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# International Capital Mobility in Emerging Markets: New Evidence from Daily Data

*Michael Kumhof**

## Abstract

This paper analyzes daily covered interbank interest differentials for three emerging markets before and after the 1997/98 financial crises, and compares them with those of four developed economies. It examines descriptive statistics of covered differentials and the long-run equilibrium (cointegrating) relationship between their interest rate and forward discount components. Mean differentials and their volatility were moderate before crises, but increased dramatically during crises. The main reasons are temporarily effective capital controls, large bank default risk premia, and capital market imperfections. The evidence for a cointegrating vector consistent with covered interest parity is strong, implying that, despite large short-term deviations, covered interest parity does hold as an equilibrium relationship.

## 1. Introduction

Assumptions about countries' degree of integration into international capital markets are key building blocks of macroeconomic models of open economies. The standard assumption of "perfect capital mobility" states that domestic agents can freely borrow and lend in international capital markets at the world real interest rate. It is difficult to devise unambiguous tests of this hypothesis. Montiel (1993) contains an overview of standard approaches used in the empirical literature, with specific reference to emerging markets. These include using the magnitude of capital flows as an indicator, testing for lack of effectiveness of sterilization, Feldstein–Horioka saving–investment correlations, Euler equation approaches, and interest arbitrage conditions including covered, uncovered and real interest parities. As pointed out by both Montiel (1993) and Frankel (1992, 1993), all but covered interest parity tests cannot be interpreted unambiguously as tests of a country's integration into international capital markets.

Covered interest parity states that, under full integration, capital flows should equalize the returns on any two assets that differ only in their country of issue and currency of denomination, while being identical in terms of maturity, liquidity, and default risk. This requires that their interest differential be equal to the forward discount between the two currencies. As shown by Obstfeld (1995), for eurocurrencies the covered interest differential equals the onshore–offshore interest differential, an unambiguous measure of international capital market integration. Obstfeld (1995) and Frankel (1993) show that for developed economies covered interest parity holds almost perfectly, but for emerging markets this has long been hard to test for lack of good data.

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* Kumhof: Stanford University, Stanford, CA 94305, USA. In 2001/2: on leave at the IMF, Washington, DC 20431, USA. Tel: 202-623 9020; Fax: 202-623 4740; E-mail: kumhof@stanford.edu. The author thanks the IMF for financial support. Helpful comments were received from two anonymous referees, Menzie Chinn, Sajjid Chinoy, Michael Horvath, Subir Lall, and seminar participants at Columbia and Stanford. Giovanni Facchini provided excellent research assistance. Help with obtaining data is gratefully acknowledged from Halim Alamsyah (Bank Indonesia), the Bank of Thailand, Alejandro Werner (Banco de Mexico), and Maria de las Nieves Rebollar (Banamex).

This paper uses daily data on emerging-market interest rates and forward exchange rates which have recently become available. Econometric tests taking account of the nonstationarity of interest rates and forward discounts are used. The covered interest parity hypothesis is tested only for the country's banking sector.

The main difficulty in testing for covered interest parity in emerging markets has been that liquid forward foreign exchange markets with publicly quoted prices did not exist until very recently. For larger emerging markets, forward markets were created in the 1990s, but only monthly data were typically available and used in studies such as that of de Brouwer (1997). An arbitrage condition like covered interest parity should, however, hold continuously, making data of higher frequency useful. Daily data are now available on Bloomberg from the mid-1990s for some large emerging markets including Indonesia, Mexico, and Thailand. They are used in this study, and compared with data for four European economies from the same source.

The existing literature often tests for covered interest parity by regressing the forward discount on the nominal interest differential. For an example, see Chinn and Frankel (1994). This assumes that nominal interest differentials are stationary, but especially between emerging market currencies and the US dollar they are often highly nonstationary. In that case ordinary least squares leads to spurious results if the interest differential and the forward discount are not cointegrated, and conventional rejection criteria lead to faulty inference even if they are. This paper therefore analyzes only descriptive statistics of covered differentials and the long-run equilibrium (cointegrating) relationship between their interest rate and forward discount components. It is found that mean differentials and their volatility were moderate before financial markets crises, but increased dramatically during crises. The main reasons are temporarily effective capital controls, large bank default risk premia, and a variety of capital market imperfections. The evidence for a cointegrating vector consistent with covered interest parity is strong, implying that, despite large short-term deviations, covered interest parity does hold as an equilibrium relationship.

Interest parity tests with specific sets of interest rates are commonly interpreted as evidence on the integration of the whole country into international capital markets. This is likely to be an overinterpretation, as the capital market integration of different sectors may differ greatly. Chinn and Dooley (1997) examine the firm sector, through tests of interest parities for lending interest rates. They find that "capital is not completely mobile . . . because the market in bank lending is not well integrated with either domestic or international capital markets." This paper examines only the domestic banking sector, by using the domestic interbank rate for parity tests.

## 2. Emerging Financial Markets

This section provides some country-specific information, mainly on Indonesia and Thailand, which will be useful to understand and interpret the empirical results. For a comprehensive analysis of many aspects of the Asian crisis, the reader is referred to Rivera-Batiz (2000). The focus here is more narrowly on the institutional features characterizing financial markets in these countries. The discussion is based on conversations with International Monetary Fund officials and on Lall (1997) and International Monetary Fund (1997).

