INTERNATIONAL JOURNAL OF FINANCE AND ECONOMICS
Int. J. Fin. Econ. **10**: 117–132 (2005)
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/ijfe.264

DIMENSIONS OF FINANCIAL INTEGRATION IN GREATER CHINA: MONEY MARKETS, BANKS AND POLICY EFFECTS

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ABSTRACT

The financial linkages between the People's Republic of China (hereafter 'China') and the other Greater China economies of Hong Kong and Taiwan are assessed, and compared against those of China with Singapore, Japan and the United States. For both sets of links, there is evidence that *ex post* uncovered interest parity tends to hold over longer periods, and the magnitude of the parity deviations is shrinking over time. The deviations depend upon the extent of capital controls, and in certain cases, exchange rate volatility. However, while the money markets of China are increasingly linked to money markets in the rest of the world, our empirical results suggest that the banking sector—the main source of capital for Chinese firms—remains insulated. Copyright © 2005 John Wiley & Sons, Ltd.

JEL CODE: F31; F41

KEY WORDS: Uncovered interest parity; exchange rates; capital mobility; financial market integration

NON-TECHNICAL SUMMARY

There has been a relative dearth of research on the financial—as opposed to trade—links that tie the People's Republic of China to other economies. In this paper, the linkages between the People's Republic of China and the other Greater China economies of Hong Kong and Taiwan are assessed, and compared against those of the People's Republic of China with the economies of Singapore, Japan and the United States. This assessment is conducted in a series of steps. First, we measure the differences in interest rates, expressed in a common currency. We use interbank lending rates as our measure of interest rates, because these are typically the most liquid and well-developed in emerging markets. The condition that the common-currency interest rate difference is on average zero is called *ex post* uncovered interest parity. For both groups, there is evidence that this parity condition tends to hold over longer periods, although never instantaneously. In addition, we find that the magnitude of the deviations from parity is shrinking over time, particularly vis-á-vis Hong Kong and the United States. These results suggest that the People's Republic of China is enhancing its external financial linkages regionally as well as globally. To gain further insight, we next turn to examining the determinants of the parity deviations. Specifically, the relevance of regulatory barriers and macroeconomic policy uncertainty is evaluated by estimating regressions of the uncovered interest differentials on measures of capital controls, exchange rate and inflation rate volatility. We find that the degree of financial integration depends significantly upon the extent of capital controls and, in certain cases, the amount of exchange rate volatility. Finally, we discuss how relevant this measure of international financial integration is for domestic financial intermediation overall. Chinese firms rely

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heavily upon bank lending as a source of capital. Hence, we investigate the responsiveness of bank lending rates to interbank rates that are increasingly linked to foreign interest rates. Using an error correction model, we find that for the People's Republic of China and Taiwan, bank lending rates and interbank rates share essentially no covariability. The utter disconnection of bank lending rates from interbank rates makes a stark contrast with the results for the United States that indicate one-for-one comovement between the two rates. Hong Kong, Japan and Singapore are found to be intermediate cases where bank lending rates and interbank rates share some degrees of covariability. In view of these empirical results, we conclude that while the interbank markets of the People's Republic of China are increasingly linked to money markets in the rest of the world, the banking sector nonetheless remains insulated.

1. INTRODUCTION

The economies of Greater China—the People's Republic of China, Hong Kong and Taiwan—constitute one of the most dynamic regions of the world economy. Moreover, there is abundant documentation of the effects their economies are having upon the trade and production patterns of the region, and the world.[1]

In contrast, there is less information on another important aspect of economic integration, namely the degree to which capital markets in these economies are linked to those in the other major regional and world economies.[2] Yet, as evidenced by the attention focused on the actions by the People's Bank of China to raise benchmark rates in October of 2004, there is a clear need for additional information regarding the nature and strength of these financial linkages.

To remedy this deficiency, we investigate the evolution of financial linkages between short-term interest rates in the region. Specifically, we will examine the extent to which deviations from *ex post* uncovered interest parity exist. This parity condition is routinely used as a gauge of the degree of integration in financial capital markets. We will also examine how these deviations depend upon macroeconomic policies and regulatory impediments.

In East Asia, most of the borrowing and lending for physical investment takes place not through bond and money markets, but rather the banking sector, so we will also examine the degree to which the banking sector is integrated within and between economies.[3]

The plan of the paper is as follows. In Section 2, we lay out a framework for analysing the financial integration, and examine the behaviour of these deviations, in terms of stationarity characteristics, persistence and trends. Section 3 examines how these deviations can be related to economic factors. Section 4 discusses the relationship of the banking sector to these commonly investigated markets. Section 5 concludes.

2. ASSESSING THE INTEGRATION OF MONEY MARKETS

2.1. A framework

At first glance, it would appear easy to make the case that financial integration is proceeding rapidly. Figure 1 depicts one-month interbank (deposit) interest rate differentials for the People's Republic of China (hereafter 'China') on the one hand, and Hong Kong and Taiwan on the other. Figure 2 presents the differentials with respect to Singapore, Japan and the United States. Apparently, the differentials with respect to Hong Kong and Taiwan are smaller than those for the other three economies. In the mid-1990s, Chinese interest rates were above those of Hong Kong and Taiwan. With the exception of the period of the speculative attack on the Hong Kong currency board in mid-1998, those differentials have tended closer to zero. That convergence is also evident with respect to Japan, Singapore and the United States.

Simple interest differentials mask complex interactions and offsetting factors, however. Consider the difference in expected interest rates between two economies on assets of equal maturity and default risk,

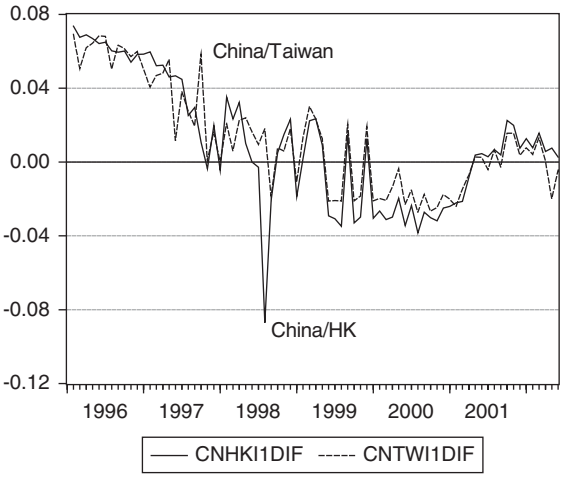

Figure 1. One-month interest differentials for China against Hong Kong and Taiwan.

