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Interest Rate Determination in China: Past, Present, and Future*

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Abstract

How should we think about the determination of interest rates in China after interest rate liberalisation? Would effective deposit rates, lending rates and bond yields move higher or lower? We argue that interest rates in a liberalised environment would need to be anchored by the conduct of monetary policy. If monetary policy is to achieve the objective of price and output (or employment) stabilisation, the policy rate should be set close to China's equilibrium or natural rate. We sketch three preliminary approaches to estimation of the natural rate in China. Based on these we argue that interest rates on large deposits in the banking system and short-term money market rates would likely to move higher following interest rate liberalisation. The effect on effective lending rates is somewhat ambiguous as the contestability of the banking sector and the competition in bond markets are likely to increase after interest rate liberalisation. We leave the determination of the curvature of the yield curve to future research.

Keywords: Interest Rate, Monetary Policy, Economic Reform, Chinese Economy, The People's Bank of China (PBC)
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1. Introduction

Interest rate liberalisation is an essential part of China's price reforms, which are at the heart of the country's transition from a planned to a market economy**.** While most goods and services are now market determined, there remain significant government controls on prices of the factors of production. For the prices of capital, ceilings imposed by the People's Bank of China (PBC) on deposit rates in the banking system are a notable binding constraint on the freedom of price discovery in financial markets. Even though interest rates in the money and bond markets are now market determined, their level and movement is constrained by regulated deposit rates, due to the dominance of the banking sector in overall financial intermediation.

The Chinese authorities have recently announced plans to speed up the pace of interest rate liberalisation, raising expectations that the process will culminate with a final removal of the ceilings on deposit rates in the medium term. Accompanying the process will be an overhaul of the monetary policy framework, away from a focus on credit targets toward a focus on the level of interest rates, and an expansion of the fixed income markets, facilitating the formation of a complete risk free yield curve.

How should we think about the determination of interest rates in China after interest rates are fully liberalised? Would effective deposit rates, lending rates and bond yields move higher or lower? In this paper we argue that interest rates in a liberalised environment would need to be anchored by the conduct of monetary policy. If monetary policy is to achieve the objective of price and output (or employment) stabilisation, the policy rate should be set close to China's equilibrium or natural rate. We sketch three preliminary approaches to estimation of the natural rate in China. Based on these we argue that interest rates on large deposits in the banking system and short term money market rates would likely to move higher following interest rate liberalisation. The effect on effective lending rates is ambiguous as the contestability of the banking sector and the competition in bond markets are likely to increase after interest rate liberalisation. We leave the determination of the curvature of the yield curve to future research.

At present, the ceilings on deposit rates are imposed by the PBC through administrative orders. After interest rate liberalisation, the PBC will use the composition and size of its own balance sheet to influence market rates. As the monopoly supplier of high powered money, the PBC will be in a position to anchor short term interest rates. As an interim measure, the PBC may still consider setting targets for medium term interest rates and managing the shape of the yield curve through direct interventions in the bond markets. The case for managing the yield curve is strong because the bond markets will take time to expand and mature following liberalisation, and over time this will help development of a smooth yield curve determined primarily by market forces.

The rest of this paper is organised as follows. Section 2 reviews key developments in interest rate liberalisation and describes the current interest rate structure in China. Section 3 analyses the determination of interest rates under the current policy framework. Section 4 sketches three approaches to estimating the natural rate of interest and discusses the determination of bank rates and market rates after full liberalisation. Section 5 offers our view on the prospects for interest rate liberalisation and the sequencing of reforms in the period ahead. Section 6 concludes with a discussion on open questions.

2. Current Interest Rate Structure

In the past three decades, China has made substantial progress toward a market oriented system of interest rates. According to Yi's (2009) account, more than 123 interest rates had been liberalised and only 24 interest rates were still regulated as of the end of 2008. At present, interest rates in China can be grouped into four types: interest rates for central bank operations, interest rates of banking products, interest rates in the money and bond markets, and interest rates in other financial markets.

2.1 Interest Rates for Central Bank Operations

In the era of the planned economy, there were almost no financial markets. Financial resources were allocated by government plans, and all interest rates were set by the central bank. The PBC, the only bank in the economy, performed the role of central bank and commercial bank, and used a planning system of "centralised deposits and credits" to manage funds.

A series of reforms in the early 1980s helped to establish a commercial banking system through a number of large state owned banks, which are still a major part of China's financial system today. The PBC began to function exclusively as a central bank in 1984, and a series of interest rates were created to conduct monetary and financial stability policy along with other direct quantitative policy instruments such as loan quotas and reserve requirements.

Interest rates for PBC operations can be divided into three types: first, lending rates of refinance facilities, including central bank relending rates, rediscount rates and lending rates of the recently created Standing Lending Facility (SLF); second, deposit rates for required reserves and excess reserves; third, open market operation (OMO) rates, including central bank repo rates, central bank bill rates and interest rates of the newly created Short-term Liquidity Operations (SLOs). Figure 1 shows changes in rediscount rates and reserve interest rates in the last decade. In recent years, the central bank repo rates and central bank bill rates become increasingly important tools to signal PBC's policy intentions and to guide market interest rates toward desired levels (Zhang, 2012).

2.2 Interest Rates of Banking Products

In the banking sector, most deposit rates are regulated through administratively imposed ceilings, while most lending rates, except mortgage rates, were liberalised in July 2013. There were deposit rate ceilings and lending rate floors imposed on bank lending before the 2013 reforms.

As shown in Figure 2, the PBC implicitly shapes the term structure of the yield curve by imposing ceilings on deposit rates of different maturities. The deposit rate ceilings are the most powerful instrument used by the central bank to affect market interest rates and bank lending rates, and help to anchor the whole interest rates system (He and Wang, 2012, 2013). This is because deposits are the most important funding source for commercial banks, and banks still dominate the Chinese financial system.

Although bank lending rates are no longer regulated by the PBC, they may not be fully determined by market forces for the following two reasons. First, aggregate loan supply is in practice subject to an implicit PBC target (aggregate credit quotas), which affects lending rates if and when the credit quotas become binding (He and Wang, 2013). Second, lending rates are affected by regulated deposit rates owing to market frictions.

Interest rates used internally by banks for capital budgeting and transfer pricing are still based on benchmark deposit rates, instead of market rates such as repo rates (Jiang, 2012). This suggests that benchmark deposit rates act as an anchor for interest rates in the banking sector.

2.3 Interest Rates in the Money and Bond Markets

The interbank lending market in China was established in the mid 1980s. However, it was not confined to banks. Increased borrowing by non financial firms in the interbank market to fund their investment in equity and real estate resulted in a surge in domestic credit and inflation. Against this backdrop, a unified trading platform was established in Shanghai in 1996 to enhance the surveillance on interbank lending activity. Average transaction prices on this platform formed the basis of the China Interbank Offered Rates (CHIBORs). A number of policy measures were also introduced to restrain interbank lending at longer maturities in order to curb rapid money growth and to keep the exposure to interbank loans at a manageable level.

