Crisis, Capital Controls and Covered Interest Parity: Evidence from China in Transformation*

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Abstract

This paper aims to investigate the effectiveness of capital controls in China for both short-term and long-term, with a special attention to the period of financial turbulence bursted in the summer of 2007. On one side, we employ a two regime threshold autoregressive model to study the Renminbi yield differential between the onshore interest rate and the offshore Non Deliverable Forward-implied one for the period of 2006-2009; on the other side, we distinguish (and measure) the short-term cross-border capital flows from the long-term flows for a long horizon. Based on obtained evidence, we found the capital controls in China less effective, nevertheless, still working for some goals of Chinese government under a more opened capital accounts.

Keywords: Covered Interest Parity; Capital Control; China; Threshold Autoregressive model; Financial Crisis.

JEL Classification: C32, F21, F32.

1 Introduction

When the recovery is surprisingly brisk and global growth appears increasingly robust, the pace of growth in European countries tend to be slow partly due to the lack of effective policy stimulus. As the fears of sovereign debts spread beyond Greece and unleash more attacks on financial markets, gradually tightened fiscal policy and extended period of cheap Euro seem desirable for the rich group. Consequently, this encourages more capital to flow to emerging economies for searching higher yield, like China whose economy is now growing at double-digit rate.

However, even the most dynamic economy in the world suffered in 2009, resulting in temporary interruption of breakneck growth. This was also the case for others East Asian countries, who had hoped that they were somehow far from the financial turmoil largely confined to the rich countries, however found themselves beaten even harder than anywhere in the planet. Indeed, both the scale and speed of that downturn are breathtaking, with a so broader scope than that of the regional financial crisis a decade ago. At that time, China's relatively closed capital accounts have been considered by some commentators as an important element in its success in maintaining its commitment to a stable exchange rate (IMF, 2000), and in preventing it from suffering harmful effects. Twelve years later, when most European countries still lived in recession triggered by the financial turbulence, it is China and developing countries of the East Asia-Pacific region who first recover from the global crisis, and it would be also them who can grow rapidly in the next decade even in a weakened world.

Nevertheless, there is a great urgency in controlling capital inflows (or hot monies) to avoid the eventual overheating and bubble forming, after the fiscal and monetary stimulus effectively implemented during the turbulence period in these economies. In this circumstance, it is interesting to know how did China cope with this financial turmoil and the economic slowdown which comes to its heel. Did its capital control policy work magically again, allowing China a quick recovering from its deepest slump in almost a decade and keeping it continue to be the economic locomotive of the gloomy world?

This paper aims to investigate the effectiveness of capital controls in China for both short-term and long-term, with a special attention to the period of financial turbulence bursted in the summer of 2007. On one side, we employ a two regime threshold autoregressive model to study the Renminbi yield differential between the onshore interest rate and the offshore Non Deliverable Forward-implied one for the period of 2006-2009; on the other side, we distinguish (and measure) the short-term cross-border capital flows from the long-term flows for a long horizon. Based on obtained evidence, we found the capital controls in China less effective, nevertheless, still working for some goals of Chinese government under a more opened capital accounts.

The remainder of this paper is organized as follows: In section 2, after briefly reminding the purposes and summarizing the existing classifications of capital controls, we characterize those implemented in China and present their mechanisms; The evolution of China's capital controls is introduced in section 3; Section 4 presents the empirical methodology and evidence obtained via the covered interest rate parity; In section 5 we complement with evidence from

capital movements by discerning the cross-border capital flows of different maturities; The last section concludes.

2 Why and How to implement capital controls?

2.1 The purposes of capital controls

Capital control is one of the monetary policy devices for a country whose government uses it to restrict the movement of capital across that country's borders. The purposes of this measure are various and vary with time and place.[1] In a world where the market economy dominates, despite all its costs and certain negative effects, controls are adopted preferably to avoid the dangers generated by the free mobility of international capital.[2]

For China, a planned economy since the establishment of the new Republic and currently transforming into a market economy, cross-border capital flows were completely banned before economic opening initiated 1978 whereas the characteristics of centralized economy. This form of control, usually seen in a planned economy, aimed to impose a full constraint on the domestic resources without worrying about all external shocks and volatility. In general, this control system has functioned more or less well with respect to its designated roles (Zhang, 2006). During the process of transformation into market economy, Chinese authorities have planned to open capital accounts in the medium run(although the exact date is not revealed).[3] However, the restrictions on capital flows have still persisted in certain forms, based on following reasons: to promote the process of restructuring the national economy, to protect the national economy sectors (especially the public ones) and underdeveloped national banking system from international competition, to protect the domestic economy from the impact of the misallocation of resources, and to ensure financial stability. Moreover, certain implicit aims should also be taken into account: accumulation of foreign exchange reserves, maintaining exchange rate stability of RMB.

2.2 The styles of capital controls

Restrictions on cross-border capital movements in capital accounts of China adhere to a system called "Foreign Exchange management". The first official appearance of the term "foreign exchange in capital accounts" was in the "Regulations on the Foreign Exchange System of the People's Republic of China" promulgated in 1996.[4] Since the explicit implementation of controls in the capital accounts, China generally welcomes long-run capital inflow more than that of short term, with the goal that regulates the volatility of capital flows rather than its volumes. Before presenting the working mechanism of capital controls

[1] For a summary of purposes, methods used, control directions, examples of capital controls, see Neely (1999).

[2] For a recent review of capital account liberalization, see Henry (2007).

[3] "Provided that risks can be effectively guarded off, we should selectively, and in steps, deregulate restrictions on cross-border capital transactions and gradually establish Renminbi's (Chinese currency, hereafter RMB) convertibility on the capital account" has been declared by Central Committee of Chinese Communist Party October 21, 2003. It was the first time that China referred to the convertibility of its currency in the capital accounts as an official purpose.

[4] Last time revised in August 2008.

in China, it is necessary to distinguish several styles of them and to specify those adopted by the Chinese government.

There are four main classifications in the literature for the styles of capital controls. Based on method of control, the first distinguishes direct or administrative controls from indirect or market-based ones (IMF, 2000). The second classification is grounded on the direction of the controls (or direction of flows), two types of controls being treated in the literature: controls on capital outflows, similar to those that Malaysia imposed in mid-1998, and controls on capital inflows, similar to those implemented in Chile between 1991 and 1998. This distinction was proposed in the background when the discussion about the new international financial architecture focuses on these two types of control (Edwards, 1999). More recently, Anderson (2006) distinguishes targeted restrictions from generalized ones, which is the third classification based on range of controls. The former aims to slow down the entry and exit of short term portfolio investment funds during the periods of short-term shocks, often used in economies that has already opened to the flows of portfolio investment capital; while the latter aim to restrict almost all transactions relevant to foreign capital, that we saw in Eastern Asian and Latin American countries before the 80s and also in transition economies like China. Finally, the fourth classification is based on the maturity of capital flows: controls on the long term foreign capital flows or on the short term flows or both (Edwards, 1999).

From these four classifications mentioned above we may extract four dimensions (or aspects) of capital controls: the method, the direction, the range and the maturity. By referring to these four dimensions, we qualify the styles of capital controls in China in order to conduct further thorough analysis (see Table 1): the direct administrative controls are applied to both inflows and outflows of short-term capital flows, with generalized restrictions. The last aspect of maturity is our priority of study and some evidences based on it are presented in the section 5.

2.3 Mechanism of Capital controls in China

Replacing the "all-included" foreign exchange management system, the framework of capital controls in China has been transformed into an administrated regime which consists of three pillars: controls over foreign direct investment, over international portfolio investment, and over foreign debts.

2.3.1 Controls over Foreign Direct Investment (FDI):

As China's capital control regime discriminates cross-border flows among different capital accounts.[5] We begin with those that are less regulated and those relating to capital flows in the long term. Relaxation of control on FDI inflows to China has been implemented long time ago and welcoming FDI a long-held policy; there has also the most mobile cross-border financial transactions in this account. At present, there is no restriction on direct investment in China for foreign investors provided they follow the guidance of industrial policies set

[5]Controls on the capital accounts apply only to about a quarter of the IMF categories (Prasad and Wei, 2005).

by the Government. And for the management of foreign exchange associated with FDI inflows, there are no restrictions on repatriations of funds (and/or profits) and associated trade credit.[6]

Emphasis on the settled amount of investment funds, on foreign currencies expenditure and revenue classified as transactions in the capital account, and on foreign borrowing by companies with FDI are replaced by the government's concern of FDI outflows. Precisely, direct investment overseas by Chinese entities must be approved by the Ministry of Foreign Trade and Cooperation. The origins of their own funds in the form of foreign currencies and the risks associated with overseas investments should be verified and evaluated by the State Administration for Foreign Exchange (SAFE) in which remittances must be also registered. The purchase of foreign currency from the SAFE can be carried out for major strategic projects approved by the State. Figure 1 shows the evolution of FDI flows in two directions under controls.

This structure of control, encouraging the entry of foreign capital and limiting the domestic capital outflows, coupled with other priority policies for foreign investors, reflects China's strategy of financial openness: on one hand transferring technology and modern managerial skills through attracting FDI, and on the other hand obtaining foreign currency (Gao, 2000).

2.3.2 Controls over International Portfolio Investment

The liberalization of financial markets is an inevitable phase for a country in transition like China. But provided the problems caused by hasty opening of stock markets in several emerging markets, Chinese authorities still keep cautious in this field.

First, allowing foreign investors to invest into Chinese stock markets at the same time limiting it with certain degree, Chinese authorities have implemented two main measures: the segmentation of the stock market and the overseas listing of Chinese companies.[7] As for the former, the segmentation has existed since the first B share issued by Shanghai Vacuum Electronic Devices and Company and listed in Shanghai Stock Exchange in 1992. Until the end of August 2008, 114 Chinese companies have issued B shares, 89 of which have issued both A share and B share. In addition to the former one that consists of the origins of capital flows into stock markets in China, the latter is another channel for transferring foreign capital into China, however subjected to less stringent constraints. Once the approval is obtained from China Securities Regulatory Commission (CSRC), Chinese firms may be financed with foreign exchange by listing overseas. The only restrictions come from the fact that the foreign currency received abroad should be repatriated under a time limit. According to the CSRC, until the end of May 2008, (New York, London, Singapore, Hong Kong), there are 150 Chinese companies listed in foreign stock exchanges, 38 of which are listed both in

[6] These cross-border flows have the potential to arbitrage onshore and offshore yield.

[7] China's stock market is segmented into two markets: A share market, where stock is denominated and subscribed in local currency RMB, accessible to Chinese nationals and 65 (number updated to the end of August 2008) *qualified* foreign institutional investors (Qualified Foreign Institutional Investors, or QFII), and B share market, where stock is subscribed in foreign currencies (Hong Kong dollar for stocks listed in Shenzhen Stock Exchange and U.S. dollar for stocks listed in Shanghai Stock Exchange), is for *non-qualified* foreign investors.

mainland China and Hong Kong, 5 of which in both Hong Kong and London, 13 of which in both Hong Kong and New York. The listing in foreign stock Exchanges is already considered as a main window of capital accounts opening and as an important channel promoting the reform in large state-owned companies of China.

As for capital outflows in form of securities investment, i.e. the purchase of foreign stocks by Chinese households and the listing of foreign companies onshore along with their sales of shares in Chinese stock markets, there are certain restrictions on them, except for those approved by the CSRC, the SAFE etc. The first type is a priori prohibited. At the same time, the collection of funds denominated in foreign currencies must be financed by investors themselves and the transfer of funds be approved by the SAFE. The second is not permitted either with the exception for the sales of B shares acquired by foreign investors.

Contrary to investment in the stock markets, the China's bond market is relatively closed to foreign investors who are prohibited to buy and sell bonds and other debt instruments, which are the sources of inflows and outflows, except for the 'qualified investors' whose main transfer of principals are nevertheless under the quantity control, maximal 20% every three months after staying at least 3 years in China. Since the end of 2004, the issuance of bonds, only denominated in RMB, is permitted for some international financial institutions with nature of global development, but the conditions are still relatively strict. Organizations to be approved must have previously funded Chinese companies with an amount of at least one billion U.S. dollars; and their RMB – denominated bonds should have a rating higher than AA. Furthermore, raised funds should be used only for national projects in China. Meanwhile, investment in foreign bond markets by Chinese residents is not allowed either. The only exceptions are commercial banks, authorized and delegated by the central bank of China, and insurance companies by the Chinese Insurance Regulatory Commission (CIRC). But they can invest only with their own foreign currencies. These controls refer to that of domestic capital outflows. As to capital inflows from this channel, the issuance of bonds abroad of Chinese entities needs the approval of the Central Bank of China (PBOC) and the SAFE where the amount is recorded and included in the National plan of foreign debt. The raised funds should be as well repatriated to China within a certain time limit set by the Chinese authorities.

