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Does the Chinese Interest Rate Follow the US Interest Rate?*

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Abstract

One argument for floating the Chinese renminbi (RMB) is to insulate China's monetary policy from the US effect. However, we note that both theoretical considerations and empirical results do not offer a definite answer on the link between exchange rate arrangement and policy dependence. We examine the empirical relevance of the argument by analyzing the interactions between the Chinese and US interest rates. Our empirical results, which appear robust to various assumptions of data persistence, suggest that the US effect on the Chinese interest rate is quite weak. Apparently, even with its *de facto* peg to the US dollar, China has alternative measures to retain its policy independence and de-link its interest rates from the US rate. In other words, the argument for a flexible RMB to insulate China's monetary policy from the US effect is not substantiated by the observed interest rate interactions.

Keywords: Policy Dependence, Interest Rate Interactions, Exchange Rate Regime

JEL Classifications: F33; E5; G15

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1. Introduction

Building upon its successful economic story in the last two decades, China has entered the new millennium with rapid export growth and continuing penetration into the global market. With its increasing influences, China's economic policy is under close scrutiny by the international community. One topic that has attracted much attention is China's exchange rate policy. Since 1994, China has adopted a *de facto* peg to the US dollar. In the aftermath of the 1997 financial crisis, the fixed rate policy was praised for its role in stabilizing the regional and world economy. In the recent years, however, the same *de facto* fixed exchange rate policy has become the centre of a contentious controversy. Specifically, some countries, among which the US is the most vocal one, accuse China of gaining unfair advantages by maintaining an undervalued Renminbi (RMB) and, as a result, running a huge trade surplus and exacerbating global imbalances, which can destabilize the global economic system.[1]

To resolve the global imbalance problem, China is urged to adopt a flexible exchange rate policy and allow the RMB to appreciate. In fact, on July 21st, 2005 China re-valued its currency and announced the policy of pegging to a basket of currencies. Even though the move was warmly, albeit cautiously, welcomed, it does not soften the international demand for further RMB flexibility. Indeed, the behaviour of the RMB after July 2005 is akin to a peg to the US dollar more than to a basket of diversified currencies.

There is no shortage of proposals in both the media and academia for China to reform its foreign exchange market and policy stance.[2] One argument offered by advocates of a flexible RMB is that it is to China's benefit to float its currency. It is based on the merits of exchange rate flexibility presented in the long-standing debate of exchange rate regime choices.[3] With a (*de facto*) fixed exchange rate, China has to give up monetary policy independence and follow the policy set by the US, which is the anchor currency country in order to maintain the pegged exchange rate. Despite its increasing integration into the world economy, there is no apparent evidence that China and the US share common business cycles. In the absence of similar cyclical behaviour, it is very costly for China to follow US monetary policy.

On the other hand, a flexible currency will isolate China from external shocks and, thus, allow China to pursue an independent monetary policy to address its own domestic economic issues. Thus, China stands to gain policy autonomy and the associated economic benefits by improving its exchange rate flexibility.

The relevance of the argument is, nonetheless, not beyond doubt. A natural question to ask is: Does exchange rate flexibility allow China to pursue an independent monetary policy?

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1 The estimated degree of RMB undervaluation varies with the model under consideration. Cheung, Chinn and Fujii (2005), however, point out that there is a high degree of uncertainty surrounding the estimated degree of undervaluation.

2 Some more recent examples are Eichengreen (2006), Glodstein (2004), Goodfriend and Prasad (2006), Roberts and Tyers (2003), and Williamson (2005). McKinnon (2005, 2006) and Mundell (2004) are among the few that favor RMB stability. McCallum (2004) and Schwartz (2005) represent yet another view on the issue: China, and not outside sovereignties, should determine the complex issue of reforming its foreign exchange policy.

3 Friedman (1953) presents some classic arguments for exchange rate flexibility.

It is well known that the insulation property of a flexible exchange rate system can be imperfect.[4] In an extreme theoretical setting, a fixed exchange rate arrangement implies complete monetary policy dependence, which, in the current content, means that there is a one for one pass through of the US interest rate to the Chinese domestic interest rate.[5] The actual degree of pass through can be hampered by capital controls and sterilization operations. The link between exchange rate regimes and interest rate pass through is further complicated by the "fear of floating" phenomenon – a situation in which countries adopt a *de jure* flexible system and, at the same time, restrict the variability of their exchange rates and, thus, limit the effectiveness of exchange rate insulation property.[6]

Besides the "fear of floating", there are other reasons that countries with floating rates behave like those with exchange rates pegged to the US. For instance, countries with a substantial trade relationship with the US may find it beneficial to follow the US lead. Further, countries can take US monetary policy as an important input to their own policy making process if they perceive the US has a good gauge of the economic conditions and an adept monetary policy decision process. The observed monetary policy dependence can go beyond the extent implied by exchange rate arrangements.

The extant empirical evidence on the effect of fixing exchange rates on monetary policy dependence is mixed. Some recent studies including Borensztein *et al*. (2001) and Shambaugh (2004) find that pegged countries tend to follow their anchor currency country's interest rates more than the non-pegged ones and, thus, suggest that exchange rate flexibility enhances monetary policy independence. On the other hand, Frankel (1999), Frankel *et al*. (2004), and Hausmann *et al*. (1999) find no substantial evidence of exchange-rate-regime effects on monetary policy dependence – the interest rate pass through behaviour is similar across countries with different exchange rate regime choices.[7]

Apparently, both theoretical and empirical results are ambivalent on the issue. There is not a definite verdict that the prescription of RMB flexibility will give China an independent monetary policy.

Without the benefit of foresight, we turn our attention to a related question: Has China lost its policy independence and is the Chinese interest rate following the US interest rate under the current *de facto* pegged exchange rate arrangement? Apparently, this question has received less discussion in the debate on RMB policy. If the current Chinese interest rate is not driven by the US rate and if the Chinese economy is performing reasonably well, then abandoning the peg for policy independence may not be a relevant argument. Even a causal observer will not rule out the possibility of imperfect interest rate pass through when one takes into consideration the effects of capital restrictions (even though China's capital account is perceived porous), sterilization, and other possible policy measures.

[4] See, for example, Corden (1985), Devereux and Engel (1999), Mussa (1979), and Salant (1977).

[5] To be sure, interest rate interactions are one of the ways to infer monetary policy dependence. Linkages induced by a fixed exchange rate arrangement can also be gauged by, say, interactions between inflation (Cheung and Yuen, 2002; Ghosh *et al*., 1997; Quirk, 1994). Bergin and Jordà (2004), for example, use central bank issued policy rate targets to measure monetary policy interdependence.