With more stringent regulations imposed on uncollateralised interbank lending, the introduction of the repo market in 1997 soon replaced the interbank loan market to become the major source of short-term liquidity for banks. The rapid growth of the repo market increased the need for a reference rate to price money market instruments, resulting in the compilation of repo fixing rates for overnight, 7 day and 14 day tenors. The high turnover in the repo market made the corresponding fixing rates a widely used benchmark in the interbank market. However, the relatively short maturity in repo transactions

has restrained interbank funding with longer tenor. The authorities also realised that a benchmark money market yield curve would enhance the efficiency of price discovery in the interbank market. As a result, the Shanghai Interbank Offered Rates (SHIBORs) were introduced in January 2007.

Similar to other widely used benchmark interest rates, the SHIBORs are simple averages for different tenors of interest rates quoted by 16 eligible banks in the Shanghai money market, with the two highest and lowest quotes being excluded. The dissemination of the SHIBORs not only increased turnover in the interbank loan market, but also facilitated the pricing of a range of interest rate derivatives such as interest rate swap and forward rate agreement.

Due to the more stringent regulations on interbank lending at longer maturities, a large portion of interbank transactions are concentrated at shorter tenors of 1 month or less. In 2013, over 90% of transactions in the interbank loans market were overnight or at 7 day tenor, and more than half of trading days registered nil transaction for lending of 6 month to 1-year in the repo and interbank loan markets during the period 2010 to 13. While the intention of these measures is to prevent banks from bearing excessive credit risk in extending unsecured loans, this has restrained the use of the SHIBORs as the benchmark for pricing loans with longer maturities such as corporate and syndicated loans.

As with the money markets, bond markets also took off in the middle of 1980s, and the interbank bond market has grown very rapidly since the mid 2000s. However, bond markets remain segmented between the interbank market and the exchange market, and liquidity is relatively low compared to that in advanced economies. Anecdotal evidence suggests that entry to the primary market is still somewhat restricted.

Bond prices in the secondary market are largely market determined. However, some regulations on the pricing of bonds remain, though they may not be fully enforced. For example, the issuing rates of corporate bonds cannot be 40% higher than benchmark deposit rates with the same maturity. In addition, the maximum issuing size is only up to 40% of the issuers' net assets. These regulations, if binding, reduce the efficiency of the price discovery process.

It is worth noting that observed interest rates in the money and bond markets are not only determined by market forces, but also influenced by regulated interest rates in the banking sector. As shown in Figures 3 and 4, both the 7 day repo rate and the 1 year treasury yield seem to follow the pattern of the regulated 1 year deposit rate. Given the dominance of bank funding, we argue that the level and movement of bond yield curves are anchored by regulated deposit rates (see more discussions in Section 3).

2.4 Interest Rates in Other Financial Markets

One important recent development in the Chinese financial system is the increase in off balance sheet products and other shadow banking activities. These new products and activities are incentivised by a desire to circumvent interest rate regulations and demand for alternative investment opportunities. Activities in the shadow banking industry are wide-ranging, including wealth-management products, money market funds, trust loans, and entrust loans—to name a few. Interest rates in the shadow banking sector are closely linked to deposit rates in the formal banking though they are more volatile (Figure 5). The determination of interest rates in the shadow banking sector as with the money and bond markets are largely market determined but constrained by deposit rate ceilings.

In contrast to market determined interest rates in the shadow banking sector where banks are still major players, interest rates in the informal credit markets seem much more opaque and higher (Figure 6). Higher interest rates can be partially attributed to a higher risk premium in informal credit markets, given that major borrowers are Small and Medium Enterprises (SMEs). Despite their opacity, informal lending rates do react to changes of monetary policy and deposit rates (Qin et al., 2013).

3. Interest Rates Determination under the Current Monetary Policy Framework

The monetary policy framework in China has evolved since the mid 1990s from relying on quantity based instruments to using a mixture of both quantity and price based instruments (He and Pauwels, 2008). In recent years, the operating framework has increasingly focused on guiding market rates toward desired levels, with a notable de-emphasis on monetary aggregates, according to the most recent official guidance on the monetary policy framework (Zhang, 2012). Although the PBC still routinely announces annual targets for monetary aggregates, these quantitative aggregates have increasingly served as information variables rather than intermediate targets. With regard to credit targets, the PBC has not imposed bank specific targets since the late 1990s and, instead, has used window guidance to help move total bank credit toward its desired level. In terms of the frequency and potency of policy instruments, auctions of central bank bills are used most frequently for short term liquidity management, and a sustained change in the issuing rates in one direction typically indicates policy intentions. Changes in the reserve requirement ratio (RRR) may or may not indicate policy intentions because reserve requirements may be used merely to neutralise the effect of foreign inflows (Zhou, 2012). In contrast, a rise or a reduction in benchmark deposit and/or lending rates typically sends a strong signal of the policy stance.

The key to a good understanding of China's monetary policy is the "dual-track" interest rate system (He and Wang 2012). On the one hand, bank deposit rates are regulated by the PBC (i.e., through the imposition of a deposit rate ceiling), on the other hand, interest rates in the loan market and in the

money and bond markets are market determined. The PBC regulates deposit rates by administrative orders rather than by market channels. Although deposit rate ceilings are generally binding, this may not always be the case. For example, the deposit rate ceilings were not binding when China launched its four trillion RMB stimulus package in 2009 and monetary policy was very loose.

Although bank credit is still the most important form of financial intermediation, off balance sheet activities and market based intermediation have grown very rapidly in recent years. In fact, the share of bank credit in total social financing, a measure of the total supply of credit through both the banking sector and the capital markets, decreased from more than two thirds in the early 2000s to around half at the end of 2013 (PBC, 2012; PBC, 2014). In other words, a majority of financial intermediation in China is now conducted at market determined interest rates, which partly explains why the PBC has increasingly focused on guiding market rates toward desired levels.

This raises the question, however, of why China still retains control of benchmark interest rates in the banking sector? There are a number of explanations. According to Lardy (2008), benchmark interest rates are kept at artificially low levels to extract transfers or subsidies from households to the corporate sector, particularly the State Owned Enterprises (SOEs). Such transfers and subsidies are part and parcel of a state led development strategy.

In contrast, PBC officials tend to emphasise that interest rate liberalisation requires major players in the financial system, particularly the banks, to have hard budget constraints and be in a position to exercise self-discipline in their pricing decisions (Zhou, 2010). On the other hand, the demand for credit by borrowers should be sensitive to changes in interest rates. Up to now, however, the banks and their borrowers, particularly SOEs, have not met these standards yet. In addition, there may be another concern from the angle of monetary policy transmission. When Chinese bond markets, especially the treasury bond market, are underdeveloped, monetary policy seems more effective through direct interest rate controls in the banking sector rather than through market transmission, and controlled rates can also affect interest rates in other financial markets.

Regardless of policy intentions, in a situation in which the benchmark deposit rate ceilings are persistently below their equilibrium level, the PBC must rely on quantity based instruments to achieve its policy objectives, because of the associated price distortions in the banking system. For example, a lower deposit rate ceiling (compared with its equilibrium level) shifts the loan supply curve of commercial banks to the right (Figure 7, S1→S2), where S1 is the loan supply curve without the deposit rate ceiling. With the shifted loan supply curve (S2), banks are willing to lend to firms at lower interest rates because their funding costs are lower than they should be ($P2<P1$). Meanwhile, firms' loan demand is also higher than its equilibrium level ($Q2>Q1$).