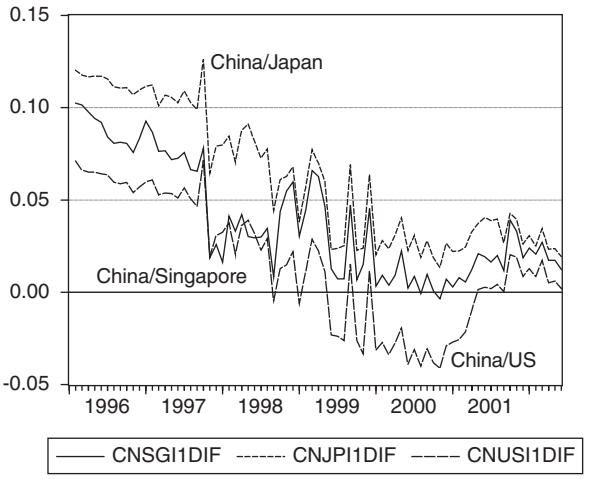

Figure 2. One-month interest differentials for China against Singapore, Japan and the US.

when expressed in common currency terms:

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

where s is the (log) exchange rate in terms of domestic currency units per foreign currency unit, and $\Delta s_{t+k}^e \equiv s_{t+k}^e - s_t$. The superscript 'e' denotes the expectations of a variable.

The objects on the right-hand side of (1) are of interest in their own right. The term in square brackets is called the covered interest differential and the term $(f_{t,t+k} - s_{t+k}^e)$ is sometimes labelled the exchange risk premium. The covered interest differential is identified as the political risk associated with capital controls or the threat of their imposition (Dooley and Isard, 1980). When both of these terms are zero, then the interest differential equals expected depreciation. Rearranging, this means the uncovered interest differential equals the sum of political risk and exchange risk:

$$(i_t^k - i_t^{k*}) - \Delta s_{t+k}^e \equiv [i_t^k - i_t^{k*} - (f_{t,t+k} - s_t)] + (f_{t,t+k} - s_{t+k}^e) \quad (1')$$

Frankel (1984) terms a zero covered interest differential a condition of perfect capital mobility, in the sense that movements of financial capital are unimpeded. The exchange risk premium is a measure to which these assets are viewed as being indistinguishable to the representative investor, either because the profile of their returns is identical, or because investors are risk-neutral.

Hence, it is not clear from the figures alone that financial integration is actually increasing. Ideally, what one would want to do is examine each of the objects on the right-hand side of (1′), as in a number of other studies (e.g., Chinn and Frankel, 1994). Unfortunately, data limitations preclude us from undertaking this approach for these economies.[4]

However, if we assume (plausibly) that Hong Kong, Japanese, Singapore and US covered interest differentials remain negligible, we can interpret the uncovered interest differentials of China against these countries as being driven by a combination of Chinese political risk and exchange risk premium. Since we do not have any independent information on covered interest differentials for Taiwan, we will interpret the Taiwan/China uncovered interest differential as representing a combination of political risk in China, Taiwan and the exchange risk premium on both currencies.

2.2. *Empirical implementation*

Strictly speaking, uncovered interest parity is an *ex ante* concept defined by expectations rather than realized depreciation rates. However, since we do not have observations on market expectations, we cannot evaluate financial integration directly. Instead, we employ an operational version based on *ex post* differentials,

$$\text{DRUIP} \equiv (i_t^k - i_t^{k*} - \Delta s_{t+k}) \tag{2}$$

to examine the data. One way to justify the use of (2) is that, under the rational expectations hypothesis, the *ex post* realizations are unbiased predictors of the *ex ante* counterparts.[5] Since there is substantial evidence that expectations are not unbiased (Chinn and Frankel, 1994), we refer to (2) as the deviation from rational uncovered interest parity (DRUIP).

For each pair of economies, the DRUIPs ($i_t^k - i_t^{k*} - \Delta s_{t+k}$) are constructed to examine the relevance of the parity conditions and assess the degree of integration between China and the other economies. For notational simplicity, we drop the term '*ex post*' hereafter. The data used are monthly observations on one-month interbank interest rates, exchange rates for China,[6] Hong Kong, Taiwan, Singapore, Japan and the United States, from February 1996 to June 2002. See the Data Appendix for a more detailed description.

The Hong Kong/China and US/China DRUIPs are shown in Figure 3, while the remaining pairs are exhibited in Figure 4. Since the currencies of China and Hong Kong are, effectively, pegged against the US dollar, it is no surprise that these differentials mimic those for the corresponding interest differentials. In stark contrast, the DRUIPs for the Taiwan, Singapore and Japan pairs are much more variable. Table 1 presents some summary statistics for these series. Several observations are in order. The DRUIP indicates that Hong Kong/China and US/China appear the most tightly linked, with the smallest mean values and smallest range. With the exception of Singapore/China, this characterization is not sensitive to whether a dummy variable for the 1997 currency crises is included or not.

We now proceed to a formal econometric examination of the time series behaviour of these DRUIPs. First, we test for the presence of a unit root in these differential series. Second, we assess the predictive ability of the past values of a differential series. Third, we examine whether the absolute value of these deviations from the parity condition are shrinking over time or not.

