Capital Controls and Interest Rate Parity:

Evidences from China, 1999-2004[*]

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Abstract

This paper shows that deviations estimated from the uncovered interest rate parity condition present strong unstationarity and persistency, thus indicating China's capital controls is still effective in driving a wedge between onshore and offshore returns. Similar results are also obtained from covered interest rate parity condition. Our findings also demonstrate that there is no evidence of money market integration with Hong Kong. However, the deviation also shows signs of moderation over time because of increased pace of capital account liberalization.

Key Words: Capital Controls, Interest Rate Parity, Financial Integration

JEL Classification: F31, F36

I. Introduction

Efficacy and effectiveness of capital controls have gained renewed interests after Malaysia re-imposed controls on capital flows at the height of the 1997-98 Asian financial crises. The Mundell Trilemma suggest that policy makers can only choose two out of the three macroeconomic policy objectives; i.e., independent monetary policy; stable exchange rate, and freedom of capital flows to maintain fundamental policy consistency. In the Malaysian case, the freedom of capital flows has been sacrificed for the sake of independent monetary policy and the stable exchange rate. Although the verdict is still out regarding whether capital controls have facilitated Malaysia's rapid recovery from the crisis (IMF, 2000), recent empirical evidences do show that emerging market economies, because of their lack of credible nominal anchor and their undeveloped capital markets, often suffered from "the fear of floating" (Calvo and Reihart, 1998) when they opt to maintain exchange rate stability while pursing free capital mobility and independent monetary policy.

China has in the past put great emphasis on independent monetary policy and stable exchange rate at the expense of the freedom of capital flows. However, such objectives have recently been under increased scrutiny and pressure. Some observers argue that its undervalued currency was blamed for the economic overheating in 2003-2004 and its pegged exchange rate regime has been blocking the global adjustment process in light of the unsustainable current account deficit in the United States (Goldstein, 2004). Indeed, these assertions implicitly assume that China's capital controls have not been effective so that both legal and illegal cross-border capital flows effectively arbitraged out the interest rate differentials between onshore and offshore,

thus making the independent monetary policy objective less obtainable. Some, before China's interest rate hike in October 2004, prematurely pointed out that the Chinese monetary authorities were afraid of raising interest rates to cool the economy because higher interest rate would attract more capital flows. However, some recent empirical studies have shown that, despite the onshore and offshore interest rate differentials have been shrinking over time, China's capital controls are still effective as these interest rate differentials still remain large (Ma, Ho, and McCauley, 2004).

Considerable progress has been made in analyzing international capital flows over the past quarter century when the volume of international capital flows, particularly private capital movements, increased rapidly, and many industrialized countries removed capital controls in the 1980s. Frankel (1992) reviewed literature on the analysis of international capital mobility in the 1970s and 1980s, and concluded that interest rate parity theory used in a seminal paper by Frenkel and Levich (1977), followed by many others including Dooley and Isard (1980), Otani and Tiwari (1981), and Frankel (1984 and 1991) among others, is one of the most useful frameworks for quantifying the degree of capital mobility. According to these studies, deviations from both covered and uncovered interest rate parity conditions capture transaction costs, including political risks, exchange rate risk (market pressure), and transaction costs--which Frankel (1991) called "the country premium"--that inhibit free mobility of cross-border capital flows. He also noted that, by quantifying international capital mobility or the lack thereof, one could examine the extent to which a country's financial market is integrated with the rest of the world.

This paper builds on this body of literature and applies the methodology adopted by Cheung, *et. Al* (2003), Otani and Tiwari (1981), and Otani (1983) to examine the effectiveness of China's capital control and money market integration with the rest of the world. Indeed, there are some strong resemblances between what China is experiencing now and what Japan experienced in the late 1970s and the early 1980s (Fukao, 2003). Thus, it would be a good time to apply the interest rate parity theory to the contemporary China. Such a study intends to provide empirical evidence on the effectiveness of China's existing capital controls, which will have far reaching implications on future arrangement of China's exchange rate regime.

The remainder of the paper is organized as follows. Section II presents a brief overview on China's capital account liberalization steps. Section III applies the interest parity framework on China to test financial integration and efficacy of China's capital controls. Section IV provides some evidences on deviations from interest rate parity, involving China's renmimbi and foreign convertible currencies, say, U.S. dollar in three distinct types of market places. One is *onshore* transaction, which involves movements between the renminbi-denominated assets and the foreign currency-denominated assets within China. Another is *cross-border* transaction, with capital moving from China to, say, Hong Kong and vice versa. A third one is a benchmark market, where the international capital market is efficient and free from restrictions so that transaction costs associated with political risks are negligible. This section also briefly describes the methodology that is to be used to quantify the impact of capital controls on the cost of transactions and presents empirical results on capital controls obtained from daily observations of spot and forward exchange rates, and relevant interest rates in three types

of the market places for the period, 1999-2004. Section V draws policy implications for

the future liberalization of financial markets in China. Section presendts concluding

remarks. Appendix I provides a chronological listing of major changes in rules and

regulations in recent years that affected transactions between renminbi-denominated

financial assets and foreign-currency-denominated assets. Appendix II provides data

descriptions, sources, and definition.

II.   Evolution of China's Capital Controls

China's capital control regime has been undergoing reforms in recent years.

