# FINANCIAL INTEGRATION IN EAST ASIA: HOW FAR? HOW MUCH FURTHER TO GO?

**by**

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# FINANCIAL INTEGRATION IN EAST ASIA: HOW FAR? HOW MUCH FURTHER TO GO?


## Abstract

This paper offers a selective survey of the recent empirical literature on financial integration in East Asia, the focus being on alternative definitions of financial integration and measurement issues and results. In particular, this paper concentrates on the ASEAN–5 plus 3 or APT economic group (i.e. Indonesia, Thailand, Malaysia, Philippines, Singapore, Korea, China and Japan) as well as Hong Kong and Chinese Taipei. These are the economies that have consciously attempted to intensify intraregional monetary and financial cooperation in the last few years, particularly since the East Asian crisis of 1997-98. While there is an enormous literature on the measurement of financial integration, we examine the most widely used ones and place them into three broad categories. The first category refers to the price based conditions involving mainly debt flows. These are largely embodied in the interest parity conditions. The second category involves quantity based measures such as savings-investment correlations and consumption correlations, current account dynamics and gross capital flows. The third category can be broadly classified as regulatory or institutional factors (such as capital controls and prudential regulations) as well as non-debt flows such as the co-movement of stock market returns.



*Keywords: capital controls, East Asia, equity, financial integration, parity conditions*

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## 1. Introduction

How financially integrated are the East Asian economies? Despite numerous empirical studies examining various facets of the topic, the degree of intraregional financial integration in East Asia remains a matter of vigorous debate. This paper offers a selective survey of the recent empirical literature on financial integration, the focus being on alternative definitions of financial integration and measurement issues and results. This paper concentrates on the ASEAN–5 plus 3 or APT economic group (i.e. Indonesia, Thailand, Malaysia, Philippines, Singapore, Korea, China and Japan) as well as Hong Kong and Chinese Taipei.[1] These are the economies that have consciously attempted to intensify intraregional monetary and financial cooperation in the last few years, particularly since the East Asian crisis of 1997-98 (Bird and Rajan, 2002a,b, Chang and Rajan, 2001 and Rajan, 2003).[2]

There is an enormous literature on the measurement of financial integration. We examine the most widely used measures and place them into three broad categories. The first category refers to the price based conditions involving mainly debt flows. These are largely embodied in the interest parity conditions, viz. the covered interest parity (CIP), the uncovered interest parity (UIP), and the real interest parity (RIP). As will be discussed, the CIP is the narrowest of measures (of capital mobility per se), the UIP being a somewhat broader measure (of financial integration), while the RIP is the broadest of arbitrage measures (incorporating both financial and real integration). The second category involves quantity based measures such as savings-investment correlations, consumption

[1] We exclude the other five members of ASEAN (Brunei, Cambodia, Laos, Myanmar and Vietnam) for which data are unavailable.

[2] More recently, however, there has been a move to integrate the APT countries plus India, Australia and New Zealand. These countries held the inaugural East Asian summit (EAS) in Kuala Lumpur, Malaysia in December 2005. See Kumar (2005) for a discussion of the EAS.

correlations, current account dynamics and gross capital flows[3]. The third category can be broadly classified as regulatory or institutional factors (such as capital controls and prudential regulations) as well as non-debt flows such as the co-movement of stock market returns. Figure 1 summarizes the various measures of financial integration. This paper will highlight the intuition as well as main strengths and weaknesses of each of these measures. Some key results relating to East Asia are presented and, where appropriate, we have conducted additional empirical analyses. The aim is to formulate some stylized facts about the extent of financial integration amongst East Asian economies.

## 2. Price Based Measures of Financial Integration

Price based measures of financial integration or arbitrage conditions seek to equate rates of returns of comparable assets across different markets/economies. In this section we examine three common interest parity conditions, viz. CIP, UIP and RIP.[4]

### 2.1 The Covered Interest Parity (CIP) Condition

The CIP may be formally stated as follows:

[3] Gross capital flows and current account dynamics will not be covered here. See Montiel (1994) and Rajan and Siregar (2002) for the former and Obstfeld (1998) and Taylor (2002) for the latter. Also see Lane and Milesi-Feretti (2001). While examination of cross-border capital flows is useful, it is probably of limited use as a measure of financial integration. For instance, a country that is highly integrated with international capital markets - in the sense of there being no significant difference in domestic and international rates of return - will experience little if any international portfolio capital flows (at least debt related flows). An interesting extension to this issue is McCauley *et al.* (2002) which examines the extent to which Asian bonds issued are bought by Asian counterparties.

[4] Another arbitrage condition is the closed interest parity condition which essentially states that the returns on identical instruments of the same currency but traded in different markets (such as onshore and offshore markets) should be equalized. Any deviation arising from this condition can be interpreted as possible evidence of the existence of capital controls in one of the two countries or the existence of other political or country risks that may prevent interest rate equalization. The measurement of the closed interest differential is difficult for developing economies as it requires that a particular asset is traded sufficiently for there to be a liquid offshore market for it (see Obstfeld, 1998 and Frankel and Okwongu, 1996).

$$i_t = i^*_t + f_{t,t+n} \quad (1)$$

where: $i_t$ is the domestic interest rate, $i^*_t$ is the foreign or benchmark interest rate (US rate unless otherwise stated) and $f_{t,t+n}$ is the forward margin (discount on the domestic currency) for $n$ periods into the future.[5]

The CIP indicates that the difference between the current spot rate and the forward rate will equal the interest differential between similar assets measured in local currencies. Therefore, in the absence of capital account restrictions and/or transactions costs, the covered interest differential (CID) ought not to differ significantly from zero. A negative differential suggests the existence of capital controls or transactions costs that restrict capital *outflows*. Investors would certainly not tolerate a lower domestic return in the absence of capital controls (Frankel, 1991).

While there have been a number of studies on the CIP involving industrial economies, there have been relatively fewer ones pertaining to developing economies. This is primarily attributable to the fact that many developing economies do not have sufficiently liquid forward foreign exchange markets, or if they do exist, the data on forward rates are not easily available.

Frankel (1991) reports the mean covered interest differentials (CIDs) for the period 1982 to 1987 for a selection of developed and developing economies using monthly observations of the 3-month local money market rate against the equivalent Eurodollar rate (Table 1). Focusing on the East Asian economies in the sample – Japan, Hong Kong, Malaysia and Singapore – the null of a zero differential is rejected for the first three economies, though only marginally, in that the CIDs are very low. The exception is Malaysia, whose mean CID is large and negative, suggesting significant controls on capital outflows.

[5] Throughout this paper, the exchange rate is quoted as the domestic price of foreign currency.

Chinn and Frankel (1992) present two further methods for estimating the CIP using similar time series data for 1982-92. The first method involves estimating the CID by regressing it on a constant and time trend. The null of the CIP involves the constant and the slope coefficient both equaling zero. Consistent with Frankel (1991), the results indicate that the CIDs were small for Japan, Hong Kong and Singapore but large for Malaysia. The second method used by Chinn-Frankel is to calculate the CIP by directly estimating the following:

$$i_t = \alpha + \beta(i^*_t + f_{t,t+n}) + \varepsilon_t \qquad (2)$$

where the null hypothesis for the CIP is $\alpha = 0$, $\beta = 1$. The $\beta$ coefficients for the two regional financial centers, Hong Kong and Singapore, are very close to one, while that for Malaysia is significantly different from unity.

de Brouwer (1999) estimates a largely similar equation using monthly data for 3-month assets between 1985 and 1994.[6] The de Brouwer results are summarized in Table 2. With the exception of Taiwan, the CIP in the strict sense is rejected due to the non-zero constant.[7] However, focusing on the slope coefficient, Japan appears to be the country that comes closest to the CIP holding, as they do in the cases of Hong Kong and Singapore. Taiwan and Thailand have maintained restrictions on their capital account transactions yet there does not appear to be any pattern emerging as a result - Taiwan seems to strongly deviate from the CIP, while Thailand has a significant constant term but the slope coefficient is close to unity.

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[6] The sample size varies slightly for each country. In de Brouwer's case, the equation estimated is: $f_{t,t+n} = \alpha + \beta(i_t - i^*_t) + \varepsilon_t$. He finds that the CIDs narrowed in East Asia in the 1980s and 1990s.

[7] The nonzero constant may be due to the presence of non-zero risk premia (country or currency).

## 2.2 The Uncovered Interest Parity (UIP) Condition

The UIP may be represented as follows:

$$i_t = i^*_t + \Delta e^e_{t,t+n} \qquad (3)$$

where: $\Delta e^e_{t,t+n}$ is the expected exchange rate change at time $t+n$.

The nexus between the UIP and the CIP is apparent by decomposing eq. (3) as follows:

$$i_t - i^*_t - \Delta e^e_{t,t+n} = [i_t - i^*_t - ( f_{t,t+n} - e_t )] + (f_{t,t+n} - e^e_{t,t+n}) \qquad (4)$$

where the first bracketed term on the right hand side is the CIP (sometimes referred to as country or political risk premium) and the second term is the currency risk premium. If the CIP holds but the UIP is rejected, this would imply that forward rates are biased predictors of future exchange rate.

