The Great Accommodation:

Chinese Central Banking in the New Millennium[1]

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1. Introduction and Summary

The main objectives of People's Bank of China (PBC) are, in Governor Zhou Xiaochuan's words: (1) to maintain low inflation; (2) to keep appropriate economic growth; (3) to keep relatively low unemployment; (4) and to maintain external balance of payments. Among the four objectives, low inflation is the paramount one and receives the heaviest weight in policy deliberation (Zhou, 2012).[2]

However, PBC's low-inflation agenda had to be carried out under the constraint of rapid expansion of the bank's asset sheet. From 2000 to 2012, PBC's foreign exchange reserve expanded almost 16 times, 21.3% annually in average. The external backdrop for the rapid accumulation of foreign exchange (forex) reserve, including the redistribution of world manufacturing activity, is obviously outside PBC's control. Even the domestic policies that lead to the over-accumulation of forex reserve, including exchange rate setting and policies for attracting FDI, are determined at a level of decision-making that is above PBC in the hierarchy of economic management.

The PBC accommodated the extraordinary expansion of asset sheet with an unconventional expansion of liability sheet. we would call this action the great accommodation both for the scale of operations and for the happy result that no severe inflation occurred. From 2000 to 2012, the average annual inflation was a mere 2.3% and the maximum monthly inflation rate was 8.7% in Feb 2008, which was largely driven by a surge in food and energy prices. This was a notable achievement by PBC, given the rapid accumulation of forex reserve and the double-digit growth in real GDP during the same period.

[1] We are grateful to Professor Pan Yingli's encouragement and helpful discussions.

[2] It is highly credible that the Chinese government and PBC are hostile to inflation. First, the Party dominated the revolutionary war after a hyperinflation eroded the power base of the once mighty Nationalist regime. This historical association is a permanent warning to the Party leaders. Second, if that remote memory is not deterrent enough, the severe inflation in the late 1980s almost undermined the reform agenda led by Deng Xiaoping.

During the great accommodation, required deposits together with central bank bills (since both are interest-bearing, we group deposits and bills together as debt financing) replaced currency issuance as the major financing instrument for the expansion of asset sheet. The central bank bill (CBB) was a major policy initiative for the sterilization of the position for forex purchase (PFP).[3] However, CBB proved to be inadequate for the flood of newly created liquidity through PFP. From 2006, PBC relied more and more on raising deposit reserve ratio of commercial banks, possibly for the lower interest cost and longer (infinite, indeed) lockup period on withheld liquidity.

The great accommodation was not without side-effects. The restrictive level of deposit reserve ratio for commercial banks was partly responsible for two recent developments: the financial disintermediation and the expansion of shadow banking system in China. Both developments would make PBC less powerful in its quantity-based liquidity management of the economy. It may well happen in the future that PBC's control of the formal banking system ceases to be relevant even when it remains successful.

The future of Chinese central banking relies on reforms on two fronts. First, China should allow a more flexible exchange rate and abandon policies for encouraging exports and FDI. This would achieve some degree of balance of payments, so that the constraint of asset sheet expansion on PBC would be relaxed. Second, PBC should move from quantity-based to price-based central banking, targeting short-term interest rate rather than money supply. To make the transition successful, of course, many more reforms of the financial markets are needed.

In the rest of the paper, we first lay out in Section 2 the challenges to PBC, especially since China joined WTO in 2001. In Section 3 we describe PBC's policy instruments, old and new. In Section 4, we examine the changes in PBC's balance sheets during the great accommodation. In Section 5, a set of recommendations is offered for the future reform of Chinese central banking. Section 6 concludes the paper.

2. Challenges to PBC

As a developing country in transition from command-based to market economy, China was prone to overheating e.g. Fan and Woo (1996). First, the rapid income growth created upward pressures on the price level. Second, the interest rate was kept artificially low to support state-owned enterprises. There were, indeed, several prolonged periods with negative real interest rate in the past three decades. Third, perhaps most importantly, the state sector and the local governments, generally operated under "soft budget constraints" and hence tended to over-borrow and over-invest. This soft-budget constraint situation created powerful

[3] The central bank bill is not an invention of PBC. Germany had something similar in early 1970s, when Bundesbank issued short-term treasury bills with an unconditional buy-back guarantee. In mid-1970s, the central bank of Philippines started to issue its own liabilities to conduct open market operations. Following Philippines, Indonesia introduced central bank bills in 1984, which subsequently became the major instrument for day-to-day monetary management. Taiwan also used central bank debt certificates in the 1980s to sterilize foreign reserve increases due to trade surpluses.

pressures on the monetary authority to loosen credit. The relationship between inflation and rate of credit expansion is clearly visible in Fig. 1. Indeed, despite the paramount weight on inflation, PBC had not been successful in reigning inflation during its early years as the central bank of China.

[Figure 1 here.]

The passage of the Law of People's Bank of China in 1995 gave PBC the legal status of the central bank of China. Along with the transition of Chinese economy, PBC started to transform itself in the following years from conducting command-based banking macro-management to market-based indirect central banking (Yi, 1999). In the new model, PBC targeted the money supply instead of total loans instead of controlling bank loans (Zhang et al., 1997).

After China joined WTO in 2001, Chinese economic growth picked up and inflation pressures came back after the Asian financial crisis. The key challenge for PBC in the new millennium was to combat inflation pressure with the constraint that PBC had to purchase every dollar from the "twin surpluses" in the current account and the capital account of the balance of payments.

Exchange rate stability

Exchange rate stability itself, especially at an undervalued level, was not among the four objectives of PBC, but it was considered crucial for the objectives of keeping "appropriate economic growth" and "relatively low unemployment". In Jan 1994, to stimulate "external demand", PBC orchestrated a big depreciation of yuan from 5.8 to 8.7 yuan/dollar.[4] From May 1995 to Jun 2005, the yuan had been pegged to the dollar de facto at about 8.3 yuan/dollar (Fig. 2), although it was allowed to fluctuate within the daily range of [-0.3%, 0.3%]. On July 21 of 2005 the yuan was officially unpegged from the dollar. But the cap on daily fluctuation remained. The yuan began to appreciate slowly against the dollar, only interrupted briefly by the 2008 financial crisis.

[Figure 2 here.]

It was, of course, PBC's job to intervene in the foreign exchange market to keep the yuan stably undervalued against the dollar. PBC had to purchase dollars from two main groups of sellers: exporters and foreign direct investors. In fact, it is mandatory that the foreign currency earned by exporters and brought in by FDI and foreign loans be converted into yuan. As this purchase of dollars by PBC necessarily resulted in yuan creation, PBC had to sterilize its effect on inflation.

"Twin Surpluses"

[4] Before the move, there were two exchange rates of yuan, one official rate of 5.8 yuan/dollar and the other unofficial adjustable (Tiao-Ji) rate. In Jan 1994 PBC unified the two rates and set the new official rate as 8.7 yuan/dollar.

With the undervalued yuan, Chinese exporters made the best of the opportunities that are opened for them by China's joining WTO. For example, the trade surplus jumped from RMB 34 billion in 2001 to 44 billion in 2002, causing the current account surplus to increase from 2.6% to 3.0% of GDP. In 2007, the current account surplus reached 10.1% of GDP.

At the same time, FDI poured into China, partly attracted by preferential policies for foreign investment[5]. As a result, China had been running both current account and financial account surpluses from 1994 to 2011, with the exception of 1998 when the Asian financial crisis was in full swing. Yu (2010) has attributed this phenomenon of "twin surpluses" as mainly due to distortionary policies that encouraged export and FDI, in which the undervalued yuan and export subsidies played important roles.

Double-edged Sword

Forex reserve was considered essential for the modernization of China and economic growth. Without foreign currency, the argument was, modern machines could not be bought for the modernization of factories. Policies designed to promote export and those to attract foreign capital were both based on this simplistic view of economic growth. Local governments were all too happy to come up with such policies, since the bank dominated financial system under-supplied funding persistently but the dollar brought by export and FDI could be converted into yuan and local credit easily.

Of course, forex reserve was indeed essential for the facilitation of international trade and the stabilization of exchange rate. However, too much forex reserve and too much growth in forex reserve were curses to China rather than blessings.

