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The Roadmap of Interest Rate Liberalization in China

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Abstract

This paper examines the roadmap of interest rate liberalization in China, including the current dual-track interest rate system and the future benchmark rate system. It provides a theoretical foundation for China to develop its own benchmark interest rate. A Vector autoregression model (VAR) is estimated to investigate the effectiveness of Chinese market interest rates, Shanghai Interbank Offered Rate (SHIBOR), and repo rates against different factors such as market size, volatility, transmission channels of monetary policy, and term structures of interest rates. The result shows that SHIBOR affects both the market and the economy. As SHIBOR promptly reflects the changes in currency markets, we argue that it has the potential to become China's benchmark interest rate.

Keywords: SHIBOR, interest rate liberalization, shadow banking.

1. Introduction

Developing countries often adopt financially repressive policies, which aim at imposing control of fiscal resources and therefore hinder economic development. McKinnon (1973) and Shaw (1973) introduced the theory of financial deepening, which suggests the abolition of excessive government interventions in financial markets. One of the key steps of financial liberalization is interest rate liberalization, which allows the level of interest rates for financing in monetary markets to be determined by market supply and demand. In an effective financial market, the benchmark interest rate, which is usually set by central banks, provides vital reference for financing costs and investment income. Benchmark interest rate with prompt response to fluctuations of markets is the prerequisite of interest rate liberation and a crucial step toward financial liberalization. Hence, the choice of benchmark interest rate has a profound influence on stability of interest rates. Table A presents the benchmark interest rates adopted by main economies around the world.

Table A near here

The Chinese government has instituted the reform of interest rate liberalization since 1993. Gradually, floating range of deposit and loan interest rates has been fixed by the People's Bank of China. However, financial institutions other than commercial banks (i.e., the shadow banking sector) price their financial products according to market interest rate, and hence a dual-track interest rate system has been put in place

throughout the years. Over the past decade, the People's Bank of China has considered using several market interest rates as benchmark interest rate, including the repo rate, rediscount rate, and the Shanghai Interbank Offered Rate (SHIBOR). Since 2006, SHIBOR has intermittently conformed to volatility of main market interest rates.

The main purpose of this paper is to examine whether SHIBOR or a bond repurchase rate provide more reference for financial market prices and better transmission for macroeconomic adjustments of the central bank. So far, there is no consensus on whether an interbank interest rate similar to LIBOR (namely, SHIBOR) or a bond repurchase rate is appropriate benchmark interest rate for China. Exploration on benchmark interest rate for China by comparison of several market interest rates available in China is rare in literature. Thus, this paper aims to illustrate the roadmap of interest rate liberalization in China and examine which market interest rate is appropriate benchmark interest rate for China.

An empirical analysis is conducted in respect of market size, relationship among market interest rates, information content, term structure, and monetary policy transmission channel. The results show that a benchmark interest rate that is similar to LIBOR conforms to the situation in China.

This paper is organized as follows. Section 2 contains the review of literatures. Section 3 demonstrates the background of the financial reform and financial market problems in China. Section 4 presents the research methodology and the empirical estimation results, which uncover the relationship among interest rates, transmission channels, and term structures. Section 5 concludes the paper and Section 6 states the

limitations and discusses possible future directions of interest rate liberalization.

2. Literature Review

In a developing country whose interest market is not fully liberalized, the forming mechanism of interest rate varies from time to time. For example, Edwards and Khan (1985) conclude that the formation of interest rates is linked to the openness of the financial system. Cho (1986) argue that for a country without a well-developed equity market, elimination of interest rate ceilings and government allocation of credit is not an efficient measure to interest rate liberalization. Cottarelli and Kourelis (1994) relate the lending rate stickiness of banks to the structure of the financial system. The shortage of competition in banking industry, limited international capital movement and the absence of negotiable short-term financial instruments (e.g., T-bills) make interest rates stick to monetary policy operations. Qin and Lu (1995) compare the process of interest rate liberalization in several developing countries, including Argentina, Chile, and Indonesia, and suggest that the People's Bank of China should ease restrictions on floating range of deposit and loan rates before the liberalization. Sa (1996) points to the dangers of possible rapid increase in interest rates brought by interest rate liberalization in an unstable macroeconomic environment with high inflation, unbalanced exchange rates, and ineffective regulatory and legal system. Rosen (2002) argues that bank interest rates not always keep pace with the fluctuations of market interest rates. In particular, when the price-cost margin is large, the response tends to be large as well.

Byrd (1983) examines the significant changes and transitions in the role of banks

and financial systems in the financial reforms in the early 1980s. Chinese researchers analyze the continued financial reform from different perspectives. For example, Zhang (1995) concludes that the financial reform was remarkable but not profound because the most distinctive change was the scale of the financial market rather than the system and structure. Dai (2000) argues that the informal financial sector is vital to the success of financial reform in China. DaCosta and Foo (2002) illustrate the inadequacy of the financial reform and conclude that financial systems remain vulnerable to crises and the entry of foreign institutions. Wu (2002) indicates the necessary of banking reform in China. Lin (2003) suggests that China should develop financial institutions in rural areas.

The People's Bank of China has been implementing both quantitative and price-based monetary policies. Nonetheless, the transmission mechanism has experienced various problems. For example, the increase in money supply caused by proactive monetary policies of the People's Bank of China from 1998 to 2002 had only “leaked” into the ‘black hole” in bank deposits and the pocket of equity market speculators rather than into the real economy (Pei and Xiong, 2003). Shao (2007) suggests that the dual-track interest rate system causes inefficiency in the transmission between interest rates and corporate investments. Saving deposits in various forms did not fluctuate with interest rates because of the ceiling on deposit rates. Most people deposit money for future expenditures such as education or medical expenses rather than investing in financial products of which price and return are based on market interest rates. Guo (2009) prove the inefficient transmission between interest rates and exchange rates or macroeconomic indicators by empirical analysis using cointegrated

model.

Wang (2001) and Yi (2009) divide the gradual process of the interest rate liberalization into three stages: liberalization of deposit and loan rates, establishment of a benchmark interest rate, and formation of a central bank interest rate regime. Xu (2003) identifies three preconditions for interest rate liberalization: well-established legal system for financial supervision, market competition, and fiscal surplus. He suggests that China should not be hasty in implementing interest rate liberalization if these conditions are not fulfilled. Since 1982, The People's Bank of China has allowed deposit and loan rates to fluctuate based on unchanged benchmark interest rate within a prescribed range. The fixing repo rate and SHIBOR are still not popular as benchmark rate.