Before formally testing eq. (3), the researcher needs to find a way of measuring the expectation of the future exchange rate. One way to make the leap from theory to empirical operationalization is by using *ex-post* differentials. This may be justified by assuming that Rational Expectations (RE) holds. This assumption - that the actual or ex-post spot exchange rate equals the expected spot exchange plus an uncorrelated error term - is a practical way of overcoming the problem of non-observable expected exchange rate changes. Another approach is to use surveys of exchange rate expectations of market agents.

As with Frankel (1991) in the case of the CIDs, Montiel (1994) estimated the uncovered interest differentials (UIDs) assuming RE for 48 industrial and developing economies for the period 1985-90 using monthly observations for short term (0-6 month)

deposit rates or 6-month treasury bill (T-Bill) rates. Focusing only on the East Asian economies in his sample, the Philippines and Thailand had significantly positive UIDs, Indonesia and Malaysia had significantly negative UIDs, while Korea and Singapore had UIDs that were not significantly different from zero.

de Brouwer (1999) also estimates the UIP relationship. His study covers several East Asian economies from 1985 to 1994. The estimated equation is as follows:

$$\Delta e^{e}_{t,t+n} = \alpha + \beta(i_t - i^{*}_t) + \varepsilon_t \qquad (5)$$

where the null hypothesis for the UIP is $\alpha$ = 0 and $\beta$ =  and assuming that RE holds. The results are presented in Table 3.

When testing for the null of $\beta$ = 1, the results are mixed. Curiously, those economies which would typically be regarded as having open capital accounts are the ones that largely reject parity, while those that are regarded as being quite closed have coefficient values that do not reject the UIP. This may be partially explained by observing that those economies perceived as closed are also the ones with largely managed exchange rates. Managed exchange rates are easier to predict than their floating counterparts, and as such the expected depreciation are relatively easier to measure (de Brouwer, 1999).[8] As expected, the UIDs of Hong Kong and Singapore are close to zero. The estimated UIDs show significant deviations for Indonesia, Korea, the Philippines, Taiwan and Thailand. This coincides with the existence of certain restrictions on the capital account for each of these economies. In a recent paper on China, Liu and Otani (2005) find that UIP does not hold for the period 1999-2004 until the effects of capital restrictions

[8] Using survey methods, Chinn and Frankel (1992) estimate the following equation: $i_t = \alpha + \beta(i^{*}_t + \Delta e^{e}_{t,t+n}) + \varepsilon_t$ for the period 1988-91 and find that the constant is typically quite high and the slope coefficient significantly different from unity.

are controlled for. Once these dummy variables are included, the UIP estimates show signs of convergence.

Flood and Rose (2001) test for the UIP using daily, weekly and monthly BIS exchange rate and Eurorate data for the 1990s. The regression equation estimated is similar to eq. 5 above. The results are more encouraging in that the estimated $\beta$ is the correct sign for most of the countries in the sample. Even more encouraging results are obtained when pooling the data, and the results are better for daily data than weekly, monthly or quarterly. Results for East Asia are summarized in Table 4. While the results for Japan appear rather dubious, comparison of Tables 3 and 4 reveals that the extent of openness in Indonesia and Thailand has increased over the latter half of the 1990s. However, this may be an artifact of the currency crisis in 1997-98, an issue explored in more detail later in the paper.[9]

### 2.3 Extending the UIP Literature

Given the popularity of the UIP as a measure of financial integration (discussed below), it warrants extending on the existing empirical literature. Recall that the basic model of the UIP argues that a risk-neutral investor will be indifferent to where an extra dollar is invested when the UIP holds. The UIP condition can be rewritten as follows:

$$UID_t = i_t - i_t^* - \Delta e_{t+n}^e \qquad (6)$$

[9] Another strand of the literature involves testing UIP over longer horizons. Two such contributions are Chinn and Meredith (2004) and Montanes and Sanso-Navarro (2005) though both only estimate the relationship for industrial countries.

where: $i_t$ is the home country's interest rate, $i_t^*$ is the foreign country's, $e_t$ is the current spot nominal exchange rate of one currency against other regional currencies[10], and $e_{t+n}^e$ is the spot exchange rate expected to prevail in period *t+n*. Thus, ($\Delta e_{t+n}^e = \frac{e_{t+n}^e - e_t}{e_t}$) is the expected proportionate appreciation of the foreign currency (if it is positive) and the UID is the uncovered interest differential. If *UID > 0*, the expected rate of return on home assets is higher than foreign assets, resulting in capital inflows into the home country. Similarly, outflows take place if *UID < 0*.

For our computations of the interest rate spread that prevailed among the East Asian economies (excluding Taiwan) during the period between 1995 and 2002, we have adopted the 6-month commercial deposit rate offered by domestic banks of each relevant country. We group the monthly interest rate observations into three sub-periods: (a) the pre crisis (January 1995 – December 1996); (b) the crisis period and immediate post crisis period (January 1998 – December 1999); and (c) the period of relative stability (January 2000 – November 2002). Though the turmoil in East Asia began in mid 1997 and reverberated rapidly to the rest of the region by the end of the year, speculative attacks on the Thai baht in particular were felt only since early 1997 (Rajan, 2001). Therefore, we only consider the time up to end 1996 as the period of relative stability (i.e. exclude 1997).

Since we are dealing with the six-month maturity and each of the reported six month deposit rates are for the entire year, we make the necessary adjustment by multiplying each of the rates by 0.50 (so as to ensure that we deal with each individual 6-month maturity term). In addition, given the lack of monthly (or even quarterly) data on the expected spot exchange rate prevailing in (*t+6*) -- 6 months from period *t* -- the expected

[10] For each currency, we calculate its nominal exchange rate against the other regional currencies. For instance, rupiah against the Singapore dollar, the Thai baht, the peso, etc. A rise in $e_t$ implies a depreciation in the nominal exchange rate of the local currency.

rate is proxied by the currency's actual spot nominal exchange rate at ($t+6$).[11] Thus, our UIDs are the actual *ex-post* interest rate differentials received by the investors at the end of the 6 month maturity period.

The UIDs are reported in Table 6. The results reveal the existence of arbitrage opportunities throughout the three different periods among the East Asian countries. Furthermore, the results (on UIDs) suggest that the markets became more segmented during the crisis period (1998) and the period immediately following that (period 2). The continued high degree of foreign exchange volatility may have contributed to the rise in the UIDs during this period. In contrast, the picture for the period of relative calm (2000-2002) suggests the presence of closer market integration among these economies during the period 3. Only Thailand experienced widening absolute UIDs.

For the five Southeast Asian economies, Indonesia is the only country which has offered substantial and persistent positive interest rate spreads over other regional economies. This is probably due to the country's high interest rate policy to defend the weak local currency. Abstracting from problems with our proxy for expected exchange rate depreciation, one might expect that the positive UIDs offered on the rupiah are, to some extent, arguably a reflection of the "peso problem", i.e. a small probability of a large rupiah devaluation as well as high country or currency risk premia.

Excluding Indonesia, Malaysia maintained a positive UID only during period 3. This is probably explained by the strength of the ringgit vis-à-vis respect to most other East Asian currencies. Thailand generally maintained positive UIDs in periods 1 and 2 against most countries except Indonesia and Korea (in period 2). Note that Singapore's commercial banks have generally maintained the lowest returns on their deposit rates. The

[11] As discussed, this procedure is commonly applied in the case of empirical studies involving developing countries (for instance, see Frankel (1991), Montiel (1994), de Brower (1999) and Khalid, 1999). We would have ideally liked to use forward-looking surveys/expectations of expected exchange rate changes. Such information is unavailable to us.

low inflationary environment, relatively stable currency and overall macroeconomic climate are all contributory factors. With regard to the North Asian economies (Korea, Hong Kong and China), the UIDs are again at the highest during period 2 at the height of the financial crisis. The high interest rate policy adopted in Korea created significant spreads against all other countries except Indonesia. In contrast, Hong Kong and China had negative spreads against all countries save Singapore. Contrasting trends appear during the last two periods (periods 2 and 3).

A combination of weaker won (especially against other crisis-affected currencies) and sharply lower key interest rates in Korea led to its UIDs turning positive only against Singapore, Thailand and the Philippines in period 3. In contrast, the lowering of interest rates in many Southeast Asian countries post crisis, and the recovery of these currencies vis-à-vis the US dollar (and thus the Hong Kong dollar and China renminibi, both of which are firmly pegged to the US dollar), were responsible for creating positive UIDs in period 3.