[6] See Calvo and Reinhart (2000) and Hausmann *et al.* (2001) for an explication of the "fear of floating" phenomenon. Dooley *et al.* (2003) assert the peg to the US dollar is part of the export-led development policy pursued by these economies.

[7] Frankel *et al.* (2004) also reported that a floating regime offers "temporary monetary independence" in the sense that the interest rate adjustment speed is lower under a floating regime than under a fixed regime.

To shed some insights on China's dependence on the US monetary policy, we follow, for example, Frankel *et al.* (2004) and Shambaugh (2004) and infer policy dependence based on interest rate interactions between these two countries.[8] Specifically, we consider data on the Chinese one-month interbank interest rates and US one-month Fed fund interest rates.

We anticipate the empirical study of interest rate interactions has to overcome the uncertainty about data persistence. In general, interest rates are bounded and do not fit the description of a nonstationary I(1) process. However, it is difficult to fix an empirical interest rate model that rejects the I(1) hypothesis. To ensure that our inferences are robust to the assumption of data persistence, we employ different empirical techniques that allow us to handle various possible scenarios. The empirical strategy will be discussed in the subsequent sections.

2. Data Description

As mentioned earlier, one-month Chinese interbank interest rates and one-month US Fed fund interest rates are used to infer the pattern of interest rate pass through.[9] Arguably, there is little doubt that the US Fed fund interest rate movements are market driven and reflect policy intentions. The Chinese interest rate, one the other hand, may not be as well understood as the US one. Thus, we provide a brief background description of the Chinese interbank market.

The interbank market is one component of the growing Chinese money market.[10] In the early 1980s, it was an informal market for township and village enterprises. In 1985, the market got official endorsement and stated-owned specialized banks were allowed to participate in the lending and borrowing activities. The major change came in January 1996. At that time, China revamped the interbank market and instituted a unified interbank trading mechanism that responds to demand and supply conditions. Indeed, it is perceived that the interbank market is an efficient segment of the Chinese money market and, say, the one-month interbank rate is representative of other short-term interest rates and is an indicator of Chinese monetary policy.[11]

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8 Chinn and Frankel (1995) employ real interest rates to assess the impacts of US and Japanese policies on Pacific Rim economies.

9 The official rates set by the Fed and the People's Bank of China are not used because these rates change only infrequently and, thus, are deemed not suitable for the statistical analysis adopted in the current study.

10 The other main components are the interbank bond market and the bond repo market. The description of the Chinese interbank market is mainly drawn from Imam (2004), Li and Peng (2002), and Xie (2002).

11 The interbank lending rate ceiling was abolished. Foreign licensed banks were allowed to borrow RMB in the interbank market after May 1998. See Imam (2004), Li and Peng (2002), and Xie (2002) for a more detailed discussion.

To facilitate interpretation, we also examine the dependence of the Hong Kong one-month interbank interest rate on the US rate. The choice of Hong Kong is driven by a few considerations. First, the theoretical insulation property of the exchange rate arrangement can be illustrated quite clearly within the framework of a small open economy without capital controls. The academic description of a small open economy without capital controls, however, represents some stringent conditions in reality. Hong Kong is a small open economy that is renowned for its laissez-faire policy, minimum government intervention, and free capital mobility. Arguably, Hong Kong is one of the few economies that has attributes very close to the theoretical description of a small open economy without capital controls. Thus, Hong Kong is a good reference point in evaluating exchange rate regime effects.

Second, Hong Kong has a *de facto* fixed exchange rate against the US dollar since adopting a currency board system in 1983. During the sample period under consideration, both Hong Kong and China follow a similar *de facto* exchange rate arrangement.

Third, Hong Kong has significant linkages with China – at least, geographically and economically. The close tie between these two economies helps compare the responses of their interest rates to the US interest rate. In sum, these features make Hong Kong a good benchmark for evaluating the interest rate interacts between China and the US.

In view of the development of the Chinese interbank market, we consider the sample period from February 1996 to April 2006. The monthly data were retrieved from Bloomberg L.P. and CEIC. Graphs of the one-month and official discount rates are plotted in Figure 1 to Figure 3. Figure 4 contains the official rates from the three economies. Two observations are apparent from these graphs. First, the three one-month interest rates in general move around their respective official rates and track their movements quite well. Thus, these market interest rates reflect the policy intentions and are suitable for studying interest rate dependence among these economies.

Second, the Hong Kong and US official rates appear to move in tandem, as expected. During the sample period, Hong Kong had a currency board arrangement. As a small open economy with almost no capital controls, Hong Kong is expected to have its interest rates follow the interest rates of its reserve currency – in this case the US dollar interest rates. While their official rates move in lockstep, the Hong Kong and the US market interest rates diverged a few times during the 1997 Asian financial crisis and in 1998 when the interest rate policy was used to defend the currency board arrangement. Around 2004, the Hong Kong interest rate moved away from the US interest rate for a different reason. During that time, because of the expectations of its currency's revaluation, Hong Kong experienced a large influx of hot money that kept its interbank interest rates lower than the US rates.[12]

The Chinese and US interest rates, on the other hands, display no obvious similarities. Thus, despite that China has a *de facto* peg, the Chinese interest rate does not vary along with the US one. Formal statistical evidence on the dependence between these interest rate data is presented in the following sections.

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12 To be exact, the market expected an imminent RMB revaluation and the HK dollar will follow the RMB move.

3. Preliminary Analyses

The augmented Dickey-Fuller (ADF) test is employed to assess the persistence of interest rate data. The ADF test is based on the regression equation:

$$\Delta Y_{it} = \omega_i + \tau_i t + \delta_i Y_{it-1} + \sum_{j=1}^{p-1} \varphi_{ij} \Delta Y_{it-j} + \varepsilon_{it} \tag{1}$$

where Y_{it} is the generic notation of economy i's interest rate at time t for i = China, Hong Kong, and the US. Δ is the differencing operation. Under the unit-root null hypothesis, $\delta_i = 0$.

Equation (1) includes both a constant and a time trend. The trend term is included to ensure the test result does not depend on the value of ω_i (Evans and Savin, 1984). West (1987) also points out that the ADF test is inconsistent if the process is stationary around a time trend and the trend term is not included. The inclusion of an irrelevant trend term, on the other hand, will lower the power of the test. In fact, for the interest rates under consideration, the trend term is only significant in a few instances. However, as a safeguard against misleading inferences, we choose to keep the trend term in the regression and accept a power loss. For completeness, we reported test results based on (1) with and without the trend term.

