



# China Economic Issues

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## **China's Monetary Regime in dealing with large BoP surpluses: framework, effectiveness and costs**

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*Facing the large BoP surpluses in recent years, capital controls and reserve accumulation coupled with sterilisation and credit controls appear to be the main tools employed by the Mainland authorities to limit the impact on the domestic monetary condition, while sizeable currency appreciation could be another way of sharing the burden. We evaluate the effectiveness of the regime and individual tools in maintaining domestic monetary control, the associated costs for the central bank, commercial banks and the non-bank sector, as well as implications for China's long-term external payment position.*

*Our analysis suggests that restrictions on capital movements and sterilisation with quantity controls played a significant part in coping with BoP surpluses, while the effect of currency appreciation was more difficult to assess. In overall terms, this regime by and large succeeded in insulating domestic monetary conditions from rapid increases in foreign reserves, and there does not appear to be a sustainability issue with this regime.*

*Our estimates show falling, but positive net interest income for the PBoC from sterilisation operations, mainly reflecting low interest bearing bank reserves on the liability side of its balance-sheet. While being squeezed by the sharp hikes of required reserves, bank profits remained strong on credit expansion and widened lending spreads. The non-bank private sector suffered from financial distortions in the forms of low returns on bank deposits.*

*The large foreign reserves have provided useful protection against external shocks, and helped the economy weather well the current global financial crisis owing to its asset allocation oriented towards high-quality government debt. However, the mismatch of the external assets and liabilities in China's risk-return profiles implies low returns in the longer term. The predominant role of the official sector in channelling capital outflows is likely to face increasing challenges over time.*

Mainland China (henceforth China) has recorded large balance of payments (BoP) surpluses in recent years as a result of sizeable trade surpluses and substantial capital inflows. International experiences suggest that sustained BoP imbalances are often associated with difficulties to the economic management and risks to financial stability. The principal problems include disruptive effects on economic activity by real appreciation in the form of nominal appreciation and/or inflation, distortions and reduced efficiency of financial intermediation caused by policy responses in dealing with large inflows, and risks of a ‘sudden stop’ which can endanger economic and financial stability.<sup>1</sup>

To control the impact of the large BOP surpluses on the domestic monetary condition, capital controls and reserves accumulation accompanied by sterilisation and credit controls appear to be the main tools in China’s current monetary framework. In 2007 and early 2008, for instance, the interest rate policy was constrained by concerns over attracting further capital inflows. Under the circumstances, capital controls constituted the first line of defence to moderate capital inflows, while quantitative measures – sterilisation through open market operations and the reserve requirement to contain base money growth as well as credit quotas on bank lending – were employed to control monetary aggregates. In the meantime, the renminbi also appreciated significantly both against the US dollar and in effective terms, which could be one way of sharing the burden in dealing with BoP inflows.

There are many important questions to consider about this regime: how effective are the overall framework and individual tools in managing domestic monetary conditions? What are the costs of doing so, and how are the costs distributed across different sectors? Given the costs and distribution of the costs, how sustainable and desirable is this regime?

This paper attempts to address these questions. In terms of methodology, this paper is similar to Cappiello and Ferrucci (2008) in that it collects information from different sources and analytical points from different areas in order to examine different aspects of the regime. In the rest of the paper, Section 1 will discuss the role capital controls play in reducing BoP imbalance. Section 2 assesses the effectiveness of quantity control measures in offsetting the impact of foreign reserve accumulation on domestic monetary conditions. The costs of China’s monetary regime and their distribution across the central bank, commercial banks and the non-bank sector will be discussed in Section 3. Section 4 further assesses the regime’s implications on China’s external position. The part renminbi appreciation plays in dealing with capital inflows is considered in Section 5, and the final section explores the policy implications.

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<sup>1</sup> See for example Kaminsky, Reinhart and Vegh (2004), and Reinhart and Reinhart (2008) for useful summary discussions.

## **Section 1. Capital controls**

While capital account liberalisation is a long stated policy goal, China has taken a cautious and gradualist approach in the process. Restrictions on cross border flows vary according to their types as well as the financial and non-financial nature of an institution. In general, the capital control regime was more liberal for inflows than for outflows until more recently, and for financial institutions than for non-financial institutions (Table 1). Within capital inflows, inward FDI – perceived to be beneficial for facilitating technology transfer and enhancing productivity – has been allowed since the economic reforms launched at the end of late 1970s, and has been actively promoted through preferential tax treatments. Although outward FDI was opened soon after that of inward FDI, it was not active until the late 1990s. The opening to portfolio flows is much more limited, as they are widely seen to be one major culprit of financial crises. A key relaxation in recent years is the introduction of the Qualified Foreign Institutional Investors (QFII) and Qualified Domestic Institutional Investors (QDII) Schemes which enables two-way portfolio flows to some extent.

Table 1. Capital control in China<sup>a</sup>

		Inward flows		Outward flows	
		Locally by non-residents	Abroad by residents	Local emission or selling by non-residents	Purchase abroad by residents
<b>Foreign debt</b>	Bond, other debt securities	Limited (QFII on listed)	Restricted	Restricted for Renminbi-denominated	Limited (QDII)
	Credit operations <sup>b</sup>	Limited and Restricted for one-year or longer	-	-	Limited
<b>Portfolio investment</b>	Capital market securities	Limited (B share and QFII for A share)	Free	Limited for sale Restricted for issuance	Limited (QDII)
	Money market instrument	Limited (QFII on publicly issued)	Free	Prohibited	Limited (QDII)
	Collective investment securities	Limited (QFII on close-end & open-end)	Free	Prohibited	Limited (QDII)
	Derivatives and other instruments	Prohibited	Restricted	Prohibited	Restricted
<b>Foreign direct investment (FDI)</b>	Direct investment	Free for manufacturing Limited for financial	-	-	Limited
	Liquidation of direct investment	-	Limited (approval required)	Limited (approval required)	-
	Real estate transactions	Limited (for self-use)	-	Limited (authorisation for FX transactions)	Free

Notes:

a. Classification:

- Free: no particular prior approval or ex-post registration required
- Limited: allowed to authorised institutions or enterprises and/or subject to some limitations or requirements
- Restricted: requiring particular and/or strict procedures for examination and approval
- Prohibited: not allowed.

b. "Credit operations" include lending to residents from non-residents and lending by residents to non-residents.

Sources: IMF (2007) and authors' compilation.

Capital controls have also been implemented with varying degrees of rigour depending on economic situations – a ‘lean-against-the-wind’ approach in the regulatory regime (Ma and McCauley, 2007). There have been periods when controls on outflows were stepped up to resist depreciation pressures on the exchange rate, and periods for stringent controls on inflows to prevent rapid currency appreciation. With large capital inflows and upward pressure on the currency in recent years, the authorities have adopted some measures to encourage capital outflows, as well as intensified enforcement of controls on inflows. This section evaluates the effectiveness of the controls on capital flows by examining both price and flow indicators of financial markets.

#### Test of covered interest parity (CIP)

Among different ways of assessing the effectiveness of capital controls is to test for the CIP which states that under the assumption of an efficient market, for which free capital movement is an important condition, the forward premium/discount should equal the interest rate differential between domestic and foreign assets. In open and efficient markets, the CIP often holds up closely such that a foreign investor should be indifferent between placing money in foreign assets and earning the foreign interest, or converting the money into the local currency at the spot exchange rate. In contrast, if domestic financial markets are effectively separated from international markets, there is a wedge between the expected exchange rate changes and the interest differential between foreign and domestic assets, and thus arbitrage opportunities exist for making profits.

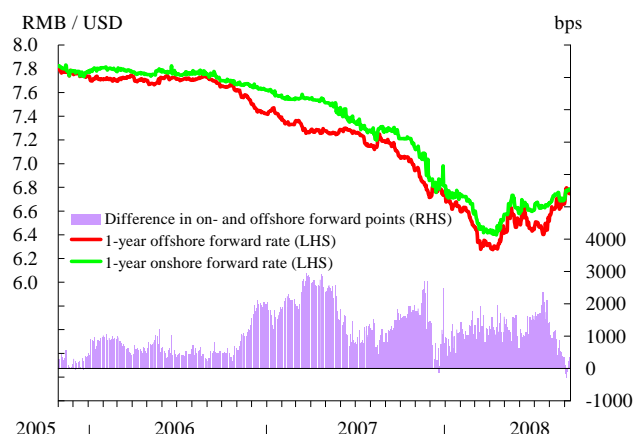
In undertaking the test, the CIP is estimated in the following form:

$$(1) \quad f_t - s_t = \alpha + \beta(i_t - i_t^*) + u_t,$$

where  $f_t$  and  $s_t$  are the logarithm of the forward and spot rates respectively measured in terms of units of the renminbi per US dollar. In testing the CIP, it should be noted that there are onshore and offshore markets for the renminbi foreign exchange and interest rate swaps (IRS). The onshore and offshore renminbi markets display some co-movements in prices as some market participants have access to both. Chart 1 shows that NDF and onshore forward rates display similar trends. The movements of onshore and offshore IRS markets are much more synchronised as limited restrictions have allowed players to continuously arbitrage away any substantial price gap. The price co-movements onshore and offshore reflect, to some extent, circumvention of capital controls by some market participants.