### 2.4 The Real Interest Parity (RIP) Condition

The third arbitrage condition is the RIP. This condition may be derived by first taking the following UIP equation:

$$\Delta e^{e}_{t,t+n} = i_t - i^{*}_t \qquad (7)$$

and substituting it into an expression for relative purchasing power parity (PPP):

$$e_t = p_t - p^{*}_t \text{ or } \Delta e^{e}_{t,t+n} = \pi^{e}_{t,t+n} - \pi^{e^{*}}_{t,t+n} \qquad (8)$$

Combining the two with the Fisher equation, $r_t = i_t - \pi^{e}_{t,t+n}$ yields the expression for the RIP:

$$r_t = r^*_t \qquad (9)$$

Clearly for the RIP to hold, the UIP, PPP and the Fisher hypothesis also need to simultaneously hold. This is no easy task given the lack of empirical success of both the UIP and PPP over the short to medium terms. Thus, the RIP is generally considered a very long run interest parity condition encompassing both real and financial linkages.[12]

There have not been many studies on estimated RIPs for the East Asian economies. de Brouwer (1999) provides differentials for the RIP and also sub-divided the estimated RIPs into its constituent parts, i.e. the UIP and PPP (Table 7). The results show that Japan, Malaysia and Taiwan have non-divergent real rates against USD rates, while the other East Asian economies tested have a lower likelihood of the RIP holding. In general, the RIP does not hold due to lack of empirical success of the UIP and relative PPP, while the condition of exogeneity for the foreign interest rate does not hold as some economies are too large to be exogenous.[13]

### 2.5 Asset Pricing and Integration

A recent methodological contribution to measuring integration is the appeal to asset pricing techniques as a way of comparing returns in different debt markets. This is especially important in measuring the extent of integration in corporate bond markets where an assessment of risk is required (see Heston and Rouwenhorst, 1994, Annaert and Ceuster, 2000 and Baele *et al.*, 2004). The basic principal involves allowing an adjustment for risk characteristics such that the effect of country factors governing integration can be isolated.

[12] The RIP may be thought of as a proxy for the marginal cost of capital.

[13] Frankel (1991) also presented some RIP differentials as part for his study. The differentials for Hong Kong, Japan, Malaysia and Singapore (with standard errors) are respectively -2.89 (0.94), -0.58 (0.62), 0.83 (1.00), 0.08 (0.68).

Francis *et al.* (2002) use asset-pricing techniques to calculate excess returns on instruments in different currencies and then test for the integration of these instruments using the UIP. The excess returns are derived as a function of three risk factors, viz. the return on a "market portfolio", an arbitrage portfolio measuring financial distress, and an arbitrage portfolio constructed to represent an investor being long in high book-to-market stocks and short in low book-to-market stocks. The principal motivation of the paper is to investigate how much of the excess returns can be explained by these risk factors and therefore be attributed to a time-varying risk premia. The authors also run some tests for the UIP for a sample of developing economies including some in East Asia (Korea, Malaysia and Thailand). The time series is split into the pre and post liberalization sub samples, though the dates of the sub samples varies from country to country. For Korea, the date is January 1992, for Malaysia, December 1988 and Thailand September 1987. The computed UIDs are given in Table 5. The results show that the UIP in general does not hold, but there is some difference between pre and post liberalization. Interestingly, the post liberalization values become positive for Korea and Thailand. This may be indicative of a relaxation of capital outflows.

### 2.6 Summary of Price Based Measure

The most popular methodology for determining the extent of financial integration is the uncovered interest parity (UIP) which was emphasized above. Indeed, as Flood and Rose (2002) have noted, "the UIP is a classic topic of international finance, a critical building block of most theoretical models..." (p.252). However, it is important to keep a number of caveats in mind when interpreting the findings. One, the test for the UIP is in fact a joint test for the CIP and the currency risk premium. We are unable to test separately for the CIP given lack of data on forward foreign exchange markets in developing East Asia. Two, the tests for the UIP generally assume that all agents form

expectations rationally. Thus, the failure of the UIP to hold (in the sense that there exists large and persistent UIDs), could be because (a) the Covered Interest Parity (CIP) does not hold (imperfect capital mobility); (b) there may be large and time varying currency risk premia (imperfect asset substitutability (see Bhatt and Virmani, 2005); or (c) rational expectations (RE) is an inappropriate assumption for the forex markets (or that the market consists of heterogeneous agents).[14]

While the CIP is a generally preferred measure of financial integration in view of the preceding limitations of operationalizing the UIP (Frankel, 1991), as noted, there needs to be a liquid forward foreign exchange market in the currency pair under investigation. While this is not problematic for industrialized economies, it is definitely a niggling problem for developing economies. In any case, Willett *et al.* (2002) observe:

> (S)ubstantial deviations from covered interest parity are a good indication that capital mobility is less than perfect..(However)..(f)inding that covered interest parity holds..is consistent with either high or low capital mobility, and there is no good reason to presume that the magnitudes of deviations from interest parity will provide a reasonable proxy for the degree of international capital mobility. In terms of modern theory, the appropriate measure of capital mobility is the extent to which uncovered rather than covered interest parity holds (pp.424-5).

With regard to the third price measure of financial integration, the RIP, the conditions for it to be held are quite prohibitive, as both the PPP and the UIP need to simultaneously hold. However, the RIP provides a useful general condition encapsulating both trade and financial linkages, and thus should not be dismissed as being altogether irrelevant. The RIP is more likely to hold over longer time horizons and acts as a useful proxy for the marginal cost of capital.[15]

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[14] MacCallum (1994) also believes that deviations from the UIP may be due to monetary policy decisions of central banks and proposes that a monetary policy reaction function be included in an expression for the UID. Bird and Rajan (2001) offer bank-based explanations for persistent interest rate differentials in East Asia. Also see Edwards and Khan (1985) and Willett *et al.* (2002).

## 3. Quantity Based Measures of Financial Integration

Whichever price measure of financial integration is used, there are two important considerations with their use. One, arbitrage conditions are probably a more appropriate way of measuring integration for certain sectors (e.g. the banking sector) rather than the whole economy (Chinn and Dooley, 1997). Two, a perennial problem with using such price measures, especially in developing economies, is what interest rate should be used, and to what extent are the available interest rates comparable across countries. Given these concerns, there is a growing body of literature that has explored quantity based measures of financial integration. We consider two such measures, viz. savings-investment correlations and consumption correlations.

### 3.1 Savings-Investment Correlations

Feldstein and Horioka (1980) - henceforth FH - pioneered this line of research. The central premise of this approach is that in a world where there is high capital mobility a country's savings are effectively part of a world pool that is able to be directed anywhere. While Savings (S) = Investment (I) hold for the world as a whole (i.e. the current account of the global economy should theoretically be in balance), deviations of savings from investment of a particular country is simply a representation of the extent of capital mobility. For the FH conclusion about high capital mobility to hold, the domestic interest rate has to be tied to the world interest rate, i.e. $r = r^*$. If capital markets are open, real interest rates are equalized across economies and savings and investment need not be correlated. If capital mobility is low, real interest differentials will not be equalized, thus making savings and investment ratios similar within national borders (see Frankel, 1991 and Bayoumi 1997). In other words, the FH measure is a quantity/national income

[15] In fact, the UIP may also be more valid over longer time horizons, i.e. over one year (see Madarassy and Chinn, 2002 and Meredith and Chinn, 1999).

accounting corollary of the RIP and should therefore be expected to hold only over the longer-run if at all.

The FH test of capital mobility is based on the following estimating equation:

$$(I/Y)_i = \alpha + \beta(S/Y)_i + \varepsilon \qquad (10)$$

The authors estimated this equation for 16 OECD economies for the period 1960-74. For the full sample the value of $\beta$ was about 0.9 and insignificantly different from one. This led FH to conclude that capital mobility for the sample of OECD economies is not very high. This high correlation of savings and investment – or small size of current account balances – has come to be known as the FH "puzzle".

The original FH study is a cross-sectional investigation. Another important cross-sectional study by Bayoumi (1997) presents regressions for 22 OECD economies using data from 1960 to 1993 and splits the sample up into a number of sub-samples. There is clearly a reduction in the correlation over a time period that is widely acknowledged to be one where there was a gradual relaxation of capital controls by certain OECD economies. Bayoumi's results are similar to those found in Obstfeld (1995) where the savings coefficient for the 1980s of 0.64 fell from the 1970s value of 0.87[16].

The literature on S-I correlations for developing economies and East Asia in particular is not very large. Montiel (1994) performs some FH-type tests for a large sample of economies over the period 1970-90. The estimations presented are simple OLS and 2SLS estimations for the correlations in levels, first differences and an error correction version. As is apparent from Table 8, capital mobility from lowest to highest is: Philippines,

[16] There have also been several papers that have examined the time series properties of savings and investment. Feldstein (1983) extended the original work by adding time series regressions as did Obstfeld (1986). Both these studies found high correlations.

Thailand, Indonesia, Korea, Malaysia and Singapore; with the slope coefficient ($\beta$) for Singapore being close to zero, suggesting perfect capital mobility.

Two more recent studies of the FH measure for East Asia warrant highlighting. Le (2000) estimates eq. 10 for 15 Asia-Pacific economies (7 for East Asian countries of relevance to this paper) using annual data for the period 1976-96. The main results are summarized in Table 9. The average slope coefficient is 0.73, suggesting relatively limited capital mobility. Examination of individual country coefficients is interesting. The coefficient for Indonesia is effectively 1 and that for China is 0.9 – signifying relative autarky. Malaysia and Korea have very low $\beta$ coefficients. Somewhat surprisingly, Hong Kong's and Singapore's coefficients are rather large at 0.8 and 0.9, respectively, casting serious doubts on the results.

Isaksson (2001) uses FH to measure financial integration for 90 developing economies. The study uses monthly observations for the period 1975 to 1995 and presents two main sets of results, viz. savings and investment rates and savings-investment regressions. The first set of results is for savings and investment rates in developing economies (measured as a percentage of GDP). If the savings-investment correlations are high, those economies with high savings rates are also likely to have high investment rates. The results for the East Asian economies are given in Table 10. It can be seen that the savings and the investment rates appear to be correlated in the sense that the average differential is only 1 percent, indicating that capital mobility may be quite low.