During the 1980s and the 1990s, China mainly took measures to encourage foreign direct

investment (FDI) inflows to the country. As China's overall balance of payments

position continued to strengthen in the early 2000s, non-FDI capital at times started to

pour into the country, thus exerting pressures on the renminbi. As a result, the authorities

took measures to open up the market for outward capital movements.[1] Indeed, Japan

took similar approaches before it fully liberalized its capital account in the late 1970s and

the early 1980s. Thus, China's capital control regime is at a critical juncture.[2] How fast

the reform is proceeding in economic terms is, however, difficult to detect by just reading

changes in the rules and regulations that the authorities have been promulgating or by

looking at the index that has been based on the presence or the absence of specific items

of capital account control measures. Surely, one can understand changes in the rules and

regulations from legalistic point of view; but it is almost impossible to know from

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[1] See Appendix I for changes in capital control measures.
[2] See Lin and Schramm (2003) for a comprehensive review of reforming the international
capital market during 1979-the early 2000s.

reading the laws and regulations what the impact of these changes is on the extent of easiness or difficulty in conducting financial transactions. This difficulty is compounded by many other factors, such as political risks, tax incentives, exchange rate risk, and even penalty of those who violate the rules and regulations that could influence financial transactions.

One way to cut through legalistic interpretation of changes in rules and regulations affecting financial transactions is to make use of the interest rate parity theory. According to this theory, deviations from the covered interest rate parity condition would reflect (broadly defined) transaction costs (including political risks) involved in converting financial assets denominated in one currency to those in another currency.[3]

In examining international capital mobility and the openness of the capital market, several questions can be raised in the case of China. First, how does the cost of transactions involving the renminbi and foreign currency denominated assets *within* China or across the country border compare with the cost of transactions involving local and foreign currencies in an economy, such as Hong Kong, where capital convertibility has been established and which is known to have a very efficient financial sector?[4] Second, how costly is it for Chinese residents to convert the renminbi denominated assets to a foreign-currency denominated assets and then back to the renminbi denominated assets *within* China and how does it compare with similar transactions *across* the country

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[3] For detail discussion of this point, see, for example, Otani (1983) and Otani and Tiwari (1990).

[4] Frankel (1991) estimated that the mean of the covered interest differential for Hong Kong during September 1982 – April 1988 was about 0.13 (three-month rates) with standard error of the mean at 0.03, very similar to estimates for U.K., Austria and Belgium, and some what less than Germany. Chinn and Dooly (1995) reported that the three-month covered interest differential during May 1988-November 1994 was 0.14 percentage points, slightly above that for Canada.

border? A third question is how effective capital control measures have been in stemming illegal capital flows in recent years.

Answers to the first question would be able to shed light on the relative efficiency position of China's onshore market and the cross-border market in relation to the benchmark set by one of the most efficient financial sector—i.e. Hong Kong, and thus would indicate how far China's financial market would need to be improved in terms of reducing the cost of transactions.

In answering the second question, it should be noted that market participants involved in transacting renminbi-denominated assets and foreign currency-denominated assets are both residents of China. However, in the onshore market, financial resources move between different currencies within the country while in the cross-border market such resources move across the border. Thus, any difference in the estimated transaction costs would reflect whether financial flows remain within China or potentially move across the national boundary. In this sense, the difference can be regarded as a first approximation for the cost of capital control measures on the broadly defined transaction costs associated with political risks.[5]

Once the impact of capital controls on the cost associated with political risks is estimated, an attempt can be made to measure the impact of the increased cost of political risks on illegal capital movements to analyze the effectiveness on capital controls on movements. In addition, statistical analyses on the deviations from interest rate parity condition can be used to measure evolution of China's capital control over time.

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[5] Transaction costs net of political risks are negligible.

III.   Assessing China's Deviation from the Interest Rate Parity Condition

1. Deviations from the Uncovered Interest Rate Parity

Following Cheung, et al (2003) and Chinn and Frankel (1997), one can derive the uncovered interest rate parity condition as follows:

$$(i_t^k - i_t^{k*}) - \Delta s_{t+k}^e = [i_t^k - i_t^{k*} - (f_{t,t+k} - s_t)] + (f_{t,t+k} - s_{t+k}^e) \qquad (1)$$

Where i_t^k refers to the interest rate on the local currency-denominated assets and

i_t^{k*} the interest rate on foreign currency-denominated assets. Both are expressed in log

form. Δs_{t+k}^e, defined as $s_{t+k}^e - s_{t,}$ is the expected change of the logged spot exchange

rate. The left hand side of the equation is in fact the deviation from the *uncovered* interest

rate parity condition expressed in logarithm.

$f_{t,t+k} - s_t$ refers to the difference between the logged forward exchange rate and

the logged spot exchange rate expressed in terms of a numeria currency. The expression

in the bracket is the deviation from the covered interest rate parity condition.

s_{t+k}^e is the expected spot exchange rate at t + k, with the expectation formed at t.

The expression in parenthesis on the right hand side of the equation thus refers to the

exchange rate risk or the premium/discount.

In the past, due to the lack of the forward exchange market in China, the non-

deliverable forward rate (NDF) has often been used as a proxy for the forward RMB

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dollar rate.[6] However, this market is located in offshore and settlement is done using the

US dollar only. Thus it is different from the standard definition of the forward exchange

rate.

Due to the lack of data, Cheung, *et al* (2003) estimated the deviation from the

uncovered interest parity condition by examining interest rate differentials and the *ex-*

post change of the exchange rate. Therefore, their results suffer from the bias due to the

use of ex-post expectation.