Forward foreign exchange and money markets in Thailand and Indonesia were highly segmented before and especially immediately after the Asian crisis, while Mexico's markets were far more liquid and far less segmented. The following remarks

describe common features of Thai and Indonesian financial markets.[1] They are followed in two subsections by country-specific information.

The forward foreign exchange markets in Thailand and Indonesia did not always quote prices on a fully hedged basis; i.e., based on domestic–foreign interest differentials. This was true especially after the Asian crisis, and reflects segmentation between money and foreign exchange markets. Quotes were instead provided on a speculative basis, based on depreciation expected by currency traders.

Money markets themselves were very highly segmented into two separate markets, one between strong (creditworthy) banks and another between the remaining weaker banks. Strong banks were able to rely on retail deposits and, before the crisis, on international borrowing. These banks commanded low money market borrowing rates and were mostly net lenders to the central bank. Weak banks had access to a separate money market with higher interest rates. These banks were net borrowers from the central bank, which therefore effectively intermediated funds from strong to weak banks.

Market participants state that the forward discount accurately reflected expected depreciation, while interest rates did not either because of heavy market intervention by the central bank or because of significant additional counterparty risk premia.

### *Thailand*

The Thai baht had been under speculative pressure for several months before its final collapse in July 1997. International Monetary Fund (1997) reports that currency attacks took place in July 1996, January 1997, and May 1997.

The Bank of Thailand's defense of its currency in 1997 can be broken into two phases. Before 15 May it intervened heavily in the forward market, effectively committing a major portion of its reserves. On 15 May it allowed interest rates to rise and switched to imposing an array of capital controls on local banks. These measures prevented speculative pressure from hitting the spot market, and created a liquidity squeeze for holders of short baht positions. This led to very high offshore baht borrowing rates and a very strong offshore baht exchange rate for a short period. Because the large price differences between offshore and onshore markets provided a strong incentive to circumvent the controls, speculative pressure continued. On 2 July the Bank of Thailand gave up its currency defense. Capital controls remained in place, but had become ineffective by late July. This led to additional controls which became difficult to enforce. Many, but not all, controls were removed in early 1998.

Thai financial institutions were known to have large currency mismatches, and very poor loan books especially because of exposure to a weak property sector. They therefore had to pay large risk premia which increased steeply following the crisis.

### *Indonesia*

In Indonesia the money/capital markets consisted of two main segments, the interbank money market and the market in short-dated central bank intervention bonds, Sertifikat Bank Indonesia (SBI). Foreign banks and investors had full access to the SBI market, but hardly participated in the interbank market, which involved much higher counterparty credit risk.

Indonesian banks and corporates had been optimistic about the rupiah for the first half of 1997, and took long rupiah positions via substantial foreign borrowing, swaps, and options. They continued to do so for several days following the Thai devaluation.

This fact, and the poor quality of their loan book, meant that following the speculative attack on the rupiah they had to pay very large risk premia. This explains why the interbank rate, which is calculated as the average of the borrowing rates paid by some of the largest banks, exceeded the SBI rate by a large margin. As will be seen, it was these risk premia which mostly explain deviations from covered interest parity in the case of Indonesia.

## 3. Data and Their Time Series Properties

Tables 1 and 2 contain information on data sample periods and the chosen sample break points for the seven economies studied. In all cases the domestic interest rate is an onshore domestic one-month interbank borrowing rate, the foreign interest rate is the one-month LIBOR, and the forward discount is calculated from the offshore forward foreign exchange rate. Figures 1–4 show the time-series graphs. With one exception all data are from Bloomberg. The Mexican forward discount data are from Banamex, a commercial bank, which was able to furnish a longer series than Bloomberg.

Because of the qualitative changes in emerging markets' time series during times of crises, the paper separately examines the full sample, the pre-crisis and the post-crisis series for each country.[2] The full sample in all cases has at least 465 observations. For developed economies, for purposes of comparison, the sample periods were chosen to be approximately equal to those available for the three emerging economies. One additional data series from September 1992 through April 1994 (400 observations) for

*Table 1. Data for Emerging Markets*

| | *Indonesia* | *Thailand* | *Mexico* |
|---|---|---|---|
| Beginning of sample | 7 October 1996 | 2 March 1997 | 1 April 1996 |
| End of sample | 28 January 1999 | 28 January 1999 | 28 January 1999 |
| No. of observations | 543 | 465 | 681 |
| No. of missing values | 13 | 10 | 5 |
| Not available before | Forward rate | Forward rate | I'bank rate (TIIE) |
| Sample break date | 11/14 July 1997 | 14/15 May 1997 | 7/10 August 1998 |
| Event at break | Jump in I'bank rate (spot rate jumped 1 week later) | Jump in I'bank and forward rate (spot rate jumped 45 days later) | Jump in I'bank and spot rate |
| Observations before break | 181 | 61 | 573 |
| Observations after break | 362 | 404 | 108 |

*Table 2. Data for Developed Markets*

| | *France* | *Germany* | *Ireland* | *Portugal* |
|---|---|---|---|---|
| Beginning of sample | 1 April 1996 | 3 April 1996 | 3 April 1996 | 3 April 1996 |
| End of sample | 28 January 1999 | 27 January 1999 | 30 December 1998 | 28 January 1999 |
| No. of observations | 693 | 692 | 675 | 670 |