However, with the new equilibrium under the deposit rate ceiling (P2, Q2), there is more credit (Q2>Q1) in the economy compared with the original equilibrium (P1, Q1), which may not be consistent with the PBC's inflation target. To achieve its inflation target, the PBC will have to constrain credit supply in the rest of the economy. At least two measures were introduced for this purpose. First, quantity based instruments such as aggregate credit quotas and RRR are used to constrain credit supply in the banking system. Second, until recently, a lending rate floor was used to curb loan demand from firms through higher borrowing costs. A lending rate floor together with a deposit rate ceiling guaranteed decent profit margins for banks.

This simple analysis demonstrates that distortions caused by price regulations have to be corrected by quantity based instruments, which is why the PBC has been using both price and quantity based instruments. The importance of quantity based instruments diminishes when the deposit rate ceilings are close to the equilibrium level of deposit rates. Thus, a necessary step in moving toward a primarily price based monetary policy framework in the broader context of interest rate liberalisation is for the PBC to move and maintain its benchmark or policy interest rates close to their equilibrium levels.

4. Interest Rate Determination After Full Liberalisation

How should we think about interest rate determination in China after interest rate liberalisation? This requires an understanding of how the PBC's monetary policy framework is likely to evolve with interest rate liberalisation. In a typical modern market economy, short term rates are largely anchored by the central bank's policy rate, while longer term interest rates are mainly determined by market forces, adjusting for term and risk premia. We believe that the PBC's policy framework would eventually converge to that in a modern market economy. Although this process may take time, a useful first step is to understand the factors that would shape the PBC's analytical thinking in determining its own policy rate.

Operationally, a fundamental change is that the PBC will use the composition and size of its own balance sheet to control and influence market rates instead of using administrative others to regulate rates. As the monopoly supplier of high-powered money, the PBC will be in a position to anchor short term interest rates. As an interim measure, the PBC may consider setting targets for medium term interest rates and managing the shape of the yield curve through direct intervention in the bond markets. The case for managing the yield curve is strong because the bond markets will take time to expand and mature following liberalisation to facilitate the development of a smooth yield curve determined primarily by market forces. With this big picture in the mind, we discuss the formation of policy rates, bank rates and market rates in the post liberalisation era in the rest of this section.

4.1 The Determination of Policy Interest Rates

The PBC has not yet articulated in public the contours of its monetary policy framework after interest rate liberalisation. In our view, however, it would likely involve setting targets for short term interest rates through OMOs in the money markets.

At what level should the PBC set the policy rate? In a mainly market based interest rate system, the Taylor rule is a simple analytical tool for understanding the conduct of monetary policy. What will r^* be in the Chinese version of the Taylor rule? To answer this question, we need a benchmark to summarise the economic circumstances against which we evaluate interest rates. The notion of the "natural," "equilibrium" or "neutral" rate of interest – terms which are sometimes used interchangeably -- has been developed in the literature to provide such a benchmark.

In the spirit of Knut Wicksell, who devised the concept more than a century ago (Wicksell, 1898), we define the natural rate of interest as the equilibrium real interest rate consistent with stable low inflation and potential output, in the absence of transitory shocks to demand and supply. Holding longer run factors constant, potential output is achieved at the full utilisation of resources.

In policy discussions, it is common to see arguments that directly link the natural interest rate to economic growth rate. This relation is known as the "golden rule" in the literature of growth. In the Solow (1956) model with an exogenous saving rate, the equilibrium interest rate equals the growth rate of output, which is the sum of technological change and population growth, on the balanced growth path that maximises consumption; see Romer (2012) for detailed exposition. The Chinese economy has been growing at an average annual rate of more than 8% over the last three decades. Should the natural interest rate also be of this order of magnitude? Our view is that the golden rule cannot be directly applied to measure the natural interest rate in China because it does not take into account the fact that the Chinese economy has a much higher saving rate than in mature economies.

If the natural rate were constant over time, as assumed by Taylor (1993), one might estimate it simply by averaging the relevant short term interest rate over a long period. This approach tends to work well when inflation and output growth are stable, but not when non transitory factors shift the natural state. For example, the natural rate may vary over time in response to changes in technology and preferences. In that case, estimation of the natural rate has to take account of a moving target.

Moreover, estimation of the natural rate should correct for the effect of interest rate controls and financial constraints in China. We are interested in the natural rate after liberalisation, while the actual data on interest rates and other macroeconomic variables that we observe contain systematic distortions.

Indeed, our knowledge of the workings of the economy is insufficiently precise that we could not attach much confidence to any single calculation that one might make of the natural rate. As put by Blinder (1998), "*[T]he neutral real rate of interest is difficult to estimate and impossible to know with precision. It is therefore most usefully thought of as a concept rather than as a number, as a way of thinking about monetary policy rather than as the basis for a mechanical rule."* We use different methods to gauge the natural interest rate in China below. The purpose is not to establish a precise number, but to provide a robust starting point for future policy experiments.

4.1.1 Calibration-Based Estimates

The seminal work by Laubach and Williams (2003) estimated the natural real interest rate and potential output growth jointly by applying Kalman filtering techniques to a system of reduced form equations that describe relations between the natural rate and observables such as output and inflation. Intuitively, this method works on the principle that the estimate of the natural rate should be partially adjusted based on how far off the implied values are from actual data of observables. Mesonnier and Renne (2007) follow a similar methodology to measure the time varying natural rate of interest for a synthetic euro area. Similar research includes Manrique and Marques (2004) and Garnier and Wilhelmsen (2005), among many others.

This method cannot be applied directly to the Chinese data. Without a clean structural model that characterises the influence of interest rate control on observables, the specification applicable to advanced economies with free interest rates cannot correct for potential institutional bias to give reasonable estimates of the natural interest rate in China. Nevertheless, the critical equation in Laubach and Williams (2003) is:

$$r^* = \frac{1}{\sigma} g + \theta, \tag{1}$$

where r^* is the natural real interest rate, σ is the intertemporal elasticity of substitution (IES), g is the growth rate of potential output, and θ is the rate of time preference. This simple relation holds in the steady state for a wide range of models. It can be derived from neoclassical models like Ramsey (1928). In new Keynesian models, the natural rate, defined as the expected real rate in the flexible price equilibrium, can be written in a similar form (Gali, 2003). Although we cannot take equation (1) to the Chinese data, we may still use it to infer the natural rate of interest by calibrating the parameters.

We choose parameter values that we consider as reasonable for China. Following Song et al. (2011), we calibrate θ to 0.3% to match China's average aggregate saving rate. Given the high saving rate, research generally assumes that households in China are more 'patient' than in other economies. For example, the calibration of Funke and Paetz (2013) corresponds to an average θ of 0.45%. For the

IES, we use the value set by Song et al. (2011) as a baseline, i.e. $\sigma = 2$. Garnier and Whilhelmsen (2005) estimate σ to be around 1.53 for Germany. As a similar high saving economy, we use this value as another reference. To reflect the possibility of higher intertemporal substitution, we also consider 2.2 for σ. For potential growth, we set g at 7.5% in the light of historical experience and the recent slowdown of the economy.

Based on different calibrations, we obtain estimates for the natural interest rate in China, which are reported in Table 1. Columns (2) and (3) seem to be reasonable baseline estimates, while columns (1) and (4) can be considered as the lower and upper bounds under our parameterisation. Based on these results, the natural interest rate in China is about 4% or slightly higher.