Dai and Liang (2006) compare the characteristics of the Federal funds rate and the London Interbank Offered Rate (LIBOR) and conclude that the seven-day fixing repo rate (R007) has larger market dominance. R007 is easier to be measured and adjusted than the other two rates. Thus, the fixing repo rate could be an appropriate benchmark interest rate. Besides an indicator mirror the information revealed in the market, benchmark interest rate should change with open market operations (e.g., the Federal funds rate). However, Wu (2007) argues that SHIROR is more suitable than the Federal funds rate to be benchmark interest rate for China. Chen and Wu (2008) conclude that volatility of SHIBOR significantly correlates to that of other market interest rates. Such correlation demonstrates the potential of SHIBOR to be benchmark interest rate. In addition, SHIBOR is a relatively stable reflection of price

fluctuation in stock market. (Zhang and He, 2009). Feng, Guo and Huo (2009) investigate the relationship between SHIBOR, central interest rate, and reserve requirement, and conclude that monetary policy Granger-causes SHIBOR.

3. Financial Reform in China

China's government implemented interest rate liberalization starting from 1993. Liberalization of Chinese interbank offered rate realized in 1996. Two years later, three policy banks (i.e., the China Development Bank, the Export-Import Bank of China, and the Agricultural Development Bank of China) issued policy financial bonds with market-oriented interest rate to finance national construction. Thereafter, commercial banks are allowed to adjust loan and saving rates on the basis of benchmark interest rate within a range stipulated by the People's Bank of China.

The Chinese financial market is transforming. Unlike other developed countries, China adopts a special dual-track interest rate system and unique monetary policies. In a free money market, the prices of money and bonds are regulated by market supply and demand; the benchmark rate serves as the upper or lower bound of the market interest rate. In China, however, deposit and loan rates are decided by the central bank. He and Wang (2012) argue that it is not feasible to set collar of loan rates whereas setting cap is feasible; thus, the deposit rate is lower than the market equilibrium rate. This low deposit rate helps commercial banks obtain capital at low costs and therefore encourage such banks to grant loans at interest rates that below market equilibrium. Such over lending by commercial banks significantly improve capital liquidity, which may cause inflation if no control measure is imposed. In order

to strike a balance between deposit rates and capital liquidity, strict controls imposed by the People's Bank of China result in various market limitations. Therefore, to realize market-oriented pricing in financial markets, financial reform which aims at interest rate liberalization need to be carried out.

The interbank lending market of China is similar to that of the US but with significantly smaller market size. The People's Bank of China performs open market operations by trading bonds and bills with 40 commercial banks. Bond repurchase rate is one of the prices available in this market. Treasury bonds, central bank bills, policy bonds, and so forth are traded under their respective repurchase agreements. The maturity of repurchased bonds range from one day to one year.

The bond repurchase market in China has not yet consolidated, and the repurchase rate is not effectively transmitted to other market interest rates. Imitating LIBOR mechanism, the People's Bank of China introduced SHIBOR, a monetary market interest rate based on the price quotations by 18 commercial banks with high credit ratings, on 7 September 2006. These quoting banks are the primary dealers of open market operations or market makers in the foreign exchange market and have sound information disclosure and active transactions in RMB in the Chinese money market. The SHIBOR Working Group of the People's Bank of China decides and adjusts the panel banks, supervises and administrates the SHIBOR operation, and regulates the behavior of quoting banks and specified publishers in accordance with the Implementation Rules of SHIBOR. The maturities of SHIBOR rates are overnight, 1 week, 2 weeks, 1 month, 3 months, 6 months, 9 months, and 1 year. Approximately 22% of the interest rate swaps and all interest rate futures are priced with SHIBOR.

However, medium-term and long-term rates of SHIBOR are less likely to be used as reference interest rate because of the small market scale. Table 1 shows the comparison between SHIBOR and LIBOR.

Table 1 near here

4. Empirical Analysis

The view that interest rate should be regarded as a policy target was brought forward in the late 1970s. Engle and Granger (1987) verify the co-integration relationship between different interest rate. Dickey, et al. (1991) provide statistical evidence that cointegration exist among M1, M2, nominal income and nominal interest rate, and this co-integration affect transmission of monetary policy to macro economy. Anderson, Granger and Hall (1992) argue that co-integration relationships exist between the different bond yields to maturity of U.S. Treasury bills, and the co-integrating vectors are defined by the spreads between yields when the Federal Reserve targeted short-term interest rate. Following the similar methods, the interest rate transmission has been perceived as empirically successful. One remarkable piece of evidence is the finding by Bernanke and Blinder (1992) that the Federal Funds Rate (FRB) well reflects expectations on movements of real macroeconomic variables. They suggest that a benchmark interest rate should be informative with regard to other open market interest rates and future movements of real macroeconomic variables, and should be a good indicator of macroeconomic control. Heffernan (1997) uses an

error correction model to capture the dynamic response of British interest rate to the fluctuation of central bank's base rate, and suggests that imperfect competition in the retail banking market causes the adjustment differences of loan and deposit rate to the changes in LIBOR, which further influences the money transmission speed. Pesaran and Shin (1998) introduce the generalized impulse response analysis using fractionally integrated vector autoregressive model and analyze the interaction between variables with a vector auto-regressive error correction model. The funds rate is sensitive to the money supply, which is an apparent indicator of monetary policy, and this transmission work through both the bank loans channel and the bank deposit channel. The change of the Funds rate is then separated into anticipated and unanticipated components (Kuttner, 2001), and the changes in Bond rates and bill yields are mainly caused by the unanticipated movements. Atesoglu (2003) examines the bilateral causality between prime rate and funds rate. Walsh (2003) argues that interest rate measures are preferred to money supply measures as monetary demand varies considerably. In this paper, to test the effectiveness of the benchmark interest rate, we estimate the following VAR model:

$$Y_t = B_0 Y_t + B_1 Y_{t-1} + C_0 P_t + C_1 P_{t-1} + u_t, \qquad (1)$$

$$P_t = D_0 Y_t + D Y_{t-1} + G P_{t-1} + v_t, \qquad (2)$$

where Y represents non-policy variables, such as macroeconomic variables; P represents policy variables, including open market interest rates such as SHIBOR and

repo rates.

4.1 Data Description and Summary

SHIBOR, bond repurchase interest rate (repo rate), interbank borrowing (IBO) rate, interbank bond transaction rate, rediscount rate, and central bank bill interest rate, among others, all reflect certain market information and are possible to be benchmark interest rate. We compare primary benchmark interest rates in the international market and Chinese market rates to analyze the interest rate characteristics in China. Table 2 lists the benchmark rates compared in the study.