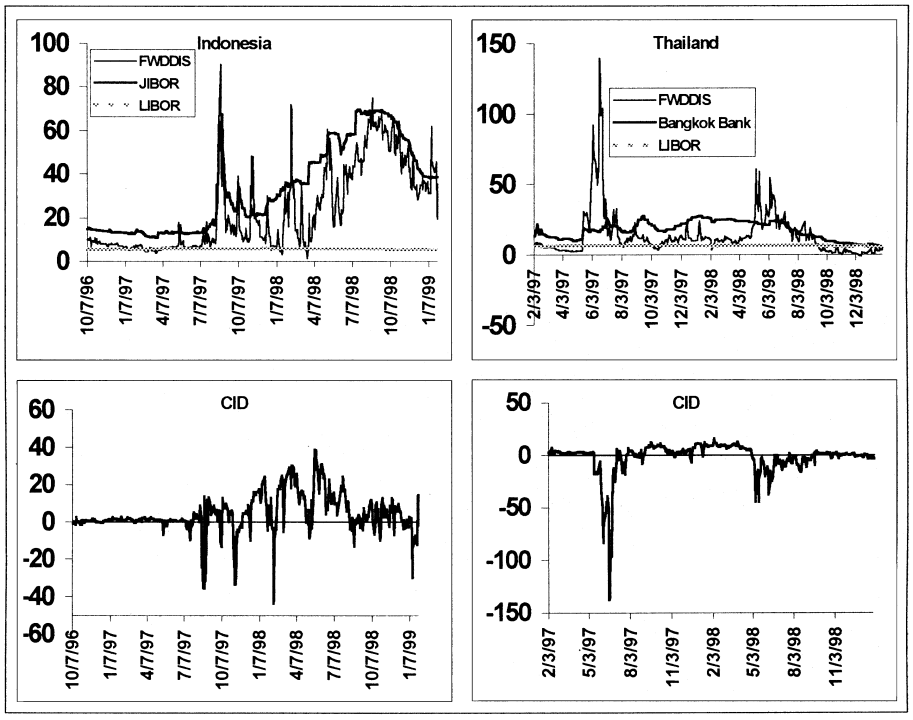


*Figure 1. Indonesia and Thailand, 1996–99*

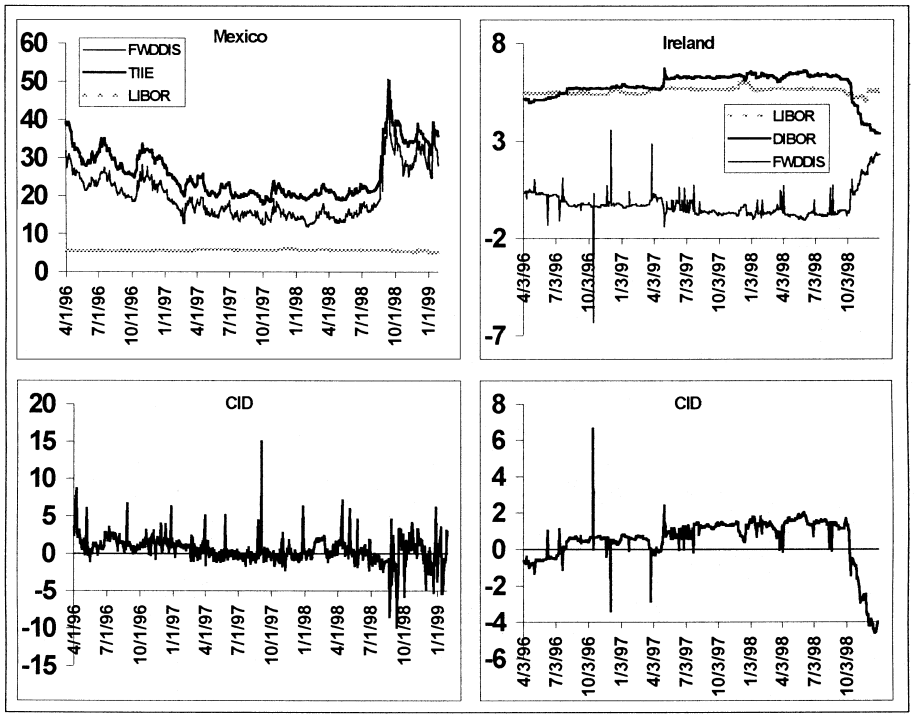


*Figure 2. Mexico and Ireland, 1997–99*

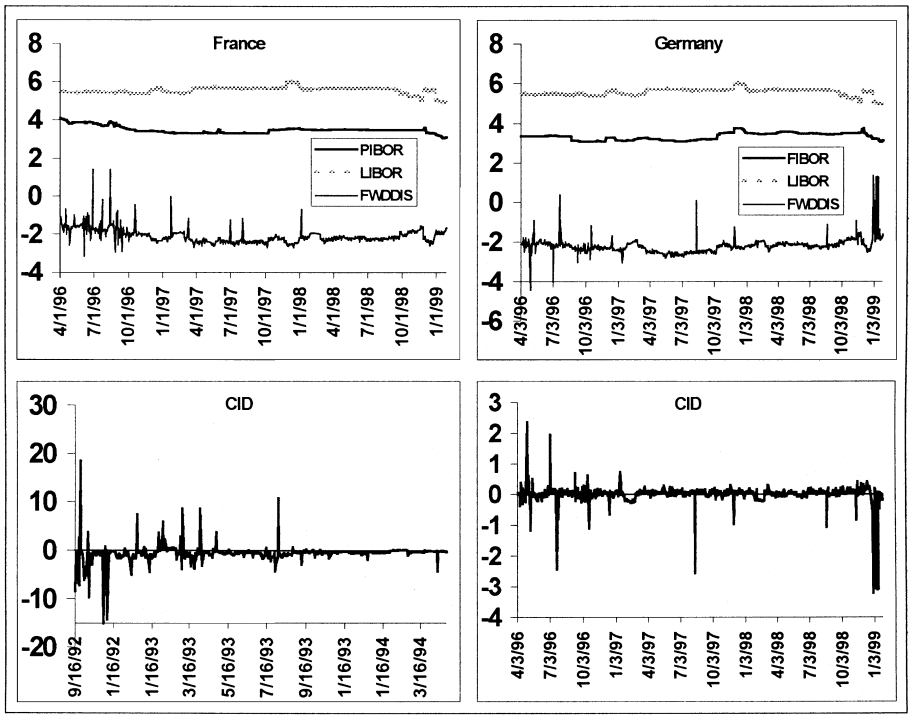


*Figure 3. France and Germany, 1996–99*

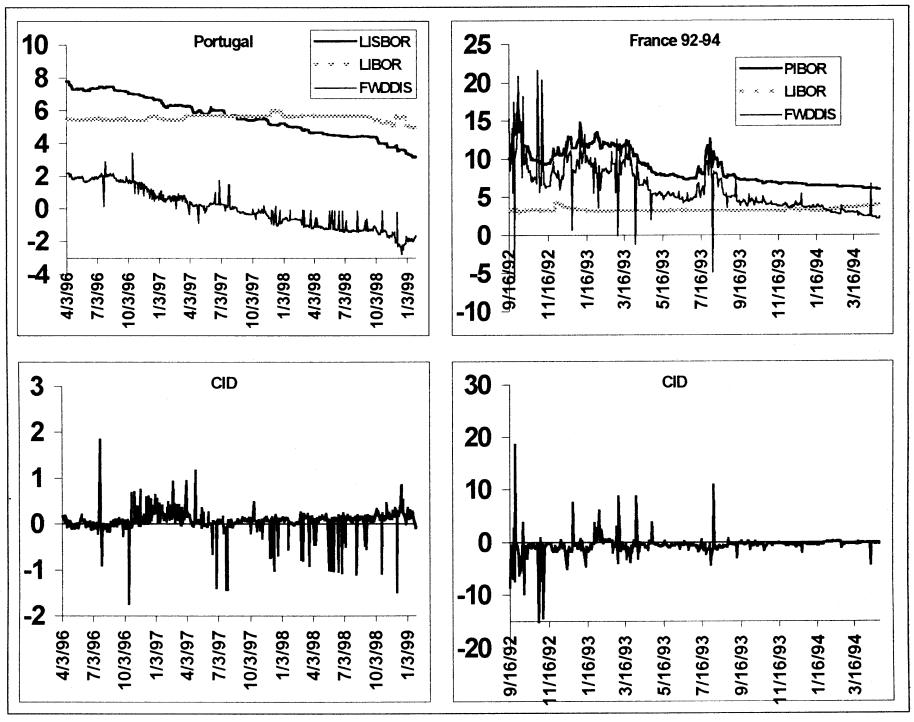


*Figure 4. Portugal, 1996–99, and France, 1992–94*

France is used to compare the effects of the ERM crisis on developed economies' interest differentials with those of the Asian/Russian crises on emerging markets.[5] For emerging markets the sample breakpoints are straightforward to date in each case.

The correct alignment of daily data is critical for the econometric exercises. Most importantly, LIBOR for a given date is fixed after the respective close of the Asian markets for that date. The LIBOR of the previous business date was therefore chosen in calculating the covered premium and in conducting cointegration tests for both Thailand and Indonesia. For Thailand, the 10% withholding tax on foreign borrowing was added to LIBOR to obtain the foreign interest rate. For Mexico, the same day's LIBOR was chosen. Forward exchange rate data for the three emerging market currencies are deemed to be determined simultaneously with domestic interest rates. Unfortunately the available data do not permit a more precise timing.

The choice of the interbank interest rate series is critical for the results of this study. For Thailand, a complete daily series is available only for the borrowing rate of Bangkok Bank, the largest Thai domestic bank. For Indonesia, the JIBOR interbank rate represents an average of rates paid by some of the larger Indonesian banks, and therefore reflects the default risk premium paid by these institutions. The Mexican TIIE rate is also an average over several banks.

To conserve space, the results of univariate unit-root tests for the time series under analysis are not reported.[3] The hypothesis that domestic and foreign nominal interest rates have a unit root cannot be rejected in any instance. For the forward discount there are a few instances where a unit-root test fails to reject the null only when using a 1% significance level.[4] These results imply that cointegration tests of covered interest parity are appropriate.