Although the China's pegged exchange rate has not changed since 1994,

the NDF market in Hong Kong[7] established in 1996 has been moving constantly

according to market expectations of the Chinese economy. Thus, the NDF market is a

very good *ex ante* exchange rate expectation, that is, s_{t+k}^e. With the NDF rate as a proxy

for exchange rate expectation, we will be able to determine the exchange rate risk

component of the deviation of the uncovered interest rate parity condition.

2: Deviations from the Covered Interest Rate Parity

Equation (1) can re-arranged to obtain the expression for the covered interest rate

parity condition as below.

$$[\, i_t^k \,-\, i_t^{k*} \,-\, (\, f_{t,t+k} - s_t \,)] = \; [(\, i_t^k \,-\, i_t^{k*} \,) \,-\, \Delta s_{t+k}^e \,] + (\, s_{t+k}^e \,-\, f_{t,t+k}) \qquad (2)$$

It has been argued that, under perfect capital mobility, the covered interest rate

parity condition holds. In other words, deviations from the interest rate parity would be

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[6] Ma and McCauley (2004) use NDF to calculate implied premium of the forward rate. In order to do the calculation, they have assumed that covered interest rate parity holds. However, many empirical studies have shown that it does not (see Frankel (1992) for a detailed survey).

[7] According to Ma, Ho, and McCauley (2004), the RMB NDF market is only one of six such markets in Asia.

zero. However, it is now well established by a number of research works that the interest rate parity condition seldom holds in the real world, even in a country where the financial sector is free from restrictions, with perfect capital mobility and with the very high efficiency. This is because all transactions incur costs of one type or another, such as commissions and other charges that need to be paid to brokerage firms and banks, time involved in searching information, political risks, possibility of future changes in control measures, possible penal charges against those who might engage in illegal transactions, etc.

Thus, deviations from the covered interest rate parity condition usually fall within in a certain band around the parity. Indeed, the size of the band would be determined by: (1) deviation from the uncovered interest rate parity—which we refer to as arbitrage risk; (2) the exchange risk; and (3) pure transaction cost. For the sake of presentational simplicity, we combine the arbitrage risk and the exchange risk and the cost associated with the sum is denoted by TCr. The pure transaction cost is denoted by TCp. Thus, the deviation from the covered interest rate parity can be interpreted as total transaction cost, TC, comprises TCr and TCp.

In order to understand characteristics of the spot and forward exchange market in China, it will be useful to consider two types of market places, A and B, both of which involve the transaction of renminbi (local currency) denominated assets and the U.S. dollar (foreign currency) denominated assets. Market A represents an onshore market for

Mainland China (hereafter China), while B a cross-order market for China.[8] In Market

A, financial resources will remain within China, while in Market B, financial resources

move between China and an offshore economy, say, Hong Kong.

Introduction of new measures intended to influence capital flows would in

principle impact, through arbitrages, on interest rates on local currency-denominated

assets as well as the spot and forward exchange rates. In this sense, deviation from the

parity will in principle be affected by capital controls.

For a given period of time, the deviation from the covered interest rate parity

would pure transaction costs, TCp, and arbitrage and exchange risks, TCr. However,

estimates made by other researches for other markets suggest that TCp is rather small, as

noted already.[9]

In addition to these two markets, Market C, involving the U.S. dollar-

denominated assets and the Hong Kong dollar-denominated assets, can be conveniently

introduced in order to compare the estimates of the transaction cost in each of the two

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[8] On April 1, 1997, the Bank of China was first allowed by the People's Bank of China
(central bank) to conduct the renminbi and the U.S. dollar forward exchange transactions.
The market is open for all resident firms including domestic, joint-venture, and foreign
firms that have an account with the Bank of China. The forward market was then
expanded to include the rest of the three major state-owned commercial banks such as the
Agriculture Bank of China, the Construction Bank of China, and the Industrial Bank of
China. To our knowledge, we are the first to utilize such a database to analyze the
deviation from the covered interest rate parity in the onshore market.

[9] For example, Clinton (1988) estimated that, during November 1985 – May 1986 ("a
period of a fair degree of exchange market turmoil"), the transaction cost in the spot
exchange for five currencies (Canadian dollar, Deutsche mark, French frank, Japanese
yen, and U.K. pound) averaged at 0.008 percentage rate (quarterly rate), the cost in the
90-day forward exchange for these currencies at 0.0148 percentage rate (quarterly rate)
and the transaction cost in euro currency deposits at 0.0171 (quarterly rate). This
suggests that TCp for these currencies on average amounts to be about 0.06 percentage
rate (quarterly rate).

markets with that of Market C (Benchmark Market), where capital movements are known to be free from restrictions.

By calculating a size of a band around the interest rate parity for each of the market for A, B, and C, denoting each by TC_a, TC_b, and TC_c, respectively, we could compare each with the other two. Such comparisons will allow us to answer the three questions in quantity terms and discuss related issues by identifying changes in capital control measures and other factors that may have influenced changes in transaction costs.

III. Empirical Results

1: Deviations from Covered Interest Parity Condition: A Comparison

This section presents the empirical results of estimating transaction costs in three markets, Market A, B, and C, by making use of the left hand side of equation (2) in the previous section. The period for the empirical study is Q4 1999 through Q4 2004, which was dictated by the availability of data for Market A, B, and C. For each market, sample data are based on daily observation of the relevant spot exchange rate, the 3-month forward exchange rate, the interest rate on 3-month local currency-denominated assets and the interest rate on 3-month foreign currency-denominated assets. [10]

The results of deviation from the interest rate parity condition for each of the three markets are summarized in Figure 1 (Comparison of Deviation from Interest Rate Parity Condition, Q4 1999 – Q4 2004). Several interesting points can be observed from this figure.