Our analysis runs from the beginning of 1996 to mid-2002. The period of analysis is dictated by data availability, and more importantly, by the realities of the liberalization process in China. A unified national interbank market was only established in January of 1996; prior to that the interbank market was substantially controlled (Xie, 2002). Hence, extending the interest rate series backwards would not yield more information relevant to assessing financial integration.[7]

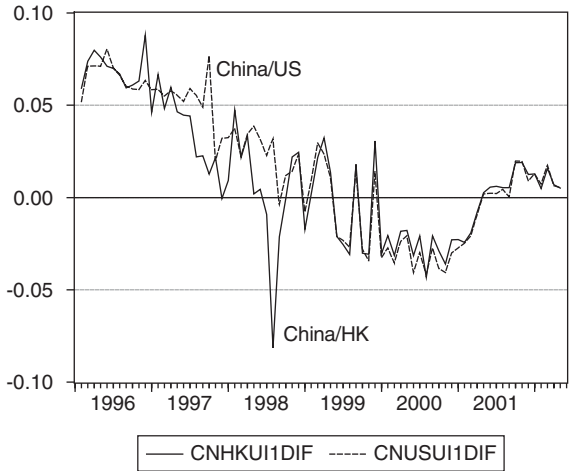

Figure 3. One-month uncovered interest differential for China against Hong Kong and the US.

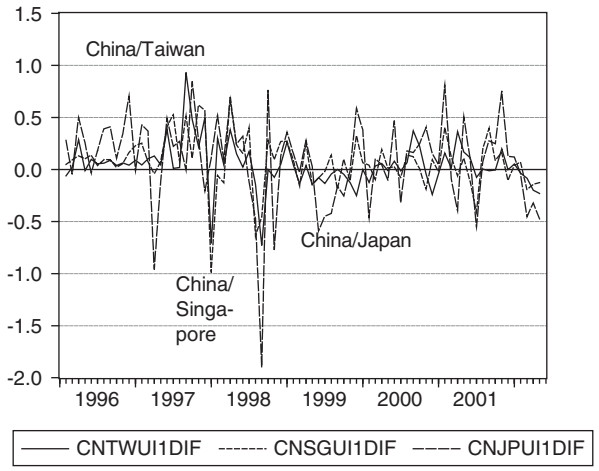

Figure 4. One-month uncovered interest differential for China against Taiwan, Singapore and Japan.

Table 1. Descriptive statistics: deviations from rational uncovered interest parity

	Hong Kong/China	Taiwan/China	US/China	Japan/China	Singapore/China
Mean	−1.276**	−7.274*	−1.718**	−17.382**	−4.523
Mean with 97 dummy	−0.792#	−2.338	−1.005*	−15.475**	−0.485
Maximum	9.787	51.813	4.434	79.034	160.636
Minimum	−9.150	−160.383	−8.377	−128.787	−53.803
Variance	14.349	714.270	13.964	1744.785	889.076
Skewness	−0.074	−2.638	−0.018	−0.535	2.748
Kurtosis	−0.224	14.016	−1.163	0.513	12.977

Note: The deviations from rational uncovered interest parity are annualized and measured in percentage terms. **, * and # indicate that the sample mean is significantly different from zero at the 1%, 5% and 10% levels, respectively.

2.3. *Are the differentials mean reverting?*

As our first test, we use the concept of mean stationarity to evaluate the parity condition. If the DRUIPs are stationary, then even though the condition does not hold in the short run, it does in the long run. The use of the stationarity criterion is appropriate because a parity relation is usually established under some idealized conditions that are unlikely to hold in the short run. The use of stationarity tests can also be rationalized by recalling that we only observe *ex post* depreciation rates; hence it makes no sense to assume that the *ex post* parity conditions hold instantaneously. As long as the parity conditions hold *ex ante* and the expectations errors are mean stationary, tests for stationarity will be informative.

A modified Dickey–Fuller test known as the ADF-GLS test (Elliott *et al*., 1996) is used to test for stationarity. While the standard Dickey–Fuller procedure is notorious for its low power, the ADF-GLS test is shown to be approximately uniformly most powerful invariant. The ADF-GLS$^{\tau}$ test allows for a linear time trend and an intercept, while the ADF-GLS$^{\mu}$ test does only for an intercept term.[8] For completeness, we conduct both tests.

Panel A of Table 2 presents the results of applying the unit root tests on the uncovered interest differential series. For all pairs, excepting the US/China, the unit root hypothesis is strongly rejected by both ADF-GLS$^{\tau}$ and ADF-GLS$^{\mu}$ test statistics. And when a dummy accounting for the 1997 crisis is included, even the US/China series exhibits stationarity. Hence all the uncovered interest differential series are stationary and shocks to uncovered interest parity are transitory.

Table 2. Characteristics of deviations from rational uncovered interest parity

	Hong Kong/China	Taiwan/China	US/China	Japan/China	Singapore/China
Panel A					
ADF-GLSμ	−2.126* [5]	−7.019* [1]	−1.698 [3]	−8.344* [1]	−8.263* [1]
Q(6)	5.554	10.304	3.748	6.429	5.454
Q(12)	10.670	18.275	14.363	14.396	13.593
ADF-GLSτ	−2.808# [2]	−4.892* [2]	−1.263 [3]	−8.794* [1]	−8.445* [1]
Q(6)	9.457	8.471	3.534	6.648	7.178
Q(12)	17.473	18.375	14.266	12.773	15.216
Panel B					
AR(1)	0.429**	0.189	0.384**	−0.022	0.031
	(0.118)	(0.115)	(0.115)	(0.118)	(0.117)
AR(2)	0.137	—	0.268*	—	—
	(0.129)		(0.119)		
AR(3)	0.070	—	0.270*	—	—
	(0.130)		(0.112)		
AR(4)	−0.073	—	—	—	—
	(0.129)				
AR(5)	0.282*	—	—	—	—
	(0.115)				
Adjusted R^2	0.620	0.022	0.829	−0.013	−0.012
Panel C					
Individual	−0.950*	−1.760	−1.005*	−0.429	−0.932
	(0.299)	(2.448)	(0.282)	(1.902)	(3.367)
Group		−1.355		−0.788	
		(1.292)		(0.979)	
Common			−1.015		
			(0.761)		

Note: The results for US/China with 97 dummy are ADF-GLS$\mu = -2.869$* [1] with Q(6) = 7.792, Q(12) = 18.096 and ADF-GLS$\tau = -3.335$* [1] with Q(6) = 6.596, Q(12) = 17.158. Levels of significance are determined using finite sample critical values (Cheung and Lai, 1995). Figures in square brackets are lag parameters selected by the Bayesian information criterion. Q(6) and Q(12) are the Box–Ljung Q-statistics based on the first 6 and 12 autocorrelations of the estimated residuals.