Table 2 near here

Observations of Funds, the overnight Federal funds rate are obtained from the official Federal Reserve's website (www.federalreserve.gov). Observations of Bill, the three-month treasury-bill rate are obtained from the US Department of the Treasury (www.treasury.gov). LIBOR001 and LIBOR007 are the overnight and one-week Libor rates, respectively, obtained from the Federal Reserve Economic Data (research.stlouisfed.org). SHIBOR001 and SHIBOR007 are the overnight and one-week SHIBOR, respectively, obtained from the official SHIBOR website (www.shibor.org). FR001 and FR007 are the overnight and one-week repo rates, respectively, and IBO001 and IBO07 are the overnight and one-week interbank offered rates, respectively (obtained from the RESSET database, www.resset.cn). The data cover the period from 1 January 2001 to 15 April 2013 because data of Chinese interest rates before the year 2001 are limited. Data of SHIBOR are only available from 2006; hence, we have fewer observations on SHIBOR compared with the other interest rates.

Central refers to the central bank bill rate, which is one of the instruments for open market operations by the People's Bank of China. We investigate the relationship between the central bank bill rate and the open market interest rate to see whether monetary policies affect market interest rates. The data cover the period from 25 June 2002 to 20 October 2011. This interest rate is not continuous because the central bank did not issue bills on a daily basis. The data are obtained from CSMAR Solution (www.gtarsc.com).

We first compare the international benchmark rates with the Chinese interest

rates in terms of market size, pattern, and other aspects. Thereafter, a comprehensive review will be conducted on the transmission mechanism between interest rates and macroeconomic activities. The following sections show that SHIBOR performs better in volatility tests and has more effective transmission in macroeconomic activities than other interest rates even though the repo rate are more popular in China.

4.2 Market Size of Open Market Interest Rates

From Table 3, the market size of the Chinese interest rate market is smaller than that of international interest rate markets, particularly the rediscount rate markets and the central bank bill interest rate markets. Thus, the rediscount rate and the central bank bill interest rate are less likely to be a reliable benchmark rate for Chinese financial market, given their relatively small trading volume and market size. Meanwhile, the rediscount rate and the central bank bill interest rate, which are intermediate targets of monetary policy, are not fully decided by the market.

Table 3 near here

The bond repurchase market has grown rapidly since 10 years ago. The repo rate is more appropriate than interbank offered market rate to be benchmark interest rate because of its superior foundational role in the money market rate system. However, bonds pricing and earnings are based on different reference rates, a situation damage the setting up of benchmark interest rate.

4.3 Interest Rates Volatility

First, we plot all interest rate trends between 2001 and 2013 to measure the volatility.

Figures 1 to 8 near here

We can see from the graph that Chinese market interest rates, except for the central bank bill rate, seem to be less volatile than Funds, LIBOR, or Bill. Funds and the central bill rate are instruments of monetary policies, which may reflect macro-control target set by central banks. We conduct the augmented Dickey-Fuller (ADF) test with an intercept but without a time trend, given that not all interest rates have obvious trends from 2001 to 2013. We estimate the following regression:

$$\Delta i_t = \mu + \varphi i_{t-1} + \sum_j^3 \alpha_j \Delta i_{t-j} + u_t, \quad (3)$$

where i is the interest rate. The null hypothesis is as follows:

$$H_0: i_t = i_{t-1} + u_t, \tag{4}$$

Table 4 near here

The ADF result also shows that the Federal funds rate is non-stationary at first but is stationary after first differencing. Similarly, data of LIBOR001, LIBOR007, and Bill, which are all non-stationary series at first, become stationary after first differencing. SHIBOR, repo, and IBO rates are stationary at the 1% level.

To see whether the benchmark rate react rationally to market news, we test if asset prices decrease more in an environment with bad news than the price increase in an environment with good news. We adopt the EGARCH model to test the asymmetric effect.

$$\ln(\sigma_t^2) = \omega + \sum_{j=1}^{p}(\alpha_j \frac{|\varepsilon_{t-j}|}{\sqrt{\sigma_{t-j}^2}} + \gamma_j \frac{\varepsilon_{t-j}}{\sqrt{\sigma_{t-j}^2}}) + \sum_{i=1}^{p} \beta_j \ln(\sigma_{t-1}^2), \tag{5}$$

where

ω stands for the average of long-term interest rate volatility; γ_j is the asymmetric coefficient (i.e., leverage coefficient to show the leverage effect); and α_j is the symmetric coefficient. If γ_j is small, the interest rate will not have a significant leverage effect on volatility. If γ_j is positive, the interest rate will fluctuate

significantly during good news, and vice versa. β_j represents the relationship between the volatility for two consecutive days. We use the first-differenced interest rates in this study since all the international interest rates are I(1) series.

Table 5 near here

The most obvious result is that compared to international interest rates, the Chinese interest rates have significantly stronger leverage effects and tend to react more to good news than bad news (the γ of the Chinese interest rates are higher by 0.2 compared with the γ of the international interest rates, which is almost zero). This result reflects market irrationality on interest rates in China. SHIBOR reacts more quickly than the other two types of interest rates and performs better than repo and IBO rates in terms of leverage effect.

4.4 Benchmark Test for Interest Rates

We use the Granger causality test to examine the relationship between different interest rates. The following regression is estimated:

$$X_t = \sum_{i=1}^{l} a_i X_{t-i} + \sum_{j=1}^{l} b_j Y_{t-j} + e_t, \tag{6}$$

$$Y_t = \sum_{i=1}^{l} c_i X_{t-i} + \sum_{j=1}^{l} d_j Y_{t-j} + u_t, \tag{7}$$

where l is the maximum lag of the model and takes the values one, two, and seven to

represent the causality effect in one day, two days, and seven days, respectively.

Table 6 near here

Table 7 near here

Table 8 near here

Table 6 shows that the overnight SHIBOR and one-week SHIBOR respectively Granger-causes the overnight repo rate. Inversely, either the overnight repo rate or the one-week repo rate Granger-causes the overnight SHIBOR or the one-week SHIBOR, thus showing that these two overnight rates have two-way causality effect.

Tables 7 and 8 show that the IBO rate does not Granger-cause SHIBOR and the repo rate respectively. Repo rates (overnight and one-week) also Granger-cause the IBO rates, whereas the overnight SHIBOR does not Granger-cause the IBO overnight rate.

Given that the SHIBOR and repo rates Granger-cause each other and that the repo rate has strong influences on the interbank offered rate, we suggest that the repo rate has a closer association with market signals than other market rates has.

4.5 Monetary Transmission Channels

4.5.1 Interest Rate as a Policy Target

The People's Bank of China usually manage money supply by purchasing or repurchasing government debt. Figure 9 shows the long-term trend of the central

bank bill rate and SHIBOR, which tend to move in tandem in the long term. Before July 2008, both SHIBOR and the central bank bill rate were relatively high. However, these rates show tendency to decrease from 2008 to 2010, followed to increase since May 2010.

