(0.656)			(0.458)	(-0.596)
FSSNt−1			1.534**	1.223***			1.266**	0.871**			1.214**	1.082***			0.843**	0.743**
			(2.403)	(3.085)			(2.125)	(2.418)			(2.421)	(3.149)			(2.023)	(2.242)
FSSSt−1			-1.147***	-1.047**			-1.091**	-0.908**			-1.332***	-1.299***			-1.099***	-1.030**
			(-2.699)	(-2.459)			(-2.581)	(-2.172)			(-3.017)	(-3.190)			(-2.787)	(-2.563)
FRgrt−1			0.038*	0.051***			0.052***	0.057***			0.012	0.041**			0.040**	0.055***
			(2.013)	(2.714)			(2.855)	(2.864)			(0.497)	(2.315)			(2.238)	(2.950)
Long-run																
π	0.259	0.300	0.332	0.288	0.684	0.798	0.537	0.587	0.243	0.281	0.559	0.385	0.682	0.816	0.768	0.622
$\tilde{y}$	-0.053	-0.054	0.339	0.136	0.002	0.012	0.303	0.064	0.096	0.004	0.252	0.156	0.006	-0.086	0.157	0.090
Adj R2	0.187	0.267	0.375	0.528	0.228	0.344	0.377	0.581	0.191	0.265	0.399	0.576	0.228	0.35	0.367	0.598
Observations								53								

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

T a b l e A4

Taylor-rules Using Different Inflation Expectations (starting in 2007)

Policy variable	**R1dR**							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.449*	0.533**	0.939	0.926*	0.201	0.259	1.016*	0.972**
	(1.960)	(2.345)	(1.673)	(1.976)	(0.955)	(1.282)	(1.707)	(2.071)
R1dRt−1	0.705***	0.648***	0.438***	0.306**	0.730***	0.688***	0.416***	0.279*
	(8.789)	(7.638)	(3.230)	(2.174)	(9.389)	(8.634)	(2.962)	(1.987)
π_P	0.182***		0.175**		0.180***		0.220***	
	(2.849)		(2.339)		(2.859)		(2.714)	
π_B		0.185***		0.341***		0.177**		0.389***
		(2.798)		(3.589)		(2.515)		(4.033)
$\tilde{y}$	0.073*	0.075*	0.069	0.035				
	(1.936)	(1.905)	(1.178)	(0.774)				
$\tilde{y}^*$					-0.026	-0.004	0.007	0.043
					(-0.913)	(-0.123)	(0.219)	(1.171)
M2grt−1			-0.014	-0.027			-0.037*	-0.039**
			(-0.474)	(-1.114)			(-1.692)	(-2.087)
FSt−1			-0.019	0.013			-0.022	0.019
			(-0.266)	(0.200)			(-0.308)	(0.285)
FSSNt−1			0.019	0.238**			0.003	0.152
			(0.151)	(2.172)			(0.018)	(1.057)
FSSSt−1			-0.412**	-0.416**			-0.382*	-0.468**
			(-2.059)	(-2.270)			(-1.779)	(-2.264)
FRgrt−1			0.014*	0.007			0.013	0.005
			(1.868)	(1.071)			(1.655)	(0.685)
Long-run								
π	0.614	0.526	0.312	0.492	0.668	0.568	0.378	0.539
$\tilde{y}$	0.247	0.212	0.124	0.051	-0.097	-0.012	0.011	0.059
Adj R2	0.615	0.611	0.631	0.688	0.596	0.588	0.623	0.691
Observations				53				

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

T a b l e A5

McCallum-rules Using Different Inflation Expectations (starting 2007)