The ADF test results from the whole sample and two non-overlapping subsamples (1996-2000 and 2000-2006) are presented in Table 1. The lag parameter was chosen to eliminate serial correlation in the estimated residuals. The choice of the two subsamples allows us to examine whether interest rate interactions before and after the crisis are similar.[13] The results in Table 1 do not present unambiguous evidence on interest rate persistence. While the two ADF tests do not offer strong evidence against the unit root hypothesis for the entire sample, they give mixed results in the subsamples. Specifically, the Hong Kong and US interest rate data reject the unit root hypothesis in the 1996-2000 subsample but not in the second subsample. The results for the Chinese data are comparable to the other two economies but the evidence of stationarity in the first subsample is weaker than the evidence for the other two economies.

One can speculate that the interest rates follow a stationary process in the first subsample and a unit root process in the second subsample period. The whole period results are driven by the data properties of the 2000-2006 period. However, such an interpretation may not be correct. For instance, during the first subsample, the extraordinary economic events including the crises may have masked the true underlying interest rate dynamics.

The unit root test is notorious for its inability to offer a sharp inference to differentiate a unit root process from a persistent but stationary one. Thus, instead of forcing a definite inference, we examine evidence under both stationary and unit-root specifications for interest rate data. Such an approach will alleviate the possibility that the empirical interest rate interactions are driven by the stationarity assumption.

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13 We take both the 1997 and 1998 crises into consideration.

4. Interest Rate Dependence

The proper choice of a statistical technique to investigate interest rate interactions crucially depends on the presence or absence of a unit root in the data. For instance, if the data contain unit roots, then a cointegration rather than a vector autoregression setup should be used. Unfortunately, the unit root test results do not provide an incisive inference. In view of the ambivalence, a few approaches are considered to cover various possible scenarios. Thus, instead of betting on a specific technique, we contemplate evidence derived from procedures that may provide the correct inferences.

4.1 Cointegration

First, we assume the interest rate data have a unit root and the cointegration framework is adopted to investigate the empirical long-run and short-term interactions. Specifically, the Johansen approach, which offers a unified and multivariate setting to test for the presence of cointegration is used to analyze the interest rate data (Johansen, 1991).

Let Y_t be a 2x1 vector containing US and the Chinese (or US and Hong Kong) interest rate series. The Johansen test for cointegration is based on the sample canonical correlations between ΔY_t and Y_{t-p-1}, where p is a lag parameter. To implement the test, two least squares regressions:

$$\Delta Y_t = C_1 + \sum_{i=1}^{p} \gamma_{1i} \Delta Y_{t-i} + \varepsilon_{1t} \quad (2)$$

and

$$Y_{t-p-1} = C_2 + \sum_{i=1}^{p} \gamma_{2i} \Delta Y_{t-i} + \varepsilon_{2t} \quad (3)$$

are estimated, where the C_i's are constant vectors and the lag parameter p is chosen to eliminate serial correlation in the estimated residuals. The sample canonical correlations between ΔY_t and Y_{t-p-1}, adjusting for all intervening lags, are given by the eigenvalues, $\lambda_1 > \lambda_2$, of $\Omega_{21}\Omega_{11}^{-1}\Omega_{12}$ with respect to Ω_{22} where $\Omega_{ij} = T^{-1}\sum_t \hat{\varepsilon}_{it}\hat{\varepsilon}'_{jt}$, i, j = 1,2. The trace and the maximum eigenvalue statistics are given by, respectively:

$$t_r = -T\sum_{j=r+1}^{2} \ln(1-\lambda_j) \quad (4)$$

and

$$t_{r|r+1} = -T\ln(1-\lambda_{r+1}),\ 0 \le r \le 1. \quad (5)$$

The former statistic tests the hypothesis that there are at most r cointegrating vectors and the latter one tests the hypothesis of r against the alternative hypothesis of $r+1$ cointegrating vectors. The eigenvectors associated with λ_1 and λ_2 are sample estimates of the cointegrating vectors. The cointegration test results are reported in Table 2.

Quite surprising, there is very limited evidence of cointegration in these interest rate series. The null hypothesis is marginally rejected in only one case – the Chinese and the US interest rates in the full sample. For this case, the estimated cointegration vector is (1, 4.690) with the Chinese coefficient being normalized to 1. The estimated vector implies that the two interest rates move in opposite directions in the long run; a result that is not consistent with the notion that the Chinese interest rate follows the US rate. Thus, we do not consider it as an evidence of the dependence of the Chinese interest rate on the US rate.

One possible explanation of the negative result is that the data are noisy and, thus, make it difficult to reject the null hypothesis of no cointegration. One way to improve the test performance is to impose the theoretical relationship on the data. Theoretically, under a fixed exchange rate arrangement, the dominating economy should dictate the common interest rate movement. In the current context, it means the interest rates in China and Hong Kong should equal the interest rates in the US, apart from, say, a risk premium. Assuming that the risk premium is stationary, the three interest rate series should move one to one in the long run. Thus, we impose the (1, -1) restriction and examine the stationarity of interest rate differentials between the US interest rates and the other two interest rate series.

The results of testing for the stationarity of interest rate differentials are presented in Table 3. There is only one case in which there is evidence of a stationary interest rate differential series. The ADF test suggests that the Hong Kong and US interest rate differential is stationary between 1996 and 2000.

In sum, there is only very weak evidence of long-run interest rate interactions between China and the US. There is a caveat: the validity of these results depends on whether the interest rate series are stationary or follow a unit root process.

4.2 Vector Autoregression

In this subsection, we consider a few additional specifications for studying interest rate interactions. Specifically, three variants of the vector autoregression (VAR) model are considered:

$$Y_t = \mu + \sum_{i=1}^{p} \Gamma_i Y_{t-i} + \varepsilon_t, \tag{7}$$

$$Y_t = \mu + \tau' t + \sum_{i=1}^{p} \Gamma_i Y_{t-i} + \varepsilon_t, \tag{8}$$

and

$$\Delta Y_t = \mu + \sum_{i=1}^{p} \Gamma_i \Delta Y_{t-i} + \varepsilon_t. \tag{9}$$

The three equations have different implicit assumptions about interest rate dynamics. Equations (7) and (8) implicitly assume the interest rate data are stationary around a constant and around a time trend, respectively. Equation (9) accounts for the case in which the data are difference stationary but are not cointegrated; see Shambaugh (2004).

The Wald-type causality test based on exclusion restrictions under the VAR framework is employed to investigate interest rate interactions between the three economies. Four different null hypotheses are considered. They are a) the US interest rate does not cause the Chinese interest rate, b) the Chinese interest rate does not cause the US interest rate, c) the US interest rate does not cause the Hong Kong interest rate, d) the Hong Kong interest rate does not cause the US interest rate. Given the *de facto* exchange rate arrangements and the dominance of the US, one expects the test will reject the null hypotheses (a) and (c) but not (b) and (d).