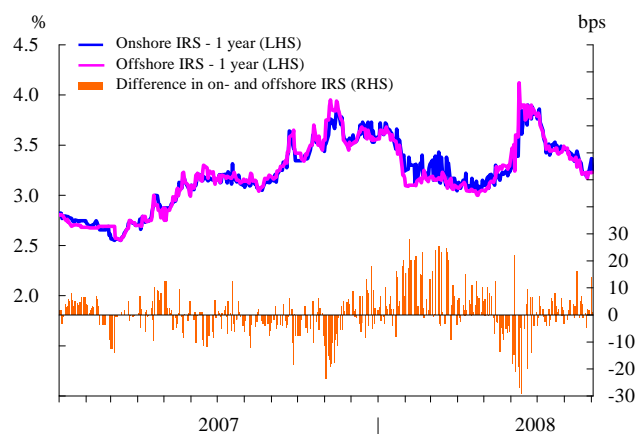
## Chart 1. Co-movements of onshore and offshore derivative prices

### a. Forward rates



Sources: Bloomberg and authors' calculation.

### b. Interest rate swap rates



Sources: Bloomberg and authors' calculation.

In the estimation, we focus on the onshore market which is more applicable to the domestic financial sector in general. One year is used as the time span for the CIP, and thus the 12-month ahead forward rate is used. The US dollar interest rate ( $i_t^*$ ) is the 12-month LIBOR. Unlike the previous studies which use inter-bank rates or weekly central bank bill auction rates (Cheung, 2007, and Ma and McCauley, 2007), the domestic interest rate ( $i_t$ ) is taken as the 12-month onshore interest rate swap (IRS) rate. Using IRS rates has a number of advantages. One-year interest rate swaps are actively traded, whilst interbank lending concentrates at the very short end (less than one week) with few transactions at the one-year horizon. Also unlike the central bank bill auction rates which are guided by the PBoC, IRS rates are market rates, and reflect true funding costs in China. In Equation (1), if  $\alpha = 0$  and  $\beta = 1$  in the estimated equation, the CIP is said to hold.

Equation (1) is estimated over two sample periods: April 2006 - May 2007, and June 2007 - August 2008, and the results are presented in Table 2. In the regression for April 2006 - May 2007,  $\alpha$  is statistically insignificant, while the Wald test shows that  $\beta$  equals one. The estimated relationship changes markedly in the second period, however, with  $\alpha$  turning significant and  $\beta$  carrying the wrong sign. The results seem to suggest that the CIP holds for the first period, but not the second. This may mean that capital controls have been more effective in the last two years.

**Table 2. Tests of the CIP in China**

	(April 2006 - May 2007)	(June 2007 - August 2008)
Constant	-0.08 (-0.92)	-5.45*** (-47.38)
$i_t - i_t^*$	0.94*** (29.58)	-0.87*** (-9.42)
Adjusted R <sup>2</sup>	0.76	0.21
Number of observations	278	334
Wald test for $\beta = 1$	3.63	411.51
p-value	[0.06]	[0.00]

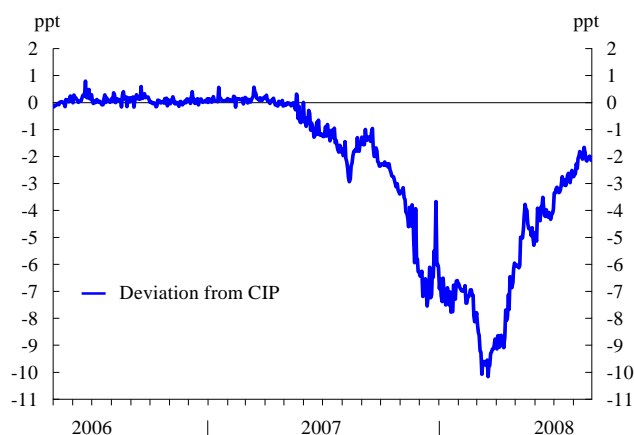
Note: t-values are in ( ), p-values are in [ ]. \*\*\* indicates that coefficients are significant at the 1% level.  
Sources: Bloomberg and authors' estimation.

The deviation of the forward premium from the CIP:

$$(2) \quad \xi_t = (f_t - s_t) - (i_t - i_t^*)$$

also contains information (Cappiello and Furrucci, 2008). The sign indicates whether arbitrage opportunities are for capital inflows or outflows, and thus the type of capital controls required (Chart 2). A positive  $\xi_t$  means an incentive for capital outflows as expected depreciation is more than offset by a higher domestic interest rate, and therefore capital controls are needed to prevent capital outflows. This characterises the situation in China during the late 1990s following the Asian financial crisis. However,  $\xi_t$  has turned largely negative in recent years, suggesting that with strong appreciation expectations, the objective of capital controls is now to restrain inflows.

Chart 2. Deviation from the CIP



Sources: Bloomberg and authors' calculation.

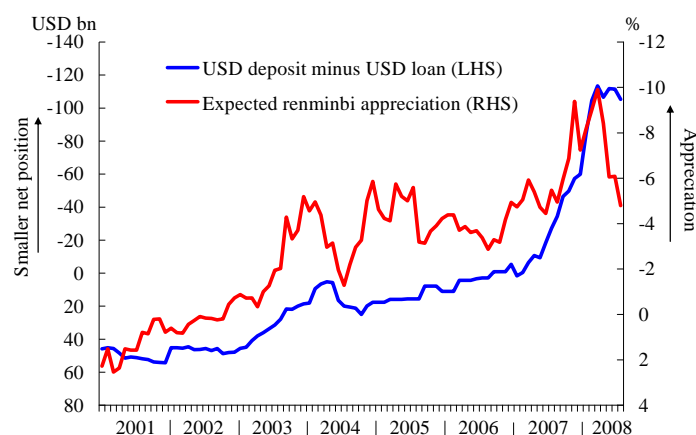
### Leakage in capital controls: flow indicators

International experiences show that capital controls tend to be porous, and incentives for circumventing them grow over time especially as economic and financial integration develops between the host economy and the rest of the world (IMF, 2000, and Aizenman, 2008). In China's case, there are also signs of leakages in capital controls. A growing body of literature in the past two years has attempted to come up with more precise measures of speculative capital inflows – often referred to as 'hot money' – to China, *e.g.* Guan *et al.* (2007), Tang and Liang (2007), Yao (2008), and Zhang and Xu (2008). While these studies differ in their estimates due to diverse methods employed and assumptions used, there is a consensus that speculative capital has been able to get through capital controls and enter China by various channels under both the current and capital accounts.

Apart from examining individual flow channels, another indication of the circumvention of capital controls is changes in certain banking aggregates as the investment position of the private banks reflects, to a large extent, the investment position of the non-banking sector. In particular, the outstanding US dollar balance in the banking system appears to be sensitive to expectations on the renminbi exchange rate (Chart 3). The large capital inflows attracted by fast renminbi appreciation against the US dollar in the first few months of 2008, which showed up as a sharp drop in the net position of the US dollar in the banking system, (suggesting that the non-bank private sector was 'shorting' the US dollar), but subsequently narrowed as the pace of appreciation decelerated. The fact that the net US dollar position responds to exchange rate expectations suggests that capital inflows have been able to circumvent controls, particularly when incentives for doing so are high.



**Chart 3. Net US dollar position and appreciation expectations**



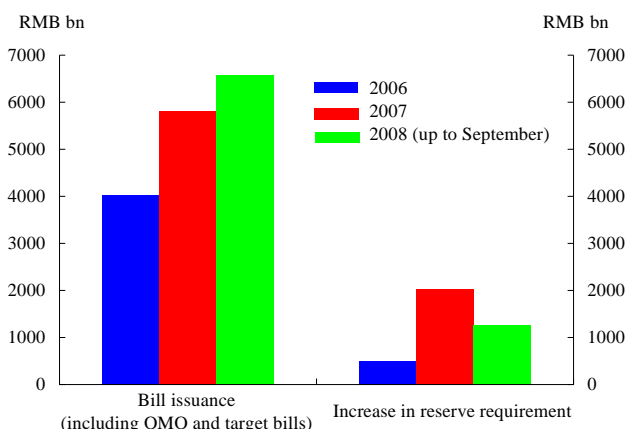
Sources: CEIC and authors' calculation.