The second set of Isaksson's results is panel data estimations of a variation of the traditional FH regressions. The regressions are for the entire Asian sample (including some South Asian ones) and not for individual economies. While a number of estimation procedures are used, since the results are broadly similar, only the OLS results are noted here. The estimated equation is as follows:

$$(I/Y)_{it} = \omega_i + \delta_1(S/Y)_{it} + \delta_2(A/Y)_{it} + \delta_3 T(S/Y)_{it} + \nu_{it} \quad (11)$$

where: A/Y is the proportion of foreign aid to GDP. The third term on the RHS is a time dummy where 1975-84 = 0 and 1985-95 = 1. Therefore, if $\delta_3 < 0$, this implies that the correlation is lower in the second time period which in turn implies that capital mobility is higher in the latter sub-sample. The savings rate ($\delta_1$) is around 0.9 for the OLS (and IV) regressions but significantly different from 1. The dummy variable parameter is negative. This may be an indication of rather low capital mobility that is increasing over time. Also, foreign aid does not seem to affect investment in the region. While individual country results are not given, results generally indicate a strongly positive relationship between saving and investment.

There have been many objections, on theoretical and empirical grounds, about the implications of the FH study. We consider two important ones below.

One of the main explanations of the high correlation is that both variables may be endogenous and respond to a third variable (Obstfeld, 1986). More generally, savings and investment are considered pro-cyclical, further encouraging a high degree of correlation. For instance, Bayoumi (1997) performs some time series FH type regressions on a sample of 10 economies but makes a distinction between *total* investment and *fixed* investment. He finds that the correlation involving total investment is higher than those involving fixed investment. As total investment includes inventories, which are driven by cyclical factors, the high correlation between savings and total investment may well be predominantly cyclical. Baxter and Crucini (1993) used a dynamic, stochastic, general equilibrium model to demonstrate that, under certain conditions, a productivity or terms of trade shock is able to produce a high savings-investment correlation in the presence of high capital mobility. Additionally, in the long run one would expect a priori savings and investment to be

perfectly correlated due to intertemporal budget constraints.[17] Savings and investment might also be highly correlated due to government fiscal and monetary policies aimed at external balance. Bayoumi (1997) points out that the use of *private* and not *total* saving and investment would mitigate that problem and, in fact, those studies using private saving and investment have lower correlations.

A second objection to the FH analysis is that the RIP must hold and an exogenous foreign interest rate must exist for the FH analysis to hold. As noted, these conditions do not generally hold over the short and medium runs, and probably do not hold for larger economies (given the non-applicability of the exogeneity assumption). For instance, Murphy (1994) examined a cross section of 17 economies and found that correlations depended positively on country size.

A recent adaptation of the FH method is Aizenman *et al.* (2004) and outlined Aizenman (2005). Essentially, the method involves the creation of a ratio of savings-to-investment, where the savings measure has been adjusted to offer an alternative interpretation (so-called "self-financing ratio"). Savings is measured as the cumulative *discounted* gross national saving. It is an attempt to capture the amount of capital that would be available for investment purposes if it were able to be sustained domestically without the reliance on external borrowing. The closer the ratio is to unity, the more able a country is in sustaining it's own investment, thereby - under the standard FH hypothesis - lowering the degree of global integration. Aizenman (2005) reports that for the Asian sample presented (China, Indonesia, Korea, Malaysia, the Philippines) the ratio is very near unity and higher than the Latin American and African samples. This figure increased after the crisis for some countries (such as Malaysia and the Philippines), a possible indication of a process put into place by authorities to increase internal financing.

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[17] One would also expect savings and investment to be more highly correlated the more flexible the exchange rate regime.

### 3.2 Consumption Correlations

While the S-I correlations are the most popular quantity measure of financial integration, a more theoretically elegant measure of financial integration is to examine the time paths of consumption within and across economies. Smoothing of consumption due to expected or unexpected changes in income in a country implies the use of capital markets to finance "excess" consumption. Intuitively, a convergence of consumption between two economies is an indication that each country is using capital markets to choose a time path for consumption that is outside the path implied by available domestic resources, thus implying access or openness to capital flows (Bayoumi, 1997 and de Brouwer, 1999).

The empirical evidence involves observing correlations of consumption growth for individual economies against an average consumption growth for the rest of the sample and against real GDP. Bayoumi reports results for 21 OECD economies between 1973 and 1990. He finds that the correlations are generally quite low, and are at odds with the theoretical predictions of risk sharing. Based on this measure, Montiel (1994) shows that the East Asian economies he considers, viz. Korea, Malaysia, the Philippines, Singapore and Thailand, have quite high capital mobility. de Brouwer (1999) computes some correlations for private and total consumption and real income for three sub-periods of G7 and East Asian economies. The sample is split into three sub-samples: 1963-72, 1973-82 and 1983-92. His analysis shows that correlations are low but have risen since the 1960s. Looking particularly at East Asian economies, the correlations for Korea, Malaysia, the Philippines and Thailand do not show any tendency in either direction – the coefficients are low in the first and third sample and high for the second. The other economies in East Asia (Hong Kong, Japan and Singapore) showed a general increase over the entire sample period, suggesting intensified capital mobility.

A more rigorous way of testing for consumption correlation is to run regressions on domestic consumption against consumption for the "rest of the world (ROW)" using a regression like the following:

$$\Delta c_{it} = \alpha + \beta X_{it} + \gamma \Delta c_{A't} + \varepsilon_t \quad (12)$$

where $\Delta c_{it}$ is the change in domestic consumption between t-1 and t, $\Delta c_{A't}$ is the change in ROW consumption and $X_{it}$ is a vector of domestic explanatory variables. The test for full risk sharing is that $\beta$ = 0 and $\gamma$ = 1. If the level of financial integration is high then the consumption patterns of domestic agents should broadly follow that of their international counterparts.

A closely related test pioneered involves estimating the following regression equation:

$$\Delta c_{it} = \alpha + \beta \Delta (y\text{-}i\text{-}g)_{it} + \gamma \Delta c_{A't} + \varepsilon_t \quad (13)$$

The variable $(y\text{-}i\text{-}g)_{it}$ measures the domestic resources available for consumption. The null hypothesis for risk sharing is $\beta$ = 0 and $\gamma$ = 1. If a country is closed to international capital markets then a country's consumption should reflect those resources available for that consumption, (y-i-g).

While Bayoumi (1997) discusses the performance of these tests for OECD countries between 1973 and 1990, to our knowledge, there have been few attempts to apply these tests (i.e. eqs. 12 and 13) to East Asia. One known recent attempt is Kim *et al.* (2004). The authors estimate a regression equation similar to eq. 13 for a sample of 10 East Asian countries. Two consumption coefficients are reported, viz. one for each country against the Asian sample, the other against the OECD average (Table 11). The results

show that the degree of risk sharing is low for most in the sample (except Singapore and Taiwan), and that there is little difference between the correlation with the Asian sample and the OECD average.

## 4. Regulatory, Institutional and other Measures

### 4.1 Capital Controls

Capital controls are often placed under the category of financial *liberalization* - rather than *integration*, but their connection to financial integration is straightforward. Financial liberalization is basically the process that policymakers engage in attempting to achieve greater financial integration. As such, the process of achieving integration involves the removal of capital controls that were imposed in an earlier regime. We can measure the degree of financial integration by observing the extent to which a country has capital controls and we can assess whether a country is becoming more or less integrated by observing whether controls are being imposed or removed over time.

The types of controls that might be in place are numerous (for instance, see Bird and Rajan, 2000). Park and Bae (2002) specify three general categories that might be imposed: (a) those that relate to financial market regulations such as legislative control over deposit rates; (b) restrictions on capital account transactions such as restrictions on term or currency and (c) regulations relating to the entry and exit of foreign financial services.[18]

How are these restrictions used to measure the extent of financial integration? A well cited paper is that of Grilli and Milesi-Ferretti (1995) who use the restrictions captured by the *IMF Annual Report on Exchange Arrangements and Exchange Restrictions* as

[18] In a recent study, Magud and Reinhart (2006) document the imposition of controls by many countries, including Asian ones. While the paper is comprehensive in its treatment of capital controls, its main purpose is to seek reasons why they are imposed/removed and evaluate their effectiveness.

dummy variables to measure their effect on variables such as capital flows. Johnston et al. (1999) does a similar thing using further disaggregated data (forty four categories of capital account transactions) Table 12 reports the results for the Asian sample using the Johnston *et al.* index. It reveals a marked reduction in capital controls in Korea and an increase in the extent of controls in Malaysia. These observations are consistent with the general observation of policy choices of the two economies in the latter half of the 1990s. The index also indicates a generally stable though gradual decline in capital account barriers in the cases of Indonesia and Thailand.

An alternative to the dummy variable based measure of capital controls is the "restrictions based" one recently developed by Edison and Warnock (2001). By using data on market capitalization they have constructed a univariate quantitative measure of the degree of capital controls in developing countries. Specifically, the Edison-Warnock measure is constructed using two indices from the Standard & Poor's/International Finance Corporation (S&P/IFC). The first is a global index (IFCG) which is an index capturing capitalization of the whole market, and the second is the Investable index (IFCI), which is constructed to capture the proportion of the market which is accessible to investors. By taking one minus the ratio of IFCI to IFCG, Edison and Warnock obtain a measure of the degree or the intensity of capital controls based on restrictions to the domestic market. The data used is of monthly frequency from 1988 to 2000.