The causality test results are summarized in Table 4. For the China and US pair, the results vary across the three VAR specifications and sample periods. The evidence of the US interest rate affecting the Chinese interest rate, in general, is not strong. Instead, there are non-negligible signs that the US interest rate is influenced by the Chinese interest rate – a result that is not expected from traditional considerations.[14]

For the entire sample, the statistics strongly reject the hypothesis that the Chinese interest rate does not Granger cause the US interest rate in all the three VAR models – these statistics have a p-value less than 1%. The significant China effect seems contradictory to the conventional argument. On the other hand, the US effect on China is relatively weak – the hypothesis that the US interest rate does not cause the Chinese interest rate is only rejected at the 8.8% level under specification (7), at the 9.2% level under (8), and at the 11.2% level under (9). The most one can infer from these results is that the evidence points to feedback between the two interest rates but China's effect on the US is more significant that the US effect on China.

For the subsample 1996 to 2000, there is no evidence that the US is causing the Chinese interest rate. China, on the other hand, appears to have had a significant impact on the US interest rate under all the three specifications, with the statistics having p-values of less than 1%. The results for the 2000-2006 subsample are mostly insignificant. The only significant case is found under specification (7) in which the hypothesis that the US does not cause China's interest rate is rejected at the 6.3% level. There is no evidence that China influenced US interest rates during this period. The results in the first and second subsamples are not consistent with the common belief that China is increasingly integrated with the global economy and its influence on the world is growing in the new millennium.

The full sample results pertaining to the Hong Kong and US pair are largely in line with the US dominance story. The statistics underscore the US influence on the Hong Kong interest rate. In all the three VAR models, the hypothesis that the US interest rate does not cause the Hong Kong interest rate is soundly rejected. Hong Kong, on the other hand, is found not to affect the US interest rate. The result is in accordance with the conventional wisdom that the Hong Kong interest rate should follow the US one because it is a small open economy with capital mobility and is pegged its currency to a large US economy.

[14] While we do not necessarily subscribe to it, there is a view that the US interest rate is affected by China's policy. For instance, consider the "revived Bretton Woods system" interpretation (Dooley *et al.*, 2003; 2005). China maintains a low currency value to promote exports and, hence, economic growth. It invests its accumulated dollar surpluses in, say US treasuries and, keeps the US interest rate at a low level.

The two subsamples, however, give a different picture on the causal relationship between the Hong Kong and the US interest rates. There is evidence of no causality in both directions in the first subsample that covers 1996 to 2000 – the US does not affect Hong Kong and vice versa. The effect of the US on Hong Kong interest rates shows up in the sample spanning 2000 to 2006. During that period, the hypothesis that the US does not cause Hong Kong interest rates is rejected at the 2.4% level or lower. Interestingly, Hong Kong is found to not affect the US at the 5% level but to affect the US at the 10% level. Thus, the Hong Kong effect is detected in the second subsample but not in the whole sample. Since the sample size is smaller in the second subsample, the results are likely to be driven by some period-specific factors and not by the power argument.

Overall, the China and US interest rate interactions revealed by the VAR results are not easily explained by conventional considerations. Specifically, the finding of the weak US effect on China and the significant China effect on the US is not in line with the argument that China loses its monetary policy independence under the *de facto* fixed exchange rate policy.

The Hong Kong and US results, on the other hand, are a little bit more comforting. They point to the big economy effect on a small open economy Hong Kong. Nonetheless, it is still puzzling to observe the Hong Kong effect on the US.

One observation is that, within each sample period, the causality results are relatively similar among the three VAR specifications, which encompass several assumptions of interest rate dynamics. Thus, the observed limited US effect on Chinese interest rates is not likely due to the model and the related assumed data dynamics.

4.3 The PSS Bounds Test

The validity of the inferences presented in the previous two subsections depends on the stationarity assumption – the data included in the model are assumed to have the same degree of integration. Recently, Pesaran, Shin and Smith (2001) proposed a procedure to detect the dependence of one variable on the others that is robust to the stationarity assumption. We call the test the PSS bounds test. In the current context, the PSS bounds test for testing the dependence between Chinese and US interest rates is based on the following autoregressive distributed lag model of order (p,q):

$$\Delta Y_{CN,t} = c + \varphi_{CN} Y_{CN,t-1} + \varphi_{US} Y_{US,t-1} + \sum_{j=1}^{p-1} \psi_{CN,j} \Delta Y_{CN,t-j} + \sum_{j=1}^{q-1} \psi_{US,j} \Delta Y_{US,t-j} + \omega \Delta Y_{US,t} + \varepsilon_t, \quad (10)$$

where $Y_{CN,t}$ and $Y_{US,t}$ are, respectively, the Chinese and the US interest rates. Under the null hypothesis of $\varphi_{CN} = \varphi_{US} = 0$, there is no relationship between Chinese and US interest rates. As suggested by Pesaran, Shin and Smith (2001), we use a flexible dynamic specification and do not restrict changes in Chinese and US interest rates to have the same lag structure.

One important assumption underlying the test is that the Chinese level variable $Y_{CN,t}$ does not cause the US level variable $Y_{US,t}$. Thus, the test implicitly imposes a conditional relationship between the two variables. It, however, does not preclude the possibility that changes in $Y_{US,t}$ ($\Delta Y_{US,t}$'s) are affected by changes in $Y_{CN,t}$ ($\Delta Y_{CN,t}$'s). The assumption may appear innocuous given the prominence of the US in both the international financial market and the global economy. To shed some light on the assumption, we will apply the PSS bounds test to an alternative specification later in this subsection.

Pesaran, Shin and Smith (2001) derive critical value bounds based on two sets of distribution functions to cover cases in which the right-hand-side variables in (10) are individually trend or individually difference stationary. Thus, the price for the robustness is the possibility of an inconclusive inference if the test statistic falls within the bounds.[15] For the Hong Kong and US interest rates, their interactions are investigated with the Hong Kong data replacing the Chinese data in (10).

The PSS bounds test results for the Chinese data are presented in Table 5. To facilitate discussion, estimates of (10) are also included. The lag parameters p and q are chosen to render insignificant serial correlation in the estimated residuals. Only significant lagged differences are reported for brevity.

The F-statistics for the null hypothesis of $\varphi_{CN} = \varphi_{US} = 0$ are listed in the last row of the Table. According to the critical values tabulated in Pesaran, Shin and Smith (2001) the bounds test statistics are not significant for the three samples under consideration. There is no evidence of the presence of a level relationship and the US impact on the Chinese interest rate. It is noted that the test results based on a less stringent assumption on data dynamics corroborate the cointegration results reported in the previous subsection.

Despite the absence of a level relationship, estimates of (10) show that changes in the Chinese interest rates respond to variations in the US interest rates. The US effect is, however, only revealed in the full sample but not in the two subsamples. Further, changes in the US rates have an overall negative effect on the Chinese rates in the entire sample. The negativity result, again, does not lend strong support to the contention that China's policy follows the US policy.

