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Impact of the Joint-Stock Reform of Commercial Banks on the Effectiveness of Monetary Policy in China

Summary: Over the past decade, the Chinese government has conducted the joint-stock reform of state-owned commercial banks. The joint-stock reform improves the marketization level of the ownership structure of commercial banks and consequently leads to impacts on the effectiveness of monetary policy. This paper first presents the impacting mechanisms of the joint-stock reform of commercial banks on the effectiveness of monetary policy and then constructs an empirical model to test those impacts. The empirical results show that the increasing degree of joint-stock reform of commercial banks enhances the effectiveness of expansionary monetary policy but weakens the effectiveness of contractionary monetary policy in China.

Key words: Commercial banks, Joint-stock reform, Monetary policy, Price level, China.

JEL: E31, G21.

China's financial system has been bank-oriented since the founding of the nation in 1949. Control of the bank credit supply is the most important instrument of monetary policy for China's central bank, the People's Bank of China (PBOC), to regulate economic growth and stabilize the price level. Before the mid-1980s, the PBOC directly controlled the credit supply. Since the reform and opening up in the mid-1980s, the function of controlling the credit supply has been separated from the PBOC and transferred to state-owned commercial banks. Because commercial banks were completely owned by the state, the PBOC could still efficiently control the credit supply. However, with the financial reform since 2000, traditional state-owned commercial banks have started to raise capital by issuing stocks in the market, which thus changed the ownership structure from being completely owned by the state into being shared between the state and private shareholders. This process of ownership structure change is referred to as the joint-stock reform of commercial banks. After such reform, China's commercial banks need to take into account the return on shareholders' investment when determining business strategies. This means that, unlike before, the business strategies of commercial banks are no longer fully consistent with the PBOC requirements. Therefore, the joint-stock reform of commercial banks eventually affects the effectiveness of monetary policy. How does the joint-stock reform of commercial banks impact the effectiveness of monetary policy in China?

This is a question worthy of study for the monetary policymaker, and this paper attempts to answer this question.

1. Literature Review

The objectives of monetary policy are to create economic growth, reduce unemployment, and stabilize the price level. According to the economic situation, the government or the central bank of a country can apply instruments of monetary policy to control the money supply and thus realize the objectives of monetary policy. In most countries, commercial banks are an important transmission medium for controlling the money supply; thus, the effectiveness of monetary policy relies heavily on the behavior of commercial banks. Under various ownership structures and systems, commercial banks may have different responses to the monetary policy adjustments implemented by the central bank.

There is substantial literature on the effects of commercial banks on the effectiveness of monetary policy. Stephen G. Cecchetti (1999) analyzed the functions of various types of commercial banks in the transmission of monetary policy in the United States, Japan, and 14 countries of the European Union; the empirical results showed that commercial banks with large-scale and good operating status can partly offset the impact caused by monetary policies. Maria C. Chiuri, Giovanni Ferri, and Giovanni Majnoni (2002) found that the loan supply activity of commercial banks is closely related to business cycles and has similar trends to the real economy in business cycles. Chris Baumann, Suzan Burton, and Greg Elliott (2005) observed a similar phenomenon and pointed out that the characteristic of procyclicality weakens the effectiveness of monetary policies to some extent. Mingwei Yuan and Christian Zimmermann (2004) reported that monetary policy has been shown to be largely ineffective in alleviating the credit crunch and that it is necessary to reform the ownership system of commercial banks to fully utilize the functions of commercial banks in the transmission of monetary policies. Florian Kajuth (2006) cited that commercial banks with different ownership structures have different responses to monetary policy and that the degree of excess procyclicality depends on the sensitivity of risk weights with respect to changes in the aggregate output and the structure of bank capital. Yuliya S. Demyanyk and Otto Van Hemert (2011) reported similar conclusions. Života Ristić (2006) analyzed the motives and effects of privatization processes in the banking sectors of the United States and the European Union. Alex Cukierman (2007) examined the institutional changes that have taken place over the last two decades in the autonomy of central banks and related institutions of monetary policy around the world and the relations between such changes and macroeconomic performance. Eric S. Rosengren (2008) suggested that the ownership structure of commercial banks needs to be adjusted to reduce the impact of lending procyclicality and improve the effectiveness of monetary policy. Ramona Jimborean (2009) studied the role of commercial banks in monetary policy transmission in the new EU member states and found that an asymmetric loan quantity adjustment exists according to specific bank characteristics. Roman Matousek and Nicholas Sarantis (2009) investigated the reactions of commercial banks to changes in monetary policy in eight Central and Eastern European countries and reported that the size, capital