First, deviations from the interest rate parity condition involving the Hong Kong dollar and the U.S. dollar in Market C (Benchmark Market) fluctuated narrowly around

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[10] See Appendix II for details on the definitions and sources of data.

zero throughout the sample period, with an average quarterly rate of only 0.013 percent (see column 1 in Table1).[11] This estimate is substantially lower than the estimate (0.06 percent) made by Clinton (1988) for the five Euro currencies mentioned above and the estimate (0.13 percent) made by Frankel (1991) for Hong Kong during September 1982 – April 1988. This comparison suggests that the efficiency of the market in Hong Kong has improved considerably in recent years.   Moreover, during the period under review, the international capital market in Hong Kong (as far as the market for the Hong Kong dollar and the U.S. dollar is concerned) was not subjected to a period of "currency turmoil." Therefore, it can be reasonably concluded that the transaction cost associated with political risks for Hong Kong is negligible during this period.

Second, deviations from the parity condition in Market A (Onshore Market)) fluctuated somewhat more than those in Benchmark Market during Q4 1999 – Q4 2002. Since then, however, deviations increased sharply through Q1 2004. This period coincides with the period when speculation for the renmnbi appreciation increased greatly. During Q2-Q3 2004, deviations from the interest rate parity dropped significantly, but they again increased rapidly in Q4 2004.

Why was the pattern of movements in the deviations in Market A (Onshore Market) so different between the period Q4 1999 – Q4 2002 and the period Q1 – Q4 2004? The answer seems to be the impact of the authorities' efforts in encouraging capital outflow and discouraging inflows in the latter period. Such efforts would tend to create shortages of funds in the domestic economy relative to the amount that would have

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[11] Note that this estimate is about one tenth of the estimate made by Frankel (1991) for the period, September 1982 – April 1988, indicating that the efficiency of the Hong Kong market has increased further since the late 1980s.

been demanded by the economy in the absence of capital controls. This shortage then would put upward pressure on the domestic interest rate. [12] However, this part is expected to be negligible in the case of China because the Chinese authorities administratively determined the interest rate on local currency-denominated deposits. As a result, the arbitrage risk has increased. Moreover, they kept the spot exchange rate of the renminbi against the U.S. dollar virtually unchanged throughout the period. As a result, the exchange risk also has increased. Therefore, virtually all of changes in the deviation from the parity would be reflected by changes in the cost stemming from the political risks associated with the introduction of capital controls.

Third, deviations from the interest rate parity condition in the Cross-Border Market were negative during Q4 1999 – Q1 2001, coinciding the period when the authorities attempted to discourage outflows. Since then, the deviations became positive and gradually increased. The rate of increase in the deviations and fluctuations are similar to those in the Onshore Market. However, the magnitude (i.e. the absolute value) of the deviation was greater than in the Onshore Market. This implies that the cost of transactions for the Cross-Border Market is greater than that for the Onshore Market. The difference indicates the additional cost incurred by taking funds across the border, and ranged from 0.36 percent at the quarterly rate to 0.05 percent, with an average of 0.15 percent.

2: Estimated Impact of Changes in Capital Controls on Transaction Cost

Various changes that the Chinese authorities introduced to influence capital flows would have different impact on transaction costs in different markets. In order to

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[12] See Otani (1983) for theoretical exposition of this point.

examine these differences in quantitative terms, we can compare estimated transaction costs of different markets (Table 1).

The first three columns present deviations from the covered interest parity for the three markets, A (Benchmark Market), B (Onshore Market), and C.(Cross-Border Market). The negative values of the estimated transaction costs from Q4 1999 through Q1 2001 suggest that the authorities tended to take measures to retard capital flight. Since then, the values of the estimated transaction costs by and large were positive, indicating that the Chinese authorities discouraged capital inflows.

The fourth, the fifth, and the six column, respectively, present the absolute value of deviations from the interest rate parity condition, which can be interpreted as the sum of TCp and TCr for the respective markets. The seventh column represents the difference between the estimated transaction costs in the Benchmark Market and those in the Onshore Market, which can be regarded an approximation for the transaction costs associated with broadly-defined political risks (i.e. TCr) for the Onshore Market, while the eighth column the difference between the estimated transaction costs in the Benchmark Market and the Cross-Border Market. The ninth column represents the difference between the estimated TCr for the Cross-Border Market and the estimated TCr for the Onshore Market.

The ninth column shows that, except Q2 2001, the transaction costs for the Cross-Border Market are estimated to be greater than those for the Onshore Market. This excess ranged from a quarterly rate of 0.05 percent to that of 0.23 percent. This difference can be interpreted as additional transaction costs that changes in capital control measures brought about for market participants in the cross-border market over and above those

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that the same set of changes in the capital control measures brought about for the market participants in the Onshore Market. Another point of interest is that the magnitude of the impact of changes in the capital control measures has have waned over time, perhaps indicating the evolving nature of changes that the authorities introduced over time. In the earlier period, the Chinese authorities adopted the measures that they thought would have greater impact on cross-border transactions, but they had to resort less potent measures as time passed.

3: Effectiveness of Capital Controls on Illegal Capital Movement

If controls on capital movements were totally effective, or if there were no capital controls, there would be no illegal movements of capital. However, 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. Of course, errors and omissions also capture movements of statistical errors and omissions that are not related to illegal movements of capital. Such statistical errors and omissions are not expected to change dramatically from one period to another at least in the short term. Therefore, large swings in errors and omissions are normally associated to movements of speculative funds that move illegally across borders seeking unexploited profits. In this context, errors and omissions could be regarded as a first approximation of such illegal movements of capital.