2.4. Are the differentials predictable?

Panel B of Table 2 reports the results of the following regression:

$$q_t = \alpha_0 + \sum_{k=1}^{p} \alpha_k q_{t-k} + \varepsilon_t \tag{3}$$

where q_t is the DRUIP series. This regression has been used in some previous studies assessing the parity condition. Under instantaneous uncovered interest parity, the expected uncovered interest differential is random, has a zero mean, and cannot be predicted by available information. Thus, the significance of the α_k's in (3) can be considered as evidence against the validity of the (instantaneous) parity condition.

The DRUIP does not appear random for the Hong Kong/China and US/China pair. For these cases, the lagged uncovered interest differential variables are positively significant and indicative of short-run persistence. The adjusted-R^2 is quite high at the level of 0.62 and 0.83, respectively. If monies are free to move across markets, arbitrage can generate profits based on the pattern of persistent deviation and help restore the parity. However, the observed persistent deviations are consistent with the capital controls prevailing in China, which make this kind of arbitrage activity quite difficult, especially in the short run. The results for the other three cases, on the other hand, suggest the deviations are quite random, although the difficulty in identifying the persistence may be due to exchange rate volatility.

2.5. Are absolute deviations shrinking?

Next, we use a simple panel setting to reveal the trending behaviour of the parity deviations. Specifically, we investigate whether the magnitude of deviation is diminishing during the sample period. To this end, we construct an annual measure of absolute deviation by averaging the monthly absolute uncovered interest differentials. For a given calendar year t and economy-pair i, the annual absolute deviation is defined by

$$\tilde{q}_{i,t} = 12^{-1} \sum_{k=1}^{12} \mathrm{abs}(q_{i,t,k}) \tag{4}$$

where $\mathrm{abs}(q_{i,t,k})$ is the absolute value of the ith economy-pair's kth-month uncovered interest rate differential during year t, i = Hong Kong/China, Japan/China, Singapore/China, Taiwan/China and US/China, and $t = 1996, \ldots, 2001$.[9] The results of estimating the trend term in the panel regression

$$\tilde{q}_{i,t} = \alpha_i + \beta t + \varepsilon_{i,t} \tag{5}$$

are reported in Panel C of Table 2. The economy-pair-specific intercept term α_i allows individual absolute DRUIP series to have different means. The pair-specific trends (first row of Panel C) are all negative, indicating that the absolute value of the deviations narrowed over the sample period, thus confirming the impressions obtained from visual inspection of Figures 3 and 4. In terms of magnitudes, the Taiwan/China coefficient is the largest (−1.76); however, it is also very imprecisely estimated, with a standard error of 2.45, so no clear conclusions can be drawn on the evolution of integration here. In fact, it would have been surprising to find a rapid change here, given the existing controls on capital flows.[10] The next largest coefficients are the differentials involving pegged exchange rates—those with Hong Kong and with the United States. These estimates are also statistically significant. Hence, one can think of Chinese political and exchange risk as decreasing with respect to Hong Kong and the United States.[11] We also check whether imposing a common trend rate of decline yields interesting results. In this case, the common coefficient (last row of Panel C) is negative, but not statistically significant.

In order to examine the hypothesis that integration is proceeding more rapidly between China and the other Chinese economies (Hong Kong and Taiwan) than between China and the non-Chinese economies of the United States, Japan and Singapore, we estimate group-specific coefficients for the two sets of pairs (second row of Panel C). We found that the estimated pace of integration between the Chinese economies appears more rapid than the corresponding pace of integration with the non-Chinese economies (−1.4 vs −0.8). Unfortunately, the imprecision of estimates is sufficiently great, so that we are only left with the tantalizing suggestion that the hypothesis has empirical content.[12]

3. THE ECONOMIC DETERMINANTS OF PARITY DEVIATIONS

One drawback of the pure time series approach is that we are unable to determine whether the decline in the size of the differentials (when it occurs) is due to increasing integration (resulting from the elimination of regulatory impediments), or due to convergence in macroeconomic policies. For instance, if uncovered interest parity does not hold perfectly, then in principle, monetary policies can exert an influence on the *ex ante* and *ex post* uncovered interest differentials, what we have termed the DRUIP. Willett *et al*. (2002) have pointed this out in the context of covered interest parity tests.

Consequently, we undertake a panel regression analysis. We posit that capital account restrictions will impede capital flows, thereby allowing greater scope for deviations from uncovered interest parity. The other two variables reflect in part macroeconomic policies. The first is the volatility of exchange rate changes; the second the volatility of relative inflation. *A priori*, one would expect that the greater volatility of exchange rates might be associated with greater deviations from *ex post* UIP. That is because greater volatility might be associated with greater expectational errors that would then show up in *ex post* UIP deviations. We do not have a strong prior on inflation volatility's effect, but we include the variable as a check.

We regress the absolute value of the deviation from the parity condition on a set of regulatory barriers, and proxies for the uncertainty of macroeconomic policy:

$$\begin{aligned}\widehat{q}_{i,t} = \gamma &- 0.539^{**} \times \mathrm{KAOPEN}_{i,t} + 0.012^{***} \times \mathrm{Var}(\Delta s_{i,t+1}) \\ &- 0.063^{**} \times \mathrm{Var}(\pi_{i,t+1}) + \hat{u}_{i,t}; \quad \bar{R}^2 = 0.32,\ N = 330\end{aligned} \tag{6}$$

where $\widehat{q}_{i,t}$ denotes the monthly value of the absolute deviation from *ex post* uncovered interest parity (that is, the absolute value of DRUIP), KAOPEN_i is a measure of capital account openness in the non-China country of country-pair i, $\mathrm{Var}(\Delta s_{i,t+1})$ is a 13-month centered moving average of the variability of the nominal exchange rate, while $\mathrm{Var}(\pi_{i,t+1})$ is the counterpart for the inflation differential. ** (***) denote significance at the 5% (1%) level.