strength, liquidity, and ownership structure of banks are the main affecting factors. Natalia Andries and Steve Billon (2010) examined the effect of the ownership structure of commercial banks on monetary policy transmission and found that different ownership structures can have different effects. Tuuli Juurikkala, Alexei Karas, and Laura Solanko (2011) studied the role of banks in monetary policy transmission in Russia and reported that the level of bank capitalization matters. Christopher Baum, Mustafa Caglayan, and Neslihan Ozkan (2013) explored the relationship between commercial banks and changes in monetary policy in the United States and found that the monetary policy transmission mechanism varies considerably across bank categories. William F. Bassett et al. (2014) reported that changes in the lending standards of commercial banks can affect the monetary policy. The review of the existing literature shows that ownership structure is one of the main factors that affect the business strategies of commercial banks in the transmission of monetary policy and thus may affect the effectiveness of monetary policy.

The ownership structure of China's commercial banks has been experiencing a significant reform over the past decade. The Chinese government has been conducting the joint-stock reform of commercial banks since 2000. The aim of the joint-stock reform of state-owned commercial banks is to build a modern and competitive banking system (John Hawkins and Dubravko Mihaljek 2001). The joint-stock reform has changed the ownership structure, as well as the business objectives, of commercial banks in China. A few researches have studied the effects of the joint-stock reform on the behaviors and performances of China's commercial banks. Richard Podpiera (2006) found evidence of changing behavior in large, state-owned commercial banks in China from 1997 through 2004 and showed that commercial banks have slowed down credit expansion and do not seem to take profitability into account when making lending decisions. Xiaoqing Fu and Shelagh Heffernan (2009) indicated that the joint-stock reform has had little impact on the structure of China's banking sector but that joint-stock commercial banks have become relatively more efficient than before. Chunxin Jia (2009) examined the relationship between ownership and the prudential behavior of banks and showed that the joint-stock reform has improved the incentive for state-owned commercial banks to behave more prudently in their lending. Xiaochi Lin and Yi Zhang (2009) investigated the effects of the ownership of China's commercial banks on the bank performances and found that the share of state ownership is negatively related to bank performances.

The joint-stock reform changes the ownership structure of China's commercial banks; as a result, the business strategies of these banks have started to consider the interests of shareholders. When shareholders' interests are affected by monetary policy adjustments, commercial banks may adopt their own strategies instead of passively obeying the instructions of the PBOC. Yiping Huang et al. (2010) indicated that through the joint-stock reform, commercial banks now have clearly defined ownerships; however, the instruments of monetary policy applied to control the money supply through commercial banks have changed almost completely from direct controls from the PBOC to indirect ones. Michael F. Martin (2012) argued that although the joint-stock reform causes state-owned commercial banks to operate more like real commercial banks, the central government or the PBOC is unwilling to fully relinquish control over these banks, and commercial banks seem to be striving to balance

their business objectives to earn profits with the monetary policy objectives stipulated by the PBOC. Therefore, the joint-stock reform of commercial banks eventually impacts the effectiveness of monetary policy in China.

In this paper, we try to empirically examine the impacts of the joint-stock reform of commercial banks on the effectiveness of monetary policy in China. To the best of our knowledge, little literature has focused on this issue. We first theoretically illustrate the impacting mechanisms of the joint-stock reform of commercial banks on the effectiveness of monetary policy. Then, we design an empirical model to study the impacts of the joint-stock reform of commercial banks on the effectiveness of monetary policy in China.

2. Reform of China's Commercial Banks

Since the founding of the People's Republic of China in 1949, the banking sector of the country has experienced four stages of reform and transformation.