Of course, these estimates depend on our choice of parameter values. There is less disagreement on time preference and potential growth, but the reasonable range for the IES is wide. We hope that future research will provide empirical evidence for the IES in China.

4.1.2 Marginal Returns to Capital

Our second approach is to measure the natural interest rate using equilibrium conditions from the production side of the economy. To estimate the return to capital, we consider a standard macroeconomic model featuring a constant returns to scale production function. Under the assumption of competitive markets, total output in the economy is distributed among factors according to their marginal productivity, without surplus or deficit. Denote the share of capital income as α. With these minimal conditions, the marginal product of capital MPK is given by:

$$MPK = \frac{\alpha}{K/Y}, \tag{2}$$

where Y is the total output and K is capital stock. The equilibrium interest rate r^* then equals the marginal product of capital net of tax and depreciation:

$$r^* = (1-\tau)(MPK - \delta), \tag{3}$$

where τ is the ratio of tax on capital income and δ is the depreciation rate. All variables are expressed in real terms. The tax deduction of depreciation expenses is allowed.

Taken to the data, the output Y is proxied by China's GDP from the National Bureau of Statistics (NBS) deflated by the GDP deflator provided by the IMF. We use the perpetual inventory method to construct estimates of the capital stock. To be consistent with the measure of the World Bank (2011), on which our method will partly rely, we proxy investment by gross capital formation deflated by the

fixed asset investment price index. The initial capital stock is given by the ratio of the first year investment to the sum of the average growth rate of investment in the first five years and the depreciation rate. Following the World Bank (2011), we set the depreciation rate at 5%. The rest of the capital stock series derives from the capital accumulation process. That is, adding investment to the existing stock, net of depreciation, yields esimates of the current capital stock. From a macroeconomic viewpoint, capital income includes taxes on both output and enterprise income. We adjust for value added tax, enterprise income tax, and operation tax, using data from the NBS.

Here we use different price indices to deflate GDP and investment. In a developing country like China, investment goods are more expensive than final goods. Not accounting for these differential prices can lead to an overestimate of the return to capital.

In the literature, it is common to back out the capital income share α as one minus the labour share α_L. However, $1-\alpha_L$ includes payments accruing to both produced and natural capital, i.e., land and natural resources. In contrast, the measure of capital stock is calculated from investment flows that cover only machinery, equipment, and plant and therefore only represent produced capital. Using $1-\alpha_L$ as the capital share biases the estimate of MPK upwards. Given that agricultural and natural resources have a large share in inputs in developing China, the potential biases can be serious.

To construct α, we first calculate the labour share α_L by taking average of the provincial labour shares weighted by GDP using data from the NBS. We then adjust for the payments to natural capital N to obtain the capital income share α corresponding to our measure of produced capital K:

$$\alpha = \frac{K}{K+N}(1-\alpha_L). \tag{4}$$

This method was proposed by Caselli and Feyrer (2007), who documented that the returns to capital are remarkably similar across countries after these necessary adjustments. The Wealth of Nations dataset compiled by the World Bank (2011) contains estimates of produced and natural capital in 1995, 2000 and 2005. For China, the three observations on the share of produced capital in total capital are 0.45, 0.50 and 0.60 respectively. We take an average, and assume that it prevails across time.

Figure 8 shows that the estimates of the natural real interest rate in China average around 4.3%, within a band between 3% and 6%. The results are relatively stable over time. Since the capital stock partially depends on current investment, which is procyclical, we also provide a moving average measure to remove high frequency components. It is worth pointing out that these estimates represent the net returns to capital in an aggregate sense, absorbing the effects of uncertainty and liquidity needs. In this basic non monetary setting, there is in equilibrium only one interest rate which

corresponds to the natural interest rate. Finally, our estimation requires only minimal assumptions of the economic structure, and hence, the estimates should be robust to model specification.

4.1.3 Cross-Country Experience

Following He and Wang (2012), we correct for the effects of interest rate control and financial repression on market interest rates to obtain estimates of the natural rate. Specifically, they used a panel data set of 49 economies between 1973 and 2005 to estimate the linear regression model that links real interest rates r_i to real GDP growth rate g_i, the aggregate saving rate θ_i, and the degree of financial repression τ_i:

$$r_i = a_0 + a_1 g_i + a_2 \theta_i + a_3 \tau_i + \pi_i + u_i, \quad (5)$$

where π_i is the country fixed effects. The saving rate is included to capture households' time preference. The financial repression index is between 0 and 1, compiled by the IMF (2008). The empirical analysis of He and Wang (2012) shows that financial repression has a significant negative effect on observed real interest rates. They use the estimated model to predict the natural rate for China, deriving an estimate of about 4.7% for 2005.

Since data on financial repression are not available after 2005, we cannot update the estimation of (5). Instead, we use linear interpolation to estimate the current level of financial repression in China. Using the empirical results of He and Wang (2012), we remove the distortions caused by financial repression on China's most recent data on real interest rates. A simple moving average is employed to smooth out cyclical shocks. In this way, we update the study of He and Wang (2012) and find that the natural rate has declined somewhat, but remained above the level of 4%. The most recent estimate is 4.31% for 2012.

Taken together, our results obtained from the above three methods are largely consistent. A reasonable interval for the estimate of the natural interest rate is between 4% and 4.5% in China. This is higher than Taylor's (1993) 2% and the estimate of Laubach and Williams (2003) of around 3% for the U.S. economy.

It is worth noting that the policy rate would be a short term rate. Our methods do not explicitly model the term structure of interest rates. In these benchmark settings, we abstract from uncertainty. In the absence of risk premia, liquidity premia should also be limited, giving a relatively flat yield curve. Corresponding to the policy rate, a small downward adjustment over our estimates may be appropriate.

4.2 The Determination of Interest Rates in the Banking Sector

In a fully liberalised interest rate system, it is likely that interest rates on large deposits and negotiable Certificate of Deposits (CDs) will track wholesale funding costs such as money markets rates closely, whereas interest rates on small deposits would probably be somewhat lower than money market rates. When market arbitrage works effectively, money market rates and interest rates on large bank deposits and CDs are well anchored by central bank policy rates. According to our estimates of the natural interest rate, there will be pressures for bank deposit rates to move toward higher equilibrium levels when they are no longer constrained by binding ceilings. Indeed, most banks raised their deposit rates close to the ceilings after the PBC announced that the deposit ceilings would be raised from 100% to 110% of the benchmark deposit rates in 2012.

The movement of lending rates in the banking sector after liberalisation would depend on, among other things, the following three factors. The first is the contestability of the banking industry. Since the effective funding costs of banking sector (deposits) are set to increase after liberalisation, banks might be able to pass higher costs on to their clients if they have sufficient market power, resulting in higher effective lending rates that borrowers have to accept. Otherwise, banks have to absorb the higher funding costs by themselves and their profit margin will be lower.

Second, the movement of lending rates will depend on whether the PBC continues to impose an aggregate loan quota on the banking industry, and whether the quota is binding after liberalisation. If the loan quota remains binding, the effective loan rate would be determined by the quota and aggregate loan demand (Figure 9, P3, Q3), and in this case the rising funding costs do not necessarily lead to a lower profit margin after liberalisation (In Figure 9, the new profit margin would be the gap between P3 and P4).