For their sample of Asian economies, Edison and Warnock find that the initial restrictions were generally quite high but decreased markedly during the 1990s. The exceptions were the Philippines, whose level of controls remained fairly constant over the time period under consideration, and Malaysia, which appeared to have very few restrictions to begin with, but increased them significantly in the aftermath of the crisis as

noted previously. The authors also compare their measure with some of the other techniques for measuring capital controls and find broad concurrence in the results[19].

A fundamental assumption with all such indices of capital controls that the removal of capital controls may, in some way, result in a more financially integrated economy. This may not be the case. There could well exist a situation where a country has very few capital controls and is yet not regarded as being integrated with other economies. This could be due to legal/political factors, cultural variables, business practices or simply that an economy has not been noticed by others as a potential place to export capital flow, i.e. it "escaped the radar" of the international financial community.

### 4.2 Stock Market Co-movements

Financing involving non-bank and non-debt channels has grown in importance in developing countries. Thus, another measure of integration of regional capital markets would invariably involve examining equity market returns. There have been any number of studies examining the extent of equity market integration in East Asia. In the main, these papers look at the univariate properties of the data and how movements in the equity markets in one country influence the series in another country. Some of the more recent papers extend the analysis by including other variables such as the exchange rate and capital flows, while others have examined the effect of the Asian crisis on their integration results. In general, the methodological applications range from simple correlations and covariances to VAR based approaches such as Granger causality for the short run analysis and cointegration tests for the long run scenario. In addition, the use of test of asset pricing models has gained popularity. We consider below a few studies using different techniques.

[19] For a more complete comparison of various measures, see Nitithanprapas, *et al.* (2002).

*a) Correlation and Causality Tests*

Hashmi and Liu (2001) examine stock market integration of the major five Southeast Asian economies (Singapore, Malaysia, Thailand, Indonesia and the Philippines). Their particular interest is on investigating the effects of the US and Japanese markets on the East Asian economies as well as the degrees of market interactions among East Asia's listed markets. They use daily stock markets indices taken at closing time and in local currency spanning the period of January 1994 to December 2000. The observation sets are further sub-divided into the pre crisis (January 1994 to July 1997) period and the post crisis (August 1997 to December 2000) period. The correlation tests were performed for the pre and post crisis samples. In general they find that the correlation coefficients have increased after the crisis. The statistics also suggest that the Southeast Asian markets are generally more correlated with the US market than with the Japanese market, with the post crisis Thailand as an exception. In acknowledgement that correlations do not make any inferences about causation, the authors also conduct Granger causality tests to ascertain whether a change on a lagged value of one country's stock market causes a change in the contemporaneous value of another county's stock market. The results are summarized in Table 13. What is noticeable about the Granger Causality results is that the fluctuations of the US market have significant effects on the Southeast Asian markets. In contrast, they find the performance of the Japanese stock market does not have any significant ramification on the Southeast Asian markets. Another noteworthy observation is that the degree of integration between Southeast Asian markets has increased since the 1997 East Asian financial crisis.

*b) Variance Decomposition Tests*

Another commonly used tool to assess the degree of capital market integration is the variance decomposition test. Hashmi and Liu (2001) present variance decompositions for pre crisis and post crisis time periods for the Southeast Asian region. The main conclusion emerging from their results is that the performance of the stock exchange of Singapore strongly influences the returns of the capital markets in the region -- stronger than that of the US. As expected, the forecast error is predominantly generated by volatility within that country. In addition to the internal factor, Singapore is found to be the source of the most influential external contributor in explaining the variance of the market index in each of the main Southeast Asian capital markets (Table 14).

Moon (2001) employs daily observations of national stock price indices from a number of East Asian countries from January 1995 to June 2000. The sample is grouped into 3 sub-samples, viz. pre crisis, crisis and post crisis periods. Of a particular interest in the paper is the influence of the US markets on domestic markets. Table 15 reports the proportion (in percent) of the forecast errors of the market indices of the East Asian economies explained by the US markets for the three time periods. The results confirm that there is a substantial rise in the influence of the US market on each of these East Asian markets during the post crisis vis-à-vis the pre crisis and the crisis period.

*c) Cointegration Tests*

A recent feature of the literature of equity market integration is the use of tests for cointegration and common stochastic trends. These tests investigate a long term relationship between stock markets. A well-cited paper is Kasa (1992), one of the first to use the Johansen cointegration technique for stock prices to assess integration. The study examines market indices of the capital markets of the US, UK, Japan, Germany and Canada, and finds a single common trend, implying that the returns in all of these markets

are highly integrated[20]. One of the earlier studies employing cointegration techniques on Asian countries is Chung and Liu (1994). Using data for the US, Japan, Hong Kong, Singapore, Taiwan and Korea, they find 2 cointegration relationships and 4 common trends. In addition to the set of testing discussed before, Moon (2001) also conducts a number of cointegration tests for his sample set of countries for the different sub-periods: before, during and after the 1997 crisis. The study finds significantly more cointegrating relationships for the post crisis sample than for the other two sub-samples, with the US market being involved in most of the cointegration relationships.

*d) Test Based on Asset Pricing Models*

As mentioned in Section 2, the use of asset pricing models has also become an increasingly popular technique to examine the degree of stock market integration. Phylaktis and Ravazzolo (2002) derive the covariance of excess returns on the stock market for 1980-98. The first step is to establish expressions for the excess returns of the domestic and foreign stock market as a function of the real interest rate, dividends paid and other variables such as lagged returns and the exchange rate. These expressions find the determinants of returns in each country. The next step is to derive the variances and covariances of the excess returns. The model is then estimated as a VAR. The principal idea is to find variables that help explain movements in the stock markets. The countries included in the sample are Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand. The authors find that variations in dividends paid are a significant source of variance in stock return. An interesting result that arises is that co-movements in output growth are directly related to stock prices, indicating a connection between real sector integration and financial integration (recall the RIP which is a broader

[20] If a common trend is shared by all variables in a system, this suggests that cointegration is present in the model. The more common trends that are identified, the less integrated the variables

price measure of integration). The paper also unearths a close connection between Thailand and the US and a high degree of integration between Korea, Taiwan and Japan.

## 5. Concluding Remarks

The detailed literature review and empirical analysis undertaken in this paper suggests there is no obvious indication of intensified financial market integration in the region on the whole. Nonetheless, the evidence seems to reveal a close correspondence between measures of financial integration and the extent of the development of financial markets in general. The three East Asian financial centers, and high-income economies of Hong Kong, Japan and Singapore are fairly highly integrated with global capital markets. The recent pace of liberalization in Korea post crisis is also intensifying the country's extent of international financial integration. The lower middle-income Southeast Asian countries, Thailand and Indonesia as well as the Philippines, are relatively less financially integrated, though evidence suggests a gradual movement towards enhanced integration. The evidence on Malaysia is mixed, while there is limited evidence on Taiwan to offer any firm conclusion at this stage.

While these countries continue with their ongoing liberalization efforts, one would expect their effective degree of financial integration to intensify. It has, however, been argued that these liberalization attempts may lead to enhanced *regional* or *global* integration (Eichengreen and Park, 2003 and Park and Bae, 2002). While this a real possibility, policy makers in East Asia have taken the view that there are positive externalities from cooperating to strengthen their individual financial sectors, to develop regional financial markets, and in particular, to diversify their financial structures away from bank-based systems to bond markets. Motivated by this, a number of financial cooperation initiatives have been underway in East Asia, including the Asian Bond Fund (ABF)

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and, as such, fewer cointegrating relationships are found. (for details, see Stock and Watson,

established by the eleven members of the Executives' Meeting of East Asia-Pacific Central Bank (EMEAP) and the Asian Bond Market Initiative (ABMI) by Asian Plus Three (APT) economies. The more successful are these early initiatives and the deeper and broader they become over time, the greater the likelihood that the region’s financial systems will become more closely intraregionally integrated.

1988).

**References**

Aizenman J. (2005). "Financial Liberalization: How Well has it Worked for Developing Countries?" *FRBSF Economic Letters*, April.

Aizenman, J., B. Pinto, and A. Radziwill (2004). "Sources for Financing Domestic Capital: Is Foreign Saving a Viable Option for Developing Countries?", *Working Paper No.10624*, NBER.

Annaert, J. and M. J. K. De Ceuster (2000). "Modelling European Credit Spreads", Deloitte & Touche Research Report, March.

Baele, L. A. Ferrando, P. Hördahl, E. Krylova and C. Monnet (2004). "Measuring Financial Integration in the Euro Area, *Occasional Paper Series No.14*, European Central Bank.

Baxter, M. and M. Crucini (1993). "Explaining Saving-Investment Correlations", *American Economic Review*, 83, pp.416-36.

Bayoumi, T. (1997). Financial Integration and Real Activity, Manchester: Manchester University Press.

Bhatt, V. and A. Virmani (2005). Global Integration of India's Money Market: Interest Rate Parity in India", *Working Paper No.164*, Indian Council for Research on International Economic Relation, New Delhi.

Bird, G. and R. Rajan (2000). "Restraining International Capital Flows: What does it Mean?", *Global Economic Quarterly,* 1, pp.57-80.