First, the excess increase in forex reserve over the current account surplus in effect financed at least part of foreign investment by domestic saving[6] (See Fig. 3). Since the interest rate received from forex reserve was necessarily lower than the return from FDI, this is a perverse kind of financial operation. It was thus ironical that the initial purpose of encouraging export and attracting FDI was to finance modernization of China. This perverse finance was pointed out by Chinese scholars as early as in mid 1990s, when "twin surpluses" first appeared e.g., Yu (1996). But all the talk of too much reserve accumulation was muted by the subsequent Asian financial crisis.

[Figure 3 here.]

Second, since the dollar was the dominant international reserve currency, the run-away

[5] For example, FDI enjoyed a corporate tax rate of 15%, while the tax rate for domestic investment was 33%. In addition, FDI enjoyed various forms of tax deduction or exemption.

[6] To see this, consider the following accounting identity (omitting changes in gold and other foreign assets),

$$\mathrm{nFDI} + \mathrm{nOCI} = \Delta \mathrm{F} - \mathrm{CAS},$$

where CAS represents current account surplus, nFDI represents net FDI, nOCI represents net other capital inflow, and $\Delta \mathrm{F}$ represents change in forex reserve. From 2001 to 2011, we have $\mathrm{nFDI} > 0$ and $\Delta \mathrm{F} - \mathrm{CAS} > 0$ in China.

accumulation of forex reserve ended up digging a "dollar trap" for China. A major depreciation of dollar would result in huge loss of wealth for China. And any attempt of switching to other types of reserves would only precipitate the feared crisis. It might even happen that China would have to keep the pace of dollar reserve accumulation just to keep dollar afloat, thus perpetuating wrong policies.

Third, the rapid increases in forex reserve and the associated RMB position for forex purchase were inflationary. Every dollar increases in forex reserve must be accompanied by an equivalent yuan creation by PBC, which is called "Position for Forex Purchase" (PFP) in the Table of "Sources & Uses of Credit Funds of Financial Institutions" published by PBC. Since 1994, money creation through increase in PFP had become major source of base money (high-powered money consisting of cash in circulation and reserve deposits in PBC) expansion.

As shown in Fig. 4, PFP accounted for a mere 10.9% of money base, which was measured by "reserve money" in PBC's balance sheets, and 4.1% of M2 in 1993. These two ratios increased dramatically in the next twenty years. The first high was in 1997, when PFP accounted for 44.0% of money base and 14.8% of M2. From 1998 to 2000, these two ratios declined slightly, thanks to the pegged yuan/dollar exchange rate during the Asian financial crisis, when other Asian currencies depreciated substantially. From 2001, the year when China joined the WTO, PFP began to pile up in unprecedented scale. In 2008, PFP accounted for 130.3% of money base and 35.4% of M2. The ratio of PFP to M2 started to decline in 2009, but not because PFP stopped to pile up, but because the stimulus package at the end of 2008 unleashed massive credit expansion which led to dramatic increase in M2 (M2 increased 27.6% in 2009). Fig. 5 compares the increases in PFP and money base (MB). From 2001 to 2009, the increase in PFP consistently topped the increase in MB. In an extreme year of 2005, the increase in PFP was 339% of that in MB.

[Figure 4 and Figure 5 here]

This was obviously a success story of PBC, maintaining a moderate growth in the high-powered base money during this period despite the rapid money creation through PFP. Before examining how PBC achieved this, we first describe PBC's policy instruments, old and new.

3. The Changing Set of Policy Instruments

Credit Plan and Credit Ceiling

In the pre-reform era, credit plan was the major monetary policy instrument. Along with cash plan and interest rates setting, credit plan was an integral part of centralized economic planning. After 1978, PBC began to experiment decentralized credit planning. However, decentralized credit planning proved to be vulnerable to pressures from credit-hungry state enterprises and local governments. As credit expansion and inflation got out of control in

1988, PBC reintroduced credit ceiling for banks. Credit ceiling thus became a major policy instrument of PBC, especially when the economy was in heated mode.

Credit ceiling was effective in controlling the inflation in late 1980s and again in early 1990s. However, it had all the limitations of command-based economic planning. The consensus was that credit ceiling was a necessary sin for the economy in transition and had to be phased out as institutional and market conditions improved. Indeed, PBC ceased to use credit ceiling in 1998.

Central Bank's Loan (CBL)

Central Bank's Loans (CBL) referred to PBC's loan to financial institutions, especially commercial banks. Before 1994, it was a major policy instrument for adjusting base money. When PBC wanted to tighten (expand) money supply, it reduced (increased) lending to banks. From 1994, CBL as a monetary policy instrument began to lose flexibility, as "twin surpluses" kicked in and rapid increases in PFP (Position for Forex Purchase) forced PBC to hold back CBL. After 1994, CBL was mainly used for injecting liquidity to financial institutions in distress or those already in debt-restructuring process.

Open Market Operations (OMO)

PBC experimented with trading treasury bonds in 1996, but only from 1998 did PBC begin to conduct open market operation (OMO) on large scale. In 1999 and 2000, when aggregate demand was weak, OMO became the major source of base money expansion (Wang, 2001). However, the ability of OMO was restricted by the amount of government bonds trading in the open market, which was very limited at the time. Furthermore, as the PBC's holding of bonds was even less, there was an asymmetry of OMO's effectiveness in expansionary and contractionary operations. If inflation became a worry, the ability of OMO to drain liquidity was very limited. This was, indeed, what happened after China joined WTO in 2001, when PFP began to pile up rapidly.

In addition to bond trading, PBC also conducted short-term repo to drain liquidity from market or reverse repo to inject liquidity. However, the same limitation, that is the limited supply of underlying assets, could be applied to repo and reverse repo operations.

Issuance of Central Bank Bill (CBB)

As PFP rapidly piled up, PBC must find ways to sterilize its effect and prevent rapid expansion of base money. One innovation was the issuance of Central Bank Bill (CBB)[7]. Unlike treasury bonds issued by the Ministry of Finance, CBB was issued by the monetary authority PBC and was not intended for financing government spending. The sole purpose of CBB was to sterilize the increases of PFP by draining liquidity from the interbank money market. CBB was of course interest-bearing. Since the interest payment was not backed by

[7]

the fiscal authority, it is part of money creation by PBC.

CBB played a dominant role in containing inflationary pressure from the "twin surpluses". As Table we shows, CBB issuance increased from 193.75 billion yuan in 2002, representing 4.3% of base money, to 3.7 trillion yuan in 2008, which amounted to 47.0% of base money. At the beginning, CBB was mostly short-term bills. The average term was about 6 months in 2002. The short-term bills were soon found to be inadequate to "lock in" liquidity brought by the increases in PFP. In 2005, the average term was about 11 months, and it increased further to about 17 months in 2007. It was not uncommon in 2007 that PBC issued 3-year bills.

For reasons that we will analyze later in this paper, PBC curtailed the issuance of CBB in 2011. The total amount of CBB issuances amounted only 6.3% of base money in 2011. In 2012, the issuance of CBB was stopped all together. Within less than a decade, CBB rose to dominance and fell back to negligibility.

[Table we here]

Deposit Reserve (DR)

PBC introduced required deposit reserve (DR) in 1984, in an attempt to strengthen the control of bank loans. For the purpose, the minimum deposit reserve ratio was 40% for urban household deposits, 25% for rural household deposits, and 20% for enterprise deposits. Furthermore, since the deposit reserve could not be used in transactions and settlements at the time, banks were required to put additional settlement reserves (5%-7%) in PBC. In 1985, PBC lowered DR ratio to 10% for all deposits. But the settlement reserve requirement remained until 1998.

The DR ratio was employed as a monetary policy instrument soon after it was introduced. The DR ratio was increased to 12% in 1987 and to 13% in 1988 to combat inflation. The move proved to be useful, thanks to the fact that money supply at the time was almost solely determined by bank loans.

In 1998, a major reform was introduced to DR policy. The DR account and the settlement reserve account merged into one. The required DR ratio was lowered to 8%, in an attempt to stimulate weak demand following the Asian financial crisis. But banks were allowed to deposit more in the new DR account ("Excess DR"), which is interest-bearing.