The bounds test and the associated regression results for the Hong Kong specification are given in Table 6. The adjusted R-squares in Table 6 range from 70% to 47%, which are higher than the range of 43% to 14% reported in Table 5. Apparently, the autoregressive distributed lag (p,q) model (10) fits the Hong Kong data better than the Chinese data. It is interesting to note that, in both cases, the second subsample gives the lowest adjusted R-squares.

There are a few observations from Table 6. First, using the appropriate bounds test critical values, the F-statistic rejects the hypothesis of $\varphi_{HK} = \varphi_{US} = 0$ in the full sample and the first subsample. Second, the φ_{HK} and φ_{US} estimates are similar in magnitudes but different in their signs during the full sample and the second subsample. Third, changes in the US interest rate have almost a one to one impact on changes in the Hong Kong interest rate in the full sample and first subsample. Fourth, even the F-statistic does not reject the null hypothesis, the second to fourth observations hold for the second subsample.

While the results are not uniformly confirmative, the observations listed above are indicative of the presence of the US effect and the dependence of the Hong Kong interest rate on the US rate. Further, in comparing results in Tables 5 and 6, we observe that the US effect on Hong Kong is more prominent than on China.

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[15] The exact critical value can be derived with information about the stationarity of the explanatory variables. The situation is similar to the use of Durbin-Watson statistic – the exact distribution of the statistic depends on information about the explanatory variables.

Tables 7 and 8 give the bounds test and regression results pertaining to the specification

$$\Delta Y_{US,t} = c + \varphi_i Y_{i,t-1} + \varphi_{US} Y_{US,t-1} + \sum_{j=1}^{p-1} \psi_{US,j} \Delta Y_{US,t-j} + \sum_{j=1}^{q-1} \psi_{i,j} \Delta Y_{i,t-j} + \omega \Delta Y_{i,t} + \varepsilon_t, \tag{11}$$

where i = China and Hong Kong. Similar to the remark made for (10), if we apply the PSS bounds test to (11) to infer the level relationship between the US and, say, the Hong Kong interest rates, we implicitly assume that the US interest rate $Y_{US,t}$ does not cause the Hong Kong rate $Y_{HK,t}$. Knowing that this may not be a viable assumption, we do not literally interpret the statistics reported in the table but, rather, treat them as preliminary results that are indicative of interest rate interactions.

One observation from both Tables 7 and 8 is that all the differences between Chinese and Hong Kong interest rates are not significant and, thus, not reported. That is, the variations of the US interest rate respond neither to the Chinese nor Hong Kong interest rate changes. While two bounds test statistics in Table 7 and one statistic in Table 8 are significant, the lagged levels of the Chinese and Hong Kong rates; $Y_{CN,t-1}$ and $Y_{HK,t-1}$, do not appear significant. Even with the reservation about inference stated in the previous graph, the two tables offer some heuristic evidence that the US interest rate is dependent of the Chinese or Hong Kong interest rate.

5. Concluding Remarks

In this exercise, we examine one argument put forth in the recent debate on China's exchange rate policy. Specifically, we consider the assertion that a flexible RMB exchange rate is beneficial to China because exchange rate flexibility offers policy independence and allows China to pursue its own monetary policy to tackle domestic economic issues.

Our exercise does not predict whether a flexible RMB exchange rate will enhance China's policy autonomy. Instead, we investigate the degree of dependence under the existing *de facto* pegged exchange rate arrangement via interest rate pass through between the two economies. The interaction between Hong Kong and US interest rates is used as a benchmark for comparison. In general, the empirical evidence of the US effect on the Chinese interest rate is quite weak while the US interest rate pass through is quite strong for Hong Kong. Indeed, there are instances in which the statistical evidence is suggestive of the pass through of Chinese interest rates to the US interest rate.

One feature of the current study is that interest rate interactions are examined under several possible scenarios. The general inference of weak US effects on Chinese interest rates is drawn from a range of models and techniques that allow for different assumptions of data persistence and from a few historical periods. In other words, the result is not driven by a specific choice of model specification. The robustness of the finding casts serious doubt on the relevance of the argument that the existing *de facto* exchange rate arrangement ties China's policy to US policy. Even with the current *de facto* fixed exchange rate arrangement, there is no substantial evidence that the Chinese interest rate is driven by the US rate.

It is important to point out that the empirical evidence does not rule out the possible dependence of Chinese policy on US policy. However, it indicates China has alternative measures to de-link its interest rates from the US rate. The goal of China's monetary policy is to "preserve the value of (its) currency and promote economic growth".[16] China has a number of policy measures to manage its domestic economy. They include interest rate adjustment, reserve requirement, and open market operations. Capital control is the often cited policy that shields China from external financial disturbances. It is perceived that the *de jure* capital control is much less effective than the *de facto* regulation. Nonetheless, the latter can be proved important at the time of crisis in managing capital flows. Last, but not least, official guidelines still are an important element of the conduit of monetary policy despite the recent reduction of direct government intervention.

It is quite obvious that the Chinese authorities have been experimenting with these policy options to manage its economy. There are signs that China has increased the reign of market mechanisms. For instance, the changes in official interest rates that occurred in 2005 and 2006 are widely interpreted as signs of assigning a bigger role for interest rates in macroeconomic management.

One indicator of China's ability to manage its economy is its economic performance after 1994, the year that the RMB adopted the *de facto* peg. In the post-1994 era – including the Asian financial crisis period – China has enjoyed relatively stable inflation and strong economic growth. Apparently, China is able to deploy various policy measures to keep its economy under control and avoid major fiascos with the *de facto* peg in place. Nonetheless, it implies neither that there is no (substantial) cost in maintaining the peg with the US dollar nor that macro management is free of troubles.

The point is, given the current economic reality, whether it is the right time for China to exit from the current exchange rate system that has worked quite well in the last decade. Given China's increasing influence, a badly-timed exit from the pegged RMB policy may create adverse rippling effects in the international community. Undeniably, China faces some very complex problems. It is not our objective here to elaborate on various arguments for China to maintain the status quo of its exchange rate system.[17] Instead, our exercise, at the risk of repeating ourselves, indicates that the argument for a flexible RMB to insulate China's monetary policy from the US effect is not substantiated by the observed interest rate interactions.

Conceivably, there is antagonism towards the statistical evidence of the absence of China's policy dependence. Our intention is not to divert the discussion of RMB policy to a pure statistical analysis. Instead, it is our intention to provide a reasonably robust empirical evidence to facilitate the discussion of policy dependence or the absence of it. We recognize the possible disconnect between statistical results and economic reality. Given the ambivalent theoretical and empirical results on the exchange rate regime effect on policy dependence and our findings of weak US effects on China's interest rates, it seems prudential to be circumspect in asserting the benefit of policy independence from floating RMB.