Bird, G. and R. Rajan (2001). "Banks, Financial Liberalisation and Financial Crises in Emerging Markets", *The World Economy*, 24, pp.889-910.

Bird, G. and R. Rajan (2002a). "The Evolving Asian Financial Architecture", *Princeton Essays in International Economics No.226*, International Economics Section, Princeton University, March.

Bird, G. and R. Rajan (2002b). "Regional Arrangements for Providing Liquidity in a Financial Crisis?: Developments in Asia", *Pacific Review,* 15, pp.359-79.

Chang, L.L. and R. Rajan (2001). "The Economics and Politics of Monetary Regionalism in Asia", *ASEAN Economic Bulletin*, 18, pp.103-18.

Chinn, M.D. and G. Meredith (2004). Monetary Policy and Long-horizon Uncovered Interest Parity. *IMF Staff Papers*, 51, 409-430.

Chinn, M. and M. Dooley (1995). "Asia-Pacific Capital Markets: Integration and Implications for Economic Activity", *Working Paper No.5280*, NBER.

Chinn, M. and J. Frankel (1992). "Financial Links Around the Pacific Rim: 1982-1992", in R. Glick (ed.), *Exchange Rate Policies in Pacific Basin Countries*, Cambridge: Cambridge University Press.

Chung, P. and D. Liu (2004). “Common Stochastic Trends in Pacific Rim Stock Markets”, *Quarterly Review of Economics and Finance*, 34, pp.241-59.

de Browuer, G. (1999). *Financial Integration in East Asia*, Cambridge: Cambridge University Press.

Edison, H and E. Warnock (2001). “A Simple Measure of the Intensity of Capital Controls”, *Journal of Empirical Finance* 10, pp 81-103.

Edwards, S. and M. Khan (1985). “Interest Rate Determination in Developing Countries”, *IMF Staff Papers*, 32, pp.377-403.

Eichengreen B. and Y.S. Park (2003). “Why has there Been Less Financial Integration in Asia than in Europe?”, mimeo (January).

Feldstein, M. (1983). “Domestic Savings and International Capital Movements in the Long-run and the Short-run”, *European Economic Review,* 21, pp.129-51.

Feldstein, M. and C. Horioka (1980). “Domestic Saving and International Capital Flows”, *Economic Journal*, 90, pp.314-29.

Flood, R. and A. Rose (2002). “Uncovered Interest Parity in Crisis”, *IMF Staff Papers*, 49, pp.252-65.

Francis B., I. Hasan and D. Hunter (2002). “Emerging Market Liberalization and the Impact on Interest Rate Parity”, *Journal of International Money and Finance*, 21, pp.931-56.

Frankel, J. (1991). “Quantifying International Capital Mobility in the 1980s”, in B. Bernheim and J. Shoven (ed.), *National Saving and Economic Performance*, Chicago: University of Chicago Press.

Frankel, J. and C. Okwongu (1996). “Liberalized Portfolio Capital Inflows in Emerging Markets: Sterilization, Expectations and the Incompleteness of Interest Rate Convergence”, *International Journal of Finance and Economics*, 1, pp.1-23.

Fujii, E and M. Chinn (2001). “Fin de Siecle Real Interest Parity”, *Journal of International Financial Markets, Institutions and Money*, 11, pp.289-308.

Grilli, V and G.M. Milesi-Ferretti (1995). “Economic Effects and Structural Determinants of Capital Controls”, *IMF Staff Papers*, 42, pp.517-51.

Hashimi, A. and X. Liu (2001). “Interlinkages Among Southeast Asian Stock Markets”, mimeo (December).

Heston, S. L. and K.G Rouwenhorst (1994). “Does Industrial Structure Explain the Benefits of International Diversification?”, *Journal of Financial Economics* 36, pp.3-27.

Isaksson, A. (2001). “Financial Liberalization, Foreign Aid, and Capital Mobility: Evidence from 90 Developing Countries”, *Journal of International Financial Markets, Institutions and Money,* 11, pp.309-38.

Johnston, R., M. Swinburne, A. Kyei, B. Laurens, D. Mitcham, I. Otker, S. Sosa and N. Tamirisa (1999). "Exchange Rate Arrangements and Currency Convertibility: Development and Issues", *World Economic and Financial Surveys,* Washington DC: IMF, Chapter 7.

Kasa, K. (1992). "Common Stochastic Trends in International Stock Markets", *Journal of Monetary Economics* 29, pp.95-124.

Khalid, A. (1999). "Modelling Money Demand in Open Economies: The Case of Selected Asian Countries", *Applied Economics*, 31, pp.1129-35.

Kim, S.., Kim, S. and Y. Wang (2004). "Regional vs. Global Risk Sharing in East Asia", *Working Paper No.04-02*, Korea Institute for Economic Policy, Seoul.

Kumar, N. (2005). "Towards a Broader Asian Community: Agenda for the East Asia Summit", *Discussion Paper No.100*, Research and Information System for Developing Countries, New Delhi.

Lane, P. R, and G.M. Milesi-Feretti (2001). "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries"*, Journal of International Economics*, 55, pp.263–94.

Le, H.G. (2000). "Financial Openness and Financial Integration", *Working Paper No.00-4*, Asia Pacific School of Economics and Management, Australia National University.

Liu, L-G and I. Otani (2005). Capital Controls and Interest Rate Parity: Evidences from China, 1999-2004", mimeo (March).

Madarassy, R. and M. Chinn (2002). "Free to Flow? New Results on Capital Mobility Amongst the Developed Countries", mimeo (August).

Magud, N. and C. Reinhart (2006). "Capital Controls: An Evaluation", *Working Paper No.11973*, NBER.

McCauley, R et al (2002). Integrating the finances of East Asia, *BIS Quarterly Review*, December, pp.83-95.

Meredith, G. and M. Chinn (1999). "Long-Horizon Uncovered Interest Parity", mimeo (May).

Montanes, A. and M. Sanso-Navarro (2005). "Another Look at Long-horizon Uncovered Interest Parity, mimeo (May).

Montiel, P. (1994). "Capital Mobility in Developing Countries: Some Measurement Issues and Empirical Estimates", *World Bank Economic Review*, 8, pp.311-50.

Moon, W-S, (2001). "Currency Crisis and Stock Market integration: A Comparison of East Asian and European Experiences", *Journal of International and Area Studies*, 8, pp.41-56

Nitithanprapas, I., S. Rongala and T.D. Willett (2002). "The Role of Capital Controls and Currency Regimes in the Asian Crisis", *Working Paper No.2002-21*, The Claremont Colleges, California.

Obstfeld, M. (1986). “Capital Mobility in the World Economy: Theory and Measurement”, *Carnegie-Rochester Conference Series on Public Policy*, 24, pp.55-104.

Obstfeld, M. (1995). “International Capital Mobility in the 1990s”, in P. Kenen (ed.), *Understanding Interdependence: The Macroeconomics of the Open Economy*, Princeton: Princeton University Press.

Obstfeld, M. (1998). “The Global Capital Market: Benefactor or Menace?”, *Journal of Economic Perspectives*, 12, pp.9-30.

Park, W. and G. Choi (2002). “Assessment of Korea’s Financial Liberalization”, mimeo (October).

Park, Y.C. and K.H. Bae (2002). “Financial Liberalization and Economic Integration in East Asia”, paper presented at the PECC Finance Forum Conference on “Issues and Prospects for Regional Cooperation for Financial Stability and Development” (Hawaii, August 11-13).

Phylaktis, K and F Ravazzolo (2002). “Measuring Financial and Economic Integration with Equity Prices in Emerging Markets”, *Journal of International Money and Finance*, 21, 879-903.

Rajan, R. (2001). “(Ir)relevance of Currency-Crisis Theory to the Devaluation and Collapse of the Thai Baht”, *Princeton Studies in International Economics No.88*, International Economics Section, Princeton University.

Rajan, R. (2003). “Safeguarding Against Capital Account Crises: Unilateral, Regional and Multilateral Options for East Asia”, in G. de Brouwer (ed.), *Financial Arrangements in East Asia,* London: Routledge.

Rajan R. and R. Siregar (2002). “Boom, Bust and Beyond”, in G. de Brouwer (ed.), *Financial Markets and Policies in East Asia*, London: Routledge.

Rajan, R., R. Siregar and I. Sugema (2003). “Capital Flows and the Credit Transmission Channel in Southeast Asia”, *Journal of International Development*, 15, pp.265-83.

Stock, J. and M. Watson (1988). “Testing for Common Trends”, *Journal of the American Statistics Association* 83, pp.179-97.

Taylor, A.M., (2002). "A Century of Current Account Dynamics", *Journal of International Money and Finance*, 21(6), pp 725-748

Willett, T., M. Keil and Y.S. Ahn (2002). “Capital Mobility for Developing Countries May Not be So High”, *Journal of Development Economics,* 68, pp.421-34.