Since 2003, to sterilize the increase in PFP, PBC began to raise the required DR ratio, gradually at first, and aggressively from 2006 (Fig. 6). The DR ratio was raised to 17.5% in mid-2008 from 8% in mid-2006, after 18 raises in about two years. The DR ratio was lowered to 15.5% at the end of 2008 when the whole world was deep in financial crisis. From 2010, when inflation pressure came back, thanks to the massive stimulus package enacted in 2008, PBC began yet another round of aggressive raises of DR ratio, from 15.5% in early 2010 to

21.5% in mid-2011 for big banks[8]. The ratio of deposit reserve to total liabilities increased slightly from 36.7% in 2003 to 37.5% in 2006, but increased dramatically since 2006 to 65.1% in 2012. There was little doubt that DR requirement had become the major monetary policy instrument in the past six years.

[Figure 6 here]

4. The Great Accommodation

In 1998, PBC stopped setting credit ceilings for the big state banks. Those for smaller banks were scrapped years earlier. This marked the PBC's transition from command-based to market-based central banking. In this new model of central banking, PBC manipulates its own balance sheet, instead of those of commercial banks, to indirectly influence the latter's operations. In this section we examine PBC's balance sheet and study how PBC accommodated the surge in foreign exchange purchase without causing severe inflation.

4.1 Balance Sheet of PBC

Like commercial banks, a generic central bank's balance sheet is composed of liabilities and capital on the one hand and assets on the other. Table II gives a detailed description of the items in PBC's balance sheet, and Table III lists data for each item from 1999 to 2012.

[Table II here]
[Table III here]

The assets of PBC include foreign assets (FA), claims on government (CG), claims on private sector, and "other assets" (OA) that are largely out of sight of the public. Foreign assets include gold reserve and, importantly, foreign exchange (forex) reserve. Claims on private sector include those on other depository corporations (CODC), those on other financial corporations (COFC), and those on nonfinancial corporations (CNFC). The assets of PBC were once dominated by CODC, which documented PBC's CBL operations. In 1999, CODC still accounted for 43.5% of all assets, while forex reserve accounted for 40.9%. In 2012, however, CODC's share dropped to 5.7% of total assets, while forex reserve rose to 82.0%. As discussed previously, the dramatic increase in the share of forex reserve was driven by the persistent "twin surpluses". As the "twin surpluses" were caused by industrial and trade policies that are largely outside PBC's domain, we may treat the change in the asset sheet of PBC as exogenous.

The liabilities of PBC include reserve money (RM, or base money), deposits of financial corporations excluded from reserve (DFIXR), bond issue (BI), foreign liabilities (FL), deposits of government (DG), own capital (OC), and "other liabilities" (OL) that are as opaque as OA. Unlike commercial banks, the central bank's liabilities are mainly in the form of base money and its own capital is often negligible. Typically, the dominant share of total

[8] PBC began to set different deposit reserve ratio for smaller banks in Sep 25, 2008.

liability is base money, of which the largest share is currency in circulation. In a normal year of 2006, for example, the share of currency in circulation in total liability was 88.4% for US Federal Reserve, 54.6% for European Central Bank, and 69.1% for Bank of Japan. For PBC, this share was 22.7% in 2006. For a more detailed cross-country study of central bank's balance sheet structure, see Wang (2010).

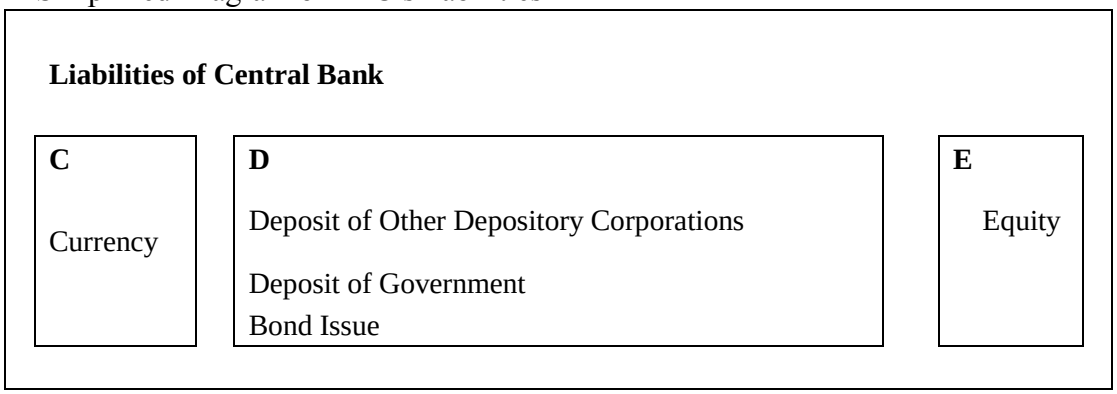
4.2 Debt Financing Replaces Currency Issuance

We may think of the liabilities of PBC, much like a commercial bank, as means of financing for asset acquisition. PBC's challenge was to manipulate its liability structure to achieve domestic price stability, at the same time finance the ballooning foreign asset acquisition, which was largely exogenous. The total liability or to borrow a term from corporate finance, total value of PBC, can be expressed as follows,

$$V = C + D + E \quad (1)$$

where C is currency in circulation, D is value of debt which includes CBB and deposits of government (DG) and financial corporations (DODC), and E is own capital (OC). Here we omit other items in the liability sheet such as DFIXR, which is negligible, and OL, which is opaque to the public.

A Simplified Diagram of PBC's liabilities



C is a zero-cost financing only available to a central bank. The monopoly use of C indeed defines a central bank. D is more expensive. The deposits of other depository corporations (DODC) bear interest, albeit low. Currently, the interest rate on required deposit reserve is 1.62% and that on excess reserve is 0.72%. Bond issue is even more expensive. Before each issuance of central bank bills (CBB), PBC would consult participants in the inter-bank market on the interest rate they would accept. A market-based interest rate is thus formed. We can see in Fig. 7 that the interest rates on CBB and government bonds (1-year term) roughly move in tandem. Like many other central banks, E is small and exhibits little variation over time. Indeed, PBC's own capital has not changed from 2003 to 2012, while V almost quintupled during this period.

[Figure 7 here]

To characterize the dynamics of debt financing replacing currency issuance, we first define equilibrium for currency issuance.

Definition: *An Equilibrium for currency issuance occurs when real demand for currency equals real balance of currency, that is* C/P.

Proposition 1: *Assume* E *is fixed and real demand for currency grows at rate* c_t. *If the total value of a monetary authority grows exogenously at a rate* v_t, *then the monetary authority achieves inflation* π_t *in the equilibrium of currency issuance if* D *expands at rate*

$$d_t = \frac{C_t}{D_t}\left(\frac{v_t}{C_t/V_t} - \pi_t - c_t\right).$$

The proof of the proposition is in the Appendix. If we assume that real demand for currency is proportional to real GDP, then $c = g$, real GDP growth. Fig. 8 illustrates the empirical validity of the proposition by charting the implied growth in D with data. Since $\frac{\partial d_t}{\partial v_t} = \frac{V_t}{D_t} > 1$, for each unit increase in v_t, d_t must increase more, given an inflation target and real GDP growth. In other words, PBC has to accommodate a quicker growth in total asset by an ever quicker growth in debt financing, either through raising required reserve ratio or issuing more central bank bills.

[Figure 8 here]

From Proposition 1 we may deduce:

Corollary 1: *The share of* D *in* V *expands if and only if*

$$v_t > \frac{C_t}{C_t + E_t}(\pi_t + c_t).$$

Since E is negligible relative to C, under the additional assumption $c = g$, it does not lose much accuracy to claim that the share of D expands if V expands faster than nominal GDP.

For PBC from 2001 to 2012, PBC's total value V expanded at an average compound rate of 17.6%, while average inflation was 2.5% and real GDP growth was 10.2%. Looking more closely, we find in Fig. 9 that the growth rate of V were consistently higher than nominal GDP growth rate from 2002 to 2008. This occurred again in 2010.