The third factor is the competition from direct finance and foreign inflows after liberalisation. The loan supply curve would become flatter if the bond markets are more developed and more firms choose bond markets to finance their projects. The loan supply curve would also be flatter after capital account liberalisation so that foreign lenders would be able to lend to domestic firms. In other words, banks have to cut their operational costs to compete with their rivals from direct finance and from abroad.

It is worth noting that the third factor also interacts with the other two in the sense that better developed bond markets and better access to foreign finance mean less market power of domestic banks as well as a less binding loan quota, because firms have alternative choices to finance their projects. Therefore, bond market development and capital account liberalisation would be key factors driving lending rates after liberalisation.

In short, our analysis indicates that deposit rates are likely to move higher after interest rate liberalisation, while the impact on lending rates seems to be ambiguous, depending on the development of China's financial markets.

4.3 The Determination of Interest Rates in the Money and Bond Markets

Interest rates in the money and bond markets after liberalisation would be determined by both market forces and monetary policy. As argued earlier, the conduct of monetary policy in the future would mainly involve a policy rate, which is typically a short term (e.g., overnight) money market rate. As a monopoly supplier of liquidity, the PBC in principle can steer the market rate to whatever level desired through its operations in the markets. Given the relatively short yield curve, interest rates in the money markets should be well anchored by monetary policy after liberalisation.

In the bond markets, monetary policy would continue to have its influence, in particular, at the short end of the yield curve. According our estimates of the natural interest rate, short term bond market rates would likely move higher after liberalisation. To some extent, the recent rise in China's interbank rates is an indication of such upward adjustment pressures. For longer term interest rates, market forces would dominate in pricing term and risk premia. The pricing mechanism is much more complicated, but it is clear that policy signals can still be passed on to the longer parts of the yield curve in deep well functioning bond markets.

As a final point, market rates and bank rates will affect each other given fund flows between the banking sector and the capital markets. In the current dual track interest rate system, He and Wang (2012) show that interest rates in the money and bond markets are constrained by regulated deposit rates, and increase in the binding deposit rate ceilings. As the ceilings are lifted and finally abolished, money market and bond market rates will also approach their higher equilibrium levels. This is consistent with the recent observation that market rates increased as the PBC lifted the deposit rate ceilings. On the other hand, shocks from the money and bond markets can also affect unregulated loan interest rates but the impact is relatively small because deposit rates are the main anchor for banking products (He and Wang, 2013).

5. Next Steps

We have discussed the determination of interest rates after liberalisation in Section 4, but this leaves the question of how to achieve such liberalisation? In a narrow sense, interest rate liberalisation seems to have only one step left, which is the removal of the deposit rate ceilings. However, its success and the functioning of the financial system in serving the economy afterwards depend on many conditions. It should also be noted that the process of interest rate liberalisation is a dynamic one: market determined interest rates at the margin will help to reduce distorted incentives and moral

hazard, thereby creating conditions for further reforms. China's success in other areas of price reform through the dual track approach bodes well for its success in interest rate liberalisation.

A carefully designed roadmap is necessary to guide the series of reforms through the process. Governor Zhou (2013) recently gave his view on how to achieve interest rate liberalisation in these steps. In the near term, the focus is to strengthen self-discipline in the formation of market interest rates, to grant financial institutions more discretion in setting their interest rates, to establish the prime lending rate fixing as an effective benchmark for the pricing of loan products, to promote the issuance and trading of negotiable CDs, and to gradually expand the scope of market based pricing of the liabilities of financial institutions. In the medium term, the focus should be on developing a relatively complete and efficient market interest rate system and to improve the monetary policy framework and monetary policy transmission.

The authorities are likely to adopt the following two approaches to deregulation of bank deposit rates. First, the PBC may lift the deposit rate ceilings gradually and allow real deposit rates to move upwards in a managed way, and remove the ceiling regulations when actual deposit rates are close enough to their equilibrium levels. Second, the PBC may allow parts of banks' liabilities other than deposits, such as CDs issued by banks, to be priced by market forces. For example, negotiable CDs can be issued to institutional investors first and then extended to individual investors. The face value of a CD can initially be set large and gradually reduced so that the CDs resemble retail deposits more.

The success of these reforms requires at least two conditions. First, major players in the financial system, particularly the banks, require hard budget constraints and to be in a position to exercise self-discipline in their pricing decisions. Second, the demand for credit by borrowers, especially SOEs and financial firms backed by local governments, should be sensitive to changes in interest rates. These conditions are not yet fully satisfied at present and necessitate further reforms in related sectors.

In particular, implicit government guarantees have to be removed for a sound banking system. For example, at present, banks expect the government to bailout potential failures when competing for deposits by raising interest rates and/or chasing after returns by lowering lending standards. In addition to strengthening banking supervision, establishing an explicit exist mechanism for financial institutions in order to contain moral hazard behaviour is a priority. A deposit protection scheme would be an important element in developing the conditions for fully liberalised deposit rates, as suggested by the experience of many other economies. The PBC is generally expected to launch such a scheme soon.

In short, as a price discovery process, interest rate liberalisation demands that banks, firms and households are responsible for their own decisions and aware of the risks associated with any given return. Before these conditions are fully satisfied, the PBC may still need to impose aggregate loan quotas on the banking sector even after the liberalised deposit rates have moved close to the equilibrium levels. Loan quotas would influence effective lending rates, as discussed in Section 4.2,

and represent a powerful policy instrument for guiding lending rates, in addition to the prime lending rate.

6. Concluding Remarks

In this paper, we have given a substantial account of the current interest rate structure in China, which can be summarised as a dual track system. On the one hand, retail deposit rates are regulated and other administrative restrictions are imposed. On the other hand, interest rates in the money and bonds markets are market determined, but remain constrained by binding deposit rate ceilings, which act as an important policy anchor.

We have offered our view on the determination of interest rates after liberalisation. The PBC, as the monopoly supplier of the monetary base, will need to continue to provide an anchor for the interest rate system by targeting a short term money market rate, while market forces will determine bank rates and market rates by adjusting risk and term premia. A fundamental change is that the PBC will use the composition and size of its own balance sheet to steer its policy rate and hence influence bank and market rates instead of using administrative orders to regulate rates.

In this policy framework, the natural interest rate will provide an informative and cyclically neutral guide for the conduct of monetary policy. We have sketched three preliminary approaches to estimation of the real natural rate, which lead to largely consistent estimates of around 4 to 4.5% for China. Based on this analysis, interest rates on large deposits in the banking sector and money market rates, as well as short term bond rates, would likely to move higher after liberalisation. We argue that the effect on effective lending rates is ambiguous, depending on market and institutional conditions.

There are many important questions that we have not addressed. For example, we have argued that short term interest rates in the bond markets may increase after liberalisation on the basis of our empirical findings, but have not examined the potential effects on the curvature of the yield curve. The liquidity preference and risk appetite of market participants may shift, following interest rate reforms. Regulatory and market structures may also change and shape pricing behaviours. The determination of the yield curve is left for future research.

In addition, we have focused on a closed economy setting when discussing the determination of interest rates after liberalisation. As a continental sized economy and with more flexible exchange rates, China is expected to be able to conduct a fairly independent monetary policy. This would imply that the PBC would be in a good position to anchor the short term interest rates. However, since the authorities have also announced plans to accelerate the pace of capital account liberalisation, the size, direction and volatility of gross and net capital flows would inevitably affect the interest rate structure in China. This issue is left for future research.