The DRUIPs are significantly linked to these variables. First and most importantly, note that capital openness exerts a strong and negative effect on the magnitude of these differentials. The capital openness variable is an index calculated by Chan-Lee (2002), utilizing the IMF's tabulation of officially recorded capital account restrictions, and following the methodology outlined by Quinn (1997). The index takes on higher values for greater degrees of openness. While the IMF indices have been widely criticized because they do not typically measure the intensity of the restrictions, the index we use attempts to incorporate the intensity of controls.[13]

One interesting aspect of the results is that while the cross-section variation in DRUIP can be attributed to increasing capital openness, most of the time series variation cannot. That is because China's (measured) degree of capital openness has been constant over the sample period, while only those of Taiwan and Japan have increased (see Figure 5). Hence, the decline in absolute values of DRUIPs for some country pairs—notably Singapore—are likely to be mostly a consequence of convergence in macroeconomic policies.

Second, exchange rate variability is positively associated with the deviations. To the extent that expectations errors are likely to be larger when exchange rate volatility is higher, this result is not surprising.[14] Interestingly, inflation volatility is negatively associated with DRUIP. This may be the result of the correlation of higher inflation with higher inflation volatility. When inflation is higher, interest rates tend to be higher, and in such cases *ex post* uncovered interest parity tends to hold better (Chinn and Meredith, 2004).

Given that both regulatory and macroeconomic variables have some impact, it would appear that diminishing DRUIPs are due to both greater integration due to decreased regulatory barriers, as well as increasing convergence in macroeconomic policies.

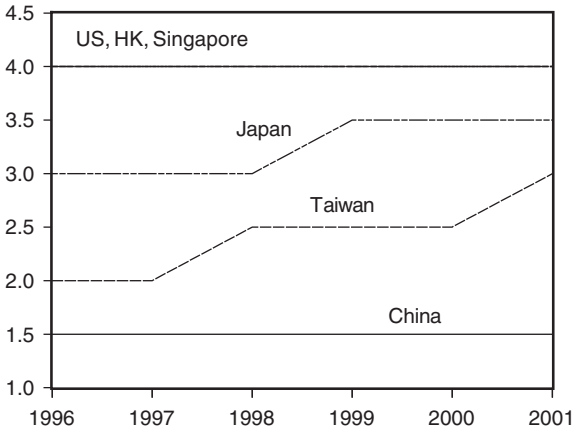

Figure 5. Measure of capital account openness.

4. AN ALTERNATIVE VIEW ON CAPITAL MARKET INTEGRATION

A fundamental issue pertaining to the foregoing analysis arises from the possibility that the interbank interest rates may not be representative of those that govern the economy, particularly investment behaviour. These rates on highly tradable assets sometimes pertain to assets traded in extremely thin markets. Non-financial firms must borrow either through the commercial paper market or from the banking system. While the commercial paper rate is likely to follow these interbank rates closely, *if* that market exists, in East Asian economies with the least developed financial markets, most enterprise or firm borrowing is typically through the banking sector.[15] With respect to China, Xie (2002, p. 31) notes that '...the volume of trade in the interbank market is still very small...'.

A natural procedure would be to consider the lending rate differentials, adjusted by the forward rate or expected depreciation, as the measure of capital mobility. Alternatively, one could examine how movements in offshore rates induce comovements in bank lending rates. Something like this approach is adopted in Browne and McNelis (1990), for the case of Ireland. They show that bank rates are not very sensitive to changes in offshore rates, thereby suggesting that bank credit is an asset that is not very tradable.

There are three key difficulties with implementing this approach in the East Asian context. First, emerging market banking systems are usually highly regulated, thereby making the market-determined lending rate unobservable. Second, even in the absence of government intervention, bank loan rates are 'sticky' due to the special functions performed by banks, specifically the screening and monitoring of projects. Thus, even in the absence of banking sector liberalization one would expect time-variation in the spread between the riskless rate and the bank lending rate due to the agency costs of external finance (e.g., Gertler *et al.*, 1991).

Third, in contrast with the other countries in this study, large portions of China's banking system are state-owned. In fact, about three-quarters of the banking system at the end of 1999 was accounted by the state banks (Shih, 2001, p. 3). Of course, ownership is not the full extent of the involvement. Although legislation passed in the mid-1990s required that bank lending be based on commercial criteria (Moreno, 2002), deposit and lending rates remain regulated by the People's Bank of China, within certain bands. Shirai (2002) documents the continued tendency for banks to lend to state-owned enterprises.

This hypothesized variation in 'stickiness' is confirmed by visual inspection of the time series plots of the interbank and loan rates (see Figures 6–11). In the USA, the prime rate by and large tracks the Fed Funds rate. At the opposite pole is the Chinese loan rate, which barely moves even as the interbank rate moves. The same is true of the Taiwanese rate. In between these two polar cases are the Hong Kong, Singapore and Japanese series.

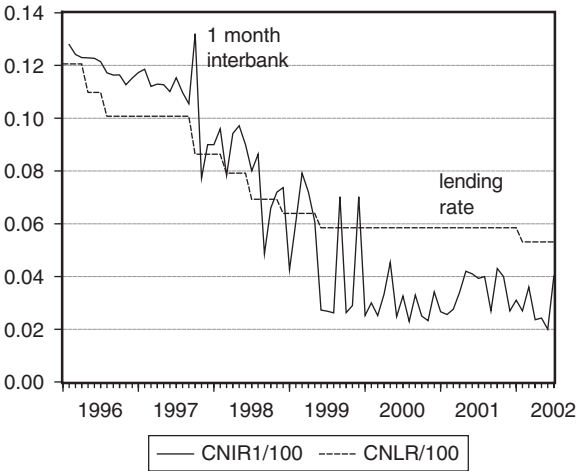

Figure 6. Interbank and lending rates for People's Republic of China.