2.3.3 Controls over foreign debts:

These controls aim to make the external debt increase compatible with that of domestic investment, government budget and current accounts, at the meantime assuring the effectiveness of monetary policies (Shinji and Shi, 2005).

The management of foreign debts, a part of which previously mentioned as controls over the issuance of bonds abroad being virtually a component of portfolio investment according to the international standard, also refers to the debt of governments, financial institutions and Chinese companies, both in long and/or short term, with foreign governments, international organizations, international banks, and foreign companies and individuals. There is also trade-related credit. The structure of the management of foreign debts is presented in the Table2. The method of controls refers to the size, structure, maturity and repayment

of debts. The approval and registration in the national plan are required. When domestic entities (financial institutions or companies) borrow from foreigners, it is necessary for them to obtain a license as qualified debtors and the amount of indebtedness expected should be approved by certain authorities. Moreover, the conditions of borrowing have to be satisfied and reimbursement of debt approved by the SAFE. The transfer of received funds in foreign currency into China is required within a fixed period of time (See Figure 1). But for companies with FDI, simply register in SAFE is sufficient in order to obtain credit for non residents. The loan granting to foreign institutions by domestic ones is subject to the constraint of delegation given by the PBOC. In the case of deferment of debt, the restrictions become more stringent: This deferment is not permitted unless it conforms to the rules for the management of assets and liabilities denominated in foreign currency, approved by the authorities and registered in SAFE respectively before and after this operation. Creditor institutions should firstly use their own funds to provide foreign currency loans. If credit amount exceeds certain threshold, the difference requires the approval of SAFE. For domestic companies or non-financial institutions, granting such loans is forbidden.

3 Evolution of capital control in the progressive opening process

Capital controls continue to evolve as the motives of government do in view of intervention of financial crisis. The capital accounts are almost completely closed during the mid-1980s. The first attempt of capital accounts liberalization is the policy of FDI inflows, initially for taking advantage of funds from Hong Kong and Taiwan. The capital inflow in this form has exploded in the early 1990s (See Figure 1). At that time, the authorities once intended to rapidly achieve full liberalization of capital accounts, but since the Asian crisis of 1997, there had been relatively little progress and no concrete action either. According to Chinese authorities, they do consider capital accounts liberation in the medium term. In this perspective, there had been no further measures only until December 2002 when the Chinese government announced the QFII scheme, some measures of which have already been mentioned previously. We could see a cautious attitude of Chinese government towards the capital accounts opening to the extent that it made an attempt to relax controls on the entry of capital before permitting the national capital exit, i.e. the FDI overseas since several years ago.

3.1 Recent deregulations

Since 2003, one relatively modest step to ease restrictions on capital flows is the promulgation of QDII (Qualified Domestic Institutional Investors) scheme in April 2006, equivalent to QFII scheme but in opposite direction respect to capital flows. It is epochal because in the past controls over the capital outflows were more strict than that for the capital inflows. From then, this scheme allows domestic investors to invest abroad in the securities markets via certain fund management institutions, insurance companies, securities companies and other assets management institutions, or QDIIs, which have been approved by CSRC. This means

that restrictions on the capital outflows in the form of portfolio investment have been released of certain degree. Similar to the QFII scheme, it is a transitional arrangement which provides limited opportunities for domestic investors to access foreign securities markets when RMB is not yet fully convertible and enough flexible, and when capitals are not perfectly mobile cross border either. For what is different, it is an approving process much faster than the QFII scheme that had been implemented since the end of 2002. Obviously, there is an emergency for of Chinese authorities to implement the QDII scheme as soon as possible, reflecting indirectly the fact that RMB is under immense pressure of appreciation facing proliferated expansion of foreign exchange reserves, rather than strong motivations for opening capital accounts.[8] The QDII scheme allows at least partially to absorb a portion of foreign exchange reserves and to ease appreciation tension of Chinese currency, with the effect to be proven.

In May 2007, the scope of QDII is further extended by the China Banking Regulatory Commission (CBRC). Therefore, banks are allowed to offer equity-related instruments under certain restrictions: The net amount invested in the shares of a "QDII" product should not exceed 50% of the total value, with net amount of a single action topped out at 5%. The minimum of agreement for each customer is 300 thousand yuan (around 30 thousand euro). In addition, the invested actions or relevant funds should be registered or approved by the foreign regulatory institutions which have signed agreement memorandums with CBRC. This enlargement is also thought as a way to cool the overheating A-share stock market when the authorities worry about explosion of bubble.

More recently in April 2008, an agreement was established between CBRC and the U.S. Securities and Exchange Commission, which provides opportunity for Chinese households to invest in the U.S. stock market. The factors determining this type of capital outflows include the performance of Chinese domestic stock market and the lack of alternative on which the Chinese households could invest their savings and gain in positive real rates of return, given the low interest rate of savings and high inflation.

3.2 Recent strengthening:

Since July 2008, the Chinese government has clearly strengthened the supervision and management on international payments, especially to prevent the entry of ' hot money ' via the channels of trade, FDI and RMB-denominated accounts of non-residents. According to the recently amended version of the "Regulations on the Foreign Exchange System of the People's Republic of China", the SAFE is given the right to monitor and apply some process of controls on capital inflows and outflow. We deduce that avoiding sudden capital outflows could be the next challenge for management of capital account.

- Trade channel: on one side, the deposit or sale of foreign currency-denominated revenue by exporters is subject to verifications from SAFE, the Ministry of Commerce, and Chinese customs, the advances in exports and the deferred payment for import by the SAFE on the other side.
- FDI channel: In July 2008 the Chinese government has issued a circular to prevent

[8]The foreign exchange reserves had exceeded 1 trillion U.S. dollars.

the abnormal capital inflows via this channel.[9] Meanwhile, the SAFE has warned commercial banks in terms of foreign currencies payments of FDI-companies' equity. What is highlighted includes the use of funds of equity converted into RMB, which should be approved by the government. Unless otherwise specified, the funds are forbidden to invest in the Chinese stock market. Furthermore, with the exception of foreign real estate enterprises, companies with FDI will not be allowed to buy real estate in China for non-operating usage with their funds converted into RMB. Obviously, the government aims to filter the unidentified capital inflows (hot money) through the FDI channel, whose real purpose is to speculate in the stock and real estate markets.

- Channel of RMB-denominated account of foreigners: the SAFE has announced several regulations on "the data submission of RMB positions of non-residents" to strengthen the supervision and control on eight categories of RMB-denominated accounts of non-residents.

Several measures aiming to strengthen the management of capital accounts have their days successively in June and July 2008, all of those increasing the arbitrage cost of short-term capital flowing into China and therefore restricting the continual entry of speculative capitals. But in a background where China becomes increasingly open and its currency more flexible, the control cost of government will increases for sure. The key question is whether the controls are effective? The following sections show some evidence from the price and from the capital flows.

4 Are capital controls effective in China: Evidence from the covered interest rate parity

4.1 A brief review of CIP literature

Endorsed by Frankel (1992), only the covered interest parity (CIP) condition, that the covered interest differential is zero, is an unalloyed criterion for "capital mobility" in the sense of the extent of financial market integration across national boundaries.[10] Attributing to this strand, CIP is widely used as the most appropriate indicator of degree of the financial integration across countries (Frankel, 1992; Holmes and Wu, 1997; Holmes, 2001) and that of capital controls which have been found interfering with the achievement of CIP in Germany between 1970 and 1974 (Dooley and Isard, 1980) and in Japan in the 1970s (Otani and Tiwari, 1981; Ito, 1987).

According to this theorem, the interest differential between two assets, identical in every aspect except currency of denomination, should be zero once allowance is made for cover in the forward exchange. Deviations from the CIP condition would reflect transactions costs (Frankel, 1992).[11] For non-comparable assets (i.e., assets issued in different political

[9] Circular on Further Strengthening and Regulating the Administration of Foreign Investment Projects.

[10] Other methods to define capital mobility includes Feldstein-Horioka definition (Feldstein and Horioka, 1980), real interest parity, uncovered interest parity (Frankel, 1993, 1992).

[11] Transaction cost in broad sense. Studies in the literature attempted to rationalize this departures in terms of transactions costs (Branson, 1969; Frenkel and Levich, 1975, 1977); capital market imperfection (Prachowny, 1970; Frenkel, 1973); capital controls (Frankel, 1993; Otani and Tiwari, 1981); data imperfection or mismatch (Taylor, 1987, 1989).

jurisdictions), as concluded by Aliber (1973) in his seminal paper, political risk accounts for much of the observed differential. For an economic agent who formulates his portfolio including assets of different political jurisdiction, political risk can be composed of different tax/tariff structure or capital controls. In the latest financial turbulence, Baba and Packer (2009) rationalize the deviation from CIP to the default risk and the liquidity risk. In this paper, by focusing on the deviation associated with capital controls, we try to derive some evidence for effectiveness of capital controls in China.

There is few studies in the literature about the evidence of CIP for China. The principal reason lies in the fact that neither the forward foreign exchange market nor the euro-currency market existed. In this circumstance, we cannot measure directly the difference between RMB's onshore interest rate and its offshore counterpart as Dooley and Isard (1980) calculated for Geman Mark; neither could we do indirectly for the difference of the arbitrage gains as Ito (1987) devised for Japanese Yen.[12] Nevertheless, with implicit assumption that the covered interest parity condition holds for RMB in the offshore financial market, Ma and McCauley (2008) calculated the yield differentials between the onshore interest rate of RMB and its offshore counterpart implied by CIP. By comparing these rates between two markets, where different regimes of capital controls exist, interest rate yield differential is showed as a quantitative indicator of the effect of capital controls. They have also showed that, even though these differentials have been shrinking over time, especially after abandoning the peg to USD in July 2005, the capital controls in China are still binding since these interest rate differentials remain large and allow the Chinese government to retain some extent of short-term monetary autonomy. However, their data sample does not include recent period of turbulence. The soar and the slump of the yield differential can not be simply explained by the effectiveness or powerlessness of the capital controls. In this context, further quantitative modeling seems necessary, and via this mean, we aim to fill the gap and shed some light on the efficacy of China's capital controls.

4.2 Quantifying the interest yield differential from covered interest parity

If covered parity condition holds, it means that international capital movement is free from capital controls, so we have:

$$\frac{F}{S} = \frac{1+R}{1+R^F} \tag{1}$$

where F is the forward rate for a given maturity, S is the spot rate (domestic price of foreign currency), R is the interest rate of the home currency, and R^F is the foreign interest rate. When the capital controls bind, non-residents may not have full access to onshore monetary market; or when onshore forward exchange market does not exist or the existing one is not well developed, non-residents cannot make use of the forward exchange contracts to cover the exchange rate risk exposure of their onshore portfolios, giving rising to the Non Deliverable

[12]Having two markets with different capital control regimes, the arbitrage gains derived from CIP on the offshore market represent only the transaction costs, while those derived on the onshore market are associated with the transaction costs and also with capital controls in place in the 1970s in Japan.

Forward (NDF) contract.[13] With this financial instrument, a gain equivalent to that of euro-currency deposit, which does not exist for most of the countries having offshore NDF markets, can be obtained. Assume that the offshore NDF market, which is considered as a benchmark market, is very active and the CIP holds there, we have:

$$\frac{NDF}{S} = \frac{1+i}{1+R^F} \tag{2}$$

where i is the NDF-implied yield rate of the home currency offshore. To the extend that the arbitrage between the onshore money market and offshore NDF market is effectively constrained by capital controls, the NDF-implied offshore interest rate, i, can differ considerable from the interest rate prevailing in the onshore money market, R. This yield differentials (or spread) can be written as:

$$Y = R - i = R - \left[\frac{NDF(1+R^F)}{S} - 1\right] \tag{3}$$

A large and persistent onshore/offshore spread Y indicates the presence of effective cross-border restrictions.[14] Moreover, a positive sign of the yield gap imply appreciation pressures on the home currency in the presence of capital controls and vice versa (Ma and McCauley, 2008).