■ Stage 1: Mono-banking system (1952-1978)

During the period of 1952-1978, the PBOC was the only bank in China, and it had the functions of a central bank, policy banks, and commercial banks. Through the PBOC, the Chinese government established a highly centralized national banking and credit management system. On one hand, the PBOC functioned as the central bank to regulate the amount of money supply, interest rates, etc. On the other hand, it also handled the business of commercial banks, such as personal savings, business loans, and other services. The PBOC controlled virtually all the financial business in China and processed 93% of the national financial transactions. However, with the fast economic growth, the mono-banking system became more and more incompatible with the increasing demand for financial business in China.

■ Stage 2: State-owned professional banking system (1979-1993)

The state professional banking system was established by making minor changes to the mono-banking system. Four state-owned banks, namely, the Agricultural Bank of China, the Bank of China, the China Construction Bank, and the Industrial and Commercial Bank of China, were separated from the PBOC, and each of these four banks had its own business. The planned economic system determined that the four state-owned banks should have independent and non-interfering businesses, and therefore, they were called state professional banks. In 1985, the four state-owned banks started an enterprise transformation to break the integration of government administration with banks and the pattern of excessive concentration of credit activities in the banking sector. However, the actual effects of the enterprise transformation were not satisfactory, and the deep contradictions accumulated under the old system caused most bank assets to become exposed to risks.

■ Stage 3: Commercial reform of state-owned professional banks (1994-2002)

To solve the problem of mixing of commercial and policy-oriented banking services, the State Council started a banking reform at the end of 1993. The reform was intended to establish the PBOC as the real central bank, transform the state-owned pro-

fessional banks into real commercial banks, and separate policy-based business from the state-owned professional banks. Therefore, three policy banks, namely, the China Development Bank, the China Agricultural Development Bank, and the China Export-Import Bank, were founded in 1994 to undertake policy-based lending business. Meanwhile, the four state-owned professional banks began their transformation from professional banks to commercial banks; their operations and management were changed from executing administrative plans and orders from the PBOC into self-restraint and independent operations under the leadership of the PBOC. Meanwhile, city commercial banks began to form based on the existing urban credit cooperatives, and non-state-owned commercial banks started to emerge.

■ **Stage 4: Joint-stock reform of state-owned commercial banks (2003-present)**

With the promotion of the banking reform, the autonomy of commercial banks expanded gradually, and their commerciality became increasingly prominent. However, the reform only repaired the existing institutional framework but did not touch on the ownership structure of the state-owned commercial banks. Although the ownership structure was called sole proprietorship, it was not clear who actually held the ownership, which resulted in a lot of negative effects, such as an ambiguous ownership structure, the lack of an efficient self-restraint mechanism, low operating efficiency, etc. To establish a contemporary commercial banking system and get rid of government interventions, the state-owned commercial banks started their joint-stock reform in 2003. Although the details of the joint-stock reform differed among banks, the procedure was generally implemented in three stages: financial restructuring, introduction of strategic investors, and issuance of stocks in the capital market. So far, all state-owned commercial banks have completed their joint-stock reform. As the main body of China's banking sector, state-owned commercial banks have entered a new period of development with new attitudes. Besides, other commercial banks have also started their joint-stock reform, and more and more commercial banks are choosing to be publicly listed on the stock market.

The joint-stock reform leads commercial banks to act more and more like a rational economic agent in the market economy system, and their market strategies are increasingly inclined toward the pursuit of benefit maximization, which leads to challenges for the PBOC to implement monetary policy adjustments; this also motivates us to examine the impacts of the joint-stock reform of commercial banks on the effectiveness of monetary policy in China.

3. Model Specifications

In this section, we first present the impacting mechanism of the joint-stock reform of China's commercial banks on the effectiveness of monetary policy and then provide the details of the regression model used in the empirical study.

3.1 Impacting Mechanism

With the joint-stock reform of commercial banks, as well as the acceleration of financial globalization, the extent of opening up and reform of China's banking sector

continues to deepen, and the ownership structure of China's commercial banks becomes increasingly diversified. The joint-stock reform leads commercial banks to become more and more independently involved in the market and to select strategies according to their own benefits. As a result, the PBOC and commercial banks, as market participants, are becoming relatively more independent of each other than ever. In particular, commercial banks cannot clearly predict whether or not the PBOC will implement monetary policy adjustments; meanwhile, the PBOC cannot exactly ensure the implementation of monetary policy adjustments by commercial banks. Therefore, information asymmetry exists between the PBOC and commercial banks.