Table 2 (China: Trade and Errors and Omissions, 1999-2004) shows data on errors and omissions and their ratio to the value of trade (both exports and imports). While the availability of such data is rather limited and they are not amenable to rigorous

statistical test, [13] a cursory observation of scattered points in Figure 2 indicates that there is a negative correlation between the increase in the transaction cost and the ratio of errors and omissions as percent of trade. To this extent, the authorities' attempt to tighten controls on capital movements retarded illegal flows of capital, as intended by the authorities.

According to the regression analysis, one basis point increase in the transaction cost in the Cross-Border Market relative to the Onshore Market that is brought about by the increase in the intensity of capital controls would result in a 0.09 percentage points reduction in the ratio of errors and omissions to trade.[14] However, given the limited number of observations, the statistical result is subject to a large margin of errors and the statistical results must be interpreted with caution.

4: Assessing Money Market Integration with Hong Kong

A) Are Uncovered Interest Rate Differentials Mean Reverting?

We first test stationary condition on the deviation from *ex ante* uncovered interest rate parity condition. The rationale to apply stationary test is that stationary series will revert to mean after an external shock whereas non-stationary series will be not be able to restore the parity condition after a shock (Cheung, et al ..., 2003).

Dickey-Fuller and Phillips-Perron unit root tests[15] are presented undrt Panel A of Table 3. The unit root hypothesis can not be rejected, indicating that the deviations from *ex ante* uncovered interest rate parity condition do not present mean reverting property.

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[13] The Chinese authorities release data on errors and omissions on a semi-annual basis only.

[14] $Y = 3.23 - 8.6 X \quad R^2 = 0.19$, where Y represents the ratio (in percent) of errors and omissions to the value of trade, while X the estimated increase (quarterly rate in percent) in the cost of transactions that is brought about by changes in capital control measures.

[15] An alternative test is to use ADF-GLS test proposed by Elliot, et al (1996) which can have more power.

Therefore, the deviations are not stationary. This then means that shocks to the uncovered interest rate parity condition are permanent. Indeed, such shocks can also include capital controls and they will permanently drive a wedge between onshore and offshore interest rate. We could also interpret that capital controls imposed on the onshore market are still effective.

B) Are the Differentials Predictable?

We then run a test on whether previous period of deviation from the uncovered interest rate parity condition can predict later ones. The results from the regression with autocorrelation corrections presented in Panel B of Table 3 indicate that the deviation of the uncovered interest rate parity is not random and can be consistently predicted. This is another way to show that deviations from the parity are not random and can be predicted by using available information. This being the case, arbitrage will take place all the time and it will not be able to make onshore and offshore rates converge.

C) Are Absolute Differentials Shrinking?

Based on previous tests, we can ascertain capital controls are effective in China. However, they can not tell whether capital controls have become less effective over time. One way to show it is to examine whether deviations from the parity is declining over the sample period. This can be tested by running a regression of using absolute value of deviation against a time trend and a time trend square. We find that the coefficient of the time trend is positive and statistically significant, thus indicating that deviation over time does not decline much over time. However, when we use time dummy over time, we do see that their coefficients are negative and statistically significant. In addition, the coefficients are getting smaller over time, indicating that deviations from the uncovered

interest rate parity are getting smaller over time as more capital account liberalization measures are introduced over the sample period (Appendix I).

V. Policy Implications

The analyses of the transaction costs in different market places in the previous subsections and that of the NDF market in Hong Kong clearly indicate two important results.

First, capital control measures would drive a wedge between the transaction cost of the market that does not involve the renminbi assets and that of the market involving the renminbi assets.

Second, interest rates on the renminbi assets does not adjust sufficiently to offset the increase in the forward premium/discount on the renminbi.

Third, such capital control measures would drive a wedge between the transaction cost in the *onshore market* and that in the *cross-border* market. This in turn indicates that the intensification of capital control measures create addition cost of transactions and thus the reduced efficiency for *cross-border* transactions.

In light of the above, it is easy to see that the intensified capital controls would certainly retard the integration of the Chinese capital market with the rest of the world.

The further integration of the capital market with the rest of the world would then require the removal of capital control measures with an appropriate sequencing. Generally speaking, consistent with the general consensus on the financial sector liberalization, the sequencing of removing capital controls should first focus on capital

transactions related to current account transactions, followed by long-term capital and then short-term capital.

Furthermore, the interest rate liberalization would have to be focused in further increasing the efficiency of the capital market. In this context, it is noteworthy that the authorities lifted the ceiling on interest rates on lending, but the reality seems to have lagged behind in that the commercial banks have not totally let market forces to determine lending rates. On the renminbi-denominated deposits, interest rates are still administratively determined and these measures need to be replaced by market forces.

The last, but not the least, the the exchange market for forward and spot transactions needs to work more efficiently.

VI. Concluding Remarks

The main purposes of this paper have been to analyze the effectiveness of capital controls on capital mobility in China by utilizing the interest rate parity theory and by estimating transaction costs in the international financial markets that involve more than one currency and to draw implications for promoting further integration of China's capital market with the rest of the world.

The empirical investigation resulted in the following major findings.

- The introduction of capital control measures generally reduced the extent of illegal transactions, consistent with the authorities intended purposes, but increased transaction costs, reducing the efficiency of the market.