If we assure that, on the offshore market, the transaction cost of interest arbitrage is non-negligible, we can write it as π, and rewrite the equation (3):

$$\pi = \frac{S}{NDF}(1+i) - (1+R^F) \tag{4}$$

$$Y = R - \left[\frac{NDF(1+R^F)}{S} - 1\right] - \pi\frac{NDF}{S} \tag{5}$$

$$Y' = Y + \pi\frac{NDF}{S} = R - \left[\frac{NDF(1+R^F)}{S} - 1\right] \tag{3'}$$

Y' consists of the pure transaction costs of arbitrage and the yield differentials of Ma and McCauley (2008) which represents only capital controls. This is the variable of interest that

[13] Like standard forward contracts, NDF Contracts fix exchange rates for conversion on a future date. But on the contrary, there is no delivery of underlying foreign currency as in forward contracts. Instead, the net US dollar is settled with a compensating payment made or due based upon the difference between the NDF contract rate and the exchange rate prevailing at maturity. For more information on NDF contract refer to the Foreign Exchange Committee website (http://www.newyorkfed.org/fxc/) and the EMTA website (http://www.emta.org/). For recent development of Asian NDF markets refer to (Ma et al., 2004).

[14] Alternative way to investigate the effect of capital controls is to calculate the price differential of exchange rate of RMB from covered interest parity: assume that the interest rate of RMB offshore is the same as in China domestic monetary market. If the CIP holds in the offshore market, we can derive an offshore spot exchange rate (with equation (1)) which should be equal to the quoted rate in the market. A eventual persistent different of this rate imply the segmented foreign exchange market due to the capitals controls or deviation of currency from its current equilibrium. In fact, this approach aims to verify the law of one price for the external value of the RMB, while the ours focus on the difference of its internal value.

we will calculate and model hereafter. We continue to call it yield differential or deviation from CIP because of the inclusion of the transaction cost π.

As to the empirical approaches relevant to our deviation from CIP, here we only consider those of univariate analysis which study the behavior and the dynamics of π, which is more consistent with our question.[15] Within this branch, we distinguish three mains methods: the first type relies on computing actual deviations from interest parity (see, e.g., Frenkel and Levich, 1975); the second type involves the stationary or unit root analysis of the deviation from CIP (see, e.g., Holmes, 2001). The speed with which deviations from CIP are eliminated is also an indicator for the effectiveness of the capital controls and the extent of financial integration between different countries.[16] A more recent approach consists in assuming and testing the behaviors of deviation from CIP based on the regime (or space) they lie in, by mean of estimating a threshold autoregressive model that we will present next(see, e.g., Peel and Taylor, 2002; Taylor and Tchernykh-Branson, 2004).[17]

4.3 Methodology: Threshold Autoregressive (TAR) model

The TAR model was first proposed by Tong (1978) and further developed by Tong and Lim (1980) and Tong (1983). It is motivated by several nonlinear characteristics commonly observed such as asymmetry in declining and rising patterns of a process, limit cycles of a cyclical time series.[18]

A special (or restricted) case of TAR, called the Band-TAR model, was first applied by Obstfeld and Taylor (1997) for testing the theory of purchasing power parity and the nonlinear adjustment of price.[19] It has been also employed to investigate the validity of CIP by taking into account the arbitrage cost in the financial market (see, e.g., Peel and Taylor, 2002; Taylor and Tchernykh-Branson, 2004).[20] Within the band which means the extent of the transaction costs, the arbitrage will not take place since the covered interest differential (CID) would not bring the excessive profit. The CIDs follow a random walk and will never revert to zero. Outside the band, unexploited profit will trigger the covered interest arbitrage, and quickly reduce the CID to a certain level (the edge of the band), with this process characterized as an autoregressive model (AR(1) for example). A simple version

[15] Accordingly, the approaches with multivariate analysis we called here refer to the studies using regression analysis, (see, e.g., MacDonald, 2007; Taylor and Tchernykh-Branson, 2004)

[16] Higher convergence speeds reflect a quicker convergence to CIP and hence stronger financial integration.

[17] By estimating a band-TAR model, Peel and Taylor (2002) supported the conjecture of Keynes and Einzig(Einzig, 1937; Keynes, 1923) that deviations from CIP in the interwar period did not tend to be arbitraged at all until they were of the order of fifty basis points.

[18] For a brief discussion of theoretical and empirical motivations of this class of model, see, e.g., Hansen (1999).

[19] A standard model with transportation costs implies that real exchange rates should follow a band threshold model where the process is a random walk within the band and mean-reversion outside it.

[20] Levy Yeyati et al. (2009) estimate an augmented Band-TAR model with generalized autoregressive conditional heteroskedastic (GARCH) effect for the cross-market premium of stock price to test the law of one price, and to shed some light on the international financial integration and effectiveness of capital controls during some periods.

of such Band-TAR model may be written as:

$$\Delta y_t = \begin{cases} \rho^{out}(y_{t-1} - c^{up}) + \epsilon_t^{out} & if \quad y_{t-1} > c^{up}, \\ \rho^{in} y_{t-1} + \epsilon_t^{in} & if \quad c^{low} \leq y_{t-1} \leq c^{up}, \\ \rho^{out}(y_{t-1} - c^{low}) + \epsilon_t^{out} & if \quad y_{t-1} < c^{low}, \end{cases} \tag{6}$$

where c^{up} (c^{low}) is the upper (lower) threshold; ϵ_t^{out} is $N(0, \sigma^{out^2})$, ϵ_t^{in} is $N(0, \sigma^{in^2})$, here ρ^{in} could be restricted to zero, and ρ^{out} is the convergence speed outside the thresholds of arbitrage (or inaction).

As showed in Figure 6, during the sample period, there are insufficient data points passing across the lower threshold that is supposed to be negative. This represents the pressure of capital inflows to China and the corresponding bindingness of capital controls. Therefore, we can not identify the band TAR model outlined above. Nevertheless, Taylor and Tchernykh-Branson (2004) point out that this is the case in most emerging markets, hence propose to specify a single upper threshold model. We follow this approach and write the model of the form:

$$\Delta y_t = \begin{cases} \rho^{out}(y_{t-1} - c^{up}) + \epsilon_t^{out} & if \quad y_{t-1} > c^{up} \\ \epsilon_t^{in} & if \quad y_{t-1} \leq c^{up} \end{cases} \tag{7}$$

When c^{up} is known, simple least squares methods can be applied to subsets of data partitioned by the single threshold. In the absence of prior knowledge about the threshold, we can still estimate this model via a grid search of all possible values of the threshold variable (here y_{t-1}) which either minimizes the sum of squared residuals or maximizes the log-likelihood function of the model.[21] For correcting the autocorrelation and the heteroskedasticity prevalent in the residual, we refine the model by adding the lag(s) of the dependent variable and the GARCH effect as did in Levy Yeyati et al. (2009), and rewrite in as:

$$\Delta y_t = 1_{out}\rho^{out}(y_{t-1} - c^{up}) + 1_{in}\rho^{in} y_{t-1} + \sum_{j=1}^{k} \phi_j \Delta y_{t-j} + \epsilon_t \tag{8}$$

$$\sigma_t^2 = \alpha_0 + \sum_{j=1}^{p} \alpha_j \epsilon_{t-j}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-j}^2 \tag{9}$$

where $1_{in}(1_{out})$ is the indicator function and equals to 1 when $y_{t-1} < c^{up}$ ($y_{t-1} \geq c^{up}$) and 0 otherwise. In this specified TAR(2,k,d) model, 2 is the number of regimes, k is the augmented lag length, and d is the delay parameter. As we will show later, we divide our sample into three sub-periods since the structural change and the outbreak of the financial crisis are represented in our data, and set k to 0 or 1 to correct the autocorrelation in the residuals. d is set to 1 for all sub-samples. ρ^{in} and ρ^{out} represent the convergence speed in the no-arbitrage and arbitrage regime, respectively.[22] Moreover, we assume the same error

[21] When the threshold variable for the grid search is the lagged value of the dependent variable with delay d (here $d = 1$), the TAR model is called self-exciting TAR or SETAR model. The Band-TAR model estimated in this paper is a SETAR with some restrictions, but we simply use TAR hereafter.

[22] Once the estimated convergence speed is insignificant (as expected according to the assumption of random walk of transaction costs within the band), we can estimate a restricted model by imposing this coefficient to

terms and conditional variance for both of the two regimes.[23] The number of ARCH and GARCH terms (p and q) could be specified differently for each sub-sample. Generally, a GARCH(1,1) is sufficient for each sub-sample to take into account the heteroskedasticity.[24]

We estimate the outlined model by following the procedure described in Obstfeld and Taylor (1997): to estimate via a grid search on the threshold variable which maximizes the log likelihood ratio $LLR = 2(L_a - L_n)$, with L_a (L_n) being the log likelihood of the alternative TAR model (null AR model).[25] The likelihood function of the above TAR can be written as:

$$L\left(\rho^{out}, \rho^{in}, \sigma^2, c^{up}\right) = -\frac{1}{2}\sum_t [\ln(\sigma^2) + \epsilon_t^2/\sigma^2] \tag{10}$$

Once the TAR model is estimated, we can run a threshold test as a test of specification for discerning the adequacy of the TAR alternative relative to the AR null. As well known in the literature, since the threshold(s) is not defined under the null, the LLR does not follow the standard χ^2 distribution and the standard inference is invalid. One way to resolve this problem is to use the Monte Carlo simulation to derive the critical value of the LLR test (see, e.g., Hansen, 1999; Obstfeld and Taylor, 1997): estimate and fit un AR(1) null model on the actual data $(y_1, \cdots, y_T)$.[26] The empirical distribution of the LLR is then calculated, and used as the inference to judge the alternative TAR model against the AR null. This method suffers from the tail heaviness of the residual which violates the hypothesis of normally distributed residual assumed in the aforementioned Monte Carlo simulation. Even Hansen (1999) propose a alternative simulation approach based on bootstrap,[27] simulating with bootstrapping an augmented AR(1) model with GARCH effect would complicate the traditional Monte Carlo procedure and be costly in time-consuming. Hence, this specification test is absent in this paper for the time being, and we leave it on the agenda for the next version.

4.4 Data

Our sample for computing the yield differential spans from May 29th, 2003 to December 12th, 2010. The short span of the sample arises principally from the availability of the data. The

zero.

[23] In other words, here we assume that the threshold effect exists only in the mean equation. For the case of distinct variance, see, e.g., Obstfeld and Taylor (1997); Taylor and Tchernykh-Branson (2004); and Glosten et al. (1993) for a threshold (or asymmetric) volatility (GARCH) model. Another extension is to relax the assumption of same error terms and conditional variance in the different regimes, and to specify a model with threshold effect in both the mean and the variance equations.

[24] Generally, lower orders such as (1,1), (1,2), and (2,1) are adopted in application since higher orders models are difficult to estimate and to interpret.

[25] Maximizing this ratio equals the maximization of the log likelihood function of TAR alternative mentioned earlier. To ensure an adequate number of observation on each side of the threshold (or in each threshold space), here we exclude the highest and the lowest 15% of the threshold variable from the grid search, as widely did in practice.

[26] For example, 600 simulation are generated for the fitted model. Then start each simulation with $y_{-b} = 0$, end at y_T, and discard the first b (set to 50) to avoid the initial value bias. And then estimate a TAR model as described above for each simulation and calculate the corresponding simulated LLR.

[27] Instead of supposing other possible forms of distribution, such as the Student-t distribution, the Generalized Error distribution (GED) and the skewed-Student distribution.

onshore-offshore Chinese (RMB) yield differential is derived from the RMB spot rate, the 3-month RMB NDF rate, the 3-month US dollar LIBOR rate and 3-month PBOC (People's Bank of China: Central Bank of China) bill rate (proxy of the onshore interest rate).[28] Datasets used for calculation, estimation and hypothesis testing are of daily frequency and extracted from *Datastream*. We divide the whole sample into three sub-samples as following: the first period (5/29/2003-7/20/2005), the second (7/21/2005-8/8/2007) and the third one (8/9/2007-2/12/2010), principally based on the historical events. Two eventual structural changes are documented in the literature. The first event was the reform of the Chinese exchange rate regime taken into effect in July 2005, which ended the peg of RMB to USD and created a management float based on a basket of currencies.[29] The second one was the recent financial turmoil bursted in August 2007 with August 8th considered as the timing of the break (see, e.g., Baba and Packer, 2009, and the references therein).

4.5 Result and discussions

These yield differentials are calculated with equation (3'), and plotted in Figure 6. The substantial and persistent RMB yield differential would, a priori, indicate large transactions costs and the implied effectiveness of capital controls.[30] Concerning the speed of reversion to "equilibrium", we rely on a TAR model with upper threshold as described above. Before presenting the results of estimation, we implement some preliminary analysis.