References

Blinder, Alan S. (1998), *Central Banking in Theory and Practice,* Cambridge, MA: The MIT Press.

Caselli, Francesco and James Feyrer (2007), "The Marginal Product of Capital," *Quarterly Journal of Economics*, 122(2): 535-68.

Funke, Michael and Michael Paetz (2013), "Financial System Reforms and China's Monetary Policy Framework," Presented at the Fourth HKIMR Annual International Conference on the Chinese Economy.

Gali, Jordi (2003), "New Perspectives on Monetary Policy, Inflation, and the Business Cycle," in M. Dewatripont, L. Hansen and S. Turnovsky, eds., *Advances in Economics and Econometrics*, vol. 3. Cambridge, UK: Cambridge University Press.

Garnier, Julien and Bjørn-Roger Wilhelmsen (2005), "The Natural Real Interest Rate and the Output Gap in the Euro Area: A Joint Estimation," ECB Working Paper No.546.

He, Dong and Laurent Pauwels (2008), "What Prompts the People's Bank of China to Change its Monetary Policy Stance? Evidence from a Discrete Choice Model," *China & World Economy*, 16 (6): 1-21.

He, Dong and Honglin Wang (2012), "Dual-Track Interest Rate and the Conduct of Monetary Policy in China," *China Economic Review*, 23(4): 928–47.

He, Dong and Honglin Wang (2013), "Monetary Policy and Bank Lending -- Evidence from Loan Level Data," Hong Kong Institute for Monetary Research Working Paper No.16.

IMF (2008), "A New Database of Financial Reforms," IMF Working Paper No.08/266.

Jiang, Xianglin (2012), "The Funds Transfer Pricing System of Commercial Banks in China," (我国商业银行内部资金转移定价机制建设情况探析), *Journal of Finance and Economics* (in Chinese), 8:59-61.

Lardy, Nicholas (2008), "Financial Repression in China," Peterson Institute for International Economics Working Paper No.PB08-8.

Laubach, Thomas and John C. Williams (2003), "Measuring the Natural Rate of Interest," *Review of Economics and Statistics*, 85(4): 1063-70.

Manrique, Marta and José M. Marqués (2004), "An Empirical Approximation of the Natural Rate of Interest and Potential Growth," Banco de España Working Paper No.0416.

Mesonnier, Jean-Stephane and Jean-Paul Renne (2007), "A Time-Varying "Natural" Rate of Interest for the Euro Area," *European Economic Review*, 51(7): 1768-84.

PBC (2012), "The Annual Report of Data and Structure of Total Social Financing Since 2002," (2002年以来社会融资规模年度数据及结构), available at: http://www.pbc.gov.cn/publish/diaochatongjisi/3172/2012/20120913102139128723838/20120913102139128723838_.html

PBC (2014), "The Annual Report of Data and Structure of Total Social Financing in 2013," (2013年社会融资规模统计数据报告), available at: http://www.pbc.gov.cn/publish/diaochatongjisi/3172/2014/20140115094914542558542/20140115094914542558542_.html

Qin, Duo, Zhong Xu and Xuechun Zhang (2013), "How Much Has Private Credit Lending Reacted to Monetary Policy in China? The Case of Wenzhou," SOAS Department of Economics Working Paper Series No.178, The School of Oriental and African Studies.

Ramsey, Frank P. (1928), "A Mathematical Theory of Saving," *Economic Journal*, 38(152): 543-59.

Romer, David (2012), *Advanced Macroeconomics*, 4th Edition, New York, NY: McGraw-Hill/Irwin.

Song, Zheng, Kjetil Storesletten and Fabrizio Zilibotti (2011), "Growing Like China," *American Economic Review*, 101(1): 196-233.

Taylor, John B. (1993), "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, 39(1): 195-214.

Wicksell, Knut (1936), *Interest and Prices* (tr. of 1898 Edition by R.F. Kahn), London UK: Macmillan.

World Bank (2011), *The Changing Wealth of Nations,* Washington, DC: The World Bank.

Yi, Gang (2009), "Progress of Interest Rate Liberalisation in China during the 30 Years of Reform," (中国改革开放三十年的利率市场化进程), *Journal of Financial Research* (in Chinese), 343(1): 1-14.

Zhang, Xiaohui (2012), *China Monetary Policy,* Beijing, China: China Financial Publishing Housing.

Zhou, Xiaochuan (2010), "Some Thoughts about Advancing Interest Rate Liberalization in China," (关于推进利率市场化改革的若干思考), available at: http://www.pbc.gov.cn/publish/goutongjiaoliu/524/2012/20120112160648353655534/20120112160648353655534_.html

Zhou, Xiaochuan (2012), "China's Monetary Policy since the Turn of the Century," *Caixin News,* available at: http://english.caixin.com/2012-11-30/100467497.html?p3.

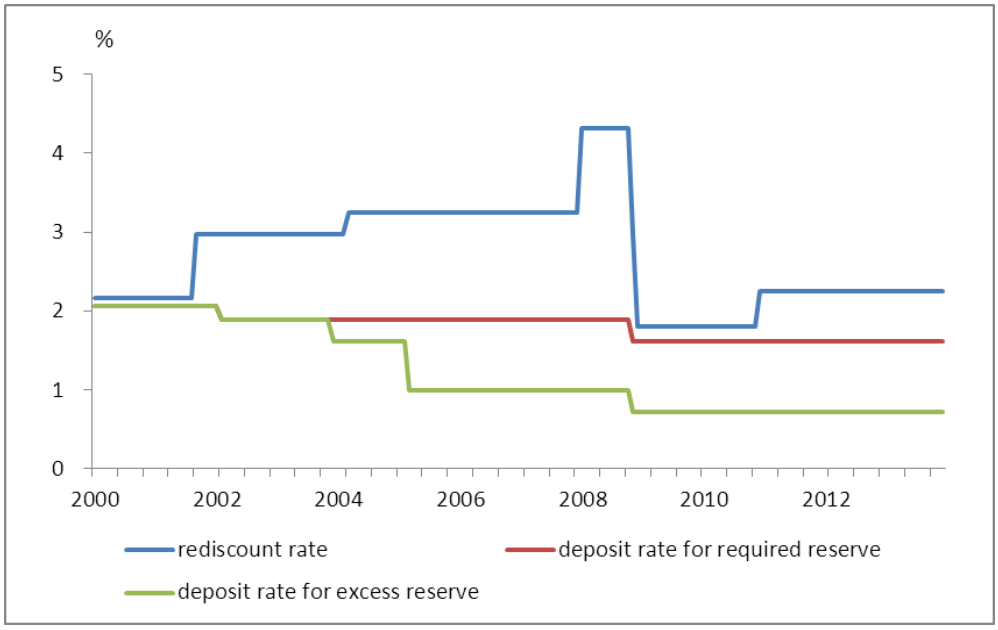
Zhou, Xiaochuan (2013), "Deepen All-Round Financial Reforms and Openness, Quicken the Development of a Financial Market System," (全面深化金融业改革开放, 加快完善金融市场体系), available at: http://www.pbc.gov.cn/publish/goutongjiaoliu/524/index.html.