[Figure 9 here]

Indeed, as shown in Fig. 10, the share of D increased dramatically since 2003, when PBC formally began to issue central bank bills (CBB). In 2010, the share of D reached an all-time-high of 77.6%. Correspondingly, the share of C declined from 42.6% in 1999 to a historic low of 17.9% in 2008, and rebounded only slightly to 20.6% in 2012.

[Figure 10 here]

4.3 The Rise and Fall of Central Bank Bills

The issuance of central bank bills (CBB) was a major policy innovation during the great accommodation. Because of the limited supply of government bonds, the usual open market operation with government bonds was unable to drain the seemingly unlimited liquidity generated from forex reserve purchase. In September 2002, PBC converted its repo position into CBB, and, from April 2003, PBC began to issue CBB on a continual basis in the inter-bank market, with terms of 3-month, 6-month, 1-year, and 3-year.

As described in previous section, CBB issuance increased dramatically in the following several years, playing an increasingly important role in debt financing (D) of PBC from 2003 to 2006. Fig. 11 shows that the share of CBB position in D increased from 9.9% in 2003 to 33.7% in 2006. From 2006 to 2012, however, the share of CBB declined all the way to 6.1%. In fact, PBC has stopped issue new CBB since 2012. The inverted U-shape of CBB's share in D documented the rise and fall of CBB in the great accommodation.

[Figure 11 here]

The advantages of CBB over usual OMO with government bonds are obvious. With CBB, PBC's ability of draining liquidity is no longer bounded by the supply of operatable assets such as government bonds. However, PBC incurs a higher cost in issuing CBB, which bears a market interest rate, than, say, requiring deposit reserve (DR). The cost difference between CBB and DR, indeed, may partly explain the fall of CBB.

From 2003 to 2011, the average interest rate on CBB was generally higher than the interest rate paid on required DR, which was a constant 1.89%. The only exception occurred in 2009, when demand for safe assets was unusually high after the financial crisis. In some years, interest rate on CBB was much higher than that on DR. In 2008, for example, the average interest rate on CBB was 3.78%, double of that on DR.

Unlike government bonds, the interest burden of CBB is not on the fiscal authority but on the PBC, and the interest payment is backed not by taxation but money creation. As PBC pays interest, the payment automatically adds to base money. From a long-term perspective, thus, there is little sterilization in the issuance of CBB. CBBs are similar to government bonds in that CBBs only transfer, but not lower, some of the current inflationary pressure to the future, just like government bonds only transfer, but not lower, current tax burden to the future. In the case of CBB, the delay of inflationary pressure was at most three years, a not-too-distant future indeed.

In contrast, the required DR bears a much lower interest rate, and equally important, the required DR may delay the current inflationary pressure to an indefinite distant future. As a result, there is *real* sterilization in raising required DR from a long-term perspective. It was thus natural for PBC to rediscover the merit of DR in 2006, when "twin surpluses" was in full

swing. From 2006 to 2012, as shown in Fig. 11, DR share of debt financing (D) reclaimed the lost ground to CBB.

4.4 An Assessment

The surge in forex reserve purchase was a consequence of China's industrial and trade policies, which were largely outside PBC's control. PBC accommodated the great expansion of balance sheet via a structural twist to its liabilities such that growth in currency issuance was reined in and large pool of liquidity was locked in PBC's vault. From 2001 to 2012, China's inflation averaged 2.5% against the backdrop of an average 17.6% growth in PBC's total liability. The highest monthly inflation rate was 8.7% occurred in Feb 2008, which was driven by food price. This was a notable achievement of central banking in a tough place and tough era.

The great accommodation was not without cost. The frequent use of reserve requirement ratio as a monetary policy instrument meant reduced flexibility and profitability of commercial banks. Indeed, Abiad et al. (2008) classify a require deposit reserve ratio of equal or greater than 20% as "restrictive", a line China crossed in 2011. There were two kinds of developments in response to the rising reserve requirement ratio.

First, in a process called "financial dis-intermediation", many borrowers turned to other types of financing. In 2002, the share of bank loans in aggregate financing of the economy was 95.5%. The share dropped to 52% in 2012. In contrast, the share of corporate bonds increased from 1.8% in 2002 to 14.3% in 2012, and the share of trust loans increased from almost zero in 2002 to 8.15% in 2012. In recent years, indeed, trust became a significant player in financing and at the same time, an important destination for household savings[9].

Second, banks moved more and more lending "off balance sheet". The usual instruments include entrusted loans, undiscounted banker's acceptance, and trust loans in cooperation with trusts. Financial innovation abounded, taking advantages of loopholes in regulations. For example, entrusted loans were originally one-to-one, meaning that one agent lends directly to another through a bank, which collected a processing fee without assuming any risk. In recent years, however, there appeared one-to-many, many-to-one, and even many-to-many entrusted loans. In these creative forms, banks could not escape responsibilities if loans became bad. These creative entrusted loans, indeed, had every characteristic of normal bank loans, except, they are "off balance sheet".

Some of these developments are favorable, such as the expanding role of corporate bonds. Indeed, there is still large room for the development of direct financing, either in the form of equity or bond. But some other developments are not so favorable. Many so-called financial innovations transform regulated activities into those under no or less regulation. In this

[9] Trust loan is a form of direct financing from trust investors to debtors. A trust company is, in legal terms, not responsible for bad loans. In practice, however, trusts guarantee payment of the principal at least, for fear of losing market or more seriously, losing their license. This implicit guarantee makes a trust a bank-like entity. It is not unreasonable that some characterize trust loans as shadow banking business.

process, traditional financial institutions such as banks, brokers, and trusts become part of the fast expanding shadow banking system. Without proper regulation and surveillance, the shadow banking system will make the entire financial system more vulnerable to internal and external shocks.

The above developments could make PBC less powerful in influencing monetary and liquidity conditions of the Chinese economy. The reserve requirement ratio is a quantitative instrument only effective in the control of bank loans. As the role of bank loans becomes even smaller in the economy, reserve requirement would become less powerful in influencing aggregate financing of the economy.

5 Chinese Central Banking in the Future

The future of Chinese central banking will partly depend on the future of its asset sheet, which largely depends on China's trade and industrial policies. Therefore, part of the policy recommendations that we outline as follows will be outside PBC's usual domain. It is indeed not possible to reform Chinese central banking by reforming PBC's practices alone.

5.1. Balance of Payments

Policy makers should give higher priority to the external balance of payments (BoP) position. BoP equilibrium is listed as the No. 4 objective of monetary policy, but it was essentially ignored during the great accommodation. There are different interpretations of the meaning of the BoP equilibrium. One particularly strict definition of BoP equilibrium would require both current and capital accounts to be balanced individually.[10] A less strict definition of BoP equilibrium would require the sum of current and capital surpluses to be zero, which would amount to zero growth in forex reserve, an outcome that is consistent, one, with a current account surplus and capital account deficit, and, two, with a current account deficit and capital account surplus. Zero growth in forex reserve would, of course, always be guaranteed when PBC stops its intervention in the forex market, i.e. when the RMB floats freely against the other currencies.

While there is a growing consensus about the importance of BoP equilibrium, the issue of how much the exchange rate should be allowed to fluctuate remains contentious. There is a school of commentators who emphasize the role of "structural reasons" for the BOP imbalance. They would argue that the imbalance of trade is caused by the gap between saving and investment. Specifically, China saves too much over investment, e.g. Bernanke (2005). In the view of the structuralists, the value of the exchange rate is not important for the imbalance of trade, finding support from the fact that Chinese net export to the US kept expanding even after yuan began to appreciate since 2005.

[10] PBC's recent communications with the press seem to imply that PBC wishes to achieve this strict sense of BoP equilibrium. Vice Governor Yi Gang summarized PBC's recent policy directions as "expand internal demand, adjust structure, decrease surpluses, and achieve balances."

The structuralists also see China's capital account surplus as the result of weakness in the Chinese financial sector. As the underdeveloped financial industry could not convert Chinese savings into domestic investment, the job has then been outsourced to the Wall Street. The Wall Street converts the cheap funding from PBC's forex reserve purchase into high-return FDI into China.