Figure 9 near here

The above discussion shows that the central bill interest rate is stationary at one stage, and SHIBOR is stationary most of the time. The regression model about SHIBOR001 and the first differencing of the central bank bill rate is estimated. Unit root test is carried out to examine the stationarity of the residuals. If the residual is stationary, we further test whether Granger causality exists between these two interest rates.

$$\text{SHIBOR001} = 2.101 + 0.375\ \text{d_Central}, \tag{8}$$

(1.3) (4.54)

$$\text{SHIBOR007} = 3.877 + 0.726\ \text{d_Central}, \tag{9}$$

(24.1) (5.302)

We then apply the ADF test to the residuals. The results are −7.4 and −10.3, which are smaller than the t-statistics (−3.43). Thus, we use the Granger causality test to test the relationship between SHIBOR and the central bank bill rate.

We test whether changes in the central bank bill rate will Granger-cause

SHIBOR. This causality is important as it represents the first step of monetary policy transmission. If the central bank bill rate can affect SHIBOR, SHIBOR will be a good intermediate target for the central bank to implement monetary policies and influence the financial market.

Table 9 near here

From Table 9, we conclude that changes in the central bank bill rate do slightly Granger-cause SHIBOR changes. The result is not strong due to a lower frequency of open market operations than that of changes in SHIBOR. Furthermore, it is difficult to investigate the direct effects of monetary policies on SHIBOR. Nevertheless, the central bank bill rate has certain impact on SHIBOR.

4.5.2 Information Content of Market Interest Rates

The second procedure of monetary transmission to be determined on SHIBOR is that whether changes in SHIBOR have an effect on the real economy. We also conduct a battery of Granger causality tests. Each row of Table 10 presents an equation that forecasts several macroeconomic indicators based on various market interest rates and measures of money supply, M1 and M2. We also add lags of M1 and M2 to compare the effects of interest rates.[1] Macroeconomic indicators include investment, real estate investment, real estate sale, consumption, and consumer price index (CPI).

Table 10 near here

[1]All the interest rates used are adjusted to monthly averages of daily figures and expressed as annual rates.

Table 10 shows that the overnight SHIBOR provides better prediction on macroeconomic indicators than the other eight variables do. All interest rates are superior to M1 and M2 in terms of prediction ability. In particular, M1 provides no reference for the movement of macroeconomic indicators. The overnight SHIBOR is also superior to the interbank offered overnight rate in prediction on the movement of three indicators.

4.6 Interest Rate Term Structure

Estrella and Hardouvelis (1991) argue that the term structures of interest rates should reflect future economic trend. They prove that the term structure of the US Treasury bill rates has a strong prediction upon on the US economy for four years by employing Treasury bill rates data from 1955 to 1988. In this paper, we regard the seven-day interest rate and the overnight rate as the long-term rate and the short-term rate respectively, and estimate the following model:

$$Y_{t,t+k} = \alpha_0 + \alpha_1 i_t + e_t, \tag{10}$$

$$Y_{t,t+k} = \left(\frac{400}{k}\right) \ln\left({}^{y_{t+k}}/_{y_t}\right), \tag{11}$$

where k is the prediction term, and y_t is the GDP at time t.

$$i_t = i_t^{long\ term\ rate} - i_t^{short\ term\ rate}. \quad (12)$$

Most IBO rate coefficients on the GDP are statistically insignificant. When i_t is larger than zero, the expectation of the future economy is optimistic; thus, the coefficient should be positive. Repo rates perform slightly better than the IBO rates but are still statistically insignificant.

Table 11 near here

5. Conclusions

Over the past two decades, China has adopted numerous policy changes to advance its financial market. Interest rate liberalization is one of the most important changes in this process. The Chinese interest rate market transformed from a fully controlled market to a dual-track interest rate market, under which banks and capital markets work together on the monetary resource allocation. However, regulatory controls over interest rates have not yet been implemented. A distinct market distortion along with quantitative controls also exists on credits. In this paper, we consider both international experiences and Chinese national situation when analyzing the choice of a benchmark rate for China. Although China currently does not have any interest rate which is perfect for benchmark rate, China can adopt a benchmark rate similar to LIBOR or the US Federal funds rate.

Since 2006, SHIBOR rate has already shown some characteristics of benchmark

interest rates, though they are not very stable. SHIBOR is an interest rate based on a relatively large daily trading volume and has close relationships with other open market interest rates. The People's Bank of China has been trying to promote the Shibor as the benchmark that provide reference for short-term borrowing costs. For longer-tenor categories, short-term repos is more popular as trading references because SHIBOR has no real traded prices for this category. If the market of negotiable certificate of deposit can take over the direct deposit deals in the future, Shibor might gain its market recognition and be a real market-oriented benchmark that is similar to Libor. Although SHIBOR may not be a good intermediate target of monetary policies in current transmission mechanism, it affects the market as well as the economy. As a result, SHIBOR is considered a potential benchmark interest rate. Interest rate liberalization in China is in progress, and a benchmark interest rate will play a significant role in future reforms. The People's Bank of China should continue to pursue a systematic interest rate liberalization approach and encourage the use of SHIBOR in China's financial market.

6. Limitations and Future Direction

The LIBOR manipulation scandal in 2012 revealed several serious problems of the interest rate quotation mechanism in choosing the market benchmark rate. A lesson learned from the LIBOR scandal is that fully relying on the interest rate quotation system can be injudicious and risky. Apart from the possibility of manipulation, SHIBOR may sometimes be very volatile. For example, on 20th of June 2013, SHIBOR surged as the overnight SHIBOR rate had increased to 13.4%, which

was due to the temporary liquidity shortage in the inter-bank market. Thus, the People's Bank of China should carry out proper regulation and mechanism to prevent market manipulation and reduce its volatility.

An advantage of adopting SHIBOR as policy rate is that it has an off-shore counterpart to serve as a reference rate. The trial conducted by the Hong Kong Monetary Authority (HKMA) on offshore RMB interbank offered market interest rate provides a good reference rate for SHIBOR. In June 2013, the HKMA announced a panel of 16 active commercial banks, which have since offered their interest rates on offshore RMB (CHN HIBOR). This system is similar to SHIBOR, facilitates the development of a variety of RMB products, and helps market participants to better evaluate the risk of interest rates denominated in RMB. The presence of CHN HIBOR provides a benchmark for offshore loan facilities, which supports interest rate liberalization in China and the use of Shibor as benchmark interest rate in future.