4.5.1 Unit Root (UR) Analysis

If the yield differentials have a unit root, it indicates that these deviations are persistent and not mean-reverting, meaning the effective capital controls; while the stationary characteristics represents a process of returning to equilibrium level, via the activity of arbitrage in the market. Furthermore, the speed of the convergence can be calculated by estimating the autoregressive parameter of the stationary process validated. A relatively low speed can still imply the binding control on capital flows. But a mean-reverting with high speed may indicate the ineffectiveness of capital controls or a higher degree of financial market integration.

Following the traditional practice in the literature, non-stationarity check is executed before specifying the linear (or nonlinear) characteristic of the series. However, standard UR tests are known to be biased towards the non-rejection of a unit root when they are applied to time series with non-linear dynamics.[31] Numerous UR tests with various alternative hypothesis of non-linearity are proposed to increase the power of the UR test. Here we only apply the generalized least squares (GLS) UR test (NP test hereafter) of Ng and Perron (2001) and the Momentum-TAR test of Enders and Granger (1998) which assumes a M-TAR

[28] For the reason to choose these proxies and for a detailed description of their characteristics, see, e.g., Ma and McCauley (2008).

[29] However, several authors have doubts on the real effect of this change (See, e.g., Goldstein and Lardy, 2006).

[30] Table 3 summarizes the means and t-statistics of the measured yield differentials for different sub-periods.

[31] For the low power of traditional tests of unit-roots in the presence of asymmetric adjustment, see, e.g., Enders and Granger (1998).

model in the alternative. Our statistical inferences are mainly based on the latter, while the former is for comparison.[32]

The two RU tests are applied to the whole sample and also to each sub-sample, with the results reported in Table 6. No surprisingly, for the whole sample, both of them reject the RU null, since the tests become biased facing the structural changes. To adequately model and carefully investigate the series of the yield differentials, we also apply these two tests to each sub-sample, respectively, instead of using a UR test with structural changes (breaks).[33] The results, this time, do not always give the same evidence: the NP test can not rejected the UR null for either of the three sub-periods (see Table 6), implying the absence of the mean reverting of yield differential, while the M-TAR test only accepts the UR for the third sub-period. Based on the results of M-TAR test, during the first two sub-periods, the yield differentials are stationary but nonlinear. As to the third one (the period the financial turbulence), even with the same conclusion of the two tests, we accept the non-stationarity of the yield differential with caution. [34] However, what is unclear is the reason of this violation of interest rate parity: is it the liquidity risk or the strengthening of the capital controls or even both (see Figure 3, 4)? We will provide an answer at the end of this section.

4.5.2 AR v.s.TAR

We have justified our choice of TAR model with theoretical arguments, and now we try to present the empirical justification. Could we reject the linearity? To answer this question, we apply several widely used linearity tests: the BDS test (Brock et al., 1987, 1996), the F-test of Tsay (1989) and the sup-LM test of Hansen (1996). Since they assume that the series are independently and identically distributed (iid), we build an AR(p) model for each sub-sample to assure that the residuals contain no serial correlation. Because the heteroskedasticity is prevalent in our series as is common for high frequency financial data, we refine our model by adding the GARCH effect, leading to the homoskedastic standardized residual. Then we check the linearity of the standardized residual by using the aforementioned linearity tests.[35] Specified models and their estimated coefficients are presented in Table 5 and the results of linearity tests in Table 6.

As these results do not allow us to obtain unambiguous inference, we provide some possible explanations. On one hand, as opposed to our expectation, the linearity can not be rejected in the most cases; BDS test reports, only for the third period, the nonlinearity that

[32] By means of Monte Carlo experiment, Choi and Moh (2007) showed that the M-TAR test and $Inf - t$ test due to Park and Shintani (2005) outperform the others, and have reasonable power of discerning the unit root.

[33] See, e.g., Bai and Perron (1998); Lee and Strazicich (2003) for this class of UR tests. Furthermore, in an earlier version, the break was found at the period of reform via the UR test of Perron (1997) in which the timing of the single break is endogenous.

[34] The results of Choi and Moh (2007) also indicate that the often claimed "unit-root first, nonlinearity second" approach will be of reduced merit when the associated AR parameters take large values which makes challenging for the extant technical devices to detect stationary of processes with high AR parameter regardless of linearity. They suggest that what determines the power of unit-root tests is not the specific type of nonlinearity in the alternative model, but how far the alternative model is away from the unit-root process. The procedure proposed by Harvey and Leybourne (2007) provides an alternative of testing the linearity before the checking of UR.

[35] To have correct size, BDS test is applied to logarithm of squared standardized residuals, instead of standardized ones (see, e.g., de Lima, 1996).

itself can not be proved as the specific TAR form. In other words, the TAR alternative may be misspecified since the threshold nonlinearity disappear once the GARCH effect has been taken into account. On the other hand, fail to reject the linearity may be related to the estimated coefficients of the conditional variance terms (see the coefficients of variance equation reported in Table 5). The sum of α_1 and λ_1 superior to 1, indicates the non-stationarity in volatility which may affect the consistency, convergence rates and asymptotic distributions of the coefficients.[36] Based on these facts, non-rejection of linearity, non-stationarity of the volatility in linear autoregressive model and the absent of an powerful specification test for discerning the competing models, we focus on the specified TAR model and take its linear counterpart for comparison.

Following the method described in subsection 4.3, we estimate the threshold and the TAR model using the same specification as to the AR-GARCH model. Then some restrictions are imposed according to significance of estimated coefficients. The results are reported in Table 7.

We discuss the results of estimation for each sub-periods. Before the peg regime of RMB has been abandoned in July 2005, the threshold estimated is about 200 base points, which approximates its unconditional mean (367 points, see Table 3) indicates the extent of the capital controls and pure transaction costs. Following a random walk when below the threshold, the yield differentials revert to it under the force of the arbitrage when they go cross through the threshold, but with a low speed (Half lift of 36 days). The AR model reports a shorter HL of 21 days, while a unconditional mean (9.2) far below its unconditional one can not be easily interpreted. However, both of them show a long HL of mean-reversion and the non-stationary volatility, allowing us to concluding on the market segmentation and the effectiveness of the capitals controls. An autonomy of monetary policy and a fix exchange rate regime are maintained with the effective restrictions on cross-border capital flows.

After the new managing float regime has been introduced, the threshold given by the TAR model has, opposite to what we expected, increased to about 270 base points, even exceeding its reduced unconditional mean. Nevertheless, an half life (HL) of only 3 days indicates a more unified and active monetary and exchange market where the unexploited profit are quickly reduced by arbitrage to the threshold once the yield differential exceeds it. Contrasted to the TAR model, the linear AR one reports an much longer HL (about 14 days), which itself decreased relative to that of the first sub-period. Moreover, even the GARCH effect persists the volatility become stationary according to the results of both Models, showing another evidence of the more liquid market.

Here we try to give some possible explanations for the increased threshold and the far shortened HL. On one side, the higher threshold implies that for this sub-period as a whole, the capital controls are still binding; and that the extent of controls are strengthened. This is mainly due to some policy measures introduced later in this sub-period to stem the short-term cross-border flows. This result is consistent with the explanation that for the initial

[36] Petrucelli and Woolford (1984) show that the necessary and sufficient conditions for the stationarity of δy_{t-1} is: $\rho^{in} < 0, \rho^{out} < 0$ and $(1+\rho^{in})(1+\rho^{out}) < 0$ for any value of c. In our case, the ARCH and the GARCH effect are significant for all sub-samples, while the volatility is stationary only in the second sub-sample.

episode of the new regime, the narrowing of the onshore and offshore RMB yield differential is a chosen outcome of policy rather than as a waning effectiveness of the capital controls interpreted by market observers (see Ma and McCauley, 2008), which is used to interpret the much lowered unconditional mean after the regime change. On the other side, the quick mean-reverting process (or a shorter HL) implies that once the unexploited profit appears and exceeds the transaction costs and risk associated to capital controls, the active arbitrage funds take the risks and assume the costs to obtain the excessive part of the profit, even the capital controls are binding. This action reduce quickly the yield differential to the level of the threshold. If the capital controls can be bypassed, it means to some extent the ineffectiveness of the restrictions and it triggered the strengthening of them by the Chinese government.

4.5.3 Capital control and Financial crisis

Entering into the period of turbulence, the spiral upwards and downwards of yield differential could not be totally explained by the eventual strengthening of capital controls of the Chinese government. A glance at the countries with highly financial integration (Figure 3) and some Asian economies with NDF markets (Figure 4 and Table 8) reveals some common factor(s) of abnormal behavior of the yield differentials.

In this context, it is implicitly assumed that the effects of the financial turmoil on the evolution of yield differentials can be represented by a few (or even one) latent common factors F, e.g., the liquidity risk.[37] Here we use the principal component approach to estimate this latent factor for six Asian economies having NDF market.[38,39] Then, we regress the raw data of yield differential of third period over the first factor that we assume to be the variations (of transaction cost) triggered by liquidity risk attributed to the financial crisis. The residual net of this principal component is the "deflated series" with which we estimate the alternatives models and implement the hypothesis testing.

This corrected yield differentials are plotted in Figure 6, accompanied by the whole sample raw data. The volatility (the standard deviation) is largely reduced to the half of that derived from the original data (see also last line of Table 3), but still higher than the tranquil sub-periods (the first two). However, during the period of turbulence, the yield differentials are mean-reverting, supported by both of the UR tests (see last line of Table 6). An HL of about 13 days (slightly shorter than the second sub-period) confirm this result, even the estimated AR model with GARCH effect reports a non-stationary volatility. Contrasted with the model specified with original data, the HL are much more shortened once the volatility are deflated. In other words, when we include the liquidity risk premium as an additional transactions costs when liquidity declines, incurred extra volatility make the

[37] As to a further investigation of the possible economic determinants of this common "crisis" factor, it is out of scope of this paper. The liquidity risk is identified as one main factor of the soar of transaction costs in the financial market during the period of financial crisis (see, e.g., Baba and Packer, 2009; Levy Yeyati et al., 2009).

[38] China mainland (CNY), Indonesia (IDR), India (INR), Philippines (PHP), South Korea (KRW) and Taiwan (TWD), with the abbreviation of their currency in parenthesis.

[39] The results are reported in Table 11; Alternative way to estimate the latent common factor is to use a dynamic factor model based on Kalman filtering, this could be an extension of this version.

mean-reverting process much slower, and consequently, creates an illusion that the longer HL results from the tighter and more effective capital controls.

Our TAR model gives the different results: the threshold has increased by 80 base points (see Table 7) and the HL (about 4.6 days) sightly extended, indicating that the extent of the capital control has been strengthened by the Chinese government. For instance, in August 2008, the issued regulation requires the companies with FDI to submit their reports on the verification of capital denominated in foreign currency, aiming to limit the inflows of hot money via the aforementioned FDI channels. As to the HL, whatever estimated by AR or TAR model, it changes only slightly relative to that of the second sub-period, implying that the market are more and gradually integrated with the advent of new currency regime, even maybe partly affected by the financial turbulence. The introduction of the RMB currency swap market in August 2008 and that of the foreign exchange dealer system into the interbank foreign exchange market in October the same year can be interpreted as the purpose of Chinese government to further develop and deepen the foreign exchange market and to increase the liquidity of the associated derivative market.

5 Complementary evidence from cross-border capital flows: long horizon

The measuring of the cross-border capital movements could provide an intuitive impression about the intensity of capital controls. The conventional way lies in, by analyzing the details of balance of payments, measuring capital flows of its main categories and finding the source of capital flows (or volatility) and relative regulation to evaluate the effectiveness of capital controls. Through examining the gross cross-border flows (via the current and capital accounts) in China, Ma and McCauley (2008) conclude that the large and growing size of cross-border flows would suggest limited effectiveness of capital controls or leaky capital account in China, and that it is the capital account flows which increase quickly and gain relative importance, especially the non-FDI capital flows (hot money).[40] They identify the channels through which hot money flows into China: the current receipts and payments in the current accounts, domestic banks' lending and/or borrowing with their overseas counterparts under *other investment* terms of capital accounts, and unrecorded flows in the *errors and omission* terms.[41]

As Ma and McCauley (2008) mentioned, the intensity of capital controls over different types of capital flows may vary, and consequently, capital flows differ in the different categories or sub-categories of capital account, it is not obvious to assess directly if the capital controls are effective. In order to circumvent this difficulty, we try to obtain some evidence from another angle. As one main purpose of capital control is to shape the size and the composition of capital flows, effective capital control could be confirmed once this goal is achieved. As Zhang (2003) mentioned "at present, appropriate action should be taken to

[40]These so-called "hot money" aims to pursue onshore yield differential between RMB and foreign denominated deposit, or to bet on the RMB appreciation.