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[16] Dai (2002).

[17] One practical view is to take full RMB convertibility as medium to long-term policy objective. Some commonly mentioned preconditions for the RMB to exit from the peg include reforms in the financial sector and in the setting of monetary and policies. It is also perceived that some obstacles to liberalizing the exchange rate arrangement are the high level of non-performing loan in the banking industry, the lack of corporate governance, and rigidities in the labor market. In sum, there is substantial risk in liberalizing the RMB before China's economy has established a sound financial sector and capital market and reduced impediments in the real sector.

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Table 1. Unit Root Test Results

		1996:2 – 2006:4		1996:2 – 2000:6		2000:7 – 2006:4	
		Constant	Constant + Trend	Constant	Constant + Trend	Constant	Constant + Trend
A. China							
	ADF	-2.830**	-1.091	0.326	-5.212*	-1.489	-2.108
	Lag	2	2	2	0	1	1
B. Hong Kong							
	ADF	-1.229	-1.496	-3.479*	-3.438**	-2.257	-0.430
	Lag	7	7	0	0	7	1
C. US							
	ADF	-1.911	-2.114	-4.708*	-3.676*	-3.009*	-1.071
	Lag	12	12	12	12	4	1

Note: The table reports results of applying the ADF tests to the Chinese, Hong Kong, and the US interest rates in Panel A, Panel B, and Panel C. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. "ADF" gives the ADF test statistics. "LAG" gives the lag parameters used in the test procedures. "*" and "**" indicate the rejection of the unit root null hypothesis at the 5% and 10% level, respectively. The Cheung and Lai (1995) finite sample critical values are used. In all cases, the Box-Ljung Q-statistics calculated from the first 5 and 10 estimated residual autocorrelations are not significant.

Table 2. Cointegration Test Results

		1996:2 – 2006:4		1996:2 – 2000:6		2000:7 – 2006:4	
		EIGENV	TRACE	EIGENV	TRACE	EIGENV	TRACE
A. China/US							
	r=1	6.1668	6.1668	0.1763	0.1763	2.5143	2.5143
	r=0	12.7248	18.8916	2.3018	2.4781	9.1555	11.6698
B. Hong Kong/US							
	r=1	2.2839	2.2839	0.0437	0.0437	4.1058	4.1058
	r=0	9.4839	11.7679	8.9298	8.9736	6.5875	10.6932

Note: The results of testing for cointegration between the Chinese and the US and between the Hong Kong and the US interest rates are reported in Panel A and B. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. Eigenvalue and trace statistics are given under the columns "EIGENV" and "TRACE." "r=0" corresponds to the null hypothesis of no cointegration and "r=1" corresponds to the hypothesis of one cointegration vector. The no-cointegration null is not rejected in all cases. The Cheung and Lai (1993) finite sample critical values are used. In all cases, the lag parameter used is selected using information criteria and the resulting Box-Ljung Q-statistics calculated from the first 5 and 10 estimated residual autocorrelations are not significant.

Table 3. Stationarity of Interest Rate Differentials

		1996:2 – 2006:4		1996:2 – 2000:6		2000:7 – 2006:4	
		Constant	Constant + Trend	Constant	Constant + Trend	Constant	Constant + Trend
A. China-US							
	ADF	-2.002	-2.125	0.581	-2.152	-1.544	-0.577
	Lag	8	5	1	1	8	0
B. Hong Kong-US							
	ADF	-1.801	-2.720	-3.637**	-1.137	-2.135	-2.418
	Lag	7	7	0	6	1	1

Note: The table reports results of applying the ADF tests to the interest rate differentials between China and the US, and between Hong Kong and the US in Panel A and Panel B. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. “ADF” gives the ADF test statistics. “LAG” gives the lag parameters used in the test procedures. “**” indicates the rejection of the unit root null hypothesis at the 10% level. In all cases, the Box-Ljung Q-statistics calculated from the first 5 and 10 estimated residual autocorrelations are not significant.

Table 4. Causality Test Results from Vector Autoregression Specifications

	US does not cause China	China does not cause US	Lag	US does not cause HK	HK does not cause US	Lag
A. 1996:2 – 2006:4						
Model (7)	12.393	51.956	7	24.781	7.026	8
	(0.088)	(0.000)		(0.002)	(0.534)	
Model (8)	12.265	50.862	7	27.822	6.534	8
	(0.092)	(0.000)		(0.001)	(0.588)	
Model (9)	8.924	40.741	5	6.773	6.118	6
	(0.112)	(0.000)		(0.010)	(0.410)	
B. 1996:2 – 2000:6						
Model (7)	0.177	19.725	2	0.262	0.214	1
	(0.915)	(0.000)		(0.609)	(0.643)	
Model (8)	9.662	33.582	8	0.379	0.012	1
	(0.290)	(0.000)		(0.538)	(0.912)	
Model (9)	0.144	17.856	1	0.279	0.245	1
	(0.704)	(0.000)		(0.597)	(0.621)	
C. 2000:7 – 2006:4						
Model (7)	5.545	2.502	2	13.327	4.702	2
	(0.063)	(0.286)		(0.001)	(0.095)	
Model (8)	2.802	0.310	2	7.470	5.454	2
	(0.246)	(0.856)		(0.024)	(0.065)	
Model (9)	2.525	0.034	1	9.180	3.343	1
	(0.112)	(0.854)		(0.002)	(0.068)	

Note: The causality test statistics calculated from models (7), (8), and (9) are reported. The null hypotheses are listed in the first row. The lag parameters selected for the VAR models are given under column labeled "Lag." Panels A, B, and C give results from the full sample, the first subsample and the second subsample, respectively. P-values are included in parentheses underneath the statistics.

Table 5. Bounds Tests on the Dependence of the Chinese Interest Rates

	2/1996 – 4/2006	2/1996 – 6/2000	7/2000 – 4/2006
Constant	0.107	0.279	0.216
	(1.015)	(0.147)	(1.109)
CN_{-1}	-0.052*	-0.018	-0.088
	(-2.719)	(-0.430)	(-1.294)
US_{-1}	-0.002	-0.087	0.001
	(-0.062)	(-0.263)	(0.072)
ΔCN_{-1}	-0.583*	-0.659*	-0.228*
	(-6.574)	(-4.194)	(-2.055)
ΔCN_{-2}	-0.184*	-0.269	–
	(-2.049)	(-1.768)	
ΔCN_{-5}	0.143	–	–
	(1.828)		
ΔCN_{-6}	–	–	-0.119
			(-1.727)
ΔCN_{-12}	0.183*	0.460*	–
	(2.301)	(2.557)	
ΔUS_{-2}	-0.440	–	–
	(-1.970)		
Adjusted R^2	0.395	0.425	0.144
F-statistic	5.110	0.114	0.846

Note: The PSS bounds test results with the change in the Chinese interest rate as the dependent variable are reported. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. The row labelled "F-statistic" gives the statistics for testing the hypothesis that both the coefficients of CN_{-1} and US_{-1} are zero (that is, the hypothesis of $\varphi_{CN} = \varphi_{US} = 0$). The upper bound of the 5% critical value is 5.73 for the three sample periods.