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Figure 1. Federal Funds Rate (2001–2013)

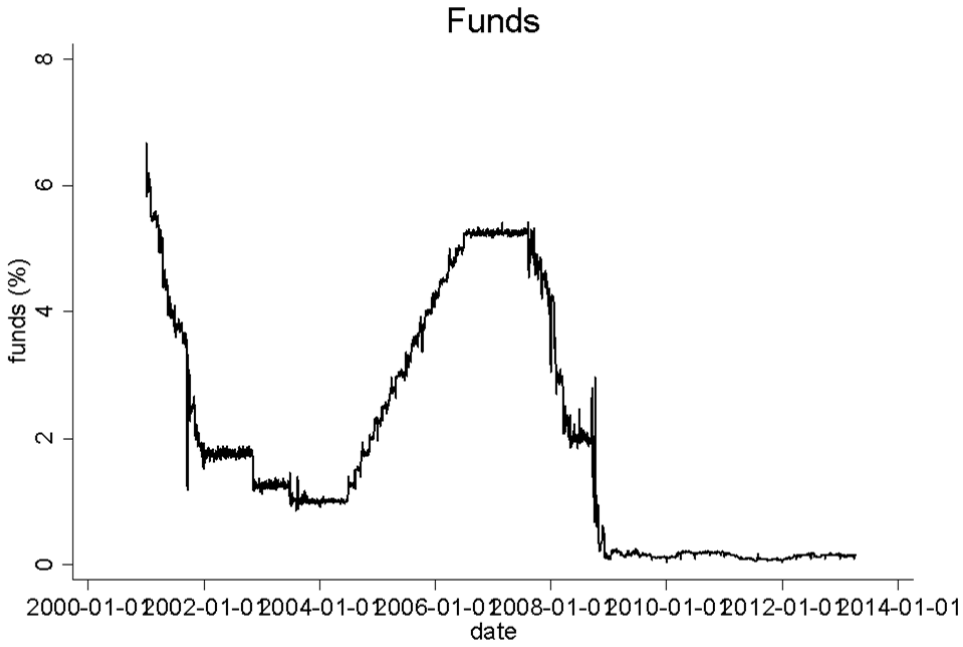

Figure 2. Treasury Bill Rate (2001-2013)

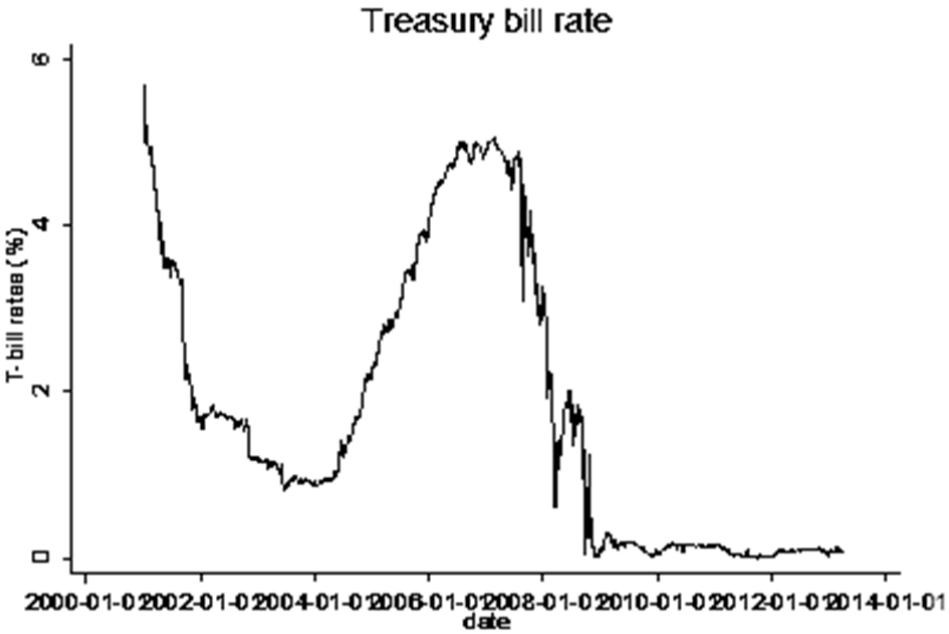

Figure 3. Overnight LIBOR Rate (2001–2013)

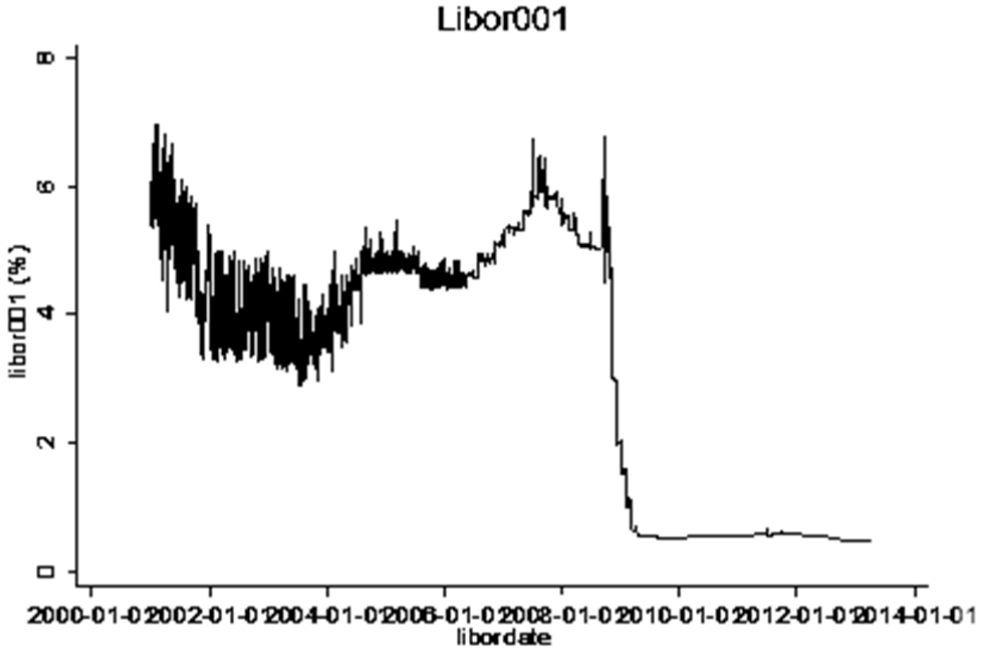

Figure 4. Seven-Day LIBOR Rate (2001–2013)