[41]The purpose of the second channel is to accommodate decisions of onshore non-bank depositors and borrowers (Chinese households and firms) in foreign currency.

encourage inflow of long-term capital while short-term capital inflows and capital flight need to be restricted". It implies that if the capital control policy is effective, the composition of the capital inflows evolves in favor of long-term inflow and the capital flight will be minimized. In this section, we focus on these two indicators to find some evidence of effective capital controls.

5.1 Measuring of long-term (short-term) cross-border capital flows

Before investigating the two indicators, we present some stylized facts of capital flows. According to their natures or functions, capital flows (CAP) basically consist of foreign direct investment (FDI), portfolio equity and other investment, which itself includes commercial lending and official debt flows.[42] But here we focus on their maturities and investigate the components of capital flows by using 3 proxies: the total normal capital flows (hereafter TNORM), the short-term capital flows (ST) and the long-term capital flows (LT).[43,44] However, these two components are not directly observable; we aggregate them respectively in the following way: short-term capital flows are derived by adding up the balance (net) of the lines (Line 35, 44, 45, 48, 49, 52, 56, 59, 60, and 63) of Balance of payment provided by SAFE. Long-term capital flows are derived by adding up the balance (net) of the lines (27, 32, 34, 37, 39, 44, 47, 51, 55, 58, and 62) of Balance of payment.[45,46]

We begin with examining the total normal capital flow for the entire period from 1982 to 2007 (excluding year 2000), China has registered an annual average of 22504 million dollars (inflow), net total flows of normal capital add up with the increasing sub-period averages to a high net volume of capital inflows of 563 billion USD (Table 9).[47] This fact results mainly from the huge and continual long-term capital inflows with an accelerating pace, averaging approximately 25706 million USD for the entire sample (see Table 9).

This result is consistent with the capital control policy of Chinese government: to facilitate the long-run capital flows into China. However, the short-term capital outflows concentrated in the period of 1982-1999, reaching the peak during the period of Asian financial crisis. This tendency had not been reversed by inflows of the sub-period 2001-2007 until certain measures of capital controls had been implemented. Nevertheless, it records an average of 3337 Million, a total of 83413 Million USD capital outflows. The coexistence of substantial and accelerated inflows of long-term capital and moderate short-term outflows and inflows during some sub-periods can be explained as follows: on one hand, the dynamics of strong economic growth in China after its economic opening and especially its entering

[42] Prasad and Wei (2005) examine the capital inflows of China by following this classification.

[43] $TNORM$ refers to the total net capital flows reported in financial account of the balance of Payments.

[44] Fedderke and Liu (2002) apply these indicators to investigate the capital inflows and outflows of South Africa.

[45] The lines for calculating ST correspond to *Asset and liability of money market instruments; short-term assets of trade credit, loans; currency and deposits assets, other short-term assets; short-term liability of trade credit, loans; currency and deposits, other short-term liabilities.*

[46] The lines for calculating LT correspond to *Foreign direct investment; assets of equity securities and long-term debt securities (bonds and notes); liabilities of equity securities and long-term debt securities (bonds and notes);long-term assets of trade credit, loans; other long-term assets; long-term liability of trade credit, loans; other long-term liabilities.*

[47] Short-term and long-term flows in 2000 can not be derived because of missing subsidiary records of short and long flows in the financial account.

into WTO imply a higher rate of return of capital for the long-term investments than in other emerging markets; on the other hand, the greater exposure to the exchange rate risk resulting from the lack of hedging instruments in the foreign exchange market, and the exposure to the political risk coming from the perspective of further capital controls both lead to short-term outflows; the speculation on the revaluation or devaluation under a less flexible exchange rate regime incurs short-term inflows and outflows. However, the net short-term flows have been less volatile than the long-term and the total normal capital flows in both of the entire sample and each sub-period (see Table 9).[48] One simple possible explication of this limited volatility is the effective capital control on gross flows.

Figure 6 shows the evolution of $TNORM$ of China during the period 1982-2007, also their short-term and long-term components. The volatility and volume of capital flows increased substantially from 1992 to 2007 along with the progressive openness of the current account and capital account. The evolution of capital flows is more or less consistent with the intension of Chinese government. Does this fact prove the effectiveness of capital controls in China? To give a definite answer to this question, we examine two indicators aforementioned: the composition of capital flows.

5.2 Composition of gross capital inflows

Following Edwards (1999) who showed some evidence of Chile's capital control effectiveness relying on the composition of capital inflows, we first calculate the long-term short-term composition of the capital inflows of China.[49] Due to the fact that the statistics of gross short-term flows and long-term flows exist only for the period from 1982 to 1997, inflows for other years are aggregated in the same way as for net capital flows (long and short term), only replacing the net flows (in balance) by the gross inflows (in credit).[50] The volumes and the percentages are reported in Table 10 and Figure 7.

Table 10 and Figure 7 present several interesting points. First, regardless of the maturity of the capital inflows, the "decade" average of gross capital flowing into China during the 21^{st} century have sharply increased relative to 1990s, this is also the case for the inflows in 1990s if compared with its precedent decade. However, both of the level and the speed of capital inflows are time-varying: from the 1980s to 1990s the long-term inflows had taken the lead with an increase of 6 times more, while they have been caught up by short term one since the advent of the new millennium, which could be illustrated by their respective share to total capital inflows. Secondly, the maturity composition (in percentage) of capital inflows has fluctuated a lot: long term inflows prevail in the 1980s and continue to increase their share, peaking at mi-1990s. This predominance was kept until 1998, after that the share of the short-term inflows began to augment, especially in recent years. The turning around of the time-varying tendency of long term (short term) inflows was showed in Figure

[48] Except the period 2001-2007 when the standard error is greater than that of TNORM

[49] One of the explicit objectives of capital controls in Chile is to slow down the volume of capital flowing into the country and to tilt its composition towards longer maturities. Here the short-term flows have the maturity less than one year.

[50] We should be cautions when interpreting the result since the published Balances of Payments of China from 1982 to 1996 are prepared under the 4th edition of the IMF Balance of Payment (BoP) Manual, while those since 1997 are prepared under the 5th edition of the IMF BoP Manual.

7. Third, the variation of the short term inflows is higher than long-term ones except the period of 1990s.

To sum up, these findings show that more and more long-term foreign capital (especially via the form of FDI) enter into China, whether quickly or slowly, implying that the policy of encouraging long-term capital inflows has been achieved under the current regime of capital controls; on the contrary, the rising share of the short term capital inflows and their higher level in recent years seem not to conform with the goal of restricting short term capital inflows. With the reading of capital flight, we complete our evidence of the effectiveness of capital controls.

5.3 Capital flight

Regardless of the mains sources (newly rich Chinese individuals and State-owned enterprises), there has been an increasing concern that a large portion of dramatic increase of capital inflows have flowed out again in the form of capital flight (Wu, 1993; Wu and Tang, 2000), since the capital flight may induce an unnecessary increase of a country's foreign debt, undermine the tax, and even result in a net real capital transfer out of the country (Gunter, 2004; Khan and Haque, 1985).[51] According to Wu and Tang (2000), what alarmed Beijing to action in 1998 (The advent of lots of policies of capital control is the evidence) was that foreign exchange reserves had stagnated at around 140 billion US$ in the first eight months of 1998, despite the healthy FDI inflows and large trade surpluses. The weak increase of foreign exchange reserve and inferred large capital flight made Beijing realized that this situation could potentially have a detrimental effect on the stability of the RMB. It was only when the stability of the RMB and the credibility of the central government, was perceived to be in danger, did Beijing act to re-impose existing rules and/or to plug loopholes.

Based on various methods, previous studies have estimated the volume of capital flight from China.[52] Seeing that different definitions of capital flight have given up various measurements, here we simply focus on one indicator of the capital flight: the *errors and omissions* term (E&O) of balance of payments. Specifically, if capital controls were ineffective, illegal movements of capital take place and would normally show up as components of errors and omissions in the balance of payments statistics (Liu and Otani,2005). Large swings of this term are normally associated with the movements of speculative funds that move illegally across borders seeking unexploited profits, rather than the statistical errors and omissions, which are not expected to change dramatically at least in the short-run. Positive errors and omissions mean illegal capital flowing into the country and negative values imply the illegal capital outflows. Therefore, E&O terms could be seen as a general measure of unrecorded capital flows (Ma and McCauley, 2008), with negative ones being regarded as a first approximation of the capital flight.[53]

[51] A common definition is that the capital flight is composed of funds fleeing across national borders in search of sanctuary haven (Brown, 1992).

[52] For examples, Balance of payments method that is credited to Cuddington, residual method (Gunter, 2004; GUNTER, 2004), residual method based on different estimates of China's external debt (Wu and Tang, 2000), and adjusted residual method (Gunter, 2004), etc.

[53] They have given a though explanation of fluctuation of this residual.

Large and increasing negative E&O terms concentrate in the 1990s, with the size and the tendency of capital flight showed in Figure 6.[54] This implies that the capital control is not effective to restrict the capital flight. The first decade of 2000s reverses the direction of E&O terms which fluctuate much more since the new millennium. However, substantial positive E&O terms indicating the capital inflows cannot justify the effectiveness of controls on capital flight either, let alone the large negative number in 2005 and 2006.[55] The unprecedent capital flight in 2008 reflect well the repatriation of foreign investment funds during the recent financial crisis, and indicate the lossing of effective capital controls on the capital flight.

To sum up, several measures of various capital flows patterns presented in the section give us different evidences of capital controls for achieving the goal of shaping size and composition of capital flows. However, the two indicators (the composition of capital flows and capital flight) show that the capital controls are not always effective.

6 Concluding remarks

This paper finds that China's capital controls are less effective than before facing the growing market forces in China's monetary and foreign exchange market, and also the impact of global crisis dated to 2007. We observe the sizable and volatile cross-border flows as well, whether in illegal way or in disguised form. However, they are still working for some goals of Chinese government, especially to prevent from equalizing the onshore and offshore NDF-implied RMB interest rate.

Further research may be extended to China's security markets and foreign exchange market for obtaining other evidences of effectiveness of capital control, or evidence reflecting the deepening of these financial markets. Whatever the field of study, if China really attempt to further open its capital accounts and to make some concrete steps, the power or the effectiveness would be weakened for sure, at least for some purposes. We have already witnessed the incapacity of capital controls to withstand the financial turmoil in the West in that the impact of this financial crisis on China and his Asian trade partners is channeled via the real economy (trade sector). Thus the administrative control system should concede to a more flexible and market-based supervising system which may promote and facilitate a more balanced growth regime.

[54] The determinants of these outflows are identified in the literature: the high inflation during the period of 1995-1999, the Asian financial crisis, and the expectation for the RMB depreciation.

[55] On the contrary, this indicates again the limited controls on short-term capital flowing into China.