### Overall assessment

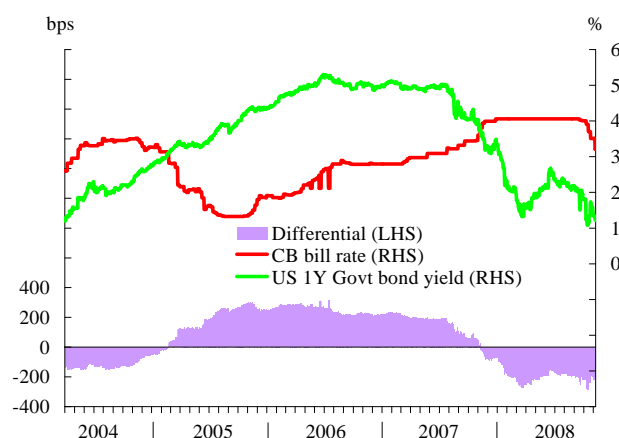
Overall, our discussions on capital controls have two major conclusions, which are similar to those of Ma and McCauley (2007) and Glick and Hutchison (2008). First, there are leakages in capital controls as sizeable capital inflows have come into China through various informal means, which have accentuated appreciation pressures and difficulties for domestic monetary controls in 2007 and early part of 2008. Second, capital controls, despite circumventions, have been able to block out large amounts of inflows, and domestic interest rates are by and large segmented from international markets. In the absence of these controls, there would have been substantially more capital inflows to China in the last couple of years, leading to even more problems of excess liquidity.

### **Section 2. Effectiveness of sterilisation**

Apart from capital controls, reserve accumulation accompanied by sterilisation has also been used heavily to manage monetary conditions. Tools for sterilisation used have included open market operations (OMOs) and reserve requirements (Chart 4). OMOs stepped up from 2007 until September 2008, withdrawing RMB2,270 billion through central bank bill issuance and repo operations. Among these, there was a total of 10 issuance of targeted bills (amounting to RMB1,075 billion in 2006-2007) to selected commercial banks. In the meantime, the reserve requirement ratio (RRR) rose by 10.0 percentage points to 17.5% between June 2006 and September 2008 before monetary easing started, accumulatively locking up RMB3,746 billion. In addition, credit quota was used to help manage broader monetary growth.

**Chart 4. OMO operations and RRR hikes**

Sources: CEIC and authors' calculation.

**Chart 5. CB bill issuance rate**

Sources: CEIC, WIND and authors' calculation.

Compared to quantitative controls, the interest rate was used less frequently as a tool during the tightening phase. The benchmark lending and deposit rates were raised by 1.35 and 1.62 percentage points respectively between April 2006 and 2007, but stayed stable until the monetary easing. Similarly, the PBoC guided the central bill issuance rates higher in the early tightening period (with the one-year bill rate rising from the bottom of 1.33% in 2005 to 4.06%), but kept the rates stable for around nine months before cutting rates in September 2008. The restrained use of the interest rate, particularly in the latter part of monetary tightening, mainly reflected concerns over attracting further capital inflows as renminbi interest rates rose above their US counterparts (Chart 5).

The effectiveness of these controls in preventing rapid monetary expansion can be assessed in different ways. From a narrow perspective, it measures the degree of liquidity withdrawal from the market to offset the increase in domestic currency liquidity due to purchase of foreign reserves by the central bank. More broadly, it can be assessed by considering overall monetary conditions.

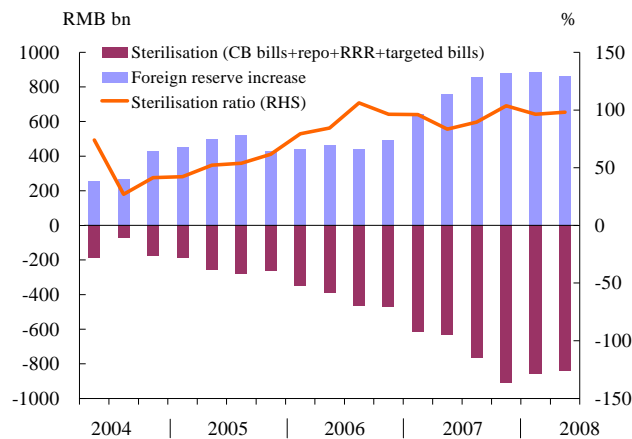
#### Narrow measures

Several measures suggest that from a narrow perspective, the sterilisation has been adequate in preventing excess growth in base money. Unlike studies such as Glick and Hutchison (2008), we take into account the effects of central bank bill issuance (including targeted bill issuance), repo operations and changes in the RRR in the assessment.<sup>2</sup> As such, the sterilisation ratio, defined as the proportion of increases in net foreign assets that are offset by liquidity withdrawal through these instruments, was close to 1 in 2007 and 2008 H1 (Chart 6). Full sterilisation contributed to some liquidity tightening in the banking system, as reflected by a continuous decline in recent years of the excess reserve ratio (Chart 7). Also after taking

<sup>2</sup> Although required reserve is included as part of the monetary base, it locks up liquidity in the banking system, and hence reduces the multiplier effect from the monetary base to broader measures of money supply.

into account the liquidity locked up due to changes in the RRR, reserve money growth has stayed largely stable at around 10% (Chart 8).

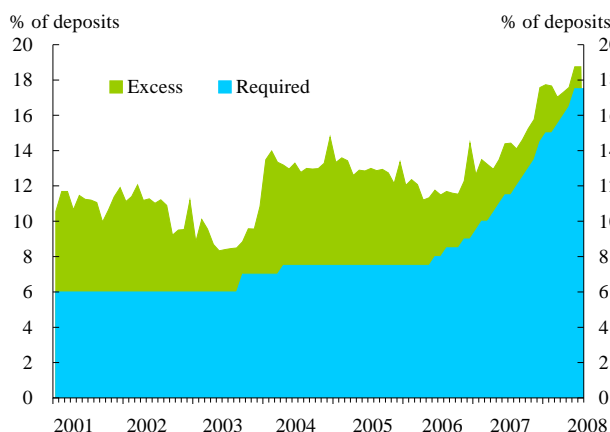
**Chart 6. Sterilisation ratio**



Sources: CEIC and authors' calculation.

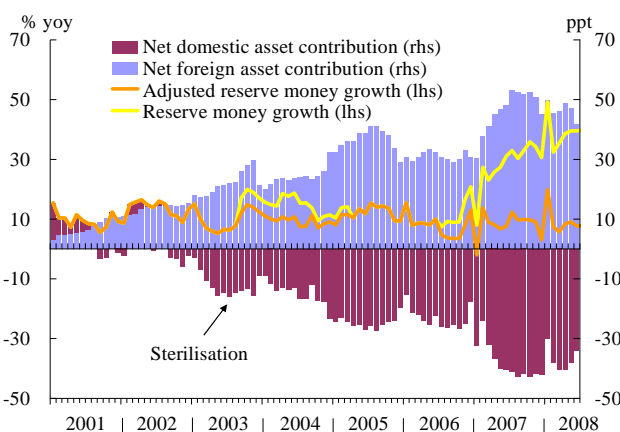
Nonetheless, fully offsetting the impact of reserve accumulation on base money does not necessarily mean that monetary policy is adequately tight for controlling the expansion of overall liquidity in the economy. Demand for bank credit could rise through a higher multiplier effect for base money for two possible reasons. First, with concerns over capital inflows and pressures on the renminbi exchange rate, the interest rate policy was constrained. As (nominal) benchmark interest rates were restrained from rising further at the later stage of the tightening phase in 2008, real interest rates declined upon higher inflation, raising the demand for credit. Second, as banks hold an increasing amount of high quality, yet low-return central bank papers, they may have incentives to expand credit supply (at the expense of other securities holdings) to raise interest earnings. To address this concern over rapid credit expansion, the Mainland authorities also employed credit quota for monetary control. A number of broad monetary aggregate measures can be used to assess the overall adequacy of the set of monetary tools.

**Chart 7. Reserve ratio**



Sources: CEIC and authors' calculation.