Table 6. Bounds Tests on the Dependence of the Hong Kong Interest Rates

	2/1996 – 4/2006	2/1996 – 6/2000	7/2000 – 4/2006
Constant	-0.188	–	-0.110
	(-1.874)		(-1.776)
HK_{-1}	-0.265*	-0.395*	-0.121*
	(-6.328)	(-4.684)	(-2.086)
US_{-1}	0.298*	0.429*	0.136*
	(5.304)	(4.256)	(2.282)
ΔHK_{-1}	0.128*	0.210*	–
	(2.393)	(2.282)	
ΔHK_{-2}	0.168*	0.231*	–
	(3.065)	(2.486)	
ΔHK_{-3}	-0.251*	–	–
	(-3.273)		
ΔHK_{-11}	–	–	-0.169*
			(-2.013)
ΔUS	1.074*	1.078*	0.931*
	(5.198)	(2.129)	(6.270)
$Adj.R^2$	0.792	0.809	0.471
F test	20.851	12.394	2.661

Note: The PSS bounds test results with the change in the Hong Kong interest rate as the dependent variable are reported. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. The row labelled "F-statistic" gives the statistics for testing the hypothesis that both the coefficients of HK_{-1} and US_{-1} are zero (that is, the hypothesis of $\varphi_{HK} = \varphi_{US} = 0$). The upper bound of the 5% critical value is 5.73 for the three sample periods. A significant 1997 financial crisis dummy variable is included in the full sample and first subsample.

Table 7. Bounds Tests on the Dependence of the US Interest Rates (on the Chinese Rates)

	2/1996 – 4/2006	2/1996 – 6/2000	7/2000 – 4/2006
Constant	0.047	1.242*	0.185
	(1.176)	(3.293)	(1.663)
CN_{-1}	0.004	-0.013	-0.027
	(0.550)	(-1.826)	(-0.697)
US_{-1}	-0.017	-0.205*	-0.040*
	(-1.522)	(-2.894)	(-3.830)
ΔUS_{-1}	0.419*	0.310*	0.467*
	(4.830)	(2.601)	(4.967)
ΔUS_{-2}	–	0.387*	–
		(3.267)	
ΔUS_{-3}	0.208*	0.413*	–
	(2.500)	(3.676)	
ΔUS_{-4}	–	0.253*	0.293*
		(2.438)	(3.103)
ΔUS_{-5}	–	0.322*	–
		(3.471)	
ΔUS_{-12}	0.473*	1.410*	0.175*
	(5.575)	(10.178)	(2.313)
ΔUS_{-13}	-0.393*	–	–
	(-4.376)		
Adjusted R^2	0.409	0.782	0.600
F-statistic	1.216	7.676	7.481

Note: The PSS bounds test results with the change in the US interest rate as the dependent variable are reported. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. The row labelled "F-statistic" gives the statistics for testing the hypothesis that both the coefficients of US_{-1} and CN_{-1} are zero (that is, the hypothesis of $\varphi_{CN} = \varphi_{US} = 0$). The upper bound of the 5% critical value is 5.73 for the three sample periods.

Table 8. Bounds Tests on the Dependence of the US Interest Rates (on the Hong Kong Rates)

	2/1996 – 4/2006	2/1996 – 6/2000	7/2000 – 4/2006
Constant	0.059	0.409	0.104*
	(1.382)	(1.156)	(2.625)
HK_{-1}	0.007	-0.009	-0.013
	(0.475)	(-0.714)	(-0.371)
US_{-1}	-0.022	-0.061	-0.027
	(-1.076)	(-0.882)	(-0.724)
ΔUS_{-1}	0.425*	0.556*	0.476*
	(4.895)	(3.283)	(5.107)
ΔUS_{-3}	0.203*	–	–
	(2.465)		
ΔUS_{-4}	–	–	0.302*
			(3.223)
ΔUS_{-12}	0.471*	1.163*	0.173*
	(5.567)	(8.233)	2.242
ΔUS_{-13}	-0.392*	-0.957*	–
	(-4.336)	(-4.177)	
Adjusted R^2	0.408	0.722	0.598
F-statistic	1.177	1.066	7.268

Note: The bounds test results with the change in the US interest rate as the dependent variable are reported. The first row lists the time periods covered by the full sample, the first subsample, and the second subsample. The row labelled "F-statistic" gives the statistics for testing the hypothesis that both the coefficients of US_{-1} and HK_{-1} are zero (that is, the hypothesis of $\varphi_{HK} = \varphi_{US} = 0$). The upper bound of the 5% critical value is 5.73 for the three sample periods.