- The limited flexibility of interest rates on the renminbi-denominated assets and of the exchange rate, particularly the spot rate, contributed to the increase

in transaction costs and the reduction in the market efficiency, following the introduction of capital control measures.

- In light of the above, furthering of the international integration of China's capital market would require further relaxation of capital control measures with an appropriate sequencing. This means that renminbi interest rates need to be further liberalized, while the exchange market for spot and forward transactions need to work more efficiently.

- The removal of capital controls would first focus on those on capital movements related to current account transactions, followed by those on long-term equity transactions, long-term portfolio transactions and then short-term capital.

Changes in Capital Control Measures, 1999 –2005

The period, 1999-2005, can be divided into three sub-periods according to the Chinese authorities' inclinations toward capital controls. The first period, 1999-2000, is characterized by the authorities' intention to discourage capital outflows, coinciding with the period when capital flight away from China was great and the forward exchange rate for the renminbi tended to show a discount. The second period, 2001, was a transition period, when the authorities moved gradually from the policy of discouraging capital outflows to the policy of encouraging capital outflows. The is the period when the forward exchange rate did not show any significant trend for either a discount or a premium. The third period, 2002-2005, clearly shows the authorities' desire to encourage capital outflows to ward off appreciatory pressures on the renminbi.

1999:

January: The SAFE helped launch a nationwide computerized network linking customs, banks and the SAFE, which, along with speeding up foreign payment, would track illegal forex movements.

March: The SAFE introduced a system for evaluating exporters' performance in meeting foreign exchange surrender requirements. Those with low surrender rates would face differential treatment in bank loans and even risk losing their export license.

April: The SAFE helped formulate new rules to grade foreign trade firms according to the size of a portion of their forex earnings they repatriated to China. Those with low repatriation rates risked losing their export licenses.

June : The SAFE ordered the BOC to halt renminbi remittances from overseas branches of foreign banks to the BOC's domestic branches. Thus, foreign BOC clients could no longer pay in foreign currency. The BOC also canceled offshore renminbi-denominated accounts, reversing an earlier policy allowing foreign banks in offshore markets to purchase renminbi from the BOC. These measures had an impact equivalent to inducing forex inflows into China.

July: The SAFE moved to ease forex restrictions on foreign-invested enterprises (FIEs) to stimulate foreign investment. FIEs could now use their forex settlement accounts as time deposits, enabling them to earn interest and deploy their funds more freely. The SAFE also relaxed restrictions on FIEs that obtain renminbi loans backed by forex collateral.   It deregulated such loans to increase FIEs' financing channels and decentralized the power to approve repayment of the principal and payment of interest on the foreign debts of all firms. The SAFE also streamlined the procedures for FIEs to get foreign exchange to import technology for upgrades.

August: "To cut down on forex smuggling," all Chinese and non-Chinese residents are required to get the SAFE's approval before taking large amounts of foreign currency abroad.

August: FIEs were allowed to use foreign exchange settlements accounts as time deposits. In addition, they were allowed to obtain renminbi loans backed by foreign exchange collateral.

2000 :

February: The SAFE and the General Customs Administration forbid trade firms from purchasing hard currency to pay for certain categories of imports.

2001:

September: The SAFE lifted the ban on the purchase of foreign exchange for repayment of past overdue debts . Restrictions on purchasing foreign exchange for advance repayment of domestic foreign-currency denominated debts were relaxed.

November: A more generous foreign exchange policy was adopted toward individuals paying for their study abroad. According to the previous regulations, individuals paying for their own study abroad could only convert their first year tuition and living expenses into foreign exchange, whereas the new rule permitted them to convert all tuition and living expenses needed throughout the period of study.

2002:

October: All enterprises with foreign trading rights including domestically-funded enterprises (DFEs) and foreign-funded enterprises (FFEs) became eligible to establish foreign exchange accounts for current international transactions.

December: Foreign-funded banks were allowed to engage in buying and selling of foreign exchange with DFEs.

2003:

March: Beijing, Tianjing, Sichuan, Heilongian and other 10 provinces started experiments to relax Chinese firms' overseas FDI requirement. Renminbi assets can be used to exchange foreign currency for FDI purposes. Overseas investment under $30 million can be approved by local SAFE branches in the 10 provinces/municipalities that were first to experiment with the relaxation of external investment.

May: If a payment made by the foreign currency credit card exceeds the foreign currency deposit, the difference can be paid using the renminbi.

May: Certain qualified foreign institutional investors (QFIIs) were allowed to invest in A-shares in China.

June: Chinese outward processed trade investment under $30 million can be approved at the provincial level of the SAFE.

August: Multinational corporations' non-trade related payments are allowed to be conducted using either foreign currency or renminbi.

September: The surrender requirement was canceled for certain current account foreign exchange earnings such as international engineering contract, labor contract, international shipping and fees and fees from shipping services.

September: Residents and non-residents can bring in or take out up to $5000 per person. Domestic residents for overseas travel can carry up to $5000 in cash per person.

October: New measures were issued to allow multinational corporations to conduct cross-border foreign exchange management. They include: (1) allowing eligible multinational corporations (MNCs) to use foreign exchange funds in China to meet their foreign exchange needs overseas; (2) allowing eligible MNCs to lend foreign exchange from their operations in China to their foreign affiliates; (3) foreign exchange transactions among subsidiaries of MNCs in China no longer need approval from the SAFE. Such transactions can be carried out using banks.

November: The system of collecting deposits that guarantee profits from investment abroad has been canceled.