We are skeptical of the structuralist explanation that sees the amount of savings and investment as exogenous variables. We see the gap between saving and investment, and the amount of FDI into China as endogenous outcomes from two sets of distortionary state economic policies. In the first set of distortionary policies, the variables that should be considered exogenous are the value of the exchange rate; China's trade policy regime of export-promotion and import-substitution[11]; preferential policies toward FDI; and various subsidies to manufacturing sector in general (cheap energy, loose environmental protection, etc.). These policies start the chain reactions that finally lead to the persistent "twin surpluses". As in Yu (2010), we would argue that *China should adopt a more flexible exchange rate, give equal treatment to all producers (exporters or not), give equal treatment to all industrial investors (foreign or domestic), and usher in reforms that promote market-based factor pricing with environmental considerations.*

In the second set of distortionary policies, the primary policy variable that has raised savings to be above, and lower investments to be below, the free market level is the over-regulation of China's financial markets and the discrimination against the domestic private sector which together keep the financial markets underdeveloped as characterised by the limited terms of variety of financial products offered to the public, the disproportionately large amount of total credit allocated to state-controlled production units, and the near-total dominance in every type of legal financial activities by state-controlled financial institutions. Woo (2008) has argued that China's current account surplus exists because its dysfunctional financial system cannot intermediate the private savings into desired private investments. The private savings rate is high because China does not have the variety of financial institutions that would, one, reduce risks by pooling them and providing medical insurance, pension insurance, and unemployment insurance; and, two, transform savings into education loans, housing loans, and other types of investment loans that would enable the private investor to reap the high returns from China's fast-growing economy. The backward financial system in China has increased precaution-motivated savings and investment-motivated savings thereby raising the private savings rate in China 7.0 to 12.2 percentage points higher than in the U.S.[12]

5.2. Opening of Capital Account and Diversification of Forex Reserve

China's forex reserve is much larger than needed for transactions and settlement in international trade and finance. It is also much larger than needed for "self-insurance" purposes. As the forex reserve is mostly in the form of long-term US treasury bills, it

[11] For example, tax rebates and preferential credit line for exporters.

[12] Woo's (2008) estimates are based on the empirical work of Liu and Woo (1994) who added a "financial sophistication variable" into the standard Modigliani-style private savings equation.

generally receives low interest, a return much lower than FDI in China, which is partly financed by Chinese saving. The over-accumulation of forex reserve thus leads to welfare loss for the Chinese public.

To reduce official holding of forex reserve and diversify the investment of forex reserve, we may rely on one simple reform: the opening of the capital account, especially outward security investments. In recent years, there have been some limited trials in opening security investment to private investors. For example, domestic financial institutions may apply for QDII (Qualified Domestic Institutional Investor), which allows qualified institutions to invest in equities and bonds abroad[13]. These trials can be enlarged gradually. In the end, everyone including retail investors should be allowed to invest abroad. Since the newly rich in China have strong incentives to diversify their assets internationally, the effects of opening capital account can be immediate and significant. First, the official holding of foreign currency will be transferred to private hands. Second, as the risk appetite of private investors naturally differs from that of the government, Chinese assets in the abroad will be diversified accordingly. Both developments would point to more efficient use of forex reserve.

5.3. Moving from Quantity-Based to Price-Based Central Banking

PBC should now move from quantity-based central banking to price-based central banking. The quantity-based central banking targets money supply, while price-based central banking targets market interest rate. Central banks in developed countries usually rely on price-based instruments such as US federal fund rate and ECB's refinance rate. In the case of US, the Fed announces a given federal fund rate which is subsequently backed by open market operations. In the case of euro area, ECB sets the refinance rate which subsequently becomes the benchmark rate for market participants. A central bank can directly and precisely control only the money base, a narrow form of money. However, the wider form of money is largely endogenous, and the supply of broad money is determined by market participants. The price-based instruments are favorable to modern central banking since they directly alter costs and incentives of market participants.

For PBC, it may not be a matter of choosing which is more favorable. The current trend may force PBC to move to price-based central banking. First, measurement of money and liquidity will become an issue as Chinese economy and financial market become more complex, making robust quantity-targeting difficult, if not impossible. Second, the most important policy instrument of PBC is now DR ratio, a quantitative tool most effective at controlling bank loans, but the role of bank loans is fast declining. Direct financing in the forms of equities and bonds will take more important share in aggregate social financing. And perhaps more importantly, shadow banking system is fast expanding, mainly driven by restrictions put on banks by PBC and other regulatory entities. The highly adaptable shadow banking system makes it impossible for PBC to target any quantitative measure by quantity restrictions on financial institutions. The quantity restrictions only drive more activities into

[13] Similarly, there is QFII (Qualified Foreign Institutional Investor).

shadow. Eventually, PBC has to target some interest rate.

PBC, indeed, has taken gradual steps to prepare for the new model of price-based central banking. First, interest rate adjustments have been used along with quantity-based measures in the past policy maneuvers. Market participants have learned to form expectations of movements in interest rates. Second, there has been important progress in the introduction of market interest rates. Interest rates in money and bond markets are already market-based. The same is true for interest rates on wealth-management-products (WMP), loans and deposits in foreign currency. Interest rate upper bound on bank deposit and lower bound on loans still remain, but the bounds have been relaxed recently[14], giving commercial banks more freedom in setting interest rates. To introduce a market-based benchmark interest rate, PBC established SHIBOR (ShangHai Interbank Offer Rate) in early 2007. SHIBOR has already become an important benchmark rate for transactions in money and bond markets. Third, financial markets are now more developed. As an important development, PBC established the interbank funding market and the interbank bond market in as early as 1997. Over the subsequent years, these two markets grew rapidly. Trading volumes in the interbank funding market and the interbank bond market reached 33.4 trillion and 163.1 trillion yuan in 2011, respectively.

These are far from enough, however. To make the new model of price-based central banking work, PBC will need more developed financial infrastructure. First, PBC is in need of a target short rate. SHIBOR, as a rate formed in the interbank funding market, is not suitable for this role. Firstly, SHIBOR is not a risk-free rate per se. Secondly, the interbank funding market is a small one compared to the bond market, whether measured in trading volumes or number and type of participants. It is thus doubtable that PBC's policy can be effectively transmitted to the financial market through the funding market. *A natural candidate for the target short rate would be repo rate on treasury bonds, which is generally regarded as risk-free.* However, the bond markets are rather fragmented. There are three bond markets in China: interbank market, security exchange market, and over-the-counter market. Repo rates on a same asset can be very different in different markets. *Institutional reforms should be introduced to allow arbitrage across different markets. In this way, we may achieve a unified bond market with diversified investors.*

Second, treasury bond issuance needs to expand,[15] not only in quantity and frequency, but also in more continuous term structure. For the sake of tradability, book-entry treasury bonds should dominate bond issuance.[16] At the same time, the Ministry of Finance should make bond issuance more regular and predictable, conditional on the fiscal conditions of the central government, so that the market may form better expectations.

[14] From June 2012, the interest rate upper bound on deposits is 10% higher than benchmark rate, which is still set by PBC, and the lower bound on loans is 30% lower than benchmark rate.

[15] This depends, of course, on whether there is need for deficit financing or not. The increase in treasure bond issuance may be accompanied by a tax cut.

[16] There are three types of treasury bonds in China: certified bond, book-entry bond, and bearer bond. Purchase of certified bond is equivalent to saving. Book-entry bond is most suitable for trading in modern exchanges.

Finally, the futures exchange market for treasury bonds should be restored. The futures market of treasury bonds is essential for hedging interest rate risk. China experimented with treasure bonds futures in early 1990s, but the experiment was unfortunately stopped following the notorious "327 treasure bond incident" in 1995. It is arguable that the failed experiment was indeed too early. But almost twenty years later, as interest rates become more volatile as liberalization forges ahead, the futures market for treasury bonds has become a necessity, for financial and nonfinancial institutions alike. The futures exchange for treasury bonds is also important for price (interest rate) finding. Indeed, for PBC, a well-functioning futures market for treasury bonds can be a powerful link in the transmission of interest rate policies to the entire financial system.