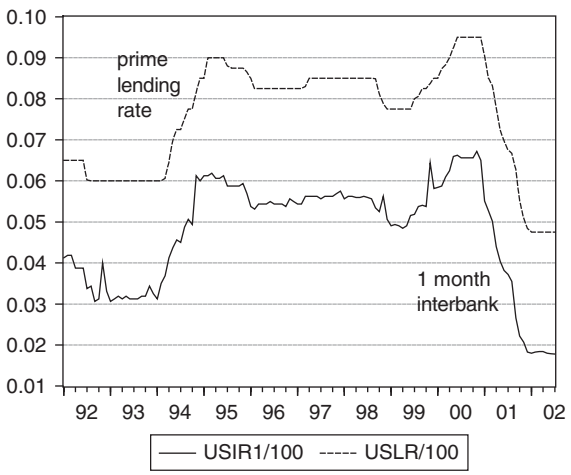

Figure 7. Interbank and lending rates for United States.

Following the work of Cottarelli and Kourelis (1994), Chinn and Dooley (1997) estimate a measure of bank loan rate stickiness from a regression of changes in bank lending rates on the change in the discount rate, a distributed lag of changes in the interbank rate and on the changes in lagged bank lending rate. Using our data set (which differs in sample period from the others), we estimate the following equation:

$$\Delta\rho_t = \psi_0 + \sum_{j=1}^{k} \psi_j \Delta\rho_{t-j} + \sum_{j=1}^{k} \sigma_j \Delta i_{t-j} + \gamma \Delta i^d_{t-1} + \varphi(\rho_{t-1} - \theta i_{t-1}) + \varepsilon_t \tag{7}$$

where ρ is the bank lending rate, i is the interbank interest rate, and i^d is the discount rate.

Note that equation (7) is an error correction model; the lending rate responds to lagged changes in own, interbank and discount rates. The presence of a lagged term involving the *levels* of the lending and interbank rate reflects the presumption that in the long-run, there is a relationship between the two variables. No such long-run relationship would be implied if equation (7) involved only changes in interest rates. The θ coefficient represents the long-run elasticity of the lending rate with respect to the interbank

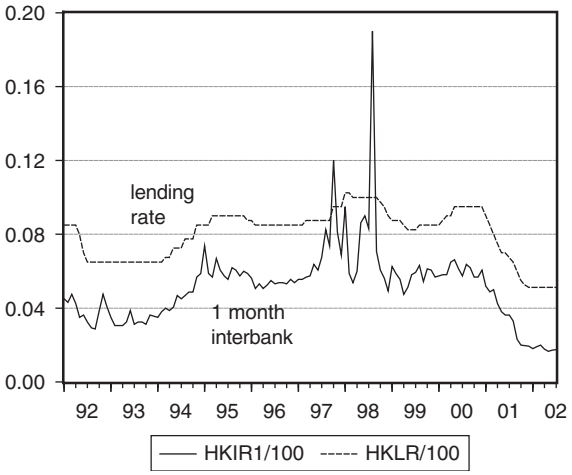

Figure 8. Interbank and lending rates for Hong Kong.

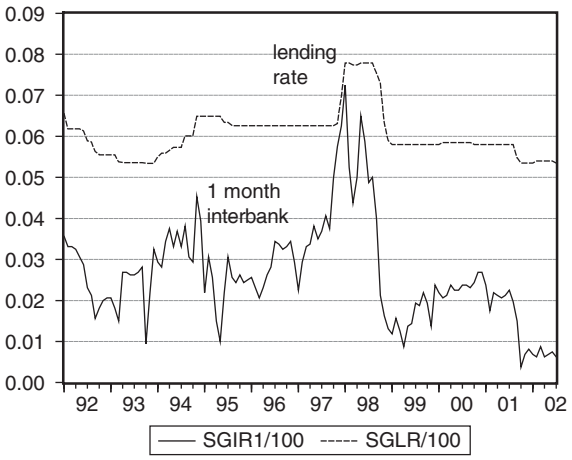

Figure 9. Interbank and lending rates for Singapore.

rate. The φ coefficient measures the rate at which the lending rate adjusts so as to close the gap between the lending and interbank rate.

Table 3 presents the results. While all the coefficients are of interest, of particular importance is the θ coefficient relating the bank lending rate to the interbank rate in the long run (labelled 'LR' in the table). The estimates here range from a high of 0.99 for the United States, to a low of essentially zero for China and Taiwan. Hence, a reasonable categorization of covariability (or low stickiness) would be:

Group 1 Hi-covariability	Group 2 Med-covariability	Group 3 No-covariability
United States	Japan Hong Kong Singapore	China Taiwan

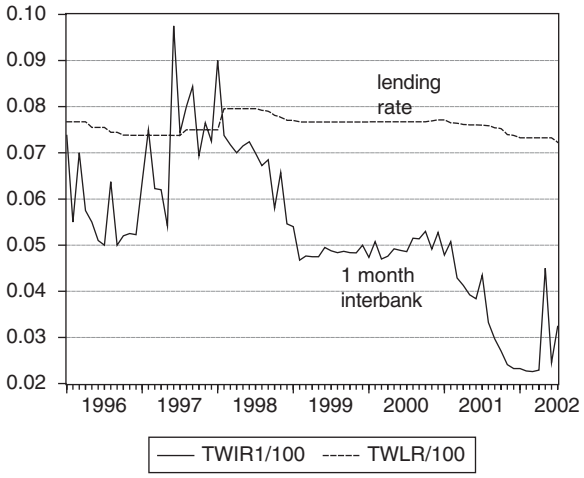

Figure 10. Interbank and lending rates for Taiwan.