**Chart 8. Reserve money growth**



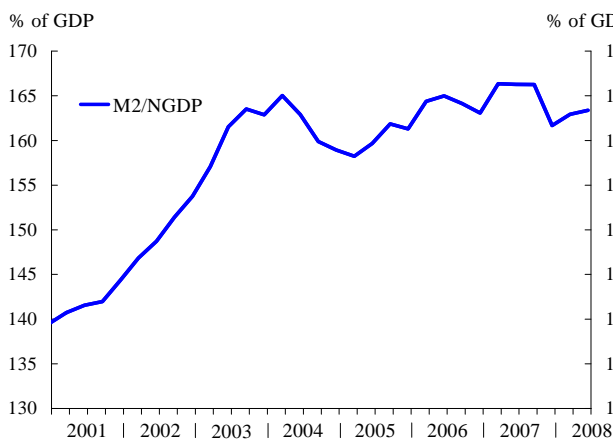
Sources: CEIC and authors' calculation.

Broad monetary aggregates: M2 and M3

The widely watched broad money indicator for China is M2, which consists of currency in circulation, demand, time and savings deposits held by the non-financial private sector with deposit-taking banks. Chart 9a shows that M2 as a ratio to nominal GDP has been broadly stable in recent years, suggesting that M2 has been growing broadly in line with the demand arising from expanding economic activity. A broader measure of liquidity is M3 which essentially equals the total liability of the banking system, and includes, on the top of M2, items such as bonds issued by banks and deposits of non-bank financial institutions with deposit-taking banks. It provides a useful indication of the long-term liquidity in the system. Chart 9b shows that M3 has been growing at a much faster rate than M2, but its growth rate began to slow towards the end of 2007.

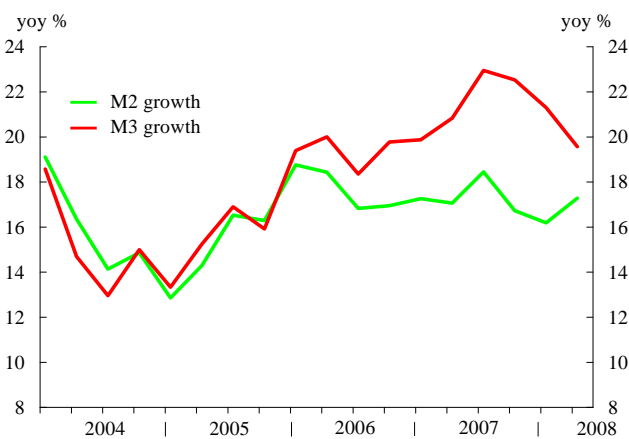
**Chart 9. Broad monetary aggregates**

a. Ratio of M2 to nominal GDP



Sources: CEIC and authors' calculation.

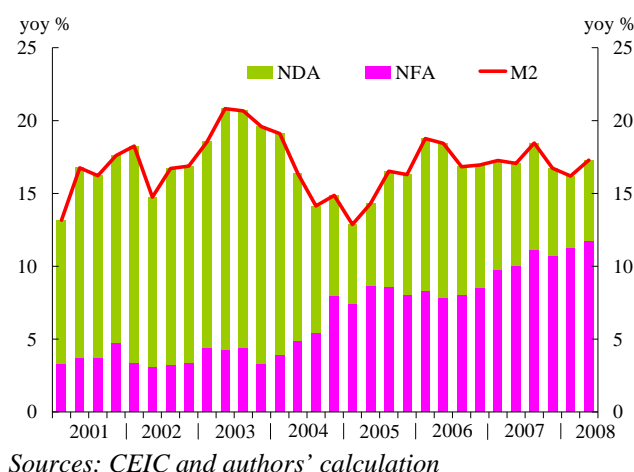
b. M2 and M3 growth



Sources: CEIC and authors' calculation.

The consolidated balance-sheet of the central bank and commercial banks also indicates the role credit controls plays in managing monetary conditions. The contribution to growth in broad monetary aggregates from net foreign assets of both the central bank and commercial banks has been rising, but offset by a slower pace of expansion in domestic assets (Chart 10). This shows that credit controls have served to limit the rate of growth in broad money. This partly explains the observation by He *et al.* (2005) that there is a disconnection between the growth of the monetary base and broad money aggregates.

**Chart 10. Contributions of NDA and NFA to M2 growth**



### Summary

Overall, a wide range of narrow and broad measures suggest that China's current regime was largely effective in managing monetary conditions, which corroborates the findings of Glick and Hutchison (2008). The direct impact of foreign reserve accumulation on base money was offset by OMOs and reserve requirements. Also, through policy tools such as credit quota, M2 growth has also been largely kept in line with nominal GDP growth, and broad financial conditions, despite some loosening in 2006-2007, tightened in the first three quarters of 2008.

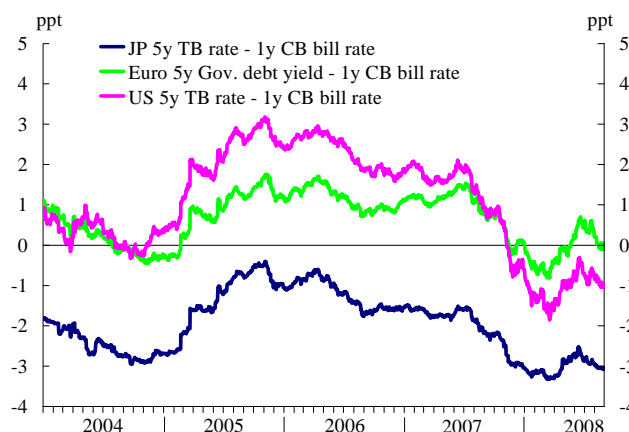
### **Section 3. Costs of sterilisation**

Whilst effective in limiting the impact of capital flows on domestic monetary conditions, this regime of using mostly capital controls, sterilisation and credit controls incurs financial costs, which are shared among the central bank, commercial banks and households. This section gauges the costs to each sector in turn.

**PBoC**

From the central bank’s perspective, the most direct cost of this regime arises from the interest differentials on foreign assets it holds and central bank papers it issues. Chart 11 shows that yields on medium-term US and European government notes turned lower than the 1-year rate on PBoC papers towards the end of 2007, although the negative interest carry between foreign and domestic asset returns has narrowed slightly since Q2 2008. This implies that the PBoC now has an interest loss from accumulating foreign reserves while issuing central bank papers, but those losses have fallen slightly in the recent periods. Table 3 illustrates the potential losses with different interest differentials between foreign and domestic debt papers based on the outstanding amount of China’s central bank bills at end-June 2008. In the illustration, the renminbi interest rate is taken as a composite rate of central bank bill issuance rates – around 4.4% at end-June 2008, and the interest loss in terms of GDP is calculated by varying the assumptions on the average returns on foreign debt papers. According to the table, when the domestic rate is around 1.4% higher than its foreign counterpart – the situation at end-2007, the loss would be around Rmb 55 billion, or 0.2% of GDP *per annum*. With a narrower interest rate gap in the second half of 2008, the cost of sterilisation from these sources should be getting smaller.

**Chart 11. Interest rates differentials**



Sources: Bloomberg and authors’ calculation.

**Table 3. Simulations on the central bank’s interest loss<sup>a</sup>**  
(loss as percentage of 2007 nominal GDP)

Returns on foreign assets	2%	3%	4%	5%	6%	7%
Interest loss/gain <sup>b</sup>	-0.4%	-0.2%	-0.1%	0.1%	0.3%	0.4%

Notes:

- a. The principle is taken as the CB bill outstanding amount at the end of 2008 H1.
- b. The interest loss/gain is calculated as the loss/gain as a result of the difference between returns on foreign assets and cost on outstanding CB bills with a composite rate of 4.4%.

Source: CEIC and authors’ estimation.

From a broader perspective, the cost of sterilisation can be assessed through the central bank's overall balance-sheet. Compared to the analysis based solely on interest rate differentials between the PBoC bills and foreign assets, return differentials between other sterilisation tools (such as required reserves which bear low interest) and foreign assets are also accounted for by this broader approach. We calculate interest income and payment based on the PBoC's balance-sheet in June 2008, applying proxy returns on individual items.<sup>3</sup> Based on these calculations, the PBoC earned net interest income of Rmb 273 bn *per annum*, or 1.4% of its total assets (Table 4a). This is lower than that of 2.1% compared to end-2006 before the scaled-up OMOs and substantial increases in the RRR (Table 4b). In contrast to the previous calculation solely based on interest rate differentials, however, estimates using this approach show positive income returns to the PBoC balance-sheet partly due to low interest bearing items in the central bank's liabilities. Most notably, the interest rates on commercial banks' reserves with the central bank, which accounted for over 40% of the PBoC's liabilities, were much lower than the composite return on foreign assets.