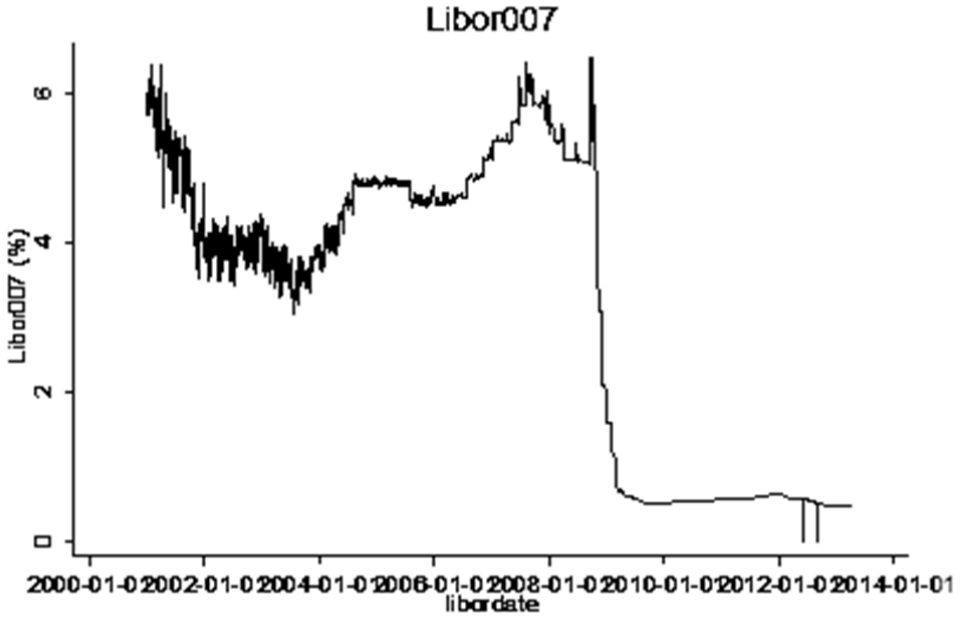

Figure 5. Central Bill Rate (2002–2011)

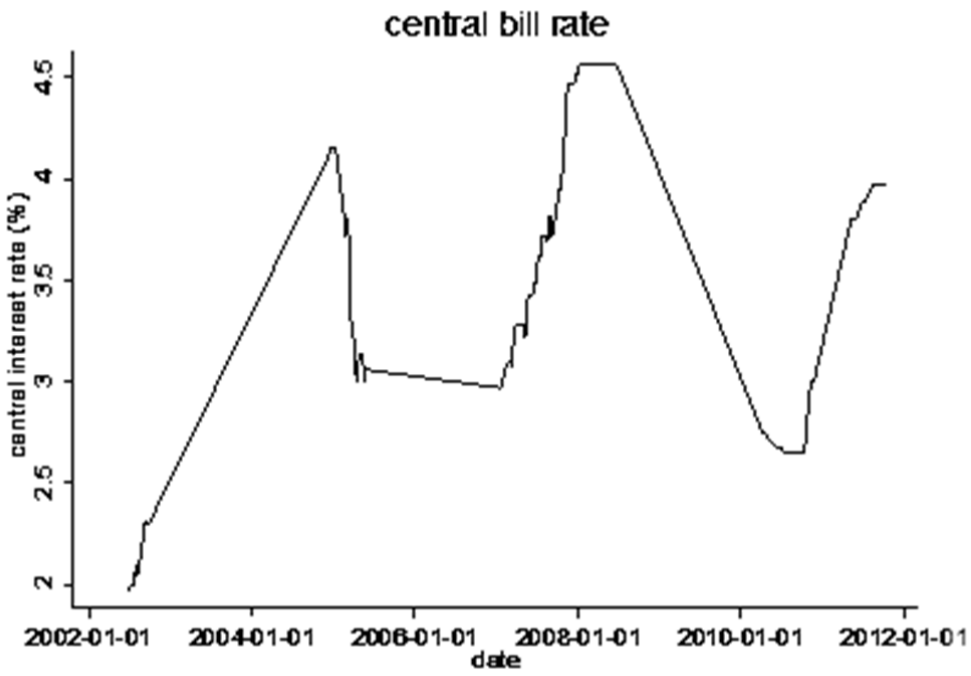

Figure 6. Overnight and Seven-Day SHIBOR Rate (2006–2013)

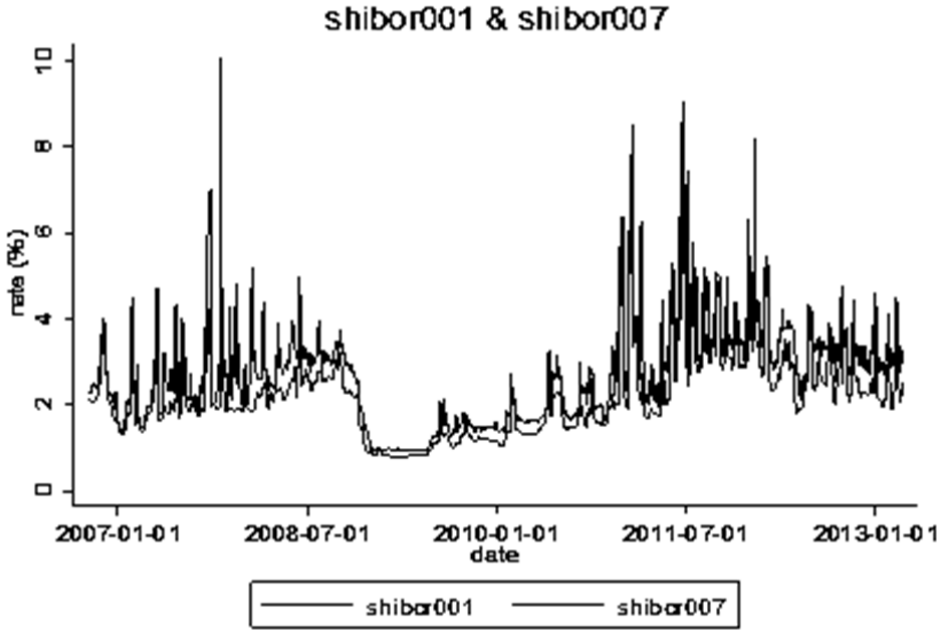

Figure 7. Overnight and Seven-Day Repo Rate (2001–2013)