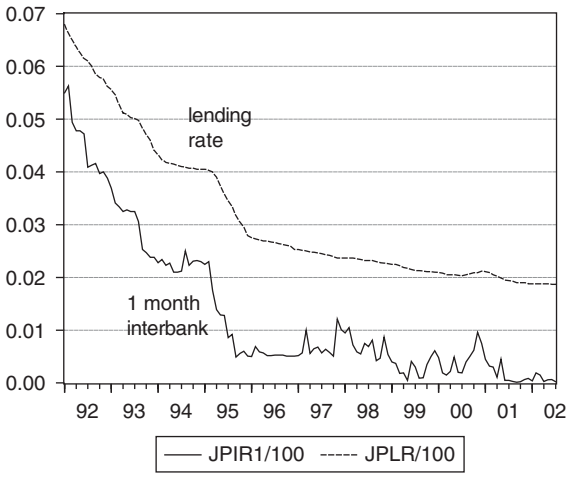

Figure 11. Interbank and lending rates for Japan.

The Group 1 countries appear to coincide with countries believed to have small DRUIPs, and high capital mobility. Consequently, one might be tempted to deduce that the same conclusions would be obtained regardless of whether money market or bank lending rates were used. However, the Group 3 country of China also falls into the small uncovered differential (with Hong Kong and US) camp. The stickiness in bank loan rates could be driven by differences in the portfolio of projects facing banks in these countries, by differences in monitoring technologies, as well as bank rate regulations, all factors not typically identified with capital mobility. Hence, it is not possible to determine whether these markets are integrated by inspecting the correlations among lending rates. In fact, we take as our prior that these portions of the capital market are *not* well integrated with offshore markets (and the rest of the economy).[16] Work by Reisen (1993) has suggested that exactly because several East Asian countries have reversed the order of liberalization to put external reform before internal financial reform, sterilization is fairly easy, although Frankel (1994) points out that this result relies upon assumptions about the nature of the disturbance affecting the country of interest.

Table 3. The response of lending rates to interbank and discount rates

Variable	China	HK	Taiwan	USA	Japan	Singapore
i_{t-1}	0.015	−0.022	0.013	−0.036	0.023	0.005
	(0.030)	(0.030)	(0.011)	(0.079)	(0.010)	(0.022)
i_{t-2}	0.008	−0.018	0.008	−0.119*	0.052**	
	(0.024)	(0.015)	(0.010)	(0.064)	(0.016)	
i_{t-3}					0.040**	
					(0.015)	
i^d_{t-1}	−0.016	0.430*	0.019	0.235*	0.039#	
	(0.131)	(0.168)	(0.069)	(0.103)	(0.022)	
LR	−0.148	0.568**	0.197	0.985**	0.790**	0.473**
	(0.984)	(0.185)	(0.141)	(0.025)	(0.070)	(0.078)
Adjust.	−0.043	−0.063*	−0.062	−0.369**	−0.041**	−0.134**
	(0.060)	(0.032)	(0.046)	(0.081)	(0.015)	(0.031)
Adj. R^2	0.070	0.016	0.1	0.570	0.676	0.320
N	75	108	76	124	123	125
Q-stat	4.070	12.319	2.167	9.817	4.981	2.434
[p-value]	[0.667]	[0.055]	[0.904]	[0.133]	[0.546]	[0.876]
Sample	1996m05–2002m07	1992m08–2002m07	1996m04–2002m07	1992m04–2002m07	1992m05–2002m07	1992m03–2002m07

Note: Selected coefficients from estimates of Equation (7) using nonlinear least squares. Standard errors in parentheses. **, *, and # indicate that the sample mean is significantly different from zero at the 1%, 5% and 10% levels, respectively. LR is the cointegrating coefficient θ. Adjust. is the adjustment coefficient φ. Q-stat is the Q-statistic for serial correlation using 6 lags [p-value for null of no serial correlation].

None of the foregoing should be taken to imply that regulatory authorities should intervene to make bank lending rates more responsive to interbank rates. Slow adjustment[17] of rates may be optimal in a world of asymmetric information, or may occur because of regulations implemented for reasons of prudential regulation. At this juncture, we merely wish to point out the fact that the banking systems in several of these countries, including most prominently China and Taiwan, are insulated in varying degrees from developments in money markets.

5. CONCLUDING REMARKS

The integration of the Chinese economy into the world economy has preoccupied business concerns and policymakers alike. There is a plethora of evidence that flows of capital and goods to and from China are increasing. This study has undertaken a price-based measure of the degree of integration—that is, we focus on asset prices rather than asset flows.

We find, to varying degrees, that the long-run version of the uncovered interest parity condition holds for the Greater China economies. Hence, there is evidence of some financial integration of these economies. On the other hand, the data do not in general satisfy the short-run parity conditions and we can conclude that China's short-term asset markets are not completely integrated with those of the other economies.

One interesting aspect of this study is that we find increasing convergence in not only nominal interest rates in local currency terms, but also in common currency terms. That is, interest differentials adjusted for changes in exchange rates are found to be shrinking in absolute value over time. We also determine that the size of these deviations depends upon policies both of a macroeconomic and regulatory nature. The differentials are greater when there is greater exchange rate volatility associated with floating regimes. On the other hand, the differentials appear to be smaller the more open the capital account is.

Finally, we observe that while financial capital appears to be increasingly mobile, it is unclear how much this increased mobility translates into the sphere of financial intermediation. To the extent that the banking sector taps into the interbank market, there is clearly some effect. However, the fact that the lending rates are so detached from the interbank rates suggests that the banking sector remains to a great degree insulated from rest-of-the-world relative prices.

It is important to note at this point that we do not necessarily believe that greater integration, either internationally or between the money markets and the banking sector, is necessarily desirable.[18] In this study, we have merely sought to characterize the degree of integration, using some standard tools of finance. The normative assessment of whether greater capital mobility is desirable, and whether lending rates should be further liberalized, can only be made in the context of a more complete model of the economy, wherein the problems of non-performing loans, uncertain property rights, asymmetric information and contingent liabilities are accounted for.