**Table 4a. PBoC balance-sheet (as of June 2008)**

Assets				Liabilities			
	(RMB bn)	(% of total)	Income		(RMB bn)	(% of total)	Cost
Foreign assets	14,958	77.3%	3.5%	Reserve money	11,535		
				Currency issue	3,308	17.1%	0.0%
				Deposits of financial corporations	8,228	42.5%	1.9%
Claims on government	1,628	8.4%	4.3%	Bond issue	4,180	21.6%	4.4%
Claims on other depository corporations	810	4.2%	5.7%	Foreign liabilities	91	0.5%	
Claims on other financial corporations	1,219	6.3%	5.7%	Deposits of government	2,741	14.2%	4.0%
Claims on non-financial corporations	4	0.0%		Own capital	22	0.1%	
Other assets	738	3.8%	4.0%	Other liabilities	788	4.1%	4.0%
<b>Total Assets</b>	<b>19,358</b>	<b>100.0%</b>	<b>3.84%</b>	<b>Total Liabilities</b>	<b>19,358</b>		<b>2.48%</b>

*Note: figures under 'income' and 'cost' are assumptions for rates of return on individual balance-sheet items. Details on the assumptions can be found in Appendix.*

*Sources: CEIC and authors' calculation.*

**Table 4b. PBoC balance-sheet (as of December 2006)**

Assets				Liabilities			
	(RMB bn)	(% of total)	Income		(RMB bn)	(% of total)	Cost
Foreign assets	8,577	66.7%	4.3%	Reserve money	7,776		
				Currency issue	2,914	22.7%	0.0%
				Deposits of financial corporations	4,846	37.7%	1.9%
Claims on government	286	2.2%	2.7%	Deposits of non-financial corporations	16		
Claims on other depository corporations	652	5.1%	3.5%	Bond issue	2,974	23.1%	2.8%
Claims on other financial corporations	2,195	17.1%	3.5%	Foreign liabilities	93	0.7%	
Claims on non-financial corporations	7	0.1%		Deposits of government	1,021	7.9%	3.0%
Other assets	1,141	8.9%	4.0%	Own capital	22	0.2%	
				Other liabilities	972	7.6%	4.0%
<b>Total Assets</b>	<b>12,858</b>	<b>100.0%</b>	<b>4.03%</b>	<b>Total Liabilities</b>	<b>12,858</b>	<b>100.0%</b>	<b>1.90%</b>

*Note: figures under 'income' and 'cost' are assumptions for rates of return on individual balance-sheet items. Details on the assumptions can be found in Appendix.*

*Sources: CEIC and authors' calculation.*

<sup>3</sup> See Appendix for details on the assumptions for returns for each balance-sheet item.

While subject to uncertainties in the assumptions on relative return rates of domestic and foreign assets and liabilities, this analysis has given some indications of the size of sterilisation costs to the PBoC. It appears to suggest that although significant, the magnitude might have been overstated.

### Commercial banks

The central bank's sterilisation operations (including OMOs and reserve requirement) lead to increases in banks' low-return assets, which means that the banking sector bears part of the sterilisation costs. In China's case, the interest rate on required reserves with the central bank has been a flat rate of 1.89% since 2002 until the cut by 27 basis points in November 2008, and the yield on 1-year PBoC papers was about 4% towards the end of the tightening cycle – compared with the 1-year benchmark lending rate of 6.7%. As central bank papers and deposits with the PBoC account for over 20% of commercial banks' total assets, questions have been raised about the impact of increasing reserve requirements on bank profitability.<sup>4</sup>

**Table 5a. Commercial banks balance-sheet (as of June 2008)**

Assets				Liabilities			
	(RMB bn)	(% of total)	Income		(RMB bn)	(% of total)	Cost
Foreign assets	2,016	3.4%	-5.0%	Liabilities to non-financial institutions & household	41,046		
Reserve assets	8,388			Demand deposits	12,464	20.9%	0.7%
Deposits with central bank	8,099	13.6%	1.9%	Time deposits	7,798	13.1%	4.1%
Cash in vault	289	0.5%	0.0%	Saving deposits	19,427	32.6%	4.1%
Claims on government	3,004	5.0%	4.3%	Transferable deposits	366	0.6%	4.1%
Claims on central bank	3,810	6.4%	4.4%	Other deposits	672	1.1%	4.1%
Claims on other depository corporations	6,875	11.5%	4.5%	Other liabilities	320	0.5%	4.1%
Claims on other financial institutions	1,201	2.0%	5.7%	Liabilities to central bank	626	1.0%	5.7%
Claims on non-financial institutions	25,553	42.9%	7.5%	Liabilities to other depository corporations	2,770	4.6%	4.5%
Claims on other resident sectors	5,530	9.3%	7.5%	Liabilities to other financial corporations	3,824	6.4%	5.7%
Other assets	3,255	5.5%	4.0%	Foreign liabilities	556	0.9%	-5.0%
				Bond issue	3,822	6.4%	5.7%
				Paid-in capital	1,867	3.1%	2.0%
				Other liabilities	5,120	8.6%	4.0%
<b>Total Assets</b>	<b>59,631</b>	<b>100%</b>	<b>5.33%</b>	<b>Total liabilities</b>	<b>59,631</b>	<b>100.0%</b>	<b>3.48%</b>

Note: figures under 'income' and 'cost' are assumptions for rates of return on individual balance-sheet items. Details on the assumptions can be found in Appendix.

Sources: CEIC and authors' calculations.

<sup>4</sup> See Appendix to see the assumptions of returns on individual balance-sheet items.



**Table 5b. Commercial banks balance-sheet (as of December 2006)**

Assets				Liabilities			
	(RMB bn)	(% of total)	Income		(RMB bn)	(% of total)	Cost
Foreign assets	2,134	4.8%	-4.0%	Liabilities to non-financial institutions & household	32,539		
Reserve assets	5,023			Demand deposits	9,880	22.4%	0.7%
Deposits with central bank	4,816	10.9%	1.9%	Time deposits	5,277	12.0%	2.5%
Cash in vault	207	0.5%	0.0%	Saving deposits	16,159	36.6%	2.5%
Claims on government	2,270	5.1%	2.7%	Transferable deposits	332	0.8%	2.5%
Claims on central bank	3,175	7.2%	2.8%	Other deposits	842	1.9%	2.5%
Claims on other depository corporations	4,168	9.4%	2.4%	Other liabilities	49	0.1%	2.5%
Claims on other financial institutions	1,190	2.7%	3.5%	Liabilities to central bank	620	1.4%	3.5%
Claims on non-financial institutions	21,574	48.9%	6.7%	Liabilities to other depository corporations	1,512	3.4%	3.5%
Claims on other resident sectors	2,373	5.4%	6.7%	Liabilities to other financial corporations	1,876	4.3%	3.5%
Other assets	2,223	5.0%	4.0%	Foreign liabilities	532	1.2%	-4.0%
				Bond issue	2,587	5.9%	3.4%
				Paid-in capital	1,310	3.0%	2.0%
				Other liabilities	3,154	7.1%	4.0%
<b>Total Assets</b>	<b>44,130</b>	<b>100%</b>	<b>4.52%</b>	<b>Total liabilities</b>	<b>44,130</b>	<b>100.0%</b>	<b>2.27%</b>

Note: figures under 'income' and 'cost' are assumptions for rates of return on individual balance-sheet items. Details on the assumptions can be found in Appendix.

Sources: CEIC and authors' calculations.

Again, two exercises can be conducted to show how much stress banking profitability is under. The first is also to calculate the net interest margin using the consolidated balance-sheet of the banking sector (Table 5a).<sup>5</sup> This shows that the net interest income was around Rmb 1,102 bn, or 1.9% of total assets in June 2008. This was lower than 2.3% at end-2006, although the decline is smaller than that for the PBoC's balance-sheet during the same interval (Table 5b). The second exercise is to calculate the return on assets at different levels of the RRR while keeping other balance-sheet items constant (Table 6). According to this calculation, the RRR can rise to 23.5% before the banking sector makes a loss as measured by a zero return on assets, a rate significantly higher than the RRR of 17.5% at the end of the tightening cycle.