For Indonesia it is clearly identified as between 11 July and 14 July 1997. Bank Indonesia widened its intervention band on 11 July. This led to immediate large position-taking against the Rupiah by offshore investors, who anticipated a devaluation. Interbank rates jumped from 13% to 15% and the forward discount from 9% to 13% in a day. Domestic investors followed suit one week later, at which time the spot exchange rate collapsed. For Thailand, the sample breakpoint is again clearly identified. On 15 May 1997, Bank of Thailand ceased intervention in the forward foreign exchange market, which led to an immediate large increase in the forward discount from 5% to 31% and in onshore interbank interest rates from 12.5% to 19%. The spot rate collapsed on 2 July. The date 10 August marks the beginning of contagion from the Russian crisis in Mexican financial markets, a period characterized by much larger market turbulence. Interbank rates jumped from 22% to 24%, and the forward discount jumped from 17% to 19% initially, and soon much higher. There is in fact a break of 12 days in Bloomberg's data series at that time. The sample was therefore broken into a pre-Russia and a post-Russia period.

## 4. Covered Interest Parity

For interbank borrowing transactions, covered interest parity between a local currency and the US dollar states that the US dollar cost of borrowing locally in that currency and buying the repayment forward against the US dollar should be equal to the cost of borrowing in the US in US dollars. The comparison in this paper, for reasons of data availability, is between one-month loans. Letting $i_t$ = domestic interbank interest rate, $i_t^*$ = LIBOR, and $fd_t$ = forward discount of local currency against the US dollar, we have

$$(1+i_t) = (1+i_t^*)\,(1+fd_t). \tag{1}$$

This says that, under covered interest parity, the covered interest differential, defined as

$$CID_t = (1+i_t) - (1+i_t^*)(1+fd_t), \tag{2}$$

should be equal to zero. Alternatively one could directly examine the relationship between the components of $CID_t$ in equation (1). Given the nonstationarity of these data, covered interest parity must be formulated as a cointegrating property of $\ln(1 + i_t)$, $\ln(1 + i_t^*)$, $\ln(1 + fd_t)$,[6,7] possibly allowing for a nonzero constant in the cointegrating space.

For emerging markets there are several reasons, apart from outright capital controls, why covered interbank interest parity may not hold continuously. One, which will be shown to have been important in section 5, is that the interbank rate may differ from the interest rate used by forward market participants to figure their quotes, such as the government bond rate, because domestic banks have to pay a default risk premium. This means that the assets underlying $i_t$ and $i_t^*$ are not fully comparable. Another reason for imperfect asset substitutability is political or country risk, due for example to a perceived risk of expropriation or taxation. While the former is not, *per se*, evidence against capital market integration, the latter clearly is. A further reason for deviations from covered parity reflecting limited capital market integration is that the above-mentioned segmentation of money and foreign exchange markets may impede arbitrage. And finally there is the important issue of increased transactions costs and therefore a higher band of inaction around covered interest parity in conditions of market turbulence, discussed in Levich (1998), Taylor (1989), and Frenkel and Levich (1977). Unfortunately our dataset for emerging markets does not allow us to address this issue as explicitly as Frenkel and Levich (1977).[8]

### *General Discussion*

The time-series graphs in Figures 1–4 reveal a great deal of interesting detail by simple inspection. In all three emerging economies, covered differentials were close to zero and stable prior to the Asian (Indonesia, Thailand) and Russian (Mexico) crises. This barely changed in Mexico following the Russian crisis, where at that time we can observe an upward jump of similar magnitude of the domestic interest rate and the forward discount. There were, however, drastic changes in Asia. In Indonesia, domestic interest rates rose to such an extent that the average covered differential turned sharply *positive*. This was accompanied by much higher volatility in the covered differential owing to higher volatility in the forward discount. This latter fact is also true for Thailand, but almost the opposite move in average differentials was observed there. Domestic interest rates rose very little compared with the forward discount, resulting in a sharply *negative* covered differential. This was, however, limited to a fairly short period of less than three months, after which the covered differential returned to close to zero. There was a second short period of negative covered differentials around May/June 1998. The only European country where covered differentials of a similar order of magnitude to emerging markets were observed is Ireland, while German, French and Portuguese differentials in the recent period, and French differentials during the ERM crisis, were very close to zero at all times.

*Properties of the Covered Interest Differential*

Table 3 contains descriptive statistics of covered interest differentials, $CID_t$, for each country and each sample period. For the three emerging markets results are reported for three subperiods, BC for the period before the crisis, AC for the period after the crisis, and FS for the full sample. The unit-root test for stationarity of the covered differential is in most cases an augmented Dickey–Fuller statistic.[9] The Ljung–Box $Q$-statistics generally show a very high degree of autocorrelation. The mean of the differential is therefore reported with a $p$-value computed from Newey–West (1987) autocorrelation robust standard errors, with the maximum lag length for the Bartlett kernel reported in the next column as NW lags. Additional evidence on deviations from covered interest parity is shown by the mean of the absolute deviation from parity. Finally, the sample standard deviation of the differential is reported.

The pre-crisis mean differential was well below 1% with moderate variability in Indonesia and Mexico. While both mean and standard deviation were several times larger than for France, Germany, and Portugal, they were comparable to Ireland. As will be shown in section 5, the 2% mean for Thailand's Bangkok Bank is due to bank default risk.