6. Conclusions

In this paper we document PBC's accommodation of foreign exchange reserve accumulation with an unconventional liability expansion, which avoided rapid expansion in base money and severe inflation. The unconventional expansion of liability was a process in which currency issuance was replaced by debt financing, which mainly includes issuance of central bank bills and frequent changes in the required deposits of commercial banks. These steps have been effective in the fight against inflation.

However, the use of these instruments has sowed the seeds for undermining their effectiveness. PBC's reliance on deposit reserve ratio, coupled with other regulations on banks, already set forth: (a) a dis-intermediation process, in which direct finance replaces bank loans; and (b) the expansion of shadow banking. In the end, PBC may end up in a position where its control of bank loans is no longer effective in controlling the macro economy. For viable and better central banking in the future, policy makers should relax constraints on PBC by adopting a more flexible exchange rate, abandonment of export-promotion policies and preferential policies toward FDI, and the opening of the capital account. Opening the capital account, in particular, achieves reduction in, and diversification of the official foreign exchange reserve at the same time.

It should be stressed that besides the pricing reform of using a more market-determined exchange rate to restore independence to monetary policy and to reduce the trade imbalance, there should also be institutional reform that allows the private sector a greater presence in the different financial markets in order to improve financial intermediation that will translate more of the domestic savings into domestic investments and hence reduce the trade imbalance and the creation of liquidity. Equally important is that the strong growth of private Chinese financial firms will produce a more competitive and dynamic financial sector and a more efficient growth pattern for China.

Appendix

Proof of Proposition 1: Let R be real demand for currency and P be price level. Apply the

equilibrium condition $R = C/P$, we write

$$D_t = V_t - R_t P_t - E_t.$$

Differentiate both sides of the equation with respect to t, we have

$$d_t = \frac{dD_t}{D_t}$$

$$= \frac{dV_t}{V_t}\frac{V_t}{D_t} - \frac{dR_t}{R_t}\frac{P_t R_t}{D_t} - \frac{dP_t}{P_t}\frac{P_t R_t}{D_t} - \frac{dE_t}{E_t}\frac{E_t}{D_t}$$

$$= v_t \frac{V_t}{D_t} - c_t \frac{C_t}{D_t} - \pi_t \frac{C_t}{D_t}.$$

Note that $c_t = \frac{dR_t}{R_t}$ is growth in real demand for currency, $\pi_t = \frac{dP_t}{P_t}$ is inflation rate, and that $\frac{dE_t}{E_t} = 0$ by assumption. Collecting terms yields the desired result. **Q.E.D.**

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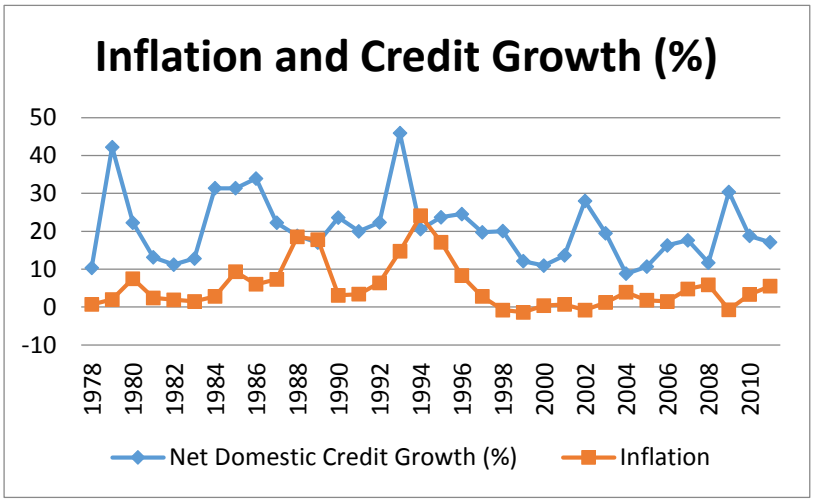

Figure 1: Inflation and Credit Growth, 1978-2011.

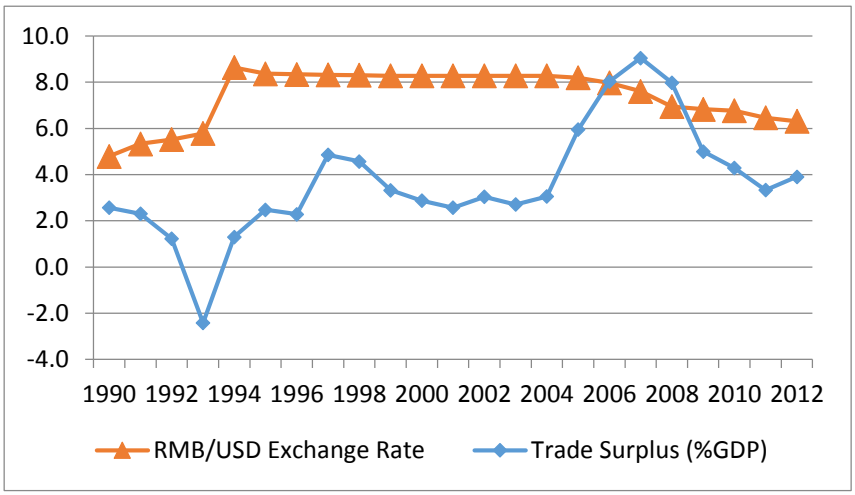

Figure 2: RMB/USD Exchange Rate and Trade Surplus of China (Percentage of GDP), 1990-2012.

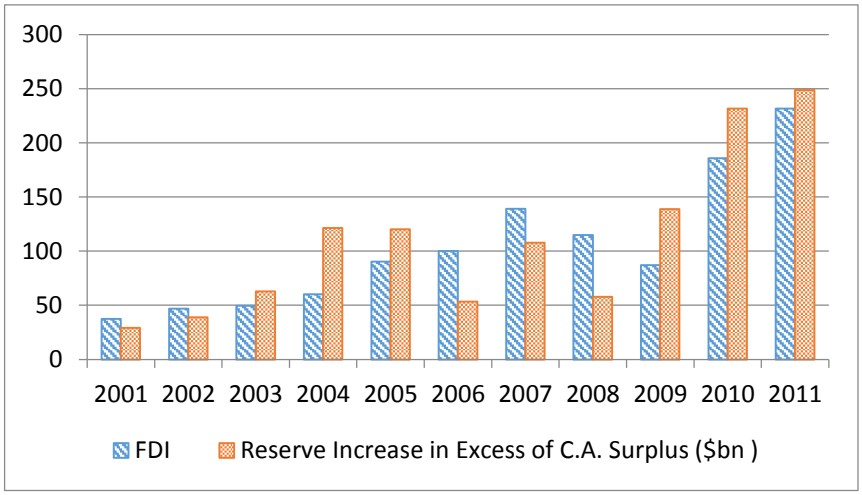

Figure 3: FDI and Forex Reserve Increase in Excess of Current Account Surplus (in billion dollars).

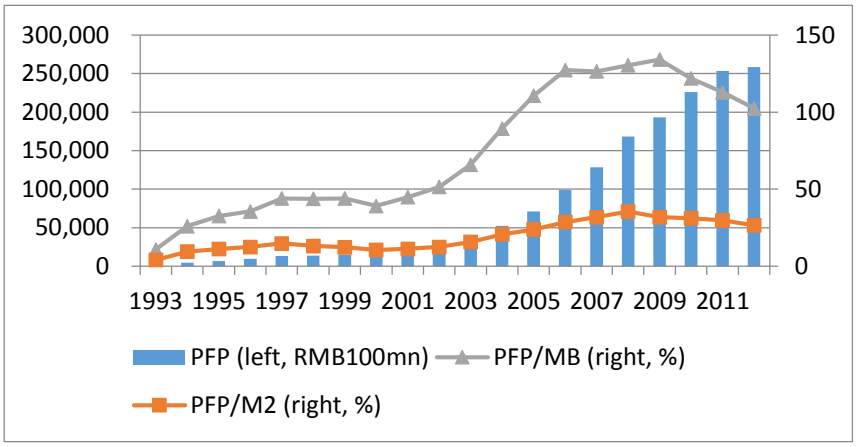

Figure 4: Position for Forex Purchase (PFP) and Its Share in Money Base (MB) and M2.