**Table 6. Impact of RRR hikes on banking profitability**

<b>RRR</b>	17.5%	18.5%	19.5%	20.5%	21.5%	22.5%	23.5%
<b>Return on assets</b>	0.24%	0.20%	0.16%	0.12%	0.08%	0.05%	0.01%

Note: The cost on assets is assumed to be 1.6%, based on the difference between our calculated net interest margin for end-2006 and a Standard and Poor's survey suggesting the return on assets was 0.65% in 2006. The return on assets in the simulation is then calculated as the net interest margin minus the cost on assets.

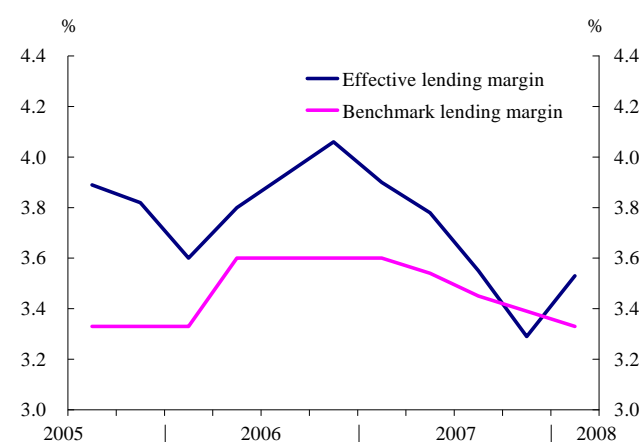
Sources: CEIC and authors' calculation.

Indeed, there are a number of factors countering the squeeze on bank profitability exerted by sterilisation. First, banks' total assets/liabilities are rising at a fast rate, in line with strong economic growth, providing room for earnings growth. Second, in the current policy and institutional environment, the lending margin actually improves in a policy tightening phase. Specifically, while the benchmark deposit rate set by the PBoC serves as a ceiling, almost all deposits earn interest at that rate in practice owing to competition among banks for funds. On

<sup>5</sup> Details on the assumptions for each asset and liability item are given in Appendix.

the other hand, lending rates are permitted to vary from 0.9 to 1.7 times the benchmark rate. Thus, if the benchmark deposit and lending interest rates are raised by the same amount, the effective lending spread increases (Peng, 2008a). Reflecting the strong demand for credit, the share of loans earning an interest rate at or above the benchmark rate has been rising since Q4 2007. Furthermore, the way interest payments are computed on deposits and loans is somewhat different, leading to a faster pace of adjustment on the lending side and thus raising lending spreads in an environment of rising interest rates.<sup>6</sup> Based on the effective lending rate data released in the PBoC monetary policy implementation reports, the lending margin, as measured by the difference between one-year effective lending and deposit rates, has indeed begun to increase sharply from Q4 2007 (Chart 12).

**Chart 12. Lending spreads: benchmark vs effective rates**



Sources: WIND and authors' calculation.

Overall, the analysis suggests that intensive sterilisation has hurt banking profitability, yet banks remain profitable owing to continuing credit expansion and their pricing power in a monetary tightening phase. Nonetheless, a couple of qualifications to the above analysis should be noted. First, it is based on the banking system's consolidated balance sheet, and the impact of the RRR increases may vary significantly among banks depending upon their individual situations. Banks whose financial condition was already in a less favourable position would be less resilient. Second, the large lending spread reflects policy controls on deposit rates. While this is positive for banks' financial health in the near term, it does not help the development of a competitive and commercial-based banking system.

<sup>6</sup> Specifically, the interest rate on a time deposit is fixed during the entire term at the initial level even if the benchmark rate is raised, but the interest rate on loans is generally adjusted to reflect changes in the benchmark rate every 12 months, even if the term of the loan is longer than 1 year.

## Non-bank sector

While the current regime of monetary controls appears to be sustainable from the perspectives of the central bank and commercial banks, its costs have been mainly borne by the non-bank sector. The financial controls adversely affect the household and corporate sector in different ways. For the household sector, the negative effect is associated with the low and negative real interest rate on deposits. The one-year deposit rate averaged 4.1% in the first three quarters of 2008, compared with the average CPI inflation of over 7%. Thus, there was an erosion of the real value of bank deposits at an annual rate of about 3%. This led to a worsening of long-standing distortions in the economy associated with policy-induced low returns on savings. In the short term, a drop in real interest rates may stimulate consumer spending due to an inter-temporal substitution effect. However, persistent negative real returns may induce households to save more, as this is perceived to lead to slower growth in permanent income. From this perspective, the current regime of monetary controls may prolong structural problems in the Mainland economy.

The corporate sector is also affected, albeit indirectly. The potential delay in developing a competitive and commercially oriented financial system means that the funding environment for many firms, especially small- and medium-sized enterprises, would continue to be subject to many uncertainties given a lack of clear market-based price signals.

## **Section 4. Implications on China's external position**

China's monetary regime also has implications on the country's external position. According to the latest official data on international investment position (IIP), China's total assets stood at USD 2,288 bn in 2007, while total liabilities amounted to USD 1,266 bn (Table 7). These leave a net asset position of USD 1,022 bn, or 31% of GDP – among the highest in the world.

**Table 7. China's International Investment Position, 2007**

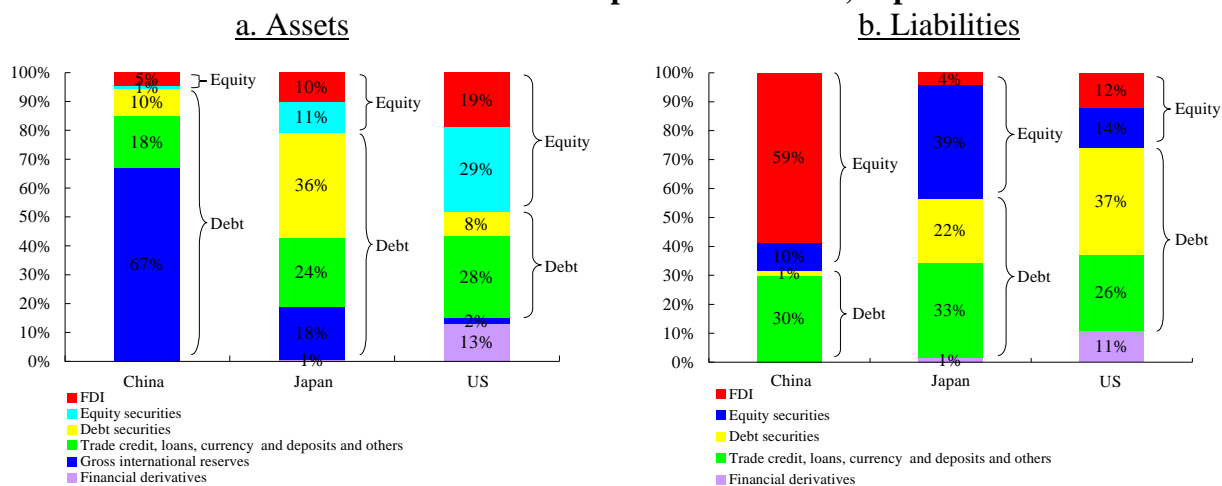
<b>Assets</b>			<b>Liabilities</b>		
	(USDbn)	(% of total)		(USDbn)	(% of total)
FDI	107.6	5%	FDI	742.4	59%
Portfolio Investment	239.5	10%	Portfolio Investment	142.6	11%
Equity securities	18.9	1%	Equity securities	125	10%
Debt securities	220.6	10%	Debt securities	17.6	1%
Other Investment	406.1	18%	Other Investment	381	30%
Trade Credit, Loans, and	280.6	12%	Trade Credit, Loans, and	333.7	26%
Currency and Deposits			Currency and Deposits		
Others	125.5	5%	Others	47.3	4%
International Reserves	1,534.9	67%			
<b>Total Assets</b>	<b>2288.1</b>	<b>100%</b>	<b>Total Liabilities</b>	<b>1,266.1</b>	<b>100%</b>
			<b>Net Foreign Assets</b>	<b>1,022.0</b>	

Sources: SAFE and authors' calculation.

The structure of China’s external position reflects its monetary and capital account regime. On the asset side, China’s holdings of debt-type instruments (including official reserves and the private sector holdings of bank loans, trade credit and debt securities) accounted for 94.5% of total assets in 2007. Most notably, the share of official reserves – mainly invested in foreign government and government agency bonds – amounted to two thirds of the total assets. In comparison, equity-type investments – direct investment overseas and equity holdings by the private sector – had a small share of around 5.5%. This structure of ‘long debt and short equity’ is opposite to that of the US’s ‘hedge fund’ type external position in which holdings of equity and financial derivatives accounted for over one third of the assets (Chart 13a) (Lane and Milesi-Ferretti, 2006). Another instructive comparison is with Japan – another country with substantial net foreign assets and a ‘long-debt, short-equity’ asset profile. Compared to China, Japan has a bigger share of FDI and equities holdings (21%) in the assets, and international reserves accounted for a much smaller proportion of 18%.