**Table 1**
**Covered Interest Differentials (CIDs), 1982-87**

| Country | Mean CID | Std Dev |
|---|---|---|
| Hong Kong | 0.13 | 0.03 |
| Japan | 0.09 | 0.03 |
| Malaysia | -1.46 | 0.16 |
| Singapore | -0.30 | 0.04 |

Source: Frankel (1991)

**Table 2**
**Covered Interest Parity (CIP), 1985-94**

| Country | $\alpha$ = 0, (St Dev) | $\beta$ = 1, (St Dev) |
|---|---|---|
| Hong Kong | -0.04 (0.01) | 0.97 (0.05 |
| Japan | -0.01 (0.002) | 1.01 (0.05) |
| Malaysia | 0.14 (0.03) | 0.87 (0.03) |
| Taiwan | 0.00 (0.04) | 0.59 (0.20) |
| Thailand | -0.30 (0.16) | 0.99 (0.05) |
| Singapore | 0.20 (0.03) | 0.96 (0.03) |

Source: de Brouwer (1999)

**Table 3**
**Uncovered Interest Parity (UIP) and Uncovered Interest Differentials (UIDs), 1985 - 1994**

| Country | $\alpha$ = 0 | $\beta$ = 1 | UID |
|---|---|---|---|
| Hong Kong | -0.04 (0.03) | -0.29 (0.07) | 0.06 (0.05) |
| Indonesia | 0.90 (0.12) | 0.02 (0.07) | -0.69 (0.13) |
| Japan | -2.80 (0.65) | -2.41 (0.75) | -0.71 (0.64) |
| Korea | -0.10 (0.23) | 0.58 (0.15) | -0.59 (0.22) |
| Malaysia | -0.51 (0.19) | -1.04 (0.20) | 0.49 (0.29) |
| Philippines | 0.34 (1.15) | 0.23 (0.37) | -1.83 (0.55) |
| Singapore | 2.03 (0.40) | -2.29 (0.47) | 0.02 (0.25) |
| Taiwan | 0.14 (0.20) | 1.25 (0.22) | -0.58 (0.24) |
| Thailand | -0.34 (0.20) | 0.14 (0.20) | 0.71 (0.16) |

Note: * = Statistical significance at the 5 percent level.
Source: de Brouwer (1999)

**Table 4**
**Uncovered Interest Parity (UIP), 1990s**

| Country | $\beta = 1$ (Std. Dev) |
|---|---|
| Hong Kong | -0.35 (0.18) |
| Indonesia | 0.22 (2.05) |
| Japan | -0.82 (1.36) |
| Korea | 3.41 (4.12) |
| Thailand | 0.52 (1.86) |

Source: Flood and Rose (2001)

**Table 5**
**Uncovered Interest Differentials (UIDs), 1975-95**

| Country | Pre Liberalization | Post liberalization |
|---|---|---|
| Korea | -0.068 | 0.112 |
| Malaysia | -0.353* | -0.141 |
| Thailand | -0.096 | 0.005 |

Source: Francis *et al.* (2002)

**Table 6**
**Uncovered Interest Differentials (UIDs) (in percent)**
**(Period 1: January 1995 - December 1996;**
**Period 2: January 1998 - December 1999;**
**Period 3: January 2000 - June 2002)**

**A. Domestic Economy: Indonesia**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Malaysia | 2.98 | 21.4 | 0.04 |
| Philippines | 2.53 | 20.6 | 2.80 |
| Singapore | 4.83 | 24.7 | 3.30 |
| Thailand | 1.98 | 17.8 | 3.60 |
| Korea | 5.26 | 13.1 | 2.04 |
| China | 1.02 | 23.4 | 0.60 |
| Hong Kong | 3.84 | 22.8 | -0.03 |
| Average | 3.21 | 20.54 | 1.76 |

**B. Domestic Economy: Thailand**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Malaysia | 1.01 | 2.74 | -3.38 |
| Philippines | 0.54 | 1.73 | -0.78 |
| Singapore | 2.85 | 5.99 | -0.56 |
| Indonesia | -1.98 | -17.8 | -3.60 |
| Korea | 3.27 | -4.81 | -1.76 |
| China | -0.96 | 5.09 | -2.82 |
| Hong Kong | 1.73 | 4.40 | -3.44 |
| Average | 0.92 | -0.38 | -2.33 |

**C. Domestic Economy: Malaysia**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -2.98 | -21.40 | -0.04 |
| Philippines | -0.45 | -0.65 | 2.80 |
| Singapore | 1.85 | 3.53 | 2.44 |
| Thailand | -1.01 | -2.74 | 3.38 |
| Korea | 2.41 | -7.11 | 1.37 |
| China | -1.96 | 2.68 | 0.56 |
| Hong Kong | 0.66 | 1.99 | -0.07 |
| Average | -0.21 | -3.39 | 1.49 |

**D. Domestic Economy: Philippines**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -2.53 | -20.6 | -2.80 |
| Malaysia | 0.45 | 0.65 | -2.80 |
| Singapore | 2.28 | 4.00 | 0.02 |
| Thailand | -0.54 | -1.73 | 0.78 |
| Korea | 2.87 | -6.21 | -1.13 |
| China | -1.51 | 3.08 | -2.24 |
| Hong Kong | 1.44 | 2.39 | -2.86 |
| Average | 0.35 | -2.63 | -1.58 |

**E. Domestic Economy: Singapore**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -4.83 | -24.70 | -3.30 |
| Philippines | -2.28 | -4.00 | -0.02 |
| Malaysia | -1.85 | -3.53 | -2.44 |
| Thailand | -2.85 | -5.99 | 0.56 |
| Korea | 0.54 | -10.44 | -0.45 |
| China | -3.79 | -0.86 | -1.94 |
| Hong Kong | -1.23 | -1.55 | -2.57 |
| Average | -2.33 | -7.30 | -1.45 |

**F: Domestic Economy: Korea**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -5.26 | -13.10 | -2.04 |
| Philippines | -2.87 | 6.21 | 1.13 |
| Malaysia | -2.41 | 7.11 | -1.37 |
| Thailand | -3.27 | 4.81 | 1.76 |
| Singapore | -0.54 | 10.44 | 0.45 |
| China | -4.37 | 9.65 | -1.31 |
| Hong Kong | -1.92 | 8.95 | -1.94 |
| Average | -2.95 | 4.87 | -0.47 |

**G: Domestic Economy: China**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -1.02 | -23.40 | -0.60 |
| Philippines | 1.51 | -3.08 | 2.24 |
| Malaysia | 1.96 | -2.68 | -0.56 |
| Thailand | 0.96 | -5.09 | 2.82 |
| Singapore | 3.79 | 0.86 | 1.94 |
| Korea | 4.37 | -9.65 | 1.31 |
| Hong Kong | 2.68 | -0.69 | -0.63 |
| Average | 2.04 | -6.25 | 0.93 |

**H: Domestic Economy: Hong Kong**

| Foreign Countries | Period 1 | Period 2 | Period 3 |
|---|---|---|---|
| Indonesia | -3.84 | -22.80 | 0.03 |
| Philippines | -1.44 | -2.39 | 2.86 |
| Malaysia | -0.66 | -1.99 | 0.07 |
| Thailand | -1.73 | -4.40 | 3.44 |
| Singapore | 1.23 | 1.55 | 2.57 |
| Korea | 1.92 | -8.95 | 1.94 |
| China | -2.68 | 0.69 | 0.63 |
| Average | -1.03 | -5.47 | 1.65 |

Source: Authors' own calculation

**Table 7**
**Decomposition of Real Interest Parity Differentials (RIDs), 1980-94**

| Country | RID | UID | PPP |
|---|---|---|---|
| Hong Kong | 1.03* (0.13) | 0.05 (0.07) | -0.98* (0.15) |
| Indonesia | -0.70* (0.29) | -0.81* (0.20) | -0.11 (0.26) |
| Japan | 0.11 (0.11) | -0.94 (0.87) | -1.05 (0.85) |
| Korea | -0.62* (0.18) | -0.65* (0.27) | -0.03 (0.29) |
| Malaysia | 0.05 (0.14) | 0.48 (0.34) | 0.43 (0.32) |
| Philippines | -1.73* (0.35) | -1.97* (0.62) | -0.24 (0.57) |
| Singapore | 0.26* (0.10) | -0.04 (0.31) | -0.30 (0.33) |
| Taiwan | -0.24 (0.18) | -0.49 (0.36) | -0.25 (0.43) |
| Thailand | -0.47* (0.20) | -0.93* (0.23) | -0.46 * (0.18) |

Note: * = Statistical significance at the 5 percent level.
Source: de Brouwer (1999)

**Table 8**
**Savings-Investment Correlations for East Asia, 1970-90**

| Country | Ordinary Least Squares (OLS) | | | Instrumental Variables (IV) | | |
|---|---|---|---|---|---|---|
| | Levels | First Difference | Error Correction | Levels | First Difference | Error Correction |
| Indonesia | 0.82[a] | 0.23[b] | 0.20[b] | 1.37[a] | -0.04[b] | 0.23 |
| Korea | 0.35[c] | 0.15[b] | -0.37[b] | 0.31[c] | 0.50 | 0.07[b] |
| Malaysia | 0.24 | 0.11[c] | -0.06[b] | 0.41 | 0.08[b] | 0.08[b] |
| Philippines | 1.16[c] | 0.56[c] | 0.45[c] | 1.04[a] | 0.49[c] | 0.67[c] |
| Singapore | 0.06[b] | 0.08[b] | 0.17[b] | - | - | - |
| Thailand | 0.72[c] | 0.62[c] | 0.55[c] | -0.53 | -0.11 | -0.30 |