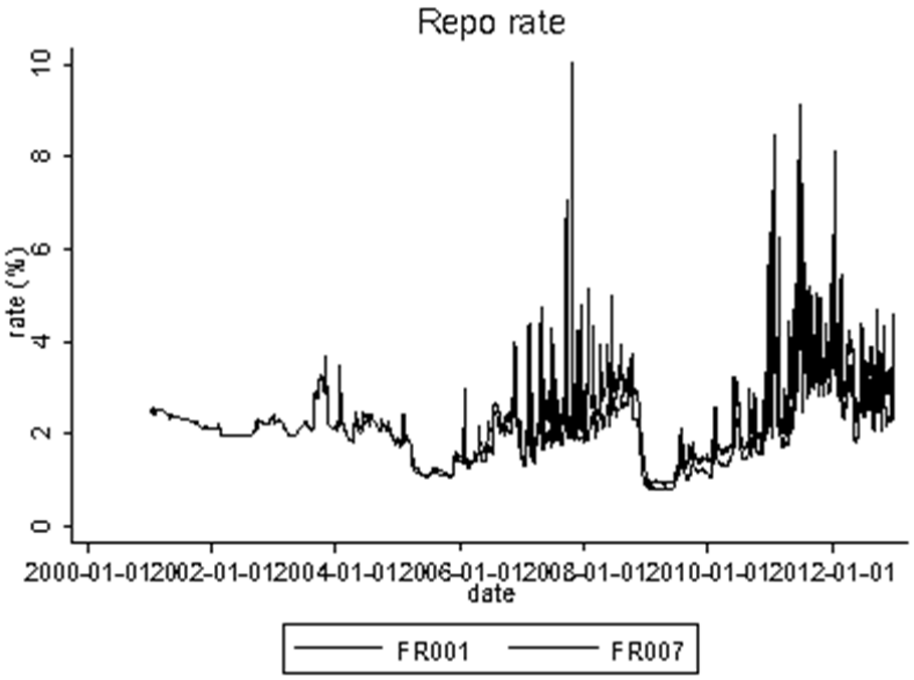

Figure 8. Overnight and Seven-Day Interbank Borrowing Rate (2001–2013)

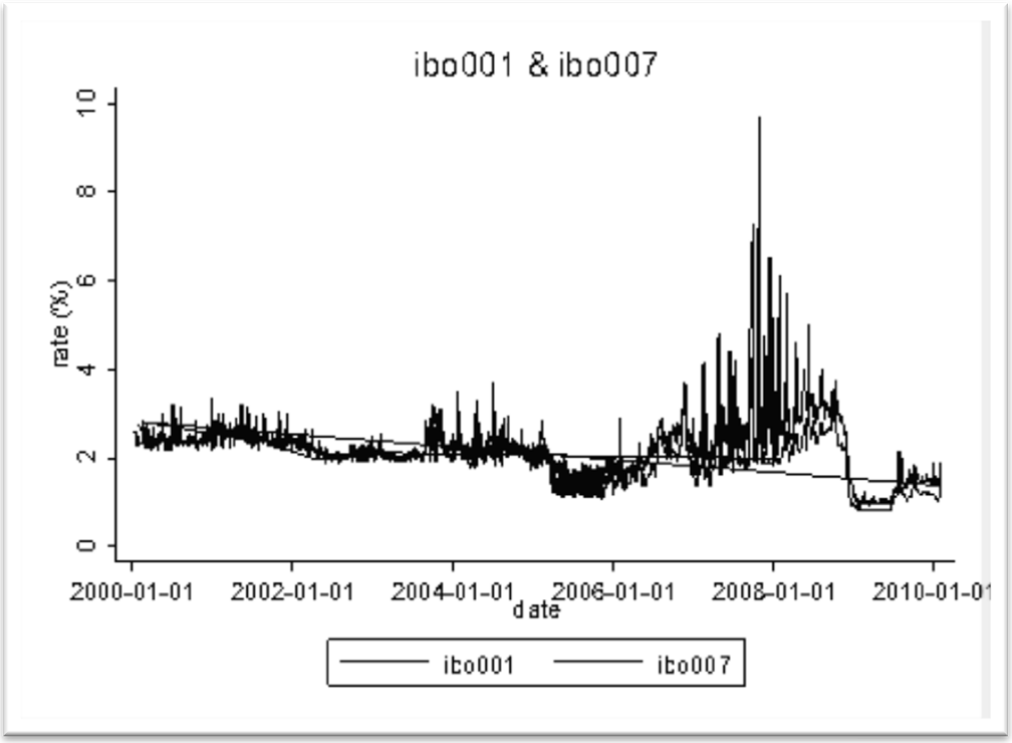

Figure 9. SHIBOR and Central Bank Bill Rate (2006-2011)

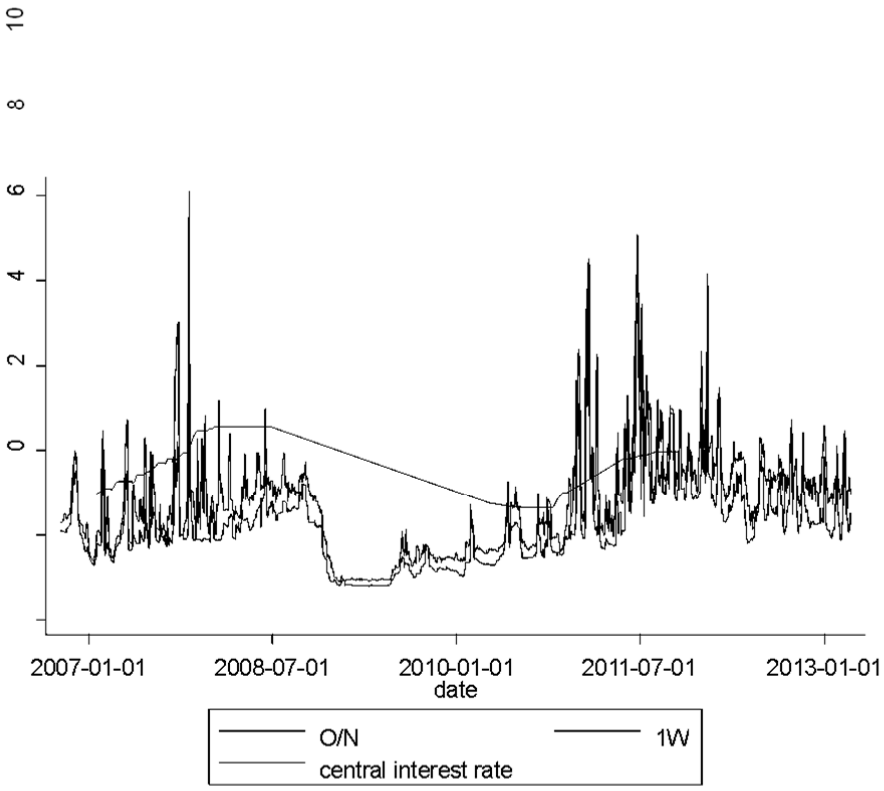

Table A. Benchmark Interest Rates around the World

Country	Benchmark Interest Rate
United States	Federal funds rate
United Kingdom	LIBOR
France	One-week bond repurchase rate
Germany	One-week and two-week bond repurchase rate
Japan	TIBOR
Singapore	SIBOR
China	One-year deposit and loan rate