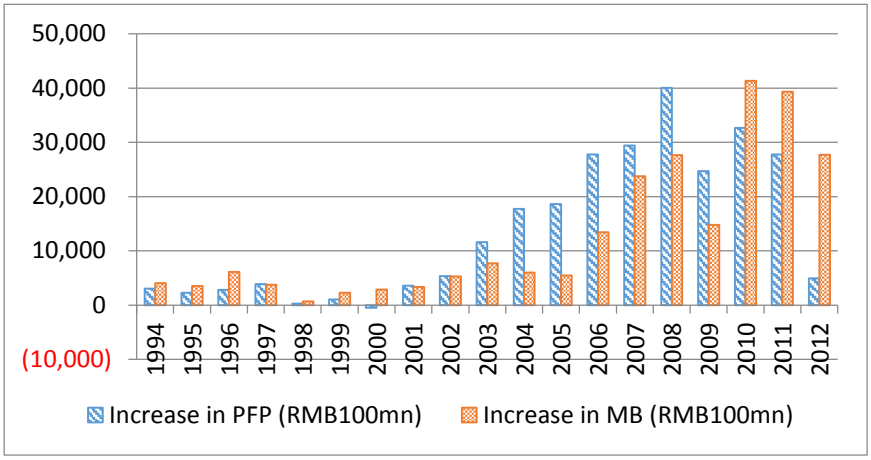

Figure 5: Increases in PFP and Money Base.

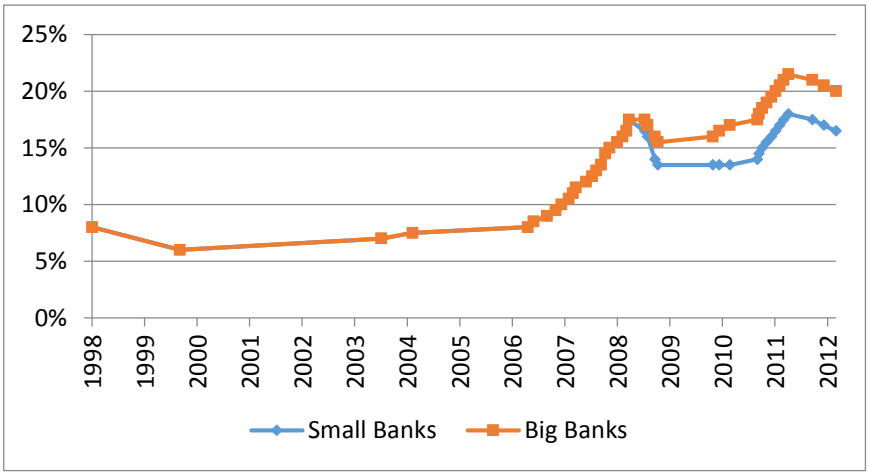

Figure 6: Minimum Deposit Reserve Ratio (%)

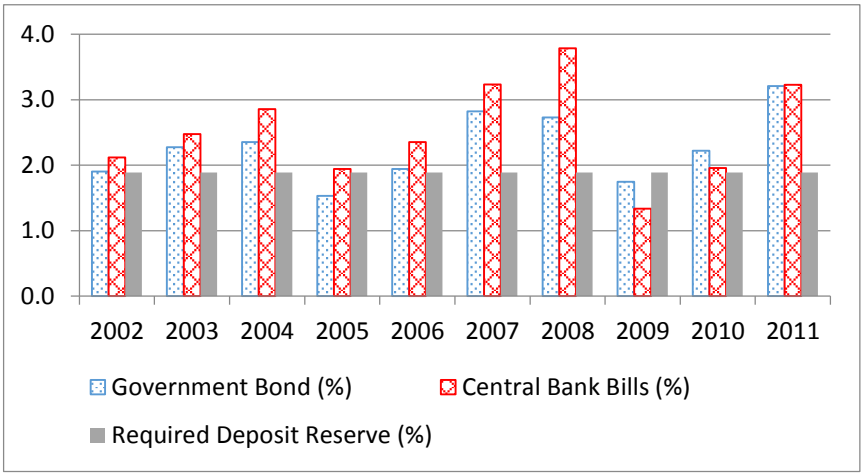

Figure 7: Average interest rate on government bonds (one-year term) and central bank bills.

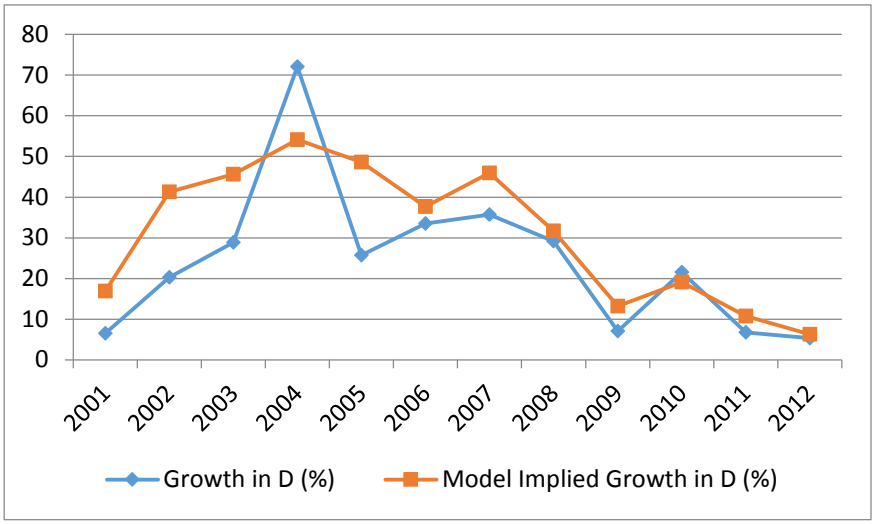

Figure 8: Growth in D financing and that implied in Proposition 1.

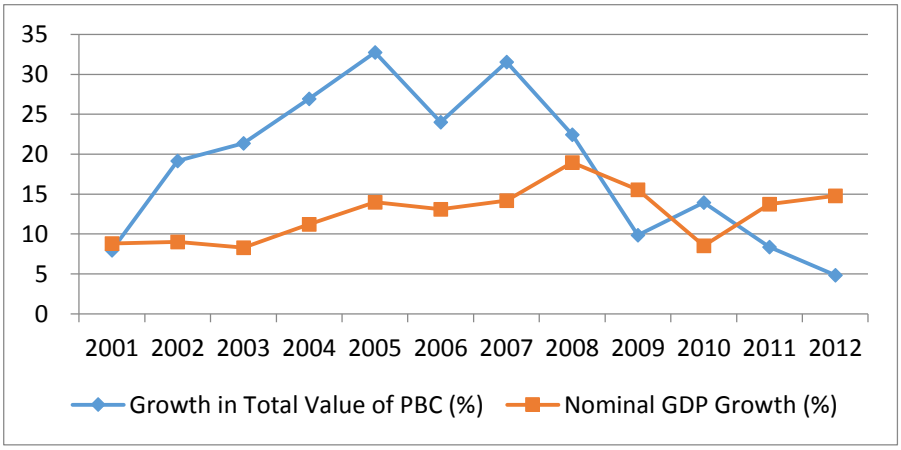

Figure 9: Growth in total value of PBC (*V*) compared with nominal GDP growth.