In recent years, the main objective of China's monetary policy has been to stabilize the price level rather than to create economic growth because China's economy has maintained stable growth since its reform and opening up. The stability of the price level can be viewed as a benefit of monetary policy adjustments. Of course, monetary policy adjustments entail costs, including formulation costs, implementation costs, unexpected international capital flows, etc. According to the price level fluctuations, the PBOC prudently determines whether to implement monetary policy adjustments on the basis of a consolidated balance of benefits and costs. In response to monetary policy adjustments, commercial banks may adopt either of two strategies: obey the instructions of the PBOC or not. If the commercial banks choose to obey, they will have their normal operating income. If they choose not to obey, they can obtain excess returns besides their normal income; however, once discovered by financial regulatory authorities, they will suffer penalties that can be regarded as the cost of disobedience. Commercial banks would select their strategy based on considerations of their own benefits and costs. Therefore, the PBOC and commercial banks have the characteristics of a rational economic agent and participate in the market to maximize their own benefits.

Because monetary policy is implemented according to the price level fluctuations, the effectiveness of monetary policy is therefore examined by checking the price level trends. No matter what instruments of monetary policy are used, the monetary policy adjustments of the PBOC are intended to control the amount of money supply. On the other hand, the price level is also affected by the velocity of money according to the quantity theory of money. Because China's financial system is bank-oriented, the velocity of money depends to a certain extent on the strategies adopted by commercial banks in response to the monetary policy adjustments. The excessive lending of commercial banks in the presence of a contractionary monetary policy or the reluctance to lend in the presence of an expansionary monetary policy will definitely affect the velocity of money. The joint-stock reform affects the strategy selections of commercial banks in response to the monetary policy adjustments, which changes the velocity of money and eventually leads to impacts on the effectiveness of monetary policy.

Figure 1 presents the impacting mechanism of the joint-stock reform of China's commercial banks on the effectiveness of monetary policy. According to the price level fluctuations, the PBOC applies instruments of monetary policy to control the amount of money supply and supervises commercial banks in their execution of its instructions. However, the joint-stock reform changes the ownership structure of

commercial banks; thus, commercial banks may select their own strategies to pursue the maximization of benefits. Such strategies change the velocity of money and thus affect the effectiveness of monetary policy.
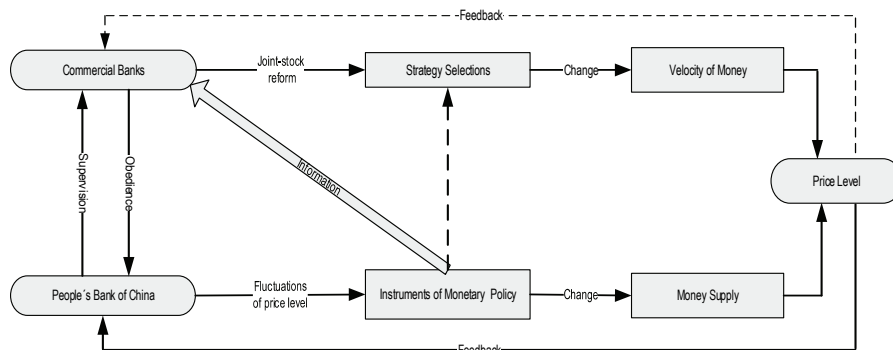
Source: The authors.

Figure 1 Impacting Mechanisms of the Joint-Stock Reform of Commercial Banks on Monetary Policy

3.2 The Model

According to the traditional quantity theory of money, the quantity equation:

$$MV = PY, \tag{1}$$

expresses the relationship between the price level *(P)*, the amount of output *(Y)*, the money supply *(M)*, and the velocity of money *(V)*. In many cases, the velocity of money is relatively stable and is further assumed to be constant over time, although it might be influenced by various factors, such as technology, social system, etc. In China, the joint-stock reform leads commercial banks to adopt their own strategies. These strategies, such as excessive lending or a reluctance to lend, may change the velocity of money. Therefore, the traditional assumption of constant velocity of money is not reasonable in China; we further assume that the velocity of money is affected by the joint-stock reform of commercial banks as follows:

$$V' = KV, \tag{2}$$

where *V* is the original constant velocity of money, and *K* indicates the degree of commercial banks' joint-stock reform.