The reaction to the crisis was very different in the three emerging markets. Mexico's differential changed little, while its standard deviation more than doubled but remained at levels comparable to those of France during the ERM crisis. In Thailand, the differential turned sharply negative following the imposition of capital outflow controls, reflecting the fact that onshore baht interest rates were significantly lower than offshore baht rates. Volatility as measured by the standard deviation went up by a factor of 20. This is unlike anything seen in Europe during the ERM crisis. Capital con-

*Table 3. Descriptive Statistics of Covered Interest Differentials*

| | *Unit root* | *Ljung–Box Q(1), Q(5), Q(10)* | *Mean CID* | *NW lags* | *Mean (abs.)* | *SD* |
|---|---|---|---|---|---|---|
| Indonesia BC | –3.45 (0.009) | 48/118/131 | 0.68 (0) | 5 | 0.98 | 1.04 |
| Indonesia AC | –4.30 (0.0004) | 223/649/808 | 5.8 (0) | 10 | 10.01 | 11.9 |
| Indonesia FS | –4.99 (0.00002) | 343/>1000 | 4.1 (0.001) | 13 | 7.00 | 10.1 |
| Thailand BC | –3.49 (0.008) | 2.1/10.7/13.1 | 2.02 (0) | 2 | 2.02 | 0.9 |
| Thailand AC | –4.05 (0.001) | 348/>1000 | –3.56 (0.21) | 13 | 9.17 | 18.3 |
| Thailand FS | –3.7 (0.004) | 400/>1000 | –2.83 (0.27) | 14 | 8.24 | 17.1 |
| Mexico BC | –2.40[a] | 292/>1000 | 0.52 (0) | 13 | 0.95 | 1.1 |
| Mexico AC | –4.82 (0.00005) | 32/49/50 | –0.39 (0.28) | 2 | 2.02 | 2.7 |
| Mexico FS | –3.41 (0.011) | 280/720/956 | 0.37 (0.013) | 15 | 1.13 | 1.5 |
| France 96–99 | –8.3 (0) | 0.04/11.3/21.3 | 0.045 (0) | 1 | 0.14 | 0.28 |
| Germany 96–99 | –6.0 (0) | 51/149/180 | 0.0004 (0.99) | 8 | 0.14 | 0.36 |
| Ireland 96–99 | –0.09 (0.65) | 554/>1000 | 0.53 (0.02) | 30 | 1.11 | 1.26 |
| Portugal 96–99 | –4.34 (0.0004) | 23/53/78 | 0.061 (0) | 5 | 0.16 | 0.27 |
| France 92–94 | –3.6 (0.007) | 0.6/10.8/16.5 | –0.55 (0) | 1 | 1.03 | 2.1 |

[a] This is a $t$-statistic for a unit root in regression with intercept. Standard normal.
$p$-values are shown in parentheses.

trols were evidently effective, albeit for a very short time, in separating Thai markets from world financial markets. Capital controls remained in place until early 1998, but the large covered differentials disappeared after about three months, providing evidence for the erosion of capital control effectiveness. In Indonesia, the differential turned sharply positive with volatility as measured by the standard deviation increasing by a factor of 12. There were no significant capital controls in Indonesia. Instead, as will be shown in section 5, the differential reflects a large increase in Indonesian bank default risk premia following the crisis, as these institutions were well known to have big currency mismatches and very weak loan portfolios.

*Cointegration Tests*

Table 4 contains the results of three multivariate and one univariate tests for cointegration between the domestic and foreign interbank rates and the forward discount, $\ln(1 + i_t), \ln(1 + i^*_t), \ln(1 + fd_t)$. This addresses the question of whether covered interest parity holds as a long-run equilibrium relationship. The lag selection criterion chosen for the multivariate tests is AIC. The first two tests check for the presence of cointegration and not specifically for the cointegrating vector implied by covered interest parity. One is the Johansen (1988) test of the null hypothesis of the presence of 0, 1, or 2 cointegrating vectors. The second is the Horvath and Watson (1995) procedure, which includes the lagged prespecified cointegrating vector in an unrestricted reduced form in differences and test for its significance, cointegration obtaining under the alternative hypothesis. The use of prior knowledge in the form of the prespecified vector improves the small-sample power of the test compared with Johansen (1988) provided the prespecified and the actual data cointegrating vector are not too different. The prespecified cointegrating vector used here is simply $CID_t$. A further two tests specifically test for the presence of the covered interest parity cointegrating vector (1,

*Table 4. Results of Multivariate and Univariate Tests*

| | *AIC lags* | *Johansen* $H_0$: $\rho \leq 0/1(2)$ | *Wald* $H_A$: *CIP* | *LR* $H_0$: *CIP* | *Univariate* $H_A$: *CIP* |
|---|---|---|---|---|---|
| Indonesia BC | 3 | 0.001/0.22 | 18.7** | 0.08 | 0.01 |
| Indonesia AC | 4 | 0.01/0.62 | 23.0** | 0.06 | 0.0 |
| Indonesia FS | 4 | 0.00/0.44 | 31.8** | 0.01 | 0.0 |
| Thailand BC | 2 | 0.28/0.42 | 18.6** | 0.004 | 0.008 |
| Thailand AC | 2 | 0.02/0.19 | 20.42** | 0.45 | 0.001 |
| Thailand FS | 2 | 0.007/0.15 | 24.1** | 0.70 | 0.004 |
| Mexico BC | 5 | 0.00/0.008/0.23 | 16.7** | 0.006 | 0.02 |
| Mexico AC | 1 | 0.00/0.08 | 50.5** | 0.09 | 0.0 |
| Mexico FS | 23 | 0.007/0.31 | 14.4* | 0.0 | 0.01 |
| France 96–99 | 7 | 0.00/0.11 | 101.5** | 0.15 | 0.0 |
| Germany 96–99 | 24 | 0.02/0.44 | 25.2** | 0.59 | 0.0 |
| Ireland 96–99 | 1 | 0.00/0.15 | 32.1** | 0.0 | 0.65 |
| Portugal 96–99 | 19 | 0.00/0.71 | 11.9* | 0.16 | 0.0 |
| France 92–94 | 22 | 0.00/0.28 | 7.1 | 0.82 | 0.007 |