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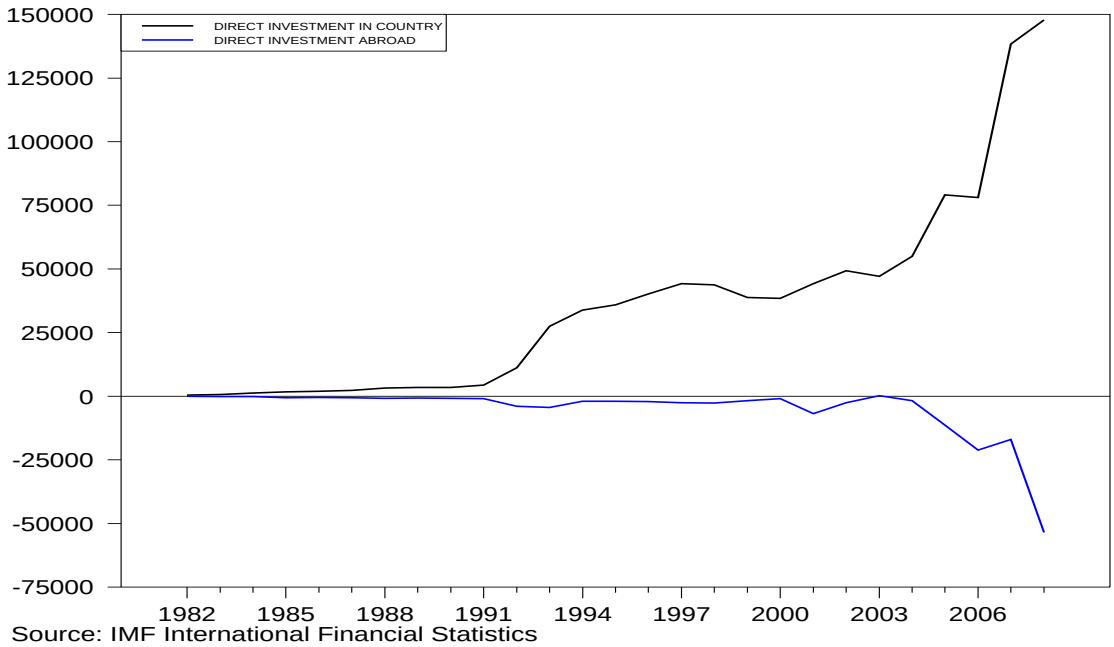


Figure 1: Foreign Direct Investment inflows and outflows of China from 1982 to 2008 (Million USD, current price)

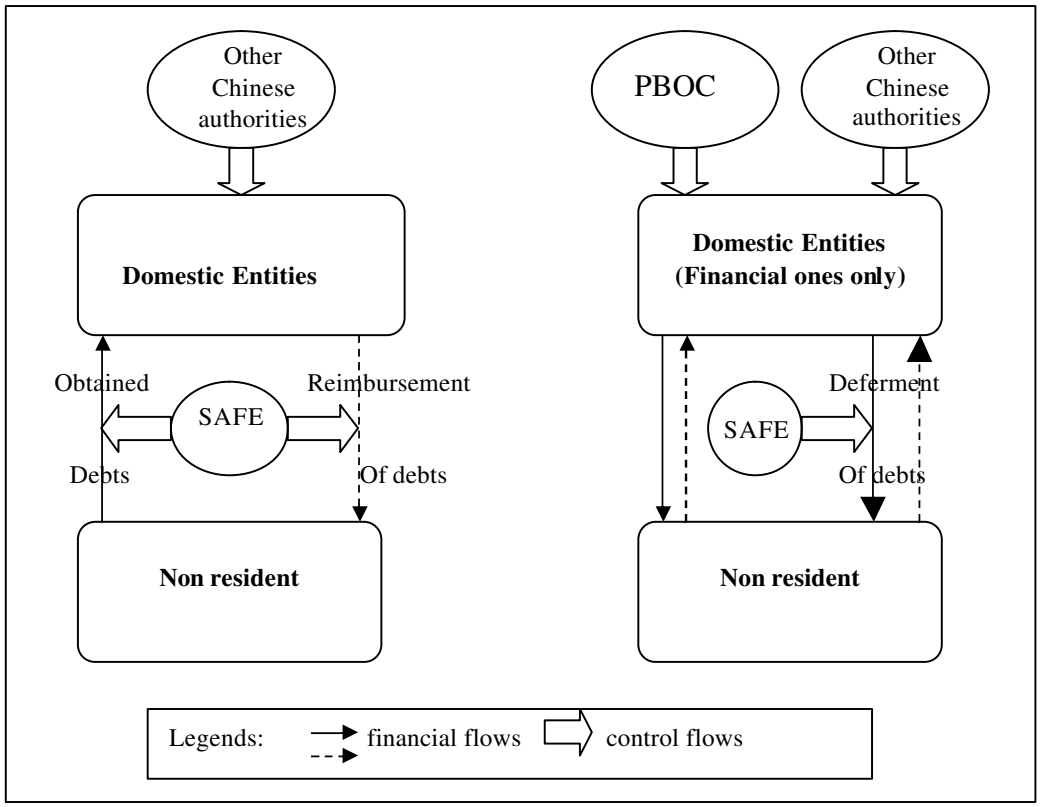


Figure 2: Mechanism of Control for cross border borrowing and lending

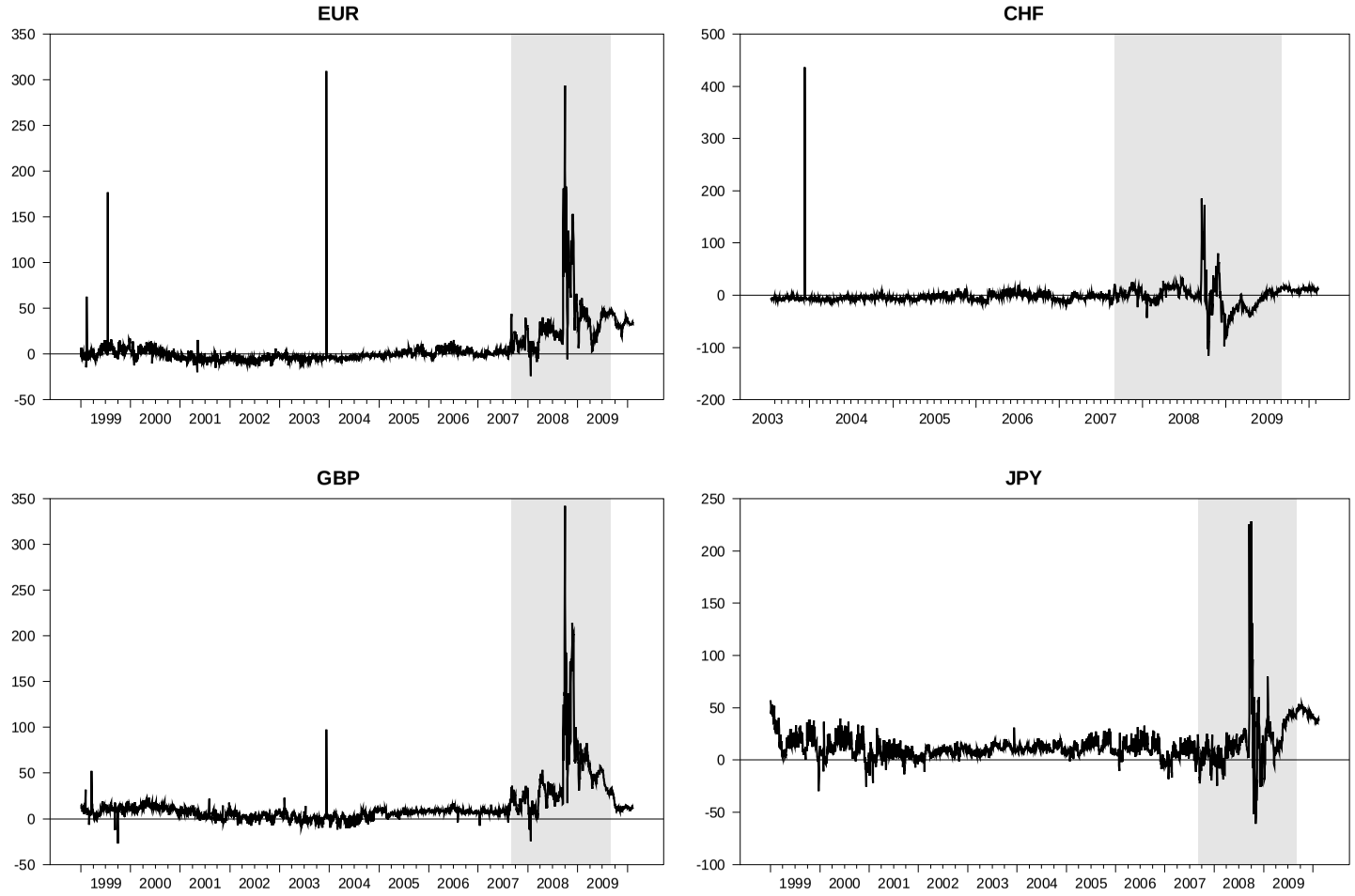


Figure 3:

Source: Datastream and authors calculation

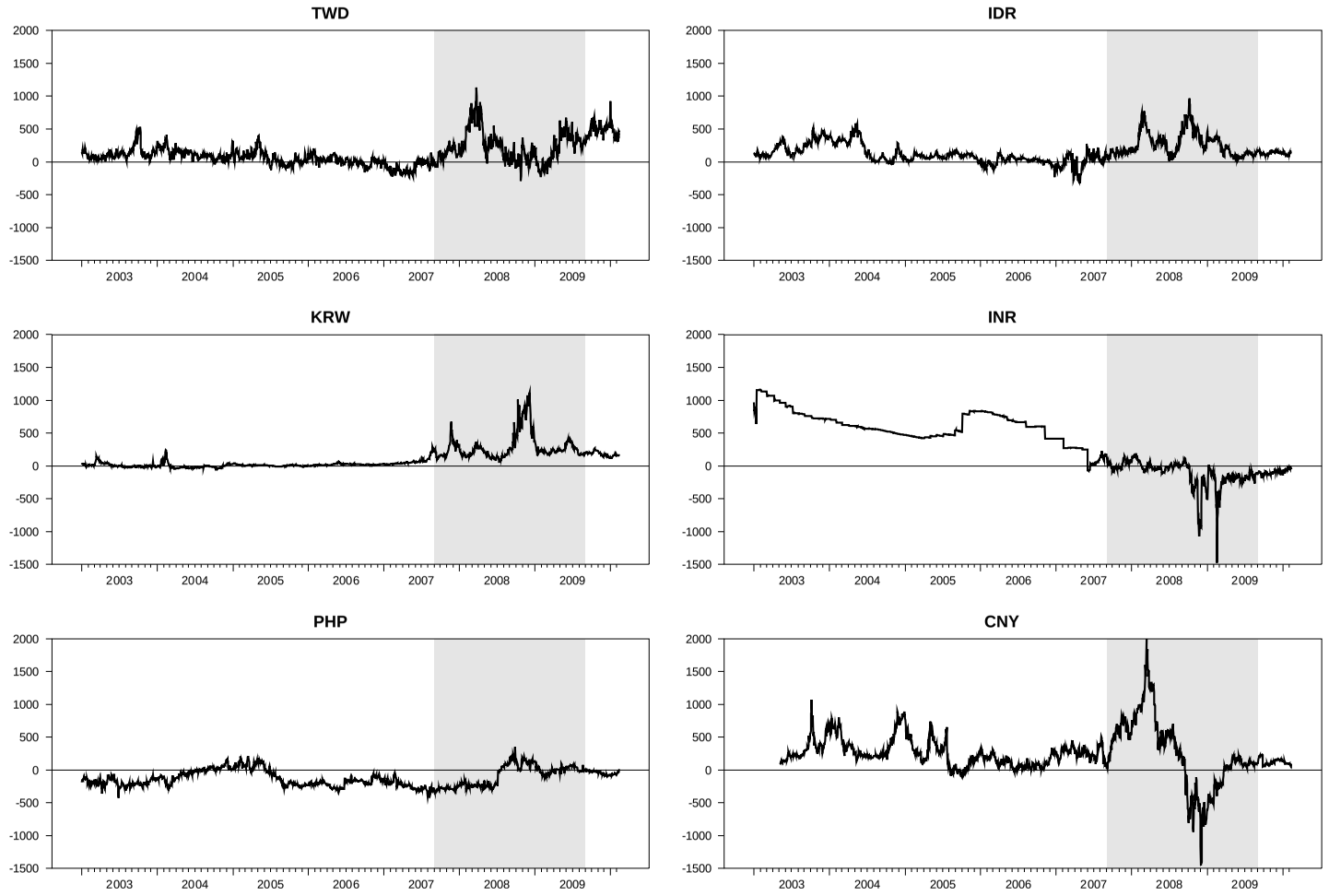


Figure 4:

Source: Datastream and authors calculation

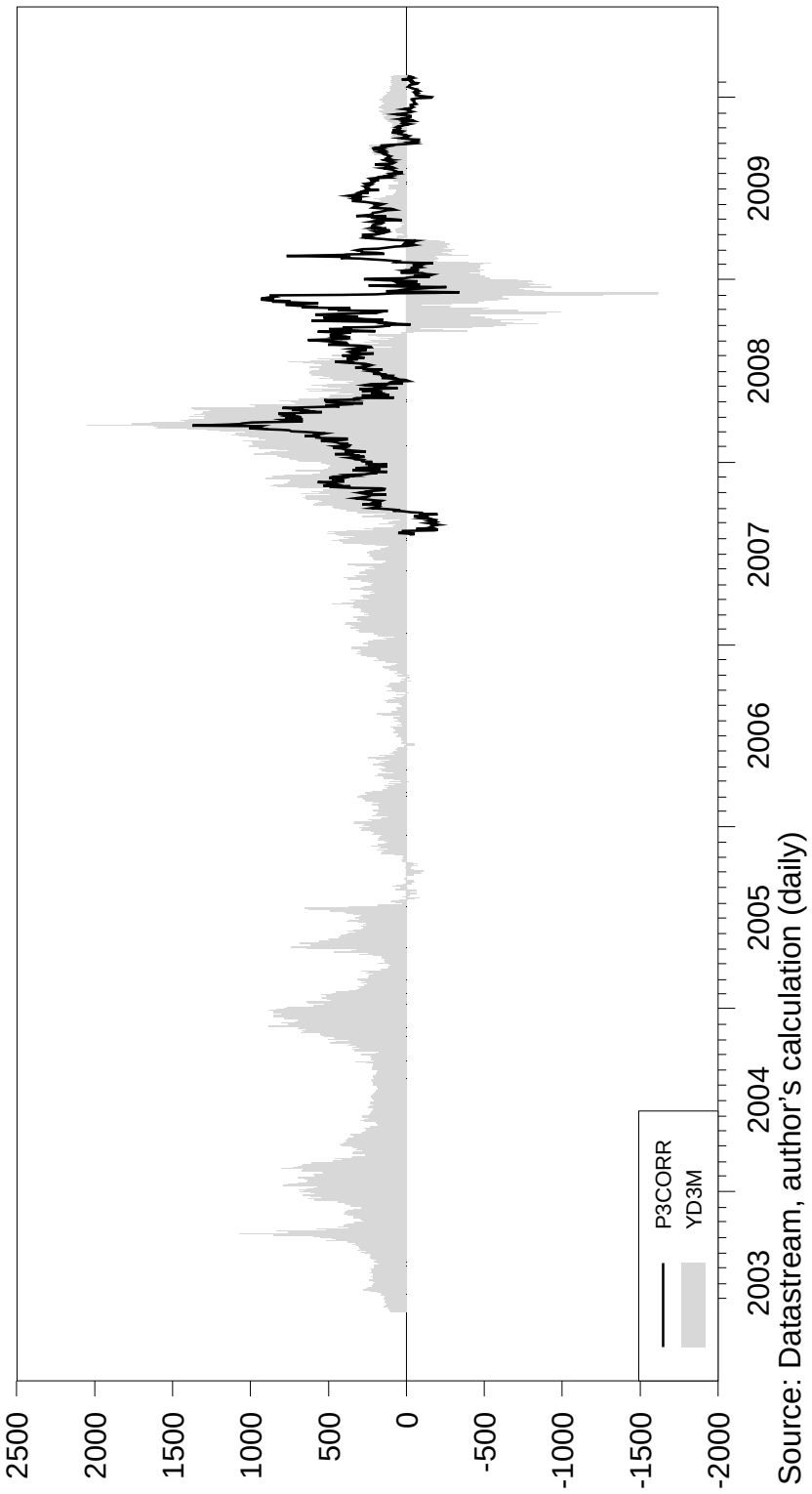
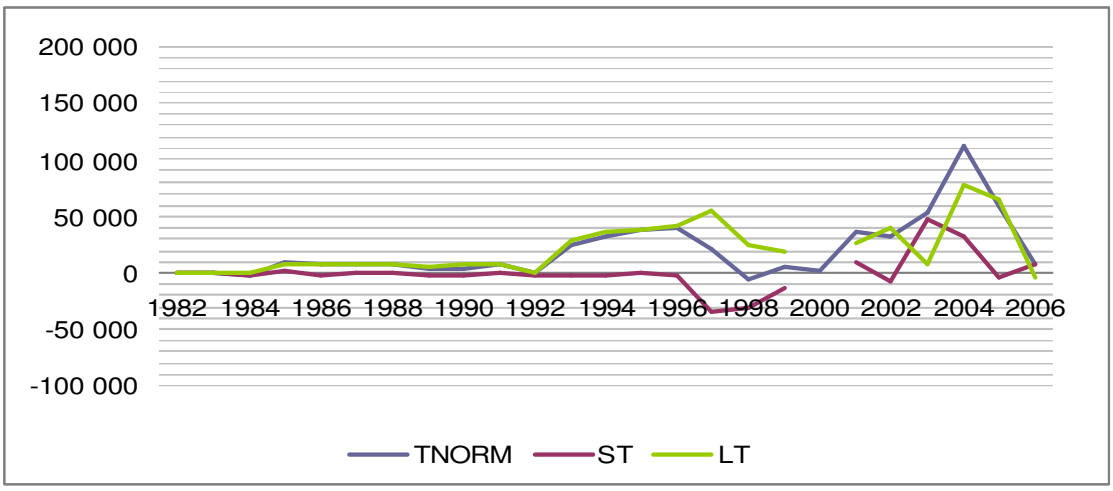
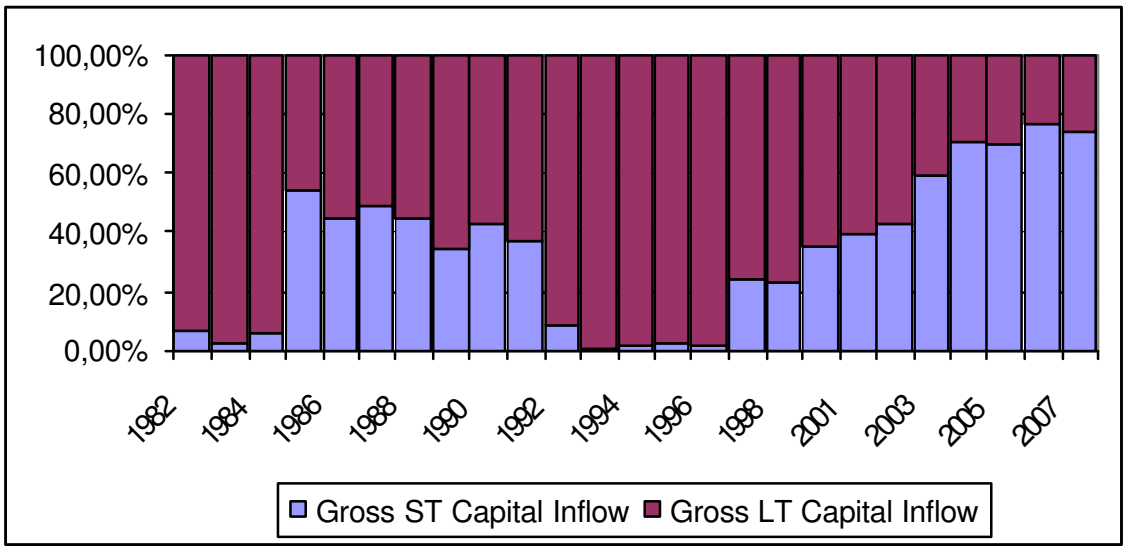


Figure 5: Interest Yield Differentials of RMB



Source: Balance of Payment from State Administration of Foreign exchange (SAFE), author's calculations

Figure 6: Normal capital flows: short-term and long-term flows 1982 to 2007 (Millions U.S. dollars)



Source: Balance of Payment from SAFE, author's estimation

Figure 7: Composition of capital inflows

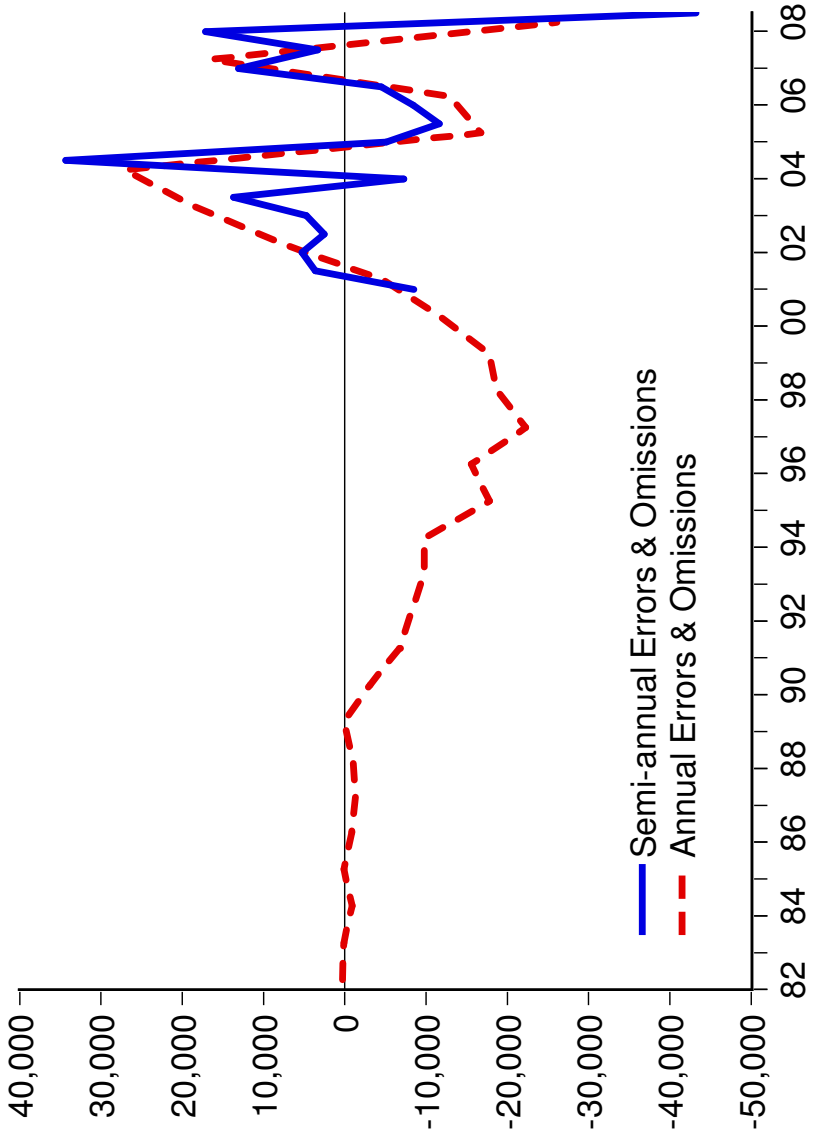


Figure 8: Errors and Omissions of China from 1982 to 2008 (Million U.S. dollars)

Table 1: Styles of capital controls in China

Methods:	Direct or administrative control[a]
Direction of control:	Inflows, Outflows
Range of Control:	Generalized restrictions
Maturity:	Short-term

Note: [a] The indirect market-based method has been implemented in the form of dual exchange rate regime until the unification of exchange rate regime in 1994.

Table 2: The source of foreign debts of China

Debtors	Creditors
Ministries under the State Council	Foreign Governments
Chinese-funded Financial Institutions	International Financial Institutions
Foreign-funded Financial Institutions	Foreign Banks and Other Financial Institutions
Credit of Foreign-funded Enterprises	Buyers
Chinese-funded Enterprises	Foreign Exporters, Enterprises and Individuals
Others	Bonds Issued Abroad
Trade Credits	Trade-related Credit
	Non-resident Deposits
	International Financial Leasing
	Liabilities to be Paid with Foreign Exchange in Compensation Trade
	Trade Credits
	Others

*S*ource: SAFE

Table 3: Summary statistics of RMB yield differentials (3M)

Period	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Obs.**
Whole	249.156	351.886	-1618.882	2052.697	1769
$1st$	366.790	192.988	100.289	1072.327	577
$2nd$	154.455	123.653	-108.764	655.957	535
$3rd$	222.961	518.072	-1618.882	2052.697	657
-	222.961	253.019	-340.988	1372.415	657

Table 4: Stationarity

Period	N-P ADF model[a]			M-TAR Model	
	MZa	MZt	Lag	ϕ^*	Lag
Whole	-14.8024**	-2.7204**	12	4.3266*	12
$1st$	-5.0047	-1.4061	5	5.5520**	8
$2nd$	-1.0801	-0.7262	8	4.8262*[b]	1
$3rd$	-3.7493	-1.3353	12	1.3486	12
-	-12.1675**	-2.4665**	3	6.7896**	2

[a] For Ng-Perron test, only intercept is included in the model.
[b] M-TAR test is run on the demeaned series. Lags are auto-selected by minimizing the AIC criteria. To ensure the estimation run over the same sample for each sub-period, we fix the number of first usable observation as the sum of k-max, the times of first difference of dependent variable and 1.
[c] When we discard the first ten points of this period (because of their abnormal behavior due to the beginning period effect of the new exchange rate regime), the power of the test is increased to 5%.