Figure 1. The Chinese one-month interbank rate and official discount rate

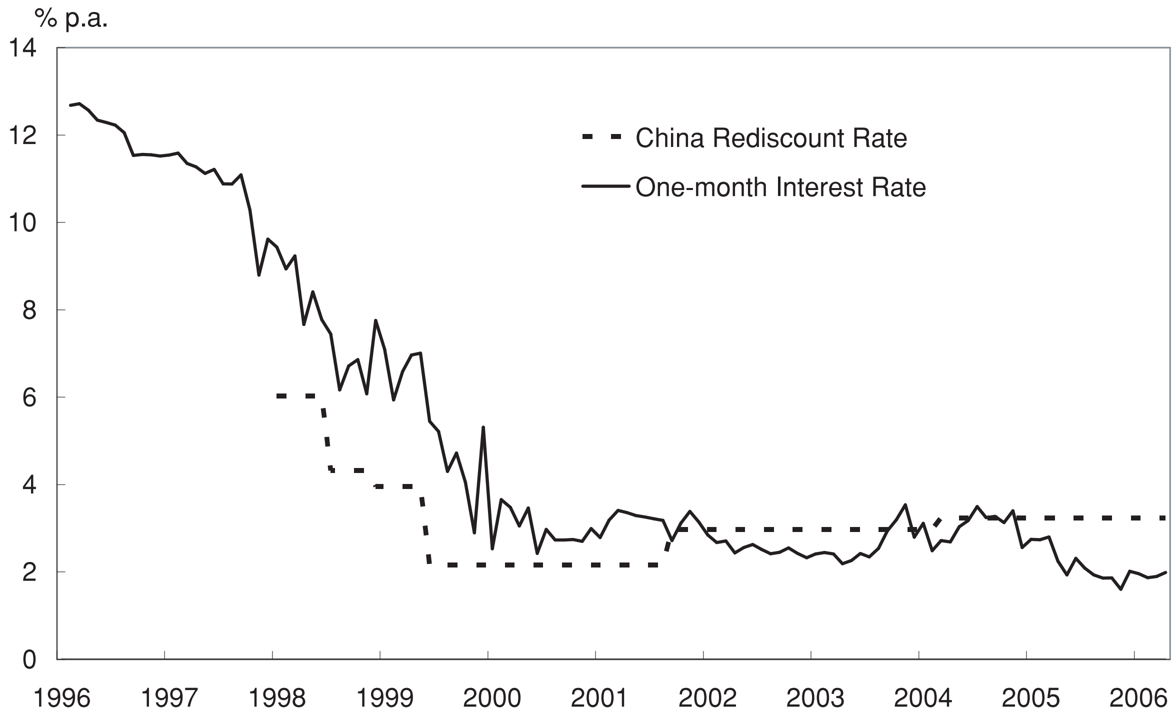

Figure 2. The Hong Kong one-month interbank rate and official discount rate

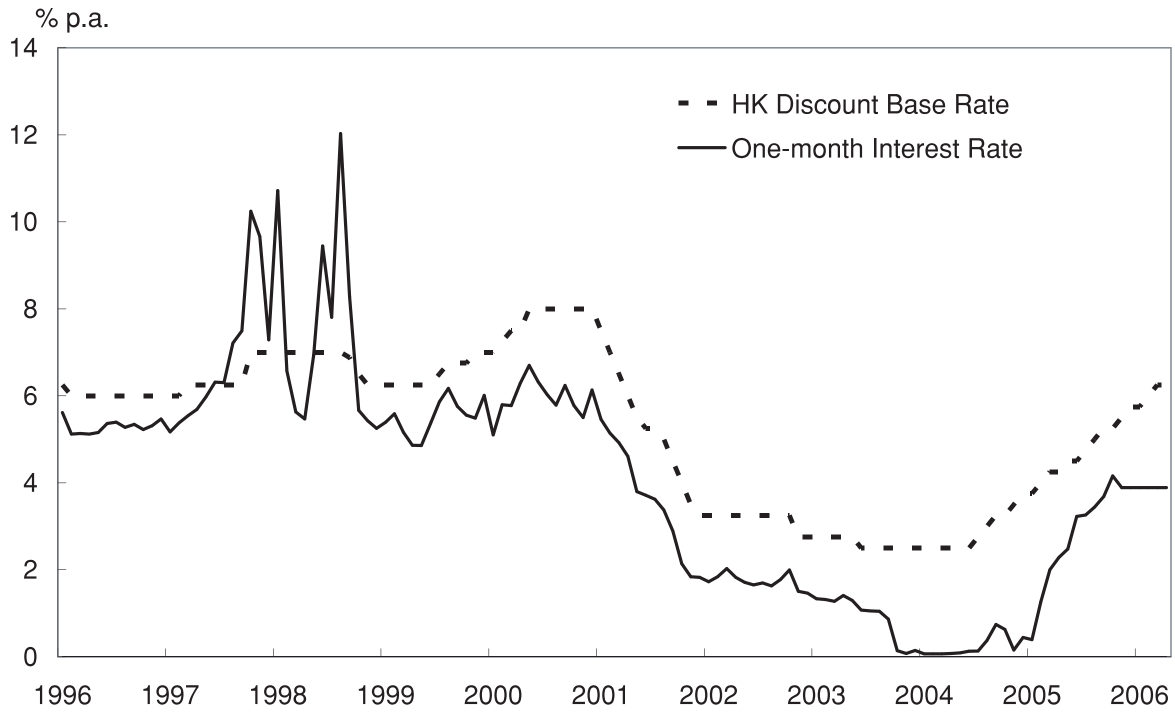

Figure 3. The US one-month Fed fund rate and official discount rate

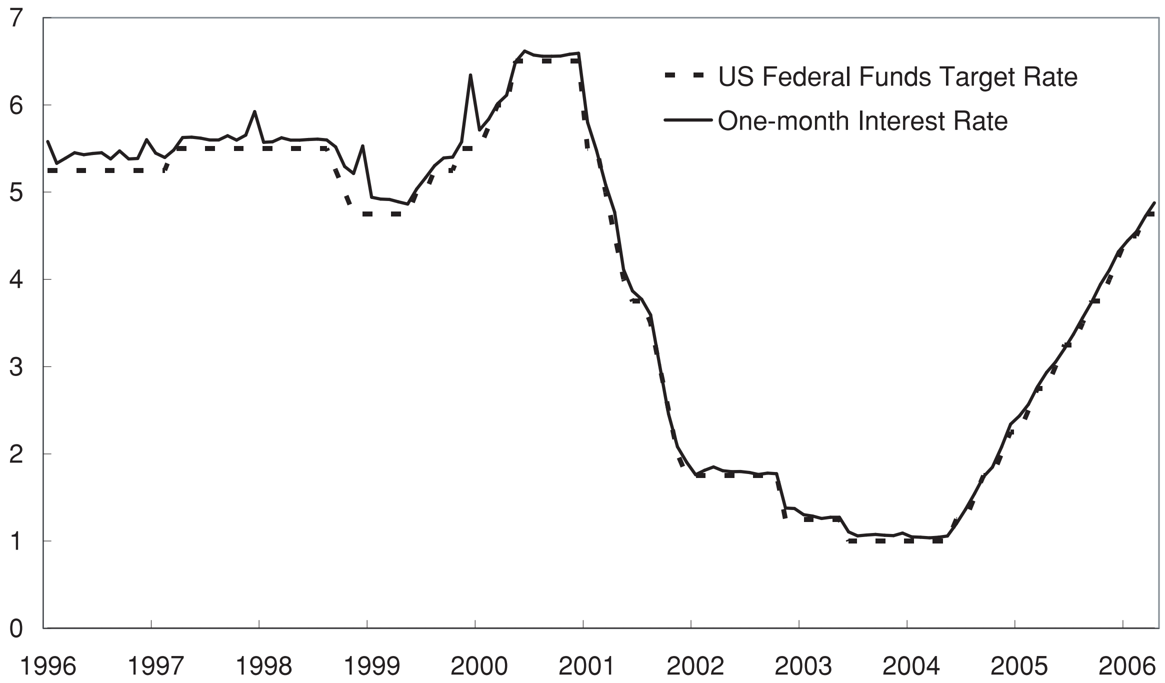

Figure 4. The official discount rates