Substituting Equation (2) into Equation (1) and taking the natural logarithm for both sides, we obtain:

$$\ln M + \ln K + \ln V = \ln P + \ln Y. \tag{3}$$

Differentiating both sides of Equation (3) yields:

$$\frac{\mathrm{d}M}{M} + \frac{\mathrm{d}K}{K} + \frac{\mathrm{d}V}{V} = \frac{\mathrm{d}P}{P} + \frac{\mathrm{d}Y}{Y}. \tag{4}$$

Because V is the constant velocity of money, $dV = 0$; thus, we obtain:

$$\frac{\mathrm{d}P}{P} = \frac{\mathrm{d}M}{M} + \frac{\mathrm{d}K}{K} - \frac{\mathrm{d}Y}{Y}. \tag{5}$$

Equation (5) indicates that changes in the price level could be affected by changes in the money supply, changes in the degree of commercial banks' joint-stock reform, and changes in the output.

Considering the lagged effects of macroeconomic variables, we establish a regression model as follows:

$$\Delta P_t = \alpha + \sum_{j=1}^{p} \beta_j \Delta P_{t-j} + \gamma \Delta K_t + \sum_{j=0}^{q} \varphi_j \Delta M_{t-j} + \sum_{j=0}^{r} \phi_j \Delta Y_{t-j} + \varepsilon_t. \tag{6}$$

In this model, ΔP_t is the change rate of the price level at time t, ΔK_t is the change rate of the degree of commercial banks' joint-stock reform at time t, ΔM_t is the change rate of the money supply at time t, and ΔY_t is the change rate of the output at time t; α, $\beta_1, \ldots, \beta_p$, γ, $\phi_0, \ldots, \phi_q$, $\phi_0, \ldots, \phi_r$, are regression coefficients to be estimated, where, p, q, r are orders of lagged variables to be determined in the empirical study, and ε_t is the error term.

In Equation (6), the coefficient γ reflects the impacts of the joint-stock reform of commercial banks on the effectiveness of monetary policy. If γ is significantly positive, then changes in the degree of commercial banks' joint-stock reform provide significant positive effects on changes in the price level. That is to say, when the PBOC is implementing contractionary monetary policy to lower the price level, an increase in the degree of commercial banks' joint-stock reform will weaken the effectiveness of such policy. Similarly, when the PBOC is implementing expansionary monetary policy to raise the price level, an increase in the degree of commercial banks' joint-stock reform will enhance the effectiveness of such policy. That γ is not significant implies that the joint-stock reform of commercial banks does not have significant impacts on the effectiveness of monetary policy. If γ is significantly negative, then an increase in the degree of commercial banks' joint-stock reform will weaken the effectiveness of expansionary monetary policy and enhance the effectiveness of contractionary monetary policy.

4. Empirical Results

In this section, we apply the model introduced in Section 4.2 to examine the impacts of the joint-stock reform of commercial banks on the effectiveness of monetary policy in China.

4.1 Variable Selection and Data

The dependent variable of the empirical model given in Equation (6) is the change rate of the price level. In the empirical study, we choose the widely used consumer price index (CPI) to represent the price level. The CPI measures changes in the price

level of a market basket of consumer goods and services and is one of the references used by the PBOC to determine whether to implement monetary policy adjustments. The explanatory variables include the change rates of the money supply and the output and degree of commercial banks' joint-stock reform. We use M2 to represent the amount of money supply. M2 is usually considered to be a broader measure of money supply than M0 and M1. We use the real GDP growth rate to indicate the change rate of the output. The selection of the proxy variable of degree of joint-stock reform of commercial banks needs specific considerations. Because commercial banks reconstruct the ownership structure by issuing stocks in the stock market, the market value of all publicly traded stocks issued by commercial banks can be used to indicate to some extent the degree of commercial banks' joint-stock reform. Finally, to reduce the influence of stock price fluctuations on the market value, we measure the degree of commercial banks' joint-stock reform, denoted by GV, by using the market value of all publicly traded stocks issued by commercial banks, divided by the banking sector index, which is a market value-weighted index of all listed commercial banks.