The structure of the liability side reflected China’s policy of encouraging long-term flows while discouraging short-term flows. Direct investment in China by foreign residents was close to 60% in total liability (Chart 13b). With other equity liabilities, equity-type instruments account for over two thirds of liabilities – much higher than their share in assets, while debt-type instruments had a share of 30%. By comparison, FDI accounted for very small shares in Japan’s and the US’s liabilities at 4% and 12% respectively, while portfolio holdings were much more important.

**Chart 13. Structure of external position of China, Japan and US**



Sources: SAFE, BoJ, BEA, and authors’ calculation.

Sources: SAFE, BoJ, BEA, and authors’ calculation.

The current structure of China’s external position has its advantages, particularly in the light of the current financial crisis which is worst in decades. The capital erosion is far less than for countries which have a substantial equity component in their assets. The large foreign reserves in the assets have also provided effective protection against a financial crisis.

Nonetheless, the current IIP structure also has its drawback. One prominent issue is that the current structure of the external investment position means much lower returns for China's overseas investment. As equity-type instruments tend to generate higher income streams, the factor payment on China's liabilities was higher than factor income on assets, with a net income from financial instruments of around 2.1% to net foreign assets in 2007 (Table 8). By comparison, the net income return was 7.3% of the US net asset position, and that for Japan was three times the ratio for China (Table 8).

Also when the mark-to-market accounting method is used, the overall IIP position might be affected unfavourably by changes in market conditions (Ma and Zhou, 2008). When the market value is considered, changes mainly occur in equity-type instruments, while the value of debt-type instruments may have limited changes throughout the years. Therefore, given the 'long-debt, short-equity' structure and particularly the dominance of official reserves largely invested in foreign government debt, the value of China's assets is not expected to differ greatly from the official data. However, the picture is drastically different on the liability side as the value of the large amount of equities and FDI can change significantly. If, for example, the FDI stock is evaluated at the current market price, China's liability would be bigger than the official figure. As FDI accounts for a large fraction of the liabilities, its revaluation would result in a smaller net asset position for the country. Admittedly, the market value is subject to substantial volatilities in market conditions. Nonetheless, it provides a useful alternative perspective which indicates that China's external position may not be as strong as indicted by official data.

**Table 8. Investment returns of China, Japan and US**

	China			Japan			US		
	2007	2006	2005	2007	2006	2005	2007	2006	2005
Net income balance / net foreign assets	2.1	1.6	2.2	6.5	6.4	6.3	-7.3	-5.7	-8.2
Income credit / gross foreign assets	3.3	2.9	2.9	3.8	3.5	3.1	9.2	9.5	8.9
Income debit / gross foreign liabilities	4.3	3.6	3.3	2.0	1.6	1.3	7.2	7.4	6.5

Note: a negative value indicates the country has a net foreign liability.

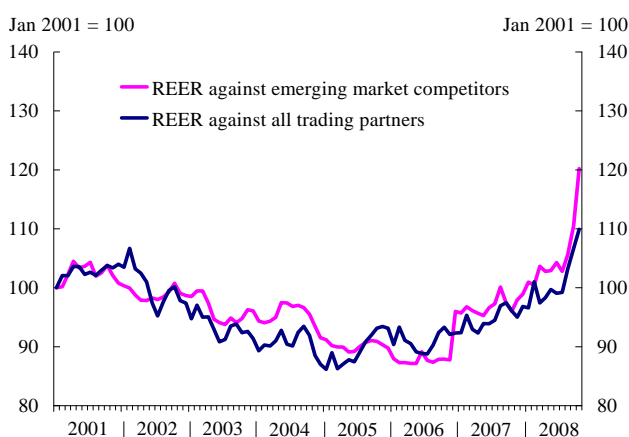
Sources: CEIC and authors' calculation.

## Section 5. Role of renminbi appreciation

The sizeable renminbi exchange rate movement since the exchange rate reform in July 2005, in principle, could also be a factor affecting BoP surpluses. In bilateral terms, the renminbi – despite some stabilisation in the recent months – gained over 20% against the US dollar from the start of the exchange rate reform in July 2005 to October 2008. The pace of bilateral appreciation was particularly rapid in early 2008, with the renminbi rising at annualised rates over 10%. But the RMB/USD rate has mainly fluctuated within a narrow range since July

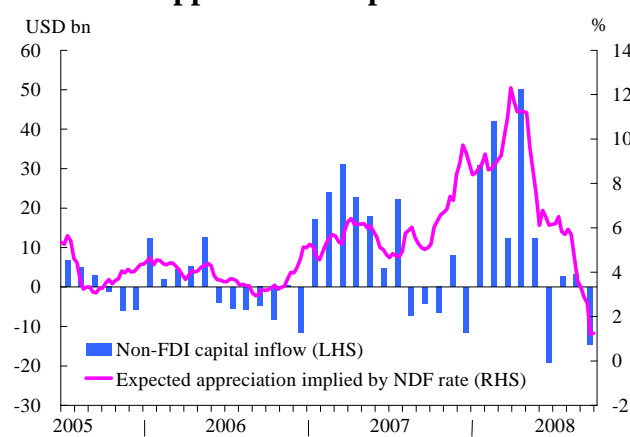
2008, as the US dollar rebounded strongly against other major currencies. The more notable development, however, is the renminbi's appreciation in effective terms, especially in recent months (Chart 14). Since the exchange rate reform in July 2005, the renminbi has appreciated by 17% in real effective terms against the currencies of China's major trading partners. The size of appreciation is even greater against China's emerging market competitors. Most markedly, the renminbi has risen by 22.7% since July 2005 in real effective terms, and particularly drastically by 16.3% within the three months between August and October 2008.

**Chart 14. Effective exchange rate**



Sources: BIS and authors' calculation.

**Chart 15. Non-FDI capital inflow and appreciation expectation**



Sources: CEIC and authors' calculation.

Conceptually, currency appreciation may reduce BoP inflows in a number of ways, which in turn could alleviate pressures on monetary management. First, appreciation in effective terms may help reduce current account surpluses by depressing demand for the country's exports while encouraging imports. Second, large appreciation may dampen expectations for further appreciation, thus reducing one incentive for capital inflows.

Nonetheless, the impact of the currency appreciation on BoP surpluses has been uncertain in China's case. China's trade balance has remained sizeable, although it is possible that fuller impacts of currency appreciation on trade may take time to feed through. In the meantime, it has been observed that there were episodes of faster appreciation being associated with more inflows in China's case. Notably, the rapid gain of the renminbi against the US dollar in early 2008 was interpreted as a shift in the authorities' exchange rate policy in favour of currency appreciation, which may have increased the incentives for capital inflows. The subsequent slower pace of appreciation may also have contributed to a decline in capital inflows (Chart 15).

Apart from uncertainties over the effectiveness, there are also other considerations in assessing to what extent the exchange rate policy can be used to address BoP surpluses. The merit of relying mainly on the exchange rate to address the trade balance of the Mainland has

been widely debated, as China's trade balance has reflected a range of structural and policy factors, not just the exchange rate. Moreover, the size of appreciation required for eliminating BoP surpluses is highly uncertain. The great uncertainties in estimating the equilibrium exchange rate for any currency are widely recognised. There has been no lack of attempts to estimate the equilibrium value of the renminbi. While most of the studies conclude that the RMB has been undervalued, the size of the corrections needed to close the gap varies considerably. As noted by Dunaway and Li (2006), small changes in model specifications, explanatory variable definitions, and sample periods chosen can lead to very substantial differences in the estimates. The estimated undervaluation of the renminbi provided before 2007 ranges from statistically insignificant (Cheung Chinn and Fujii, 2007) to as much as 60% (Goldstein and Lardy, 2007).<sup>7</sup> Estimates are yet to be updated in view of the recent appreciation of the renminbi, and any update is unlikely to provide a definitive estimate for the equilibrium level of the renminbi.