Policy variable	**M2**											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	1.156*	3.802***	0.863	3.640***	1.647**	4.629***	1.379*	3.817***	1.237	3.577***	1.817**	4.830***
	(1.826)	(4.327)	(1.362)	(3.984)	(2.454)	(5.958)	(1.951)	(3.777)	(1.672)	(2.991)	(2.358)	(5.030)
M2t−1	0.871***	0.713***	0.864***	0.672***	0.897***	0.744***	0.941***	0.826***	0.972***	0.890***	0.985***	0.875***
	(10.763)	(9.253)	(8.403)	(6.937)	(11.588)	(10.834)	(18.032)	(13.769)	(12.787)	(12.779)	(17.577)	(16.830)
πa	-0.252**	-0.235*					-0.319**	-0.461***				
	(-2.065)	(-1.896)					(-2.566)	(-3.549)				
πP			-0.229	0.085					-0.445	-0.322		
			(-0.718)	(0.323)					(-1.461)	(-1.209)		
πB					-0.580***	-0.702***					-0.665***	-0.982***
					(-2.727)	(-4.028)					(-2.715)	(-4.267)
$\tilde{y}$	-0.381*	-0.502**	-0.501**	-0.719***	-0.422**	-0.486***						
	(-1.771)	(-2.667)	(-2.299)	(-3.807)	(-2.228)	(-2.943)						
$\tilde{y}^*$							0.160	0.124	0.237*	0.187	0.138	0.071
							(1.412)	(1.162)	(1.754)	(1.426)	(1.275)	(0.725)
FSt−1		0.187		0.315**		0.191*		0.122		0.357***		0.202*
		(1.379)		(2.630)		(1.732)		(0.970)		(2.797)		(1.851)
FSSNt−1		0.323		0.484		0.257		-0.292		-0.024		-0.157
		(0.670)		(0.916)		(0.685)		(-0.608)		(-0.043)		(-0.397)
FSSSt−1		1.035***		1.190***		0.883***		0.470		0.323		0.354
		(3.130)		(3.122)		(2.841)		(1.497)		(0.876)		(1.092)
FRgrt−1		0.009		-0.020		0.024		0.032		-0.004		0.041**
		(0.438)		(-1.133)		(1.499)		(1.572)		(-0.213)		(2.238)
Long-run												
π	-1.956	-0.820	-1.678	0.258	-5.647	-2.741	-5.423	-2.655	-16.129	-2.930	-42.948	-7.879
$\tilde{y}$	-2.963	-1.748	-3.674	-2.195	-4.113	-1.898	2.725	0.716	8.591	1.701	8.912	0.570
Adj R2	0.927	0.945	0.92	0.942	0.932	0.952	0.923	0.937	0.914	0.922	0.925	0.941
Observations						53						

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.

Table A6

Monetary Policy Rules without Policy Smoothing

Policy variable	R1dR				CHIBOR				M2			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Const	1.882***	1.984***	2.051***	2.113***	2.145***	1.784***	2.640***	2.123***	13.991***	12.488***	13.324***	11.870***
	(17.713)	(16.144)	(17.708)	(17.410)	(12.547)	(6.632)	(12.652)	(7.287)	(19.101)	(12.516)	(15.722)	(14.419)
$\tilde{y}$	-0.030	-0.014			-0.199***	-0.149*			-0.303	-0.288		
	(-0.768)	(-0.293)			(-2.713)	(-1.781)			(-1.105)	(-0.983)		
$\tilde{y}^*$			-0.064***	-0.079***			-0.076	-0.105**			0.685***	0.702***
			(-2.836)	(-3.315)			(-1.334)	(-2.013)			(3.897)	(3.896)
π_a	0.135***		0.119***		0.292***		0.259**		-0.199		-0.084	
	(3.676)		(3.318)		(3.165)		(2.626)		(-0.850)		(-0.349)	
π_P		0.105*		0.103**		0.489***		0.504***		0.469		0.543*
		(1.984)		(1.997)		(3.136)		(3.239)		(1.452)		(1.789)
Long-run												
π	0.157	0.118	0.136	0.115	0.413	0.955	0.349	1.016	-0.166	0.882	-0.078	1.188
$\tilde{y}$	-0.035	-0.015	-0.072	-0.088	-0.281	-0.291	-0.103	-0.213	-0.253	-0.542	0.632	1.537
Adj R2	0.137	0.0151	0.18	0.0956	0.154	0.174	0.101	0.163	0.00827	0.0204	0.146	0.173
Observations	84											

Note: t-values based on robust standard errors are reported in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01. FRgr, FSSN, FSSS, and FS are the growth rate of foreign exchange reserves, and the financial stability indices of non-performing loans, shadow banking, and house prices, respectively.

Source: Authors' computations.