$-1, -1, \alpha$) between $\ln(1 + i_t)$, $\ln(1 + i_t^*)$, $\ln(1 + fd_t)$ and a constant $\alpha$. First a likelihood ratio test in the multivariate Johansen (1988) framework is employed. To allow for the presence of a constant nonzero differential due, for example, to bank default risk premia, the parameter $\alpha$ in the cointegrating vector is allowed to take any value in the restricted model of this test. Because only one cointegrating vector is hypothesized, simple univariate unit root tests on the covered interest differential provide an alternative.

The table reports *p*-values, and *F*-statistics for the Horvath and Watson (1995) Wald test. The latter paper reports critical values for this test, which are used in the table to report rejection of the null of no covered interest parity at the 5% (*) and 1% (**) significance levels. The Johansen test was run on TSP, which selects the optimum lag based on comparing AIC across an equal number of observations and conducts the test with the maximum available number of observations. The Horvath and Watson (1995) Wald test and the likelihood ratio test were run with PC-FIML (Doornik and Hendry, 1997) using the same procedure. In all but one case, where there was a difference in optimal lag length of one, the results of the AIC based procedure were identical to those of a general-to-specific search as advocated by Hendry (1987).

The evidence for the presence of one cointegrating vector from the Johansen (1988) and Horvath and Watson (1995) tests is strong for all countries in the sample. Even for Thailand, where there were large short-term deviations from parity, mean reversion was fast. The likelihood ratio tests for the specific cointegrating vector implied by covered interest parity are sometimes rejected, but the univariate tests do not[10] allow rejection of the parity hypothesis at the 1% significance level, and rarely at the 5% level. This was expected for the developed economies; but the fact that parity holds as an equilibrium relationship in emerging markets even during periods including financial crises is evidence of the fast mean reversion in differentials brought about by international financial markets.

## 5. Default Risk Premia

The evidence presented so far supports the claim that the interbank borrowing rates paid by domestic banks in Indonesia and Thailand did not satisfy covered interest parity for significant periods, even though over the long run the condition does hold. Especially following the Asian crisis divergences from parity were sharp, one of the reasons being increased default risk of local banks. This section discusses the data presented in Figure 5 and Tables 5 and 6. It is shown that for both countries there is an interest rate that satisfies covered interest parity more closely over short horizons than the interbank rate, owing to lower default risk. For Thailand this is the borrowing rate of Hong Kong and Shanghai Banking Corporation (HSBC), a large multinational bank of very low default risk, and for Indonesia the interest rate on short-term central bank debt (SBI). On a continuous basis, covered interest parity therefore tends to hold, if at all, only for a narrow segment of these financial markets. The remaining short-term deviations of HSBC and SBI rates from covered interest parity, especially during crises, could be due to any of the reasons discussed in section 4. They include capital controls, the segmentation of money and foreign exchange markets, political/country risk, and transaction costs especially during periods of market turbulence. The data do not allow us to distinguish these, but all of them are evidence of some degree of imperfect capital market integration.

*Thailand*

Figure 5 and Table 5 contain information about the interbank interest rates paid by Bangkok Bank and HSBC.[11] HSBC's local subsidiary borrowed in Thai money markets at rates substantially lower than those of Bangkok Bank, whose borrowing rate was in turn lower than that of most other Thai banks. Using the borrowing rate of HSBC before the Asian crisis produces a much smaller, although still substantial, covered differential. After the crisis all differentials turned negative because of the imposition of capital controls. The lower left panel of Figure 5 demonstrates the increase in default risk premia faced by domestic banks after the crisis. The difference between HSBCs and Bangkok Bank's covered interest differential widened immediately from its initial value of 1–2%, peaked at over 10% a year after the crisis, and then slowly came back to its old level.

*Table 5*

| *HSBC* | *Mean* | *SD* | *Bangkok Bank* | *Mean* | *SD* |
|---|---|---|---|---|---|
| Pre-crisis | 1.30 (0.0) | 0.53 | Pre-crisis | 2.59 (0.0) | 0.94 |
| Post-crisis | –6.13 (0.0) | 14.41 | Post-crisis | –1.87 (0.29) | 15.17 |
| Full sample | –5.02 (0.001) | 13.55 | Full sample | –1.21 (0.43) | 14.08 |