Quarterly data of CPI, M2, and real GDP are obtained from the database of the National Bureau of Statistics of China (http://www.stats.gov.cn/tjsj/). The quarterly data of the market value of all publicly traded stocks issued by commercial banks and the banking sector index are obtained from the Wind Financial Terminal (http://www.wind.com.cn/). The sampling period for all quarterly change rates is between 2000Q1 and 2011Q3, with 47 observations included in each series. Table 1 lists the descriptive statistics of the quarterly change rates of each variable.

Table 1   Descriptive Statistics of the Quarterly Change Rates of Variables

| Variable	Mean	Std. dev.	Skewness	Kurtosis	Q(8)	ADF	Jarque-Bera
CPI	0.023	0.025	0.550	2.372	71.16*	-1.57	3.74
GV	0.047	0.109	0.676	3.824	3.16	-2.56	5.10
M2	0.176	0.038	1.559	5.229	58.32*	-1.87	16.20*
GDP	0.103	0.018	0.529	2.825	88.19*	-1.80	2.70

Note: Q(8) is the Ljung-Box statistic for serial correlation with 8 lags. ADF is the augmented Dickey-Fuller statistic for the unit root test. Jarque-Bera is the χ^2 statistic for the normality test. * indicates rejection of null hypothesis at 5% level.

Source: Authors' calculations.

The quarterly change rates of the CPI have a relatively small mean of 0.023, whereas the standard deviation of 0.025 indicates the existence of fluctuations during the sampling period. The average change rate of GV is 0.047, which indicates that, in general, the degree of commercial banks' joint-stock reform continues to increase, whereas the volatility is relatively large, with a standard deviation of 0.109. M2 continues to increase during the whole sampling period, with an average growth rate of 0.176; however, the standard deviation of growth rates is 0.038, which indicates that the growth of M2 is stable. The quarterly growth rates of the real GDP is stable, with a positive mean of 0.103 and a standard deviation of 0.018. The positive values of skewness for all series suggest a greater probability of increase for all variables. The Ljung-Box tests indicate the presence of serial correlation in the series of CPI, M2, and GDP, which suggests that lagged variables should be included in the regression

model. The augmented Dickey-Fuller test statistics indicate the rejection of the null hypothesis of unit root for all series, whereas the Jarque-Bera tests reject the null hypothesis of normality for the change rates of M2.

Figure 2 shows the sample path of the quarterly change rates of all variables. Before 2008, the change rates of the CPI were generally positive, except for some quarters in 2002 due to the decrease in consumption caused by a large number of laid-off workers; meanwhile, the M2 and real GDP of China continued to increase stably. During the period of 2008-2009, the change rates of the CPI and real GDP showed an obvious downward trend due to the global financial crisis. To stimulate the economy, the Chinese government put massive amounts of liquidity into the financial market, which led to high growth rates of M2 and high inflation rates after 2009. To control the price level, the PBOC has adopted a contractionary monetary policy since 2009, which has resulted in a downward trend in the growth rates of M2. Compared with the other three series, the change rates of GV have shown obvious fluctuations over time.
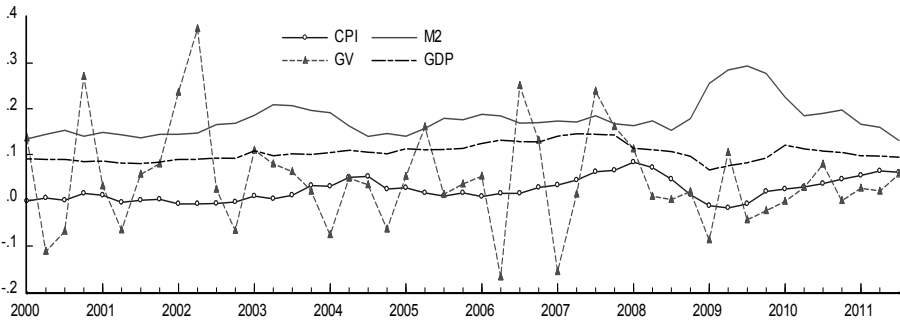
Source: The authors.