Table 1. Natural Interest Rates under Different Calibrations

Parameter	(1)	(2)	(3)	(4)
Intertemporal Elasticity of Substitution (σ)	2.2	2	2	1.53
Time Preference (θ)	0.3%	0.3%	0.45%	0.45%
Potential Economic Growth (g)	7.5%	7.5%	7.5%	7.5%
Natural Interest Rate	3.71%	4.05%	4.2%	5.35%

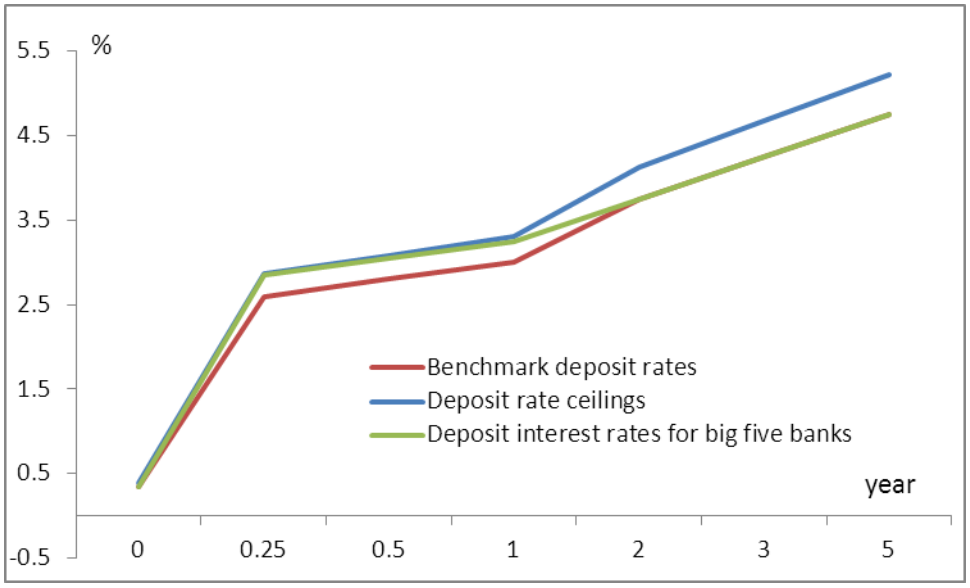
Source: authors' calculation

Figure 1. Interest Rates for Central Bank Operations



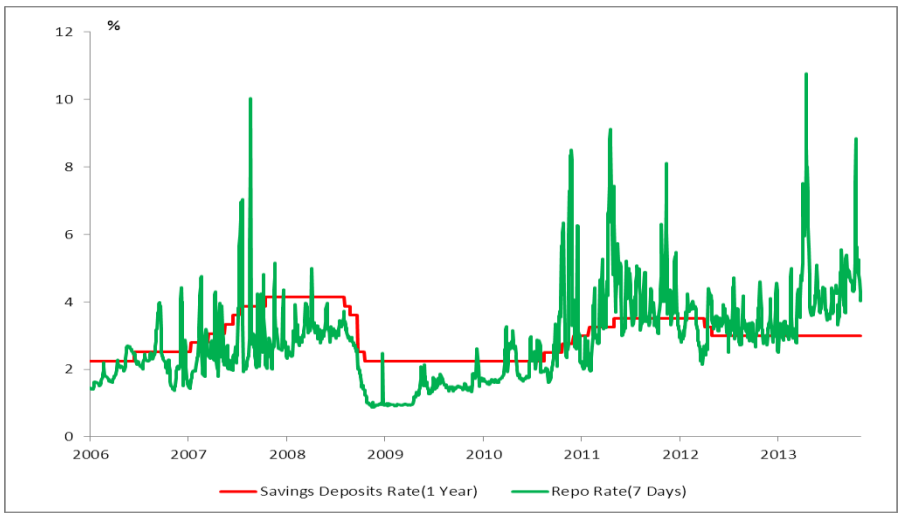
Source: CEIC

Figure 2. Deposit Rates of Different Tenors



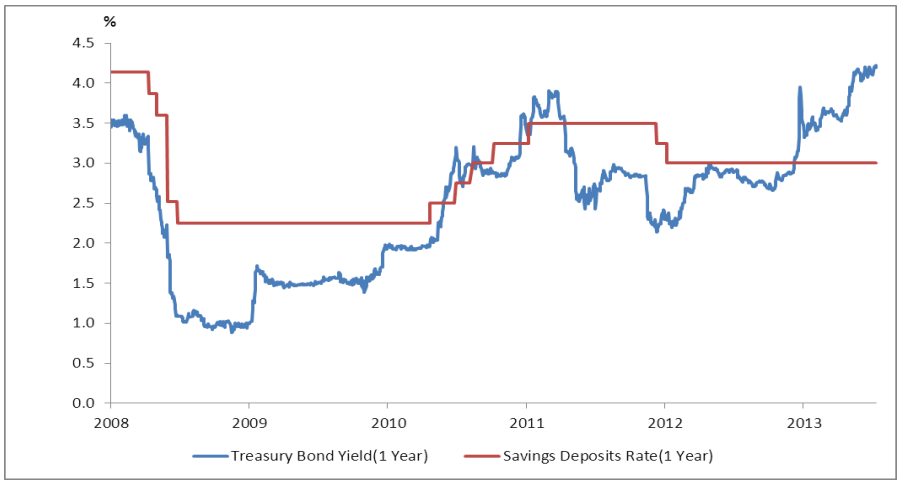
Source: CEIC

Figure 3. 7-Day Repo Rate and 1-Year Deposit Rate



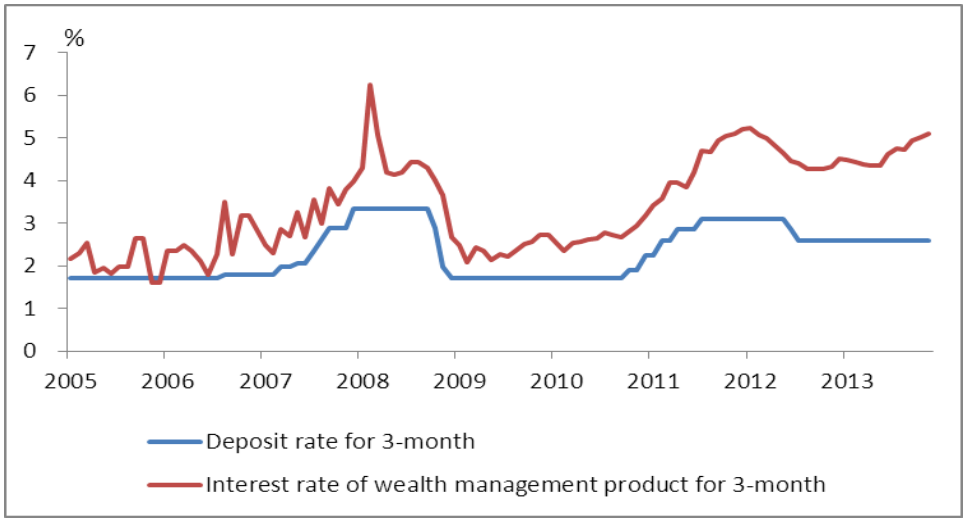
Source: CEIC