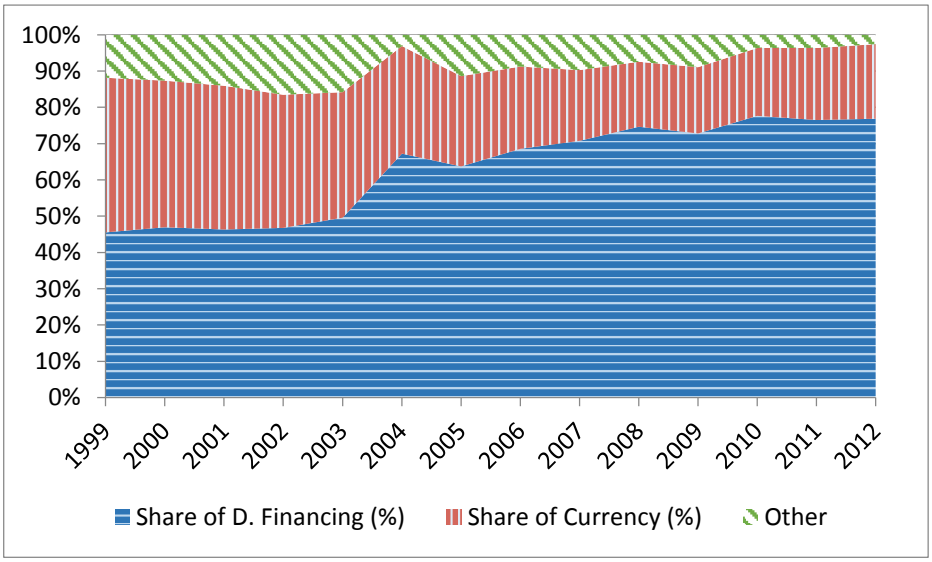

Figure 10: Liability Structure of PBC (1999-2012)

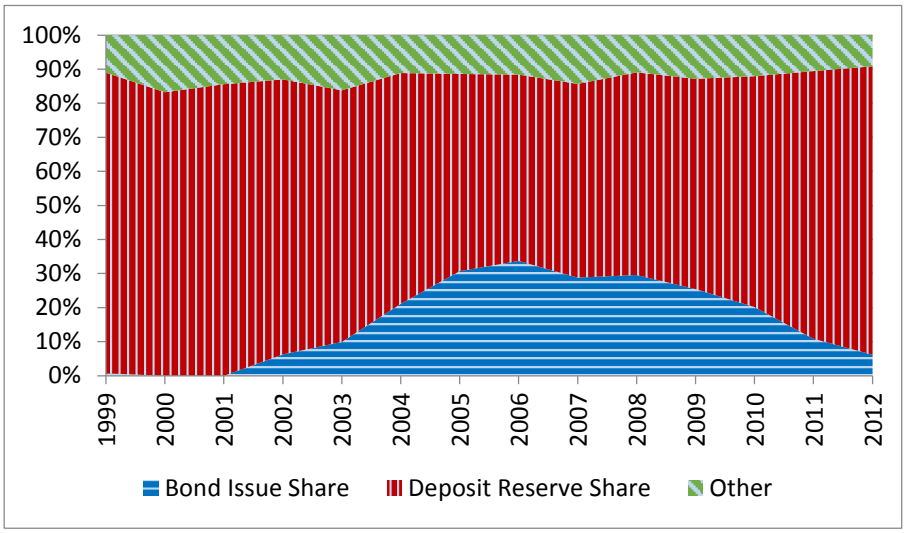

Figure 11: The Rise and Fall of Bond Issue.

Table I: Summary of Central Bank Bill Issuances (2002-2011)

	Issuances	Total Amount (RMB100mn)	Average Term (Year)	Average Annual Rate (%)
2002	19	1938	0.58	2.12
2003	63	7638	0.42	2.48
2004	105	15161	0.68	2.86
2005	124	27462	0.94	1.94
2006	97	36523	0.66	2.35
2007	141	40571	1.40	3.23
2008	122	42960	1.09	3.78
2009	71	38240	0.50	1.34
2010	114	42350	0.99	1.96
2011	100	14140	0.79	3.23

Data source: Tonghuashun.

Table II: Balance Sheet of PBC: Items of Assets and Liabilities

Assets	Liabilities
	Reserve Money (RM, "Base Money")
Foreign Assets (FA)	Currency Issue (CI)
Foreign Exchange (Forex)	Deposits of Other Depository Corporations
Monetary Gold (Gold)	(DODC)
Other Foreign Assets (OFA)	Deposits of financial corporations excluded from
	Reserve Money (DFCXR)
Claims on Government (CG)	Deposits of Government (DG)
Claims on Private Sector	Bond Issue (BI)
Claims on Other Depository Corporations (CODC)	Foreign Liabilities (FL)
Claims on Other Financial Corporations (COFC)	Other Liabilities (OL)
Claims on Non-financial Sector (CNFS)	
Other Assets (OA)	Own Capital (OC)

Table III: Balance Sheet of PBC (1999-2012)

	TA	FA	Forex	Gold	OFA	CG	CODC	COFC	CNFC	OA
1999	3535.0	1445.9	1406.1	1.2	38.5	158.3	1537.4	383.3	10.2	#N/A
2000	3939.5	1518.9	1481.5	1.2	36.2	158.3	1351.9	860.0	11.0	#N/A
2001	4254.1	1935.1	1885.0	25.6	24.5	282.1	1131.2	854.7	19.6	#N/A
2002	5068.5	2282.0	2210.7	33.7	37.5	286.4	1228.8	724.0	20.7	526.6
2003	6152.2	3065.9	2984.2	33.7	96.3	290.1	1198.3	725.6	20.6	851.6
2004	7809.3	4639.8	4594.0	33.7	68.3	297.0	1042.4	886.5	13.6	930.0
2005	10367.6	6333.9	6214.0	33.7	86.2	289.2	816.8	1775.1	6.7	1146.0
2006	12857.5	8577.3	8436.1	33.7	107.5	285.6	651.7	2195.0	6.6	1141.3
2007	16914.0	12482.5	11516.9	33.7	931.9	1631.8	786.3	1297.2	6.4	709.8
2008	20709.6	16254.4	14962.4	33.7	1258.2	1619.6	843.3	1185.3	4.4	802.7
2009	22753.0	18533.3	17515.5	67.0	950.9	1566.2	716.2	1153.0	4.4	779.9
2010	25927.5	21542.0	20676.7	67.0	798.3	1542.1	948.6	1132.6	2.5	759.8
2011	28097.8	23789.8	23238.9	67.0	483.9	1540.0	1024.8	1064.4	2.5	676.3
2012	29453.7	24141.7	23667.0	67.0	407.7	1531.4	1670.1	1003.9	2.5	1104.2

	RM	CI	DODC	DFCXR	BI	FL	DG	OC	OL
1999	3362.0	1507.0	1420.1	#N/A	11.9	#N/A	178.6	36.7	#N/A
2000	3649.1	1593.8	1539.2	#N/A	0.0	#N/A	310.0	35.7	#N/A
2001	3985.2	1686.9	1685.3	#N/A	0.0	#N/A	285.1	35.5	#N/A
2002	4513.8	1858.9	1913.3	#N/A	148.8	#N/A	308.5	22.0	75.4
2003	5284.1	2124.0	2255.5	#N/A	303.2	#N/A	495.5	22.0	95.7
2004	5885.6	2310.4	3563.3	#N/A	1107.9	#N/A	583.2	22.0	210.6
2005	6434.3	2585.4	3822.5	#N/A	2029.6	64.2	752.7	22.0	1064.8
2006	7775.8	2913.9	4822.4	#N/A	2974.1	92.6	1021.1	22.0	972.0
2007	10154.5	3297.2	6809.5	#N/A	3446.9	94.7	1712.1	22.0	1483.7
2008	12922.2	3711.6	9189.5	59.1	4578.0	73.3	1696.4	22.0	1358.6
2009	14398.5	4155.6	10228.1	62.5	4206.4	76.2	2122.6	22.0	1864.9
2010	18531.1	4864.6	13648.1	65.7	4049.7	72.0	2427.7	22.0	759.2
2011	22464.2	5585.0	16879.2	90.8	2333.7	269.9	2273.4	22.0	643.8
2012	25234.5	6064.6	19169.9	134.9	1388.0	146.4	2075.3	22.0	452.6

TA: Total Assets, FA: Foreign Assets, Forex: Foreign Exchange, OFA: Other Foreign Assets, CG: Claims on Government, CODC: Claims on Other Depository Corporations, COFC: Claims on Other Financial Corporations, CNFC: Claims on Non-Financial Corporations, OA: Other Assets.

RM: Reserve Money, CI: Currency Issue, DODC: Deposits of Other Depository Corporations, DFCXRM: Deposits of Financial Corporations eXcluded from Reserve, BI: Bond Issue, FL: Foreign Liabilities, DG: Deposits of Government, OC: Own Capital, OL: Other Liabilities.