Table 1. SHIBOR vs LIBOR

	SHIBOR	LIBOR
Panel Banks	18 domestic and foreign banks	16 large global banks
Foundation	Introduced by the central bank to build the benchmark rate	Driven by market demand
Price for Banks	The operating expenses of Chinese banks are based on the controlled loan rate rather than SHIBOR, and only a small fraction of financial products are priced based on SHIBOR	LIBOR decides almost all prices of financial products, thus directly affecting the profit of banks

Table 2. Interest Rate Summary

Interest Rate	Start Time	End Time	Number of Observations
Funds	2001/01/02	2013/03/29	3080
Bill	2001/01/02	2013/03/29	3070
LIBOR001	2001/01/02	2013/04/05	3098
LIBOR007	2001/01/02	2013/04/05	3098
SHIBOR001	2006/10/09	2013/03/19	1614
SHIBOR007	2006/10/09	2013/03/19	1614
FR001	2001/01/01	2012/12/31	3009
FR007	2001/01/01	2012/12/31	3009
IBO001	2001/01/01	2010/12/31	2222
IBO007	2001/01/01	2010/01/28	2483
Central	2002/06/25	2011/10/20	125

Table 3. Trade Volume of Different Interest Rates in China

(RMB, billion)[2]

Year	Interbank Borrowing Market	Bond Repurchase Market	Interbank Bond Market	Rediscount Market	Central Bank Bill
2001	808	4013	84	65.5	
2002	1211	10189	441	6.8	194
2003	2222	11720	3085	74	764
2004	1392	9311	2504	22	1496
2005	1232	15678	6338	2.5	2766
2006	2148	26302	10922	40	3652
2007	10651	44067	16591	14	4057
2008	15049	56382	40827	11	4296
2009	19351	67701	48868	25	3824
2010	27868	84653	64003		4235
2011	33441	96665	63620		1414
2012	46704	136617	70840		

[2]Data Source: People's Bank of China, www.pbc.gov.cn

Table 4. ADF Tests for Interest Rates

Interest Rate	ADF Test			First-difference ADF Test		
	t-statistic	1% critical	p-value	t-statistic	1% critical	p-value
Funds	−1.97	−3.43	0.2998	−38.466	−3.43	0.00
LIBOR001	−3.273	−3.43	0.0161	−38.102	−3.43	0.00
LIBOR007	−1.019	−3.43	0.7463	−33.458	−3.43	0.00
Bill	−1.721	−3.43	0.4202	−29.485	−3.43	0.00
Central	−2.727	−3.502	0.0694	−4.651	−3.502	0.00
SHIBOR001	−7.422	−3.43	0.00			
SHIBOR007	−6.909	−3.43	0.00			
FR001	−5.661	−3.43	0.00			
FR007	−7.708	−3.43	0.00			
IBO001	−6.364	−3.43	0.00			
IBO007	−8.145	−3.43	0.00			

Table 5. EGARCH Regression

Interest rate	ω	p-value	α	p-value	γ	p-value	β	p-value
Funds	−0.71	0.00	0.53	0.00	0.02	0.00	0.94	0.00
Bill	−0.06	0.00	0.21	0.00	0.01	0.00	0.87	0.00
LIBOR001	−0.09	0.00	0.45	0.00	0.05	0.00	0.98	0.00
SHIBOR001	−1.2	0.00	0.47	0.00	0.36	0.00	0.99	0.00
FR001	−1.3	0.00	0.61	0.00	0.42	0.00	0.97	0.00
IBO001	−1.42	0.00	0.33	0.00	0.55	0.00	0.89	0.00

Table 6. SHIBOR and Repo Rate

(Probability)

H0	Lags(1)	Lags(2)	Lags(7)
SHIBOR001 does not Granger-cause FR001	0.0000	0.0000	0.0000
FR001 does not Granger-cause SHIBOR001	0.0000	0.0000	0.0000
SHIBOR007 does not Granger-cause FR007	0.0000	0.0000	0.0000
FR007 does not Granger-cause SHIBOR007	0.0069	0.0188	0.0003

Table 7. SHIBOR and IBO Rate

(Probability)

H0	Lags(1)	Lags(2)	Lags(7)
IBO001 does not Granger-cause SHIBOR001	0.2881	0.4807	0.9380
SHIBOR001 does not Granger-cause IBO001	0.0873	0.1057	0.6623
IBO007 does not Granger-cause SHIBOR007	0.0899	0.5984	0.0476
SHIBOR007 does not Granger-cause IBO007	0.0000	0.0000	0.0000

Table 8. Repo Rate and IBO Rate

(Probability)

H0	Lags(1)	Lags(2)	Lags(7)
IBO001 does not Granger-cause FR001	0.4600	0.1414	0.6478
FR001 does not Granger-cause IBO001	0.0000	0.0000	0.0000
IBO007 does not Granger-cause FR007	0.0126	0.1506	0.0004
FR007 does not Granger-cause IBO007	0.0000	0.0000	0.0000

Table 9. Granger Causality Test of SHIBOR and Central

H0	Probability
SHIBOR001 does not Granger-cause Central	0.508
Central does not Granger-cause SHIBOR001	0.270
SHIBOR007 does not Granger-cause Central	0.682
Central does not Granger-cause SHIBOR007	0.109

Table 10. Interest Rates for Forecasting Economic Activity

(Marginal significance level)

Forecasted Variable	M1	M2	SHIBOR 001	SHIBOR 007	FR001	FR007	IBO 001	IBO 007
Consumption	0.52	0.06	0.00	0.31	0.43	0.96	0.57	0.12
Investment	0.17	0.16	0.04	0.03	0.83	0.53	0.83	0.86
Real Estate Investment	0.65	0.43	0.00	0.00	0.49	0.71	0.00	0.02
Real Estate Sale	0.87	0.94	0.07	0.10	0.00	0.12	0.00	0.11
CPI	0.41	0.68	0.12	0.05	0.16	0.02	0.06	0.00

Table 11. Interest Rate Term Structure (with GDP)

K (term)	IBO Rate		Repo Rate	
	Coefficient	p-value	Coefficient	p-value
1	−1597	0.46	−82.4	0.92
2	123.6	0.914	1489.2	0.33
3	−150.8	0.823	1112.8	0.26
4	−389.6	0.28	1123.6	0.21
5	−332.2	0.233	265.5	0.11
10	−139.3	0.25	589.2	0.08
15	488.6	0.148	536.6	0.16
20	479.6	0.016	64.1	0.52