With the lack of certainties in the size of appreciation required, it is useful to note that from a longer-term perspective, the recent rises in the REER were quite substantial compared with China's past episodes of large appreciation as well as with international experience (Peng, 2008b). Table 9a shows that they have far exceeded the increase between 2000 and 2002, although milder than that in the period before and during the Asian crisis when China endured severe economic pains. Also, the pace of renminbi REER appreciation in the last couple months, with an average of around 4% each month, was notably rapid, even when compared with the average monthly appreciation in the largest appreciation episodes in the world (Table 9b). Historical experience suggests that rapid appreciation, especially one that results in overshooting of the exchange rate, may leave the economy vulnerable to sharp negative external shocks.

**Table 9a. Periods of renminbi REER appreciation**

		<b>Appreciation over the period (%)</b>
Jan 1994 ~ Feb 1998	49 months	55.2
Jun 2000 ~ Feb 2002	20 months	12.4
Aug 2006 ~ Sep 2008	25 months	18.1

*Sources: BIS and authors' calculation.*

<sup>7</sup> See Cline and Williamson (2007) for a summary on 18 post-2000 studies on the equilibrium level of the renminbi.

**Table 9b. Periods of international currency REER appreciations**

			Appreciation over the period (%)	Monthly average (%)	
<b>Taiwan</b>	Jun 1973 ~ Feb 1974	8 months	44.6	5.6	
<b>Singapore</b>	Jan 1973 ~ Aug 1973	7 months	24.1	3.4	
<b>Japan</b>	Jan 1993 ~ Aug 1993	7 months	23.5	3.4	
<b>Korea</b>	Jan 1998 ~ Feb 1999	12 months	39.4	3.3	
<b>Japan</b>	Feb 1978 ~ Oct 1978	8 months	22.9	2.9	
<b>Japan</b>	Jul 1985 ~ Aug 1986	13 months	37.9	2.9	
<b>Japan</b>	Aug 1998 ~ Sep 1999	13 months	32.3	2.5	
<b>Taiwan</b>	Dec 1988 ~ Sep 1989	9 months	20.3	2.3	
<b>Japan</b>	Mar 1980 ~ Feb 1981	11 months	22.0	2.0	
<b>Korea</b>	Dec 1987 ~ Jun 1989	18 months	35.2	2.0	
<b>UK</b>	May 1979 ~ Jan 1981	20 months	31.1	1.6	
<b>UK</b>	Sep 1996 ~ Dec 1997	15 months	22.2	1.5	
<b>China</b>	Aug 2006 ~ Sep 2008	25 months	18.1	0.7	(averaged 3.7% in Aug and Sep, 2008)

Sources: BIS and authors' calculation.

Even assuming the renminbi exchange rate remains deviated from its long-term equilibrium level, the pace of adjustment does not need to be constant over time, and can vary according to economic conditions. In a booming economy with rising inflation, a faster pace of appreciation helps to contain inflation and aggregate demand growth. In this case, the need for appreciation from a cyclical perspective is aligned with the required adjustment towards the long-run equilibrium level of the exchange rate. This was arguably the situation in H1 2008. With the worst global financial crisis in decades and world economies entering a synchronised slowdown, however, the economic outlook for China has turned dramatically different in H2 2008. As growth has slowed and inflation fallen markedly, a reduced pace of effective appreciation in the period to come may also be desirable from a cyclical point of view.

## Section 6. Policy discussions

This paper has discussed the effectiveness and costs of China's current monetary regime in maintaining monetary controls in the face of large BoP surpluses. Our analysis suggests that restrictions on capital movements and sterilisation with quantity controls played a part in coping with BoP surpluses, while the impact of currency appreciation was more difficult to assess. In overall terms, this regime by and large succeeded in insulating domestic monetary conditions from rapid increases in foreign reserves. There does not appear to be a sustainability issue with this regime. The net return of the PBoC's overall balance-sheet remains positive, and the central bank has the option to transfer some of the sterilisation cost to commercial banks through higher reserve requirements. For the commercial banks, while their profits have been squeezed, they remain highly profitable for the system as a whole.



Nonetheless, effective and sustainable though the current regime is, it incurs substantial costs in the form of financial repression and distortions in the economy. We have highlighted two main areas of costs. First, with restrictions to invest overseas and limited investment instruments domestically, the household sector is compelled to place most of its savings into banks where interest rates are kept artificially low. The low returns on savings may depress consumption through the income effect. In turn, repression of domestic demand could prolong external imbalances. Second, the large reserve accumulation under the current regime has led to dominance of debt-type instruments and official outflows in China's assets. This, combined with the long standing policy of encouraging FDI inflows, has led to much lower net returns for China's net foreign assets compared to other economies'. These costs increased particularly in 2007 H2 and 2008 H1 when sterilisation with quantity controls was stepped up in the face of sizeable capital inflows bypassing controls. Indeed, the pressures on China's monetary regime only eased more recently because of the global financial turmoil and economic slowdown.

This paper has identified several areas that China's monetary regime can improve upon. In particular,

- Greater exchange rate flexibility. The recent stability of the RMB/USD exchange rate reflects probably the authorities' desire not to give a signal of weakness amidst the global financial crisis. However, as the global situation stabilises, two-way movements in the renminbi exchange rate would be desirable in helping to break expectations of persistent appreciation.
- Market based tools for monetary management. With some ease in capital flows and reserve accumulation, it is preferable that the authorities increasingly move to more market based monetary tools such as the interest rate. Recent changes in domestic and external conditions have allowed interest rates to play a bigger role in monetary policy easing. Over time, of more importance is further deregulation in interest rates. This is consistent with greater flexibility of the exchange rate and a more liberalised framework for private capital flows.
- Continuing capital account opening. While free capital movements bring risks and challenges to economic management, they have a number of long-term benefits. Apart from enhancing efficiency of the financial system, a more open capital account can allow the private sector to diversify their investment, which helps raise investment returns. A gradual re-orientation from the dominance of official capital outflows to an increase in private outflows should change the structure of the assets and liabilities of China's external position to one that enhances longer-term returns. Simultaneously, this can reduce the official sector's role in coping with cross-border flows and associated complications for domestic monetary control. It is important, therefore, for China to

work towards the goal of capital account liberalisation on a continuous basis, by building the institutional framework and devising policy plans that maximise the benefits of capital account opening, while mitigating the associated risks.

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#### **About the Series**

*China Economic Issues* provide a concise analysis of current economic and financial issues in China. The series is edited by the External Department.

## **Appendix: Supporting analysis**

### Assumptions for calculating the returns on the PBoC's balance-sheet

#### *Assets*

- Foreign reserves are assumed to comprise 70%, 20% and 10% of US, EU and JP government bonds. The government bond yields are taken as the weighted average of these governments' bond yields at different maturities.
- Claims on government: the returns are taken as the weighted average of Chinese government bond yields with different maturities.
- Claims on other depository corporations / financial corporations: assumptions on their returns are calculated based on 5-year and 10-year financial bond yields.

#### *Liabilities*

- Deposits of financial corporations: interest rate on required reserve.
- Bond issue: returns are calculated based on the weighted average of yields of outstanding CB bills.
- Deposit of government: interest rate on treasury deposits.
- Other liabilities: given lack of data, their rates of returns are arbitrarily chosen at 4%. This should not have a large impact on the analysis as this item only accounts for a small share of liabilities.

### Assumptions for calculating the returns on the banking sector's balance-sheet

#### *Assets*

- Foreign assets: returns are taken as to the difference between risk-free foreign asset returns and annual renminbi appreciation.
- Deposits with central bank: interest rate on required reserve.
- Claims on government: returns are calculated as the weighted average of Chinese government bond yields with different maturities.
- Claims on central bank: returns are calculated as the weighted average of yields of outstanding CB bills.
- Claims on other depository corporations: assumptions on returns are calculated based on weighted average of 7-day repo rate, 5-year and 10-year financial bond yields.
- Claims on other financial institutions: assumptions on their returns are calculated based on 5-year and 10-year financial bond yields.
- Claims on non-financial institutions / residential sectors: 1-year benchmark lending rate.
- Other assets: returns are arbitrarily assumed.

*Liabilities*

- Demand deposits: benchmark demand deposit rate.
- Time deposits / Saving deposits / Transferable deposits / Other deposits: use the 1-year benchmark deposit rate.
- Liabilities to central bank: assumptions on their returns are calculated based on 5-year and 10-year financial bond yields.
- Liabilities to other depository corporations / financial corporations: assumptions on returns are calculated based on the weighted average of 7-day repo rate, 5-year and 10-year financial bond yields.
- Foreign liabilities: returns are set to be the same as those of foreign assets.
- Bond issue: returns are calculated as the weighted average of financial bond yields with different maturities.
- Paid-in capital: dividend returns, assumed to be 2%.
- Other liabilities: returns are arbitrarily assumed.