DATA APPENDIX

The interbank interest rate, exchange rate and price data are collected from four sources—Bloomberg Financial Services, CEIC database, the IMF's *International Financial Statistics* (*IFS*) and the Hong Kong Monetary Authority (HKMA). The monthly money market series retrieved from Bloomberg is the China one-month interbank offer rate. The monthly series retrieved from CEIC are the Hong Kong, Singapore and Taiwan one-month interbank offer rate, the Taiwan–US exchange rate, the Hong Kong, Singapore and Taiwan CPI. The monthly series from *IFS* are dollar-based exchange rates of Hong Kong dollar, Chinese yuan and Singapore dollar. The HKMA provided the Chinese consumer price series.

The bank lending rates and discount rates for all countries are drawn from the IMF *IFS* (November 2002 CD-ROM), except for the series for Taiwan. These series were obtained from the Central Bank of China's web site. The bank lending rates are described as follows:

- China—rate on working capital loans of one-year maturity.
- Hong Kong—rate quoted by the Hong Kong and Shanghai Banking Corporation, Ltd.
- Taiwan—prime lending rate of five major banks (series discontinued in January 2003).
- Singapore—minimum lending rate, reflecting average rates quoted by 10 leading commercial banks.
- Japan—weighted arithmetic average of contracted interest rates charged by all banks on both short- and long-term loans, discounts and overdrafts.
- United States—'prime rate', base rate charged by banks on short-term business loans.

In Section 4, the capital control data were obtained from James Chan-Lee, and are described in Chan-Lee (2002). Values for 2001 were assumed to equal the 2000 values for all cases except Taiwan, which uses the preliminary value assigned.

Depending upon the country examined, the sample period is from February 1992 or February 1996 to June 2002. The X-12 routine (with multiplicative factors on the log levels) was used to seasonally adjust all the price series. The Japanese CPI series was also adjusted for the imposition of new taxes in April 1997.

ACKNOWLEDGEMENTS

We thank the discussant Eric Girardin, Yunjong Wang, Tain-jy Chen, the participants of the HWWA/Universitée de la Méditerranée Aix-Marseille II Conference on 'Major Issues in the Dynamics of East Asian Financial Markets' and the Claremont China Finance Conference for their comments. The financial support of faculty research funds of the University of California, Santa Cruz is gratefully acknowledged. The views contained herein are solely those of the authors, and do not necessarily represent those of the institutions they are associated with.

NOTES

1. See Kamin *et al*. (2004) and Rumbaugh and Blancher (2004).
2. Zhang (2003) documents the impediments to capital flows, but does not measure the economic effects. For empirical studies of financial integration in East Asia, see Chinn and Frankel (1994) and De Brouwer (1999). Cheung *et al*. (2003) investigate intra-China linkages.
3. We do not deal with stock markets. As Green and Wall (2000) point out, the stock market is still not the major source of capital for firms.
4. We have only incomplete data on forward rates, and do not have data on expected exchange rate changes, as in Chinn and Frankel (1994).
5. Specifically, we are equating the subjective market expectations with the conditional mathematical expectations, i.e., $x^e_{t+k} = \mathrm{E}(x_{t+k}|\mathrm{I}_t)$, in a steady state such that $x_{t+k} - \mathrm{E}(x_{t+k}|\mathrm{I}_t) = \xi_{t+k}$ where ξ_{t+k} is a true innovation.
6. Eric Girardin has pointed out that the Chinese interbank market at the one-month maturity is sometimes quite thin. There is much more activity at the 20-day horizon; the two rates are fairly highly correlated, so for the sake of consistency, we retain the use of the one-month horizon.
7. There is a separate question of whether the one-month rate is representative of other short-term interest rates, including the commercial paper and repo rates. Li and Peng (2002) argue that in recent years the segmentation in these short-term instruments has largely disappeared.
8. See Elliott *et al*. (1996) for further details of the tests.
9. The year 2002 is excluded because we have only six observations for that year.
10. See Ma *et al*. (2002), especially pages 20–21. These patterns of results vis á vis Hong Kong and Taiwan are mirrored in Cheung *et al*. (2003), for real interest parity and relative purchasing power parity-based criteria for real and financial integration.
11. During the sample period, both Hong Kong and China have their currencies effectively pegged to the US dollar. Thus, these two exchange rates contribute little to the associated uncovered interest differentials. For the other cases, the exchange rate change dominates the relative interest rate and makes the uncovered interest differentials much more volatile. This may be the reason why the Hong Kong/China and US/China trend estimates are significant.
12. The inclusion of a 1997 (or 1998) dummy has no material impact on the trend estimates in Table 2.
13. China's index of capital account openness is constant over the sample period, so the variation in the index occurs across the partner countries. Tain-jy Chen has pointed out that this means liberalization of capital account restrictions among the non-China countries accounts for the non-macro component of the reduction in DRUIPs.
14. A complementary interpretation is exchange rate volatility increases the exchange risk associated with domestic assets. However, since one has to make strong assumptions regarding the covariance of exchange rate changes with consumption changes, we do not stress this interpretation.
15. A natural alternative would be the bond market. However, these markets are underdeveloped, especially in China, even for government securities (Zhang and Hui, 2001). The Taiwanese market is somewhat more developed (Hsueh, 2001).
16. This point is not necessarily inconsistent with the banking system being fairly internationalized. Ma and McCauley (2003) report quite substantial dollar deposits. However, the behaviour of these deposits is not independent of government regulations.
17. The levels of statistical significance of the φ estimates in Table 3 are based on conventional critical values. Since in certain cases the bank lending rate moves discretely, a larger critical value may be appropriate. However, this appears to be most relevant to the Chinese case, where the null already fails to be rejected.
18. For more extensive discussion of the policy issues involved in opening up the capital account further and implementing currency convertibility, see for instance Bank for International Settlements (2003).

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