Table 5: Autoregressive model with asymmetric GARCH effect

	AR(1) with Asymmetric GARCH(1,1)							Ljung-Box Q-stat.	
	Cst	ρ	HL	k	α_0	α_1	λ_1	SR	SSR
$1st$	9.211	-0.033***	20.66	0	28.349	0.479	0.742	0.34[10]	0.17[10]
	(0.000)	(0.002)			(0.006)	(0.000)	(0.000)	0.87[20]	0.21[20]
$2nd$	8.054	-0.049***	13.80	1	347.656	0.180	0.689	0.21[10]	0.19[10]
	(0.005)	(0.001)			(0.006)	(0.006)	(0.000)	0.21[20]	0.28[20]
$3rd$	0	-0.015**	45.86	1	-0.865	0.137	0.915	0.57[10]	0.99[10]
		(0.015)			(0.734)	(0.000)	(0.000)	0.89[20]	0.997[20]
$3rd$*	7.305	-0.052***	12.98	1	55.463	0.160	0.891	0.47[10]	0.76[10]
	(0.001)	(0.000)			(0.030)	(0.000)	(0.000)	0.61[20]	0.76[20]

Estimated equation:

$$\Delta y_t = \rho y_{t-1} + \sum_{j=1}^{k} \phi_j \Delta y_{t-j} + \epsilon_t$$

$$\sigma_t^2 = \alpha_0 + \sum_{j=1}^{p} \alpha_j \epsilon_{t-j}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-j}^2$$

Notes: The figures in squared brackets denote the number of correlations for which the Q-statistic is applied to the residuals. SR denotes standardized residual and SSR squared standardized residual. HF is the half-life calculated as $ln(0.5)/ln(1+\rho^{out})$. * denotes the data used for this period is corrected ones. The coefficient of Asymmetric effect is significant for every sub-sample, but it is not reported here.

Table 6: Non-linear Tests

	BDS												Tsay's	Hansen's
	$\delta = 0.5\hat{\sigma}_a$				$\delta = 1.0\hat{\sigma}_a$				$\delta = 1.5\hat{\sigma}_a$				TAR-F	sup-LM
	2	3	4	5	2	3	4	5	2	3	4	5	$d = 1$	$d = 1$
$1st$	0.000288	-4.35E-06	7.93E-05	-3.68E-05	0.001082	0.000346	0.000461	1.19E-05	0.001636	0.001990	0.001902	0.003200	0.12919	20.926471
	(0.7988)	(0.9310)	(0.8236)	(0.9846)	(0.6816)	(0.8552)	(0.8204)	(0.8950)	(0.5648)	(0.6548)	(0.7054)	(0.6036)	(0.99618)	(0.294900)
$2nd$	0.000878	0.000676	0.000188	0.000138	0.001336	0.002560	0.002343	0.000919	0.000930	0.002581	0.003718	0.004013	1.55749	19.272866
	(0.5078)	(0.5034)	(0.6874)	(0.6196)	(0.6086)	(0.4848)	(0.4972)	(0.7072)	(0.7030)	(0.5884)	(0.5452)	(0.5436)	(0.14577)	(0.440300)
$3rd$	0.001407	0.000895	0.000483	9.36E-05	0.004494	0.006931	0.006351	0.004401	0.007351	0.014590	0.016169	0.015562	0.85256	16.240510
	(0.2622)	(0.3052)	(0.3188)	(0.6304)	(0.1148)	**(0.0654)**	**(0.0836)**	(0.1456)	**(0.0180)**	**(0.0060)**	**(0.0122)**	**(0.0298)**	(0.54403)	(0.752400)
-	0.000404	3.72E-05	-0.000125	3.38E-06	0.001348	0.000405	0.000547	0.001122	0.000963	-0.001065	-0.003432	-0.002508	1.24170	18.384965
	(0.6854)	(0.8872)	(0.8756)	(0.8988)	(0.5766)	(0.8370)	(0.7864)	(0.6038)	(0.6982)	(0.8904)	(0.6094)	(0.7586)	(0.27746)	(0.534900)

Notes: BDS tests are applied to the logarithms of squared standardized residuals to have correct size, while Tsay's TAR-F test and Hansen's sup-LM test are applied to the standardized residuals, respectively; 2,3,4,5 are the embedding dimensions for BDS tests; Except for TAR-F test, bootstrapped p-value (with 10000 draws) are calculated and showed in parenthesis; d denotes the delay parameter.

Table 7: Augmented Threshold autoregressive model with GARCH effect

Period		TAR(2,k,d)						GARCH(1,1) effect			Ljung-Box Q-stat.	
		c^{up}	C^{in}	ρ^{out}	ρ^{in}	HL	k	α_0	α_1	λ_1	SR	SSR
$1st$	U	199.71	-4.578	-0.019	0.069	36.13	0	19.7	0.469	0.750	0.45[10]	0.23[10]
			(0.671)	(0.055)	(0.276)			(0.025)	(0.000)	(0.000)	0.91[20]	0.25[20]
	R		0	-0.019	0.042	36.13	0	20.1	0.468	0.751	0.46[10]	0.22[10]
				(0.031)	(0.000)			(0.029)	(0.000)	(0.000)	0.91[20]	0.26[20]
$2nd$	U	271.84	7.685	-0.204	-0.049	3.04	1	340.5	0.170	0.692	0.27[10]	0.14[10]
			(0.007)	(0.007)	(0.021)			(0.010)	(0.007)	(0.000)	0.24[20]	0.28[20]
	R		0	-0.212	0	2.91	1	314.3	0.116	0.701	0.17[10]	0.22[10]
				(0.000)				(0.053)	(0.018)	(0.000)	0.09[20]	0.29[20]
$3rd$*	U	351.14	6.447	-0.138	-0.044	4.67	1	74.9	0.191	0.864	0.43[10]	0.74[10]
			(0.019)	(0.000)	(0.010)			(0.028)	(0.000)	(0.000)	0.58[20]	0.79[20]
	R		0	-0.140	0	4.60	1	75.1	0.194	0.851	0.60[10]	0.81[10]
				(0.000)				(0.033)	(0.000)	(0.000)	0.64[20]	0.87[20]

Estimated Equations:

$$\Delta y_t = \rho^{out}(y_{t-1} - c^{up}) + \sum_{j=1}^{k} \Delta y_{t-j} + \epsilon_t \quad \text{if } y_{t-d} > c^{up}$$

$$\Delta y_t = \rho^{in} y_{t-1} + \sum_{j=1}^{k} \phi_j \Delta y_{t-j} + \epsilon_t \quad \text{if } y_{t-d} \leq c^{up}$$

$$\sigma_t^2 = \alpha_0 + \sum_{j=1}^{p} \alpha_j \epsilon_{t-j}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-j}^2 \quad p = 1, q = 1, d = 1$$

Notes: Figures in parentheses denote marginal significance levels of the estimated parameters. The figures in squared brackets denote the number of correlations for which the Q-statistic is applied to the residuals. U(R) denotes unrestricted (restricted) model. SR and SSR are as defined above. HL denotes the half-life, * denotes the data used for this period is corrected ones.

Table 8: Summary statistics of yield differentials during the period of crisis (Asian NDF markets)

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
hkd	6.405	12.794	-65.785	78.817
twd	266.883	240.915	-290.743	1136.227
krw	268.177	182.717	60.435	1116.773
php	-81.870	148.875	-361.663	353.558
idr	237.304	173.773	-42.071	965.985
inr	-103.595	190.196	-1477.311	225.5
cny	222.961	518.072	-1618.882	2052.697
Obs.			657	

Table 9: Sample mean and period sums of net capital flows (Millions of U.S. dollars)

Periods	Mean			Total		
	TNORM	ST	LT	TNORM	ST	LT
1982-2007	22504	-3337	25706	562607	-83413	642645
	(-27849.4)	(-21080.1)	(-32777.5)			
1982-1989	3860	-309	4169	30883	-2470	33353
	(-3751.9)	(-1356.6)	(-3478.2)			
1990-1999	16576	-9110	25687	165763	-91105	256?867
	(-16820.0)	(-12979)	(-17391)			
2001-2007	52280	1452	50346	365962	10162	352425
	(-33244.0)	(-37790.4)	(-50028.7)			

Notes: Figures in parentheses are standard deviations; Positive (negative) values denote capital inflows (outflows); $TNORM$, ST, and LT denote the total normal capital flows, the short-term capital flows, and the long-term capital flows, respectively.
Source: Balance of Payment from SAFE, author's estimation

Table 10: Gross cross-border capital inflows of China (Millions of U.S. dollars)

Year	Short-term flows	% of total	Long-term flows	% of total	Total	Short-term average (Vol. & %)	Long-term average (Vol. & %)
1982	244	6.86%	3312	93.14%	3556		
1983	59	2.14%	2702	97.86%	2761		
1984	223	5.13%	4128	94.87%	4351	5767.0	8006.9
1985	11346	54.35%	9 531	45.65%	20 877	(-4823.9)	(-3940.9)
1986	9343	45.05%	11 394	54.95%	20 737	30.27%	69.73%
1987	9426	49.18%	9 740	50.82%	19 166		
1988	9148	45.15%	11 114	54.85%	20 262		
1989	6347	34.34%	12 134	65.66%	18 481		
1990	8766	43.02%	11 611	56.98%	20377		
1991	7465	36.73%	12 858	63.27%	20 323		
1992	2581	8.54%	27 642	91.46%	30 223		
1993	475	0.93%	50 353	99.07%	50 828	9732.4	49862.7
1994	1004	1.62%	60 789	98.38%	61 793	(-11133.6)	(-23597.3)
1995	1644	2.43%	66 068	97.57%	67 712	17.62%	82.38%
1996	1256	1.77%	69 721	98.23%	70 977		
1997	21712	23.35%	70925	58.93%	92637		
1998	20182	22.58%	69145	53.21%	89327		
1999	32239	35.14%	59515	46.67%	91754		
2001	39150	39.33%	60381	60.67%	99531		
2002	54537	42.50%	73784	57.50%	128321		
2003	130434	59.39%	89196	40.61%	219631	276044.3	120163.4
2004	240584	70.07%	102766	29.93%	343350	(-238407.6)	(-60208.7)
2005	288939	69.66%	125862	30.34%	414801	61.68%	38.32%
2006	497356	76.61%	151818	23.39%	649174		
2007	681309	74.16%	237337	25.84%	918646		
Total /mean	2075769.61		1403826.3		3479595.9 (-222707.2)	83030.8 (-171339.3) 34.01%	120163.4 (-55712.1) 65.99%

Notes: Short-term flows remain less than one year in the destination country; figures in parentheses are standard deviations.
Source: Balance of Payment (various issues) published by State Administration of Foreign exchange (SAFE), author's calculations.

Table 11: Principal Components

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.80195	1.72728	0.4670	0.4670
Comp2	1.07467	.158328	0.1791	0.6461
Comp3	.916341	.330624	0.1527	0.7988
Comp4	.585717	.138626	0.0976	0.8964
Comp5	.447092	.272863	0.0745	0.9710
Comp6	.174228	.	0.0290	1.0000
Variable	Comp1	Comp2		
twd_3	0.3013	0.3360		
krw_3	-0.4444	0.3466		
php_3	-0.4496	-0.0855		
idr_3	-0.2125	0.8038		
inr_3	0.4389	0.0225		
cny_3	0.5213	0.3362		

Table 12: Gross short-long term capital inflows

Year	Short-term flows[a]			% of	Long-term flows			% of	Total
	$PISTF$	$OISTF$	$TSTF$	total	$PILTF$	$OILTF$	$TLTF$	total	
1997	80.26	21631.70	21711.96	23.44%	54589.19	16336.01	70925.20	76.56%	92637.16
1998	10.40	20171.21	20181.61	22.59%	47533.84	21611.34	69145.18	77.41%	89326.79
1999	0.00	32239.01	32239.01	35.14%	42823.03	16691.90	59514.93	64.86%	91753.94
2000									
2001	0.00	39149.83	39149.83	39.33%	49456.28	10925.02	60381.30	60.67%	99531.14
2002	22.40	54514.56	54536.96	42.50%	55337.83	18446.51	73784.34	57.50%	128321.31
2003	46.95	130387.41	130434.36	59.39%	67766.85	21429.41	89196.25	40.61%	219630.61
2004	7.59	240576.38	240583.97	70.07%	81160.30	21605.88	102766.18	29.93%	343350.15
2005	313.66	288625.59	288939.25	69.66%	107755.04	18106.76	125861.80	30.34%	414801.05
2006	0.00	497356.26	497356.26	76.61%	132886.76	18930.76	151817.52	23.39%	649173.78
2007	2274.00	679035.39	681309.39	74.16%	213248.93	24087.68	237336.61	25.84%	918646.00

Source: Balance of Payment from State Administration of Foreign exchange(SAFE), author's calculations

Note: $PISTF$ (Portfolio investment short-term inflows); $OISTF$ (other investment short-term inflows); $TSTF$ (Total short-term inflows); $PILTF$ (Portfolio investment long-term inflows) $OILTF$ (other investment long-term inflows); $TLTF$ (Total long-term inflows).