Figure 2 Sample Path of the Quarterly Change Rates of CPI, M2, GDP, and GV

According to the variable selection, the regression model given in Equation (6) can be written as follows:

$$\Delta CPI_t = \alpha + \sum_{j=1}^{p} \beta_j \Delta CPI_{t-j} + \gamma \Delta GV_t + \sum_{j=0}^{q} \varphi_j \Delta M2_{t-j} + \sum_{j=0}^{r} \phi_j \Delta GDP_{t-j} + \varepsilon_t, \qquad (7)$$

where ΔCPI_t, ΔGV_t, $\Delta M2_t$, and ΔGDP_t denote the change rate of the CPI, GV, M2, and real GDP, respectively, in quarter t.

4.2 Empirical Results

Table 2 shows the estimated results of the regression model.

The coefficient of ΔGV_t is significantly positive, which means that the change in the degree of is positively correlated to the change in the price level. This result implies that the joint-stock reform of commercial banks has significant positive effects on the effectiveness of expansionary monetary policy in China. We interpret

this result as follows. With the deepening of their joint-stock reform, China's commercial banks have become more and more independent in the market competition, and their business objectives have gradually changed from compliance with government instructions to the pursuit of benefit maximization. Although China's commercial banks are now actively expanding their off-balance sheet business, their main source of benefits is still their on-balance sheet business, especially the traditional credit business. Commercial banks would like to lend as much as possible to realize the maximization of benefits as long as credit risks can be controlled under a certain level. Excessive lending of commercial banks can speed up the velocity of money and thus lead to an increase in the price level. This phenomenon is more obvious when expansionary monetary policy is being implemented. For instance, the expansion of the credit size of commercial banks due to the economic stimulus package led to a rapid increase in the price level during the period of 2009-2011, when the PBOC implemented expansionary monetary policy to cope with the 2008 global financial crisis. Therefore, the PBOC should be fully aware of this issue and adopt a prudent and flexible approach in the implementation of expansionary monetary policy.

Table 2 Estimates of Regression Coefficients and Significance Test Results

Variable	Coefficient	Std. error	*t*-statistic
Intercept	-0.038	0.006	-6.033*
ΔCPI_{t-1}	0.844	0.048	17.765*
ΔGV_t	0.039	0.010	3.884*
$\Delta M2_t$	0.012	0.010	1.197
$\Delta M2_{t-1}$	0.097	0.019	4.991*
ΔGDP_t	1.075	0.128	8.411*
ΔGDP_{t-1}	-0.854	0.165	-5.169*
Adjusted R²	**0.653**	***F*-statistic**	**27.38***

Note: * indicates statistical significance at 5% level. Orders of lagged terms, *p*=1, *q*=1, and *r*=1 are chosen according to the Akaike information criterion (AIC).

Source: Authors' estimations.

With respect to the other variables, $\Delta M2_{t-1}$ is significantly positively related to ΔCPI_t, whereas $\Delta M2_t$ is not, which indicates the lagged effects of the money supply on the price level. The coefficient associated with ΔCPI_{t-1} is significantly positive. This is due to the strong persistence of changes in the price level. The coefficient of ΔGDP_t is significantly positive, whereas the coefficient of ΔGDP_{t-1} is significantly negative. This result is consistent with the quantity theory of money, which states that there is a negative relationship between changes in the output and changes in the price level; however, this negative relationship is characterized by lagged effects in China.

5. Conclusions

With the financial globalization, China's financial system has been gradually open-ing up and is increasingly becoming integrated with the world financial system. As a result, the Chinese government started the joint-stock reform of state-owned com-mercial banks in 2003. The joint-stock reform changes the ownership structure of commercial banks and their strategies in the market economy, leading to impacts on the effectiveness of monetary policy. This paper first illustrates the impacting mech-anism and then empirically studies the impacts of the joint-stock reform of commer-cial banks on the effectiveness of monetary policy in China. The empirical results show that changes in the degree of commercial banks' joint-stock reform are posi-tively correlated to changes in the price level, which implies that the joint-stock re-form of commercial banks enhances the effectiveness of expansionary monetary pol-icy and weakens the effectiveness of contractionary monetary policy in China. To improve the effectiveness of monetary policy, the PBOC should strengthen the regu-lations to commercial banks' disobedience to the instructions of the PBOC by in-creasing the cost of disobedience and correct commercial banks' inappropriate be-haviors by implementing benchmark interest rate adjustments through the interest rate corridor.

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