November: China agreed to provide clearing arrangements for banks in Hong Kong to conduct personal renminbi business on a trial basis. The scope of renminbi business to be offered will be confined to transactions that facilitate personal spending but do not involve investment and other capital account transactions. The scope of the renminbi business include the following four areas. (1) Deposit taking services from Hong Kong residence. (2) Exchange of renminbi to Hong Kong dollars and vice verse. (3) Remittances by holders of renminbi deposit accounts in Hong Kong of renminbi funds to their accounts in Mainland. (4) Use by Mainland residents of their renminbi debit and credit cards issued by Mainland for spending in Hong Kong. Participating banks or their subsidiaries may also issue renminbi debit or credit cards to residents of Hong Kong for use on the Mainland.

2004:

September: The experiment to relax investment abroad under $30 million was expanded to 23 provinces/municipalities. It is estimated that 510 Chinese firms that took the opportunity invested $2.1 billion in 2003—an increase of 112.3 percent (SAFE, September 10, 2004).

2005:

January: The amount of the renminbi in cash that can be taken out or into China was raised from 6,000 yuan per person to 20,000 yuan per person.

February: China relaxed controls on foreign exchange earning retention on tow fronts. (1) Companies are allowed to retain foreign exchange earnings above the limits up to 90 days, as opposed to the previous limit of 10 days. (2) The official limits are raised to 100 % of foreign exchange earnings from the previous limits of 30% to 50% for firms that apply for higher limits. Local offices of the SAFE are given the authority to approve such increases in the limits.

Appendix II

Date Description and Sources

Data on spot and three months forward exchange rates for the renminbi, the U.S. dollar, the Hong Kong dollar and three months deposit rates on the renminbi, the U.S. dollar and the Hong Kong dollar are daily observations during 1999-2004. They are obtained from the CEIC, the People's Bank of China, the Bank of China, the Hong Kong Monetary Authority.

Data on trade (exports plus imports) and errors and omissions are from the State Administration of Foreign Exchange.

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Table 1 Transaction Costs, Q4 1999 - Q4 2004
(Quarterly Rate, Quarterly Average, in Percent)

	Diviations from Interest Rate I			Absolute Values			Political Risks		Gap in Political Risks
	col. 1	col. 2	col. 3	col. 4	col. 5	col. 6	col. 7	col. 8	co. 9
	HK US$-HK$	Onshore	Cross-Border	ABS HK	ABS On-Shore	ABS Cross-Border	col. 5-col. 4	col. 6-col. 4	co. 8-col.7
1999Q4	0.002	-0.12	-0.28	0.002	0.12	0.28	0.12	0.28	0.16
2000Q1	0.020	-0.01	-0.24	0.020	0.01	0.24	-0.01	0.22	0.23
2000Q2	0.005	0.07	-0.29	0.005	0.07	0.29	0.07	0.29	0.22
2000Q3	0.024	0.06	-0.27	0.024	0.06	0.27	0.04	0.25	0.21
2000Q4	0.016	-0.02	-0.21	0.016	0.02	0.21	0.00	0.19	0.19
2001Q1	0.016	-0.09	-0.16	0.016	0.09	0.16	0.07	0.14	0.07
2001Q2	0.020	0.03	0.01	0.020	0.03	0.01	0.01	-0.01	-0.02
2001Q3	0.018	0.03	0.09	0.018	0.03	0.09	0.01	0.07	0.06
2001Q4	0.012	-0.01	0.17	0.012	0.01	0.17	0.00	0.16	0.16
2002Q1	0.012	0.03	0.20	0.012	0.03	0.20	0.02	0.19	0.17
2002Q2	0.014	0.10	0.29	0.014	0.10	0.29	0.09	0.28	0.19
2002Q3	0.009	0.04	0.25	0.009	0.04	0.25	0.03	0.24	0.21
2002Q4	0.009	0.00	0.17	0.009	0.00	0.17	-0.01	0.16	0.17
2003Q1	0.011	0.12	0.23	0.011	0.12	0.23	0.11	0.22	0.11
2003Q2	0.009	0.40	0.51	0.009	0.40	0.51	0.39	0.50	0.11
2003Q3	0.010	0.62	0.74	0.010	0.62	0.74	0.61	0.73	0.12
2003Q4	0.014	1.13	1.25	0.014	1.13	1.25	1.12	1.24	0.12
2004Q1	0.012	1.34	1.46	0.012	1.34	1.46	1.33	1.45	0.12
2004Q2	0.013	0.68	0.80	0.013	0.68	0.80	0.67	0.79	0.12
2004Q3	0.012	0.59	0.69	0.012	0.59	0.69	0.58	0.68	0.10
2004Q4	0.016	1.74	1.79	0.016	1.74	1.79	1.72	1.77	0.05
Average	0.013	0.320	0.343	0.013	0.344	0.481	0.331	0.468	0.137

Source: The authors' calculation.