Figure 4. 1-Year Treasury Yield and 1-Year Deposit Rate



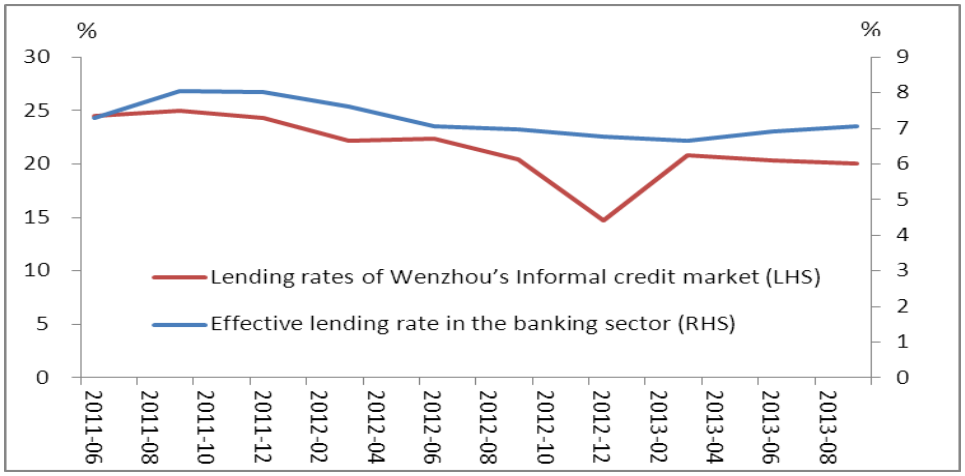
Source: CEIC and WIND

Figure 5. Interest Rates on Wealth Management Product and 3-Month Deposit



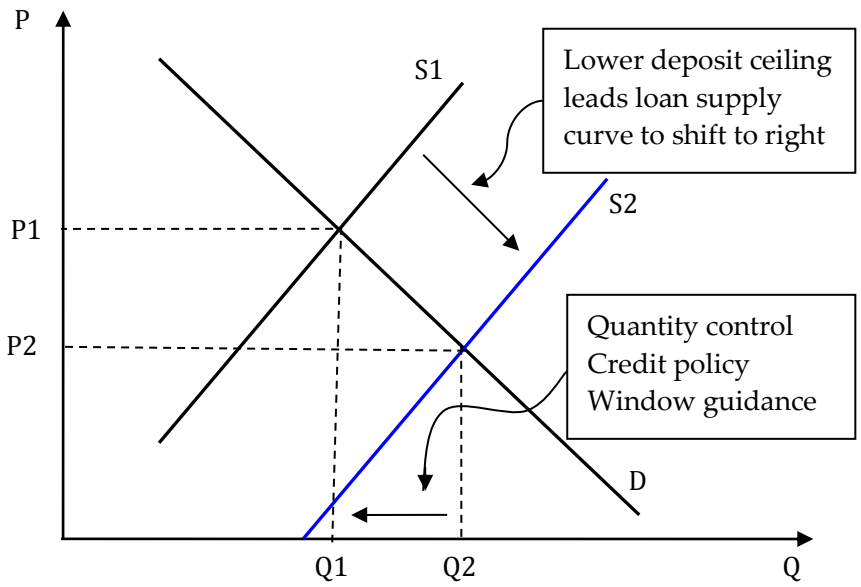
Source: CEIC and WIND

Figure 6. Lending Rates in the Informal Credit Market and Bank Lending Rate



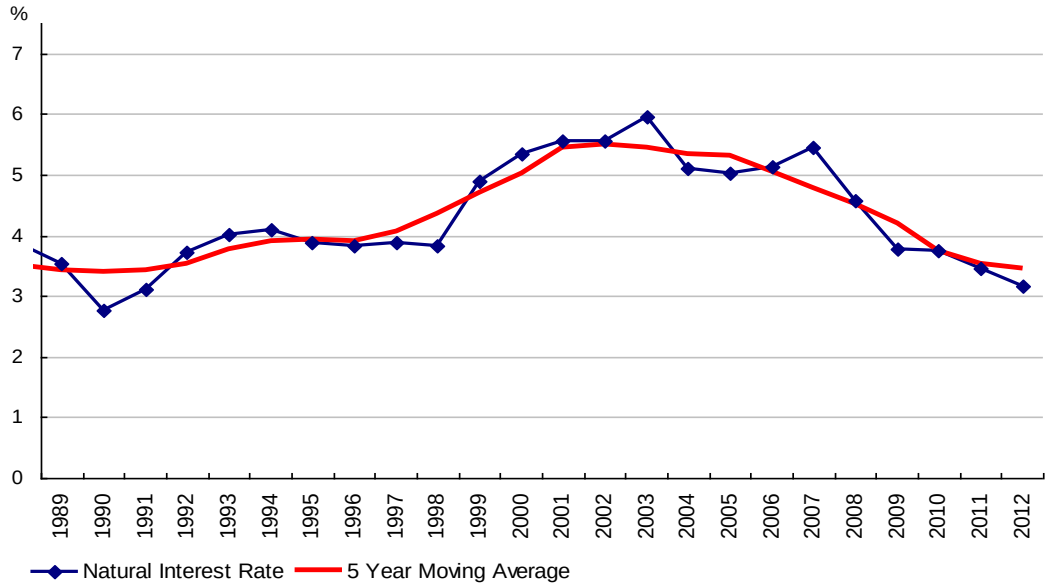
Source: CEIC and WIND

Figure 7. Credit Market with Interest Rate Distortions



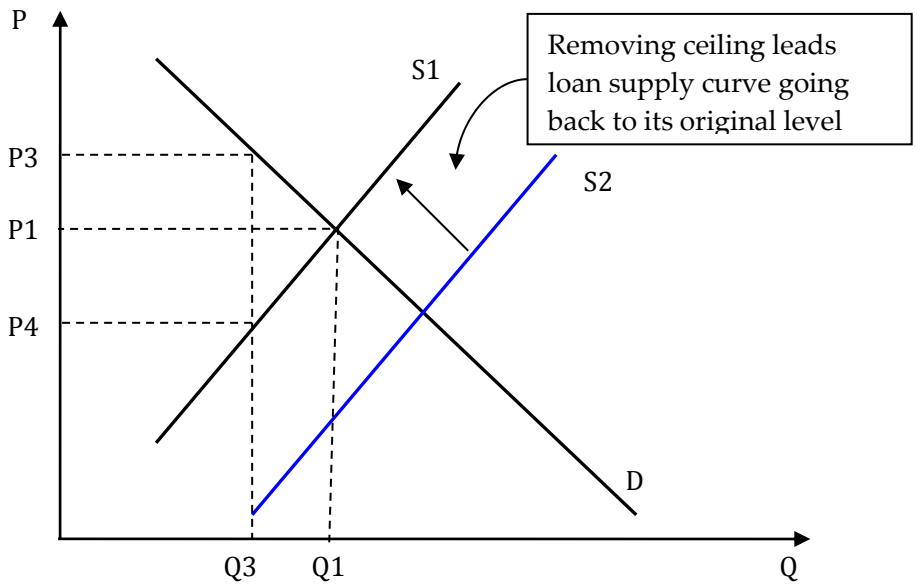
Source: He and Wang (2012)

Figure 8. MPK Estimates of the Natural Interest Rate in China



Source: authors' calculation

Figure 9. Loan Rates after Liberalisation



Source: authors' compilation