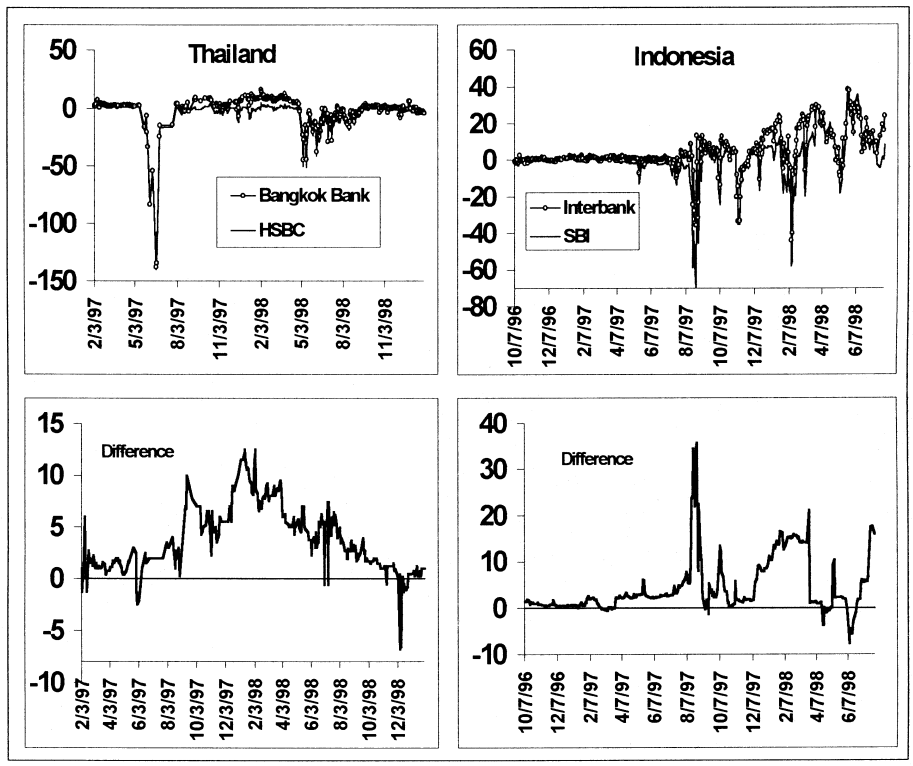


*Figure 5.*

*Table 6*

| *SBI rate* | *Mean* | *SD* | *Interbank rate* | *Mean* | *SD* |
|---|---|---|---|---|---|
| Pre-crisis | –0.79 (0.006) | 1.64 | Pre-crisis | 0.68 (0.0) | 1.04 |
| Post-crisis | 0.94 (0.72) | 16.50 | Post-crisis | 7.31 (0.0) | 13.46 |
| Full sample | 0.19 (0.90) | 12.50 | Full sample | 4.44 (0.001) | 10.68 |

*Indonesia*

Figure 5 and Table 6 show that in Indonesia the SBI interest rate was much closer to satisfying the covered interest parity condition than the interbank rate, again reflecting the high risk premium in the interbank market. The covered interest differential was calculated for both the SBI and the interbank interest rate, for the period ending in July 1998 (last available data point for the SBI series). While the SBI differential also exhibits much higher volatility following the Asian crisis, it is not significantly different from zero. The wedge between the interbank rate and SBI widened even more dramatically than that between Bangkok Bank and HSBC in Thailand.

## 6. Conclusions

The main lesson of this study is that the integration of domestic banks into international capital markets, when judged by covered interest parity tests, is generally fairly high in larger emerging markets, although not as high as in developed economies. Especially during periods of calm financial markets, the mean and variance of covered interest differentials based on interbank rates are not very much higher than those of smaller developed economies. And covered interest parity does hold as a long-run equilibrium (cointegrating) relationship in all emerging markets studied. However, this conclusion has to be qualified in three important ways.

First, explicit capital controls such as in Thailand can lead to large short-term deviations from parity of mean covered differentials. On the other hand, controls tend to become ineffective quite quickly.

Second, especially but not only following financial markets crises, interest parity conditions at most hold for a small segment of many emerging financial markets. One reason for this is that even the largest local banks often pay large default risk premia. Such premia do not indicate that capital is not free to flow across borders; but they are reflective of a high risk environment which can contribute to further domestic capital market imperfections such as high transactions costs and the observed segmentation between money and forward foreign exchange markets in Indonesia and Thailand.

Third, these imperfections appear be responsible for the fact that crises in emerging financial markets lead to far higher volatility in covered differentials, which indicates unexploited arbitrage opportunities and therefore limited integration into international capital markets. In many emerging markets these symptoms are much more severe than in developed economies, as a comparison with the ERM crisis of 1992 shows. But the severity depends significantly on the stage of development of local financial markets, Mexico showing far lower volatility than Thailand and Indonesia.

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## Notes

1. The Thai currency is the baht, and the Indonesian currency is the rupiah. The offshore money and foreign exchange markets for baht and rupiah are mainly based in Singapore.
2. Andrews (1993) proposes tests for break points. However, this paper is concerned only with the well-known and documented break points which mark the onset of financial crises in the respective countries.

3. They are available from the author upon request.
4. Rejection at 1% occurs for Thailand for the full sample and post-crisis, and for Germany.
5. The behavior of German data is similar. Insuffient data were available for Ireland and Portugal.
6. See Brenner and Kroner (1995) for a test in a similar spirit. However, these authors chose to test CIP treating the interest differential, the spot and the forward rate as separate variables.
7. For the very high interest rates observed in emerging markets, replacing the logs by levels of interest rates and forward discounts, as is sometimes done in the literature, would produce very large rounding errors.
8. In particular, these authors use data on triangular arbitrage across leading currencies to measure transactions costs in the foreign exchange market. They need to assume equal transaction costs across currencies, which is unlikely to hold for emerging currencies. The authors use data on bid–ask spreads to measure transactions costs in securities markets. From our data sources, no separate bid and ask quotes are available for emerging markets.
9. These correspond exactly to the univariate cointegration test reported in the next subsection.
10. Except for Ireland.
11. The more than 100 missing values for HSBC make a full statistical analysis including cointegration tests impractical.