Notes: - Not available
a) Different from zero at the 5 percent level.
b) Different from one at the 5 percent level.
c) Different from both zero and one at the 5 percent level.
Source: Montiel (1994)

**Table 9**
**Savings-Investment Correlations for East Asia, 1976-96**

| Country | F-H Coefficient |
|---|---|
| China | 0.90 |
| Hong Kong | 0.80 |
| Indonesia | 1.02 |
| Korea | 0.20 |
| Malaysia | 0.21 |
| Philippines | 0.51 |
| Singapore | 0.87 |
| Thailand | 1.35 |

Source: Le (2000)

**Table 10**
**Saving and Investment Rates, 1975-1995**

| Country | Saving Rate | Investment Rate | S-I |
|---|---|---|---|
| China | 35.53 | 36.32 | -0.79 |
| Hong Kong | 28.32 | 33.17 | -4.85 |
| Indonesia | 28.12 | 25.99 | 2.13 |
| Korea | 32.73 | 30.58 | 2.15 |
| Malaysia | 33.28 | 30.56 | 2.72 |
| Philippines | 24.87 | 22.06 | 2.81 |
| Singapore | 39.69 | 40.29 | -0.60 |
| Thailand | 32.51 | 27.49 | 5.02 |
| Average | 31.88 | 30.81 | 1.07 |

Source: Isaksson (2001)

**Table 11**
**Consumption Correlations**

| Country | ?? | ?? |
|---|---|---|
| China | 0.06<br>(0.10) | 0.05<br>(0.10) |
| Hong Kong | 0.11<br>(0.10) | 0.11<br>(0.11) |
| Indonesia | -0.35<br>(0.35) | -0.28<br>(0. 32) |
| Japan | 0.07<br>(0.12) | 0.05<br>(0.23) |
| Korea | 0.19<br>(0.08) | 0.14<br>(0.10) |
| Malaysia | -0.40<br>(0.44) | -0.55<br>(0.41) |
| Philippines | 0.30<br>(0.11) | 0.39<br>(0.12) |
| Singapore | 0.34<br>(0.17) | 0.63<br>(0.16) |
| Thailand | 0.17<br>(0.17) | 0.08<br>(0.16) |
| Taiwan | 0.29<br>(0.11) | 0.71<br>(0.14) |

Source: Kim *et al.* (2005). Figures in Parentheses are standard errors

**Table 12**
**Degree of Capital Controls (Johnston *et al.* Index)**

| Year | Indonesia | Korea | Malaysia | Thailand |
|---|---|---|---|---|
| 1995 | 0.53 | 0.68 | 0.71 | 0.72 |
| 1996 | 0.53 | 0.67 | 0.71 | 0.72 |
| 1997 | 0.51 | 0.58 | 0.71 | 0.70 |
| 1998 | 0.48 | 0.48 | 0.76 | 0.70 |
| 1999 | 0.49 | 0.42 | 0.76 | 0.70 |

Source: Park and Bae (2002)

**Table 13**
**Granger Causality Test Results**
(only those results significant at 5%)

| **Pre Crisis** | **Post Crisis** |
|---|---|
| US _ Japan | US _ Japan |
| US _ Singapore | US _ Singapore |
| US _ Malaysia | US _ Malaysia |
| US _ Thailand | US _ Thailand |
| US _ Indonesia | US _ Indonesia |
| Indonesia _ US | US _ Philippines |
| US _ Philippines | Singapore _ Malaysia |
| Singapore _ Thailand | Singapore _ Thailand |
| Singapore _ Indonesia | Thailand _ Singapore |
| Singapore _ Philippines | Singapore _ Philippines |
| Malaysia _ Thailand | Philippines _Singapore |
| Malaysia _Indonesia | Malaysia _ Philippines |
| Malaysia _ Philippines | Philippines _ Malaysia |
| Thailand _ Indonesia | Thailand _ Indonesia |
| Thailand _ Philippines | Indonesia _ Thailand |
| Indonesia _ Philippines | Thailand _ Philippines |
| Philippines _ Indonesia | Philippines _ Thailand |
| Singapore _ Japan | Indonesia _ Philippines |
| Thailand _Singapore | Philippines _ Indonesia |
| | Indonesia _ Singapore |
| | Indonesia _ Malaysia |

Note: All of these findings are with 2 lags. Source: Hashmi and Liu (2001)
Source: Authors

**Table 14**
**Variance Decompositions (in percent)**

| Country | Pre Crisis | | Post Crisis | |
|---|---|---|---|---|
| | Domestic | Singapore | Domestic | Singapore |
| Malaysia | 56 | 39 | 84 | 9 |
| Thailand | 83 | 12 | 71 | 20 |
| Indonesia | 74 | 14 | 75 | 15 |
| Philippines | 82 | 10 | 67 | 16 |

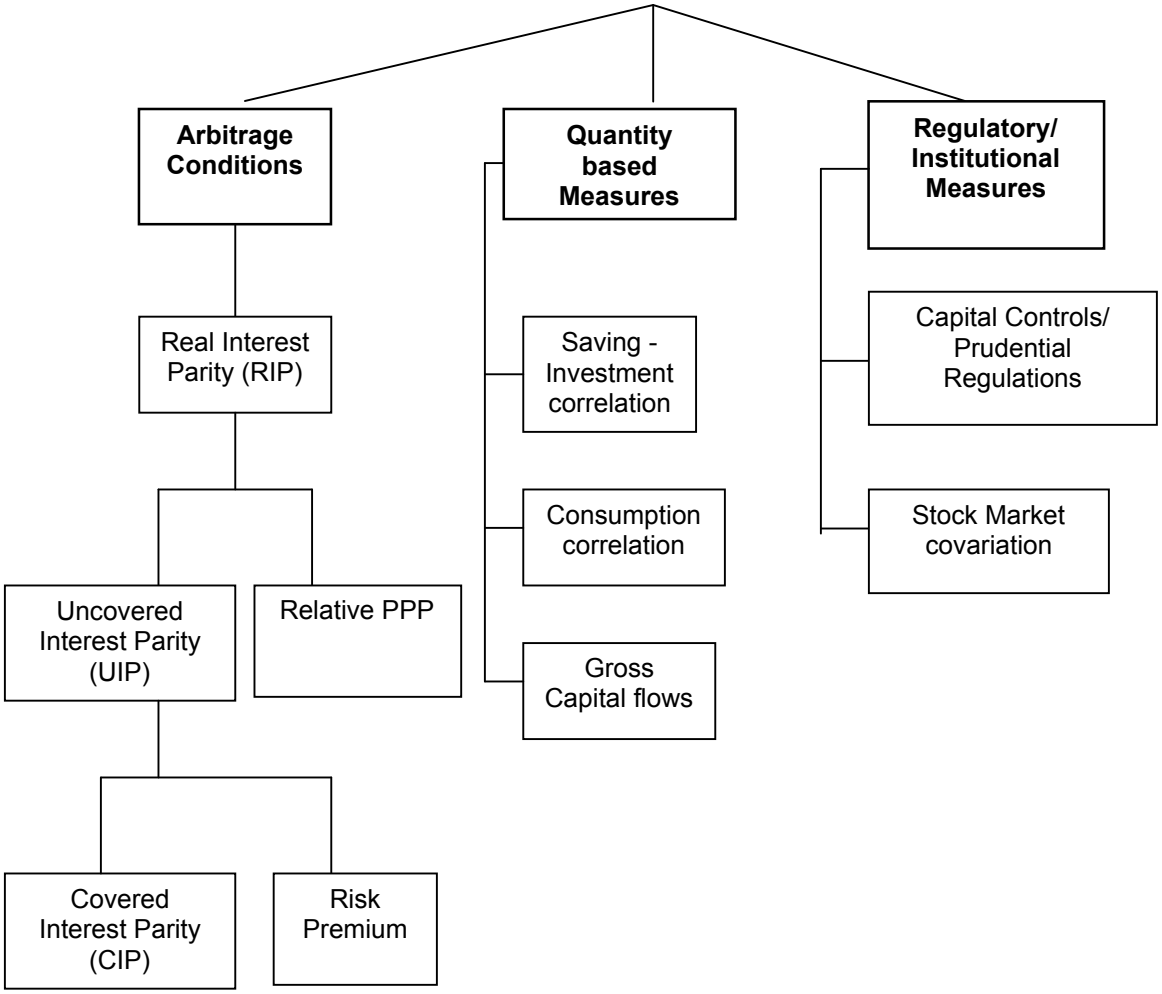
Source: Hashmi and Liu (2001)

**Table 15**
**Variance Decomposition (in percent)**

| Country | Pre crisis | Crisis | Post crisis |
|---|---|---|---|
| Japan | 5.64 | 3.62 | 18.75 |
| Korea | 0.07 | 0.37 | 14.61 |
| Taiwan | 0.50 | 3.83 | 6.07 |
| Malaysia | 4.32 | 0.25 | 14.82 |
| Singapore | 2.91 | 3.69 | 23.07 |
| Philippines | 2.95 | 3.83 | 14.46 |
| Hong Kong | 3.97 | 5.14 | 14.65 |
| Indonesia | 2.44 | 2.56 | 3.40 |
| Thailand | 1.69 | 1.83 | 13.58 |

Source: Moon (2001)

**Figure 1**
**Categorizing Measures of Financial Integration: A Simple Framework**




Source: Authors