Table 2: China Trade and Errors and Ossimions, 1999-2004
(In Billions of U.S. Dollars)

	1999	2000	2001 I H	2001 II H	2002 I H	2002 II H	2003 I H	2003 II H	2004 I H	2004 II H
Total trade	353.4	463.8	235.6	262.6	266	341	367	465	510	
Errors & Ommisions	-17.8	-11.9	-8.5	-4.9	5.3	2.5	4.7	18.4	-7.3	
(in % of trade)	-5.04	-2.57	-3.61	-1.87	2.00	0.73	1.28	3.96	-1.4	

Source: The State Administration of Foreign Exchange, China

Table 3: Statistical Properties of Deviations from Uncovered Interest Parity (DUIP)

A. Unit Root Test	T-Statistics	
Dickey-Fuller Test		
DUIP(12)	-0.6	
DUIP(24)	-0.75	
DUIP(48)	-0.22	
Phillips-Perron Test		
DUIP(12)	-1.85	
DUIP(24)	-1.28	
DUIP(48)	-1.1	
B. Predicability Regression	Coeffients	
AR(1)	-0.12	
	(-4.16)***	
AR(2)	-0.04	
	(-1.53)	
AR(3)	-0.1	
	(-3.65)***	
AR(4)	0.1	
	(3.56)***	
AR(5)	0.017	
	-0.6	
AR(6)	-0.07	
	(-2.44)**	
AR(7)	0.006	
	-0.2	
AR(8)	0.07	
	(2.4)**	
AR(9)	-0.03	
	(-1.3)	
AR(10)	0.1	
	(3.69)***	
AR(11)	-0.07	
	(-2.62)**	
AR(12)	-0.11	
	(-3.9)***	
Adjusted R Square	0.99	
C. Persistence (Dep. Variable: Absolute DUIP)	Regression 1	Regression 2
Explanatory Variable		
Constant	0.003	0.01
	(13.85)***	(58.8)***
Time Trend	0.00005	
	(14.27)***	
Year99		-0.003
		(-6.43)***
Year00		-0.005
		(-16.4)***
Year01		-0.01
		(-33.5)***
Year02		-0.009
		(-32.3)***
Year03		-0.005
		(-16.1)*
Adjusted R Square	0.13	0.54

Note: Signs ***, **, and * indicate statistical significance at 99, 95, and 90 percent, respectively.
Numbers in parentheses are t statitistics.
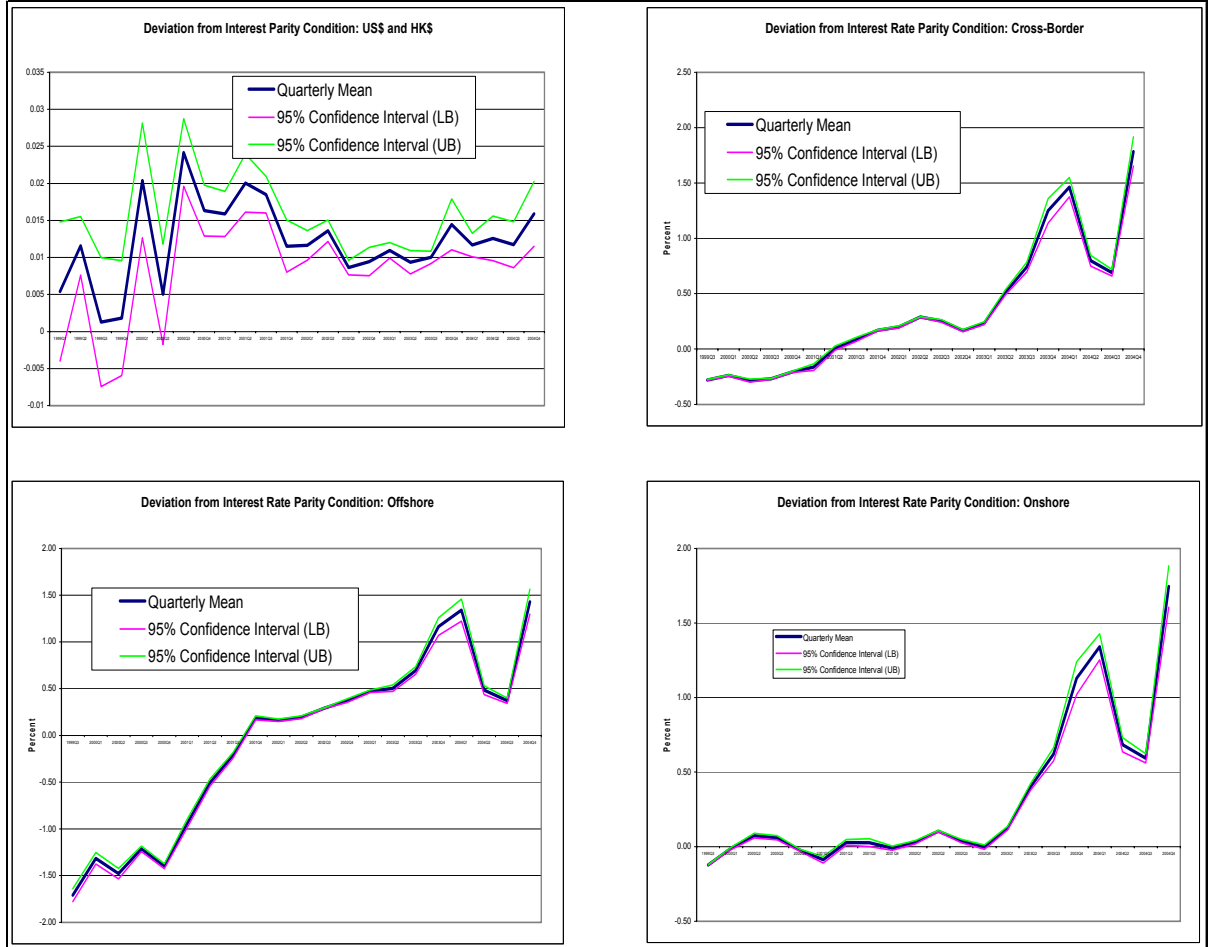
Figure 1: Comparision of Deviations from Covered Interest Rate Parity Conditions

Figure 2: E&O vs change in TC