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IS NORTH AND SOUTH EAST ASIA BECOMING A YEN BLOCK?

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IS NORTH AND SOUTH EAST ASIA BECOMING A YEN BLOCK?

Abstract

We examine the evidence of an emerging yen block in North and Southeast Asia using up to 27 years of weekly data on 9 bilateral yen exchange rates. The exchange rate returns are modelled in response to variations in their US dollar, German mark, and UK pound effective counterparts using a general-to-specific dynamic estimation strategy. We also investigate the pattern of regional trade integration over time. The results suggest increasing intra-regional trade integration, particularly regarding Japanese trade integration with the region. They also indicate the decreasing influence of the US dollar in terms of magnitude, the German mark in terms of scope and the UK pound in terms of both magnitude and scope with respect to exchange rate determination in the region. These findings are consistent with an emerging yen influence although not a *defacto* yen block.

Key Words

Exchange rates, yen block, Asian currency crisis, exchange rate systems

JEL Classification Codes

110203, 110211

1. Introduction

In the wake of the Asian financial crisis, and spurred on by the success of the European Monetary System (EMS) prior to the introduction of the Euro in January 1999, a number of analysts, policymakers and researchers have questioned whether Europe's EMS might have implications for the desirability and design of some kind of Asian exchange rate system for the future. In this vein, Bayoumi and Eichengreen (1999, 2000) show that although the economic conditions for an optimum currency area are not very different in North and Southeast Asia to those that existed in Europe prior to the establishment of the EMS, the political conditions in the region do not favour integration. As against this, however, the previously loose links that have traditionally existed between the central banks in the region are becoming stronger. Although there is limited current support for close exchange rate arrangements in the region, it has been suggested that the EMEAP (the Executive Meeting of East Asia and Pacific Central Banks from Australia, China, Hong Kong SAR, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand) should consider the establishment of an Asian institution for central banks similar to Europe's Bank for International Settlements (BIS) in Basle. This is seen as a possible move towards a more integrative monetary system for the region.

In examining the extent to which the success of the European model of exchange rate management might have implications for the design of an improved system for Asia, an interesting question arises concerning whether the Japanese yen could perform a central role like that played by the German mark in the EMS. Although many governments in Asia have traditionally managed their exchange rates in some relation to the US dollar (which continues to be the most important international invoicing currency), the developing regional economic and financial integration suggests that it is appropriate to examine whether the Japanese yen could be given more weight in the region's exchange rate management policies. If this is so, the European model might well have implications

for the design of an eventual Asian exchange rate system. If not, the conclusion follows that any future Asian exchange rate system is likely to be quite different from the model that achieved success in Europe.

The purpose of this paper is to address this question by examining whether there is evidence of an emerging *de facto* yen block in North and Southeast Asia. In examining this question, we employ an extensive dataset of regional currencies, with almost 27 years of weekly data (from November 1976 to December 2003) on 9 currencies including the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgit, the Philippine peso, the Singapore dollar, the Taiwan dollar and the Thai baht. Our analysis contains some novel contributions to the existing literature on exchange rate determination in this part of the world. *First*, evidence of increasing regional trade integration is used to motivate our econometric investigation. *Second*, the regional exchange rates are expressed as bilateral yen rates, and they are modelled in a dynamic fashion in relation to variations in the German mark, the UK pound sterling and the US dollar effective exchange rates in order to determine whether they follow the yen in response to external shocks, as would be the case in a yen block. The approach borrows from the techniques made popular in modelling the EMS as a mark-dominated system prior to the introduction of the Euro (see, *inter alia*, Artis (1986), Giavazzi and Giovannini (1986) and Bewley and Kearney (1989)). It overcomes the difficulty in selecting an individual numeraire in exchange rate modelling. *Third*, in addition to specifying the dynamic models for each yen bilateral exchange rate over the full period and deriving their short run and long run parameters, we also divide the sample in half in order to examine the extent to which the influence of the yen in the region is growing over time. In doing this, our use of weekly data raises the likelihood that the estimated models will have non-spherical error structures. Our empirical estimates are tested for this, and appropriate significance tests are applied to our coefficient estimates in order to ensure valid statistical inference. *Fourth*, the hypotheses tests consider the estimated long run parameters rather than their short run counterparts. This reflects the fact that the vast majority of central bank monetary policies tend to target other than the daily horizon. The literature neglects the importance of lagged effects. *Finally*, our findings suggest a

secondary but significant emerging yen influence in the region particularly in respect to the Korean won and the Taiwan dollar rates. This corroborates the conclusions of Tse and Ng (1997) that there exists a cointegrating relationship between the currencies in the region that hinges specifically upon the presence of these rates. Zhou (1998) finds that these rates are especially receptive to a yen influence. Our findings are also consistent with those of Kwan (1996), Aggarwal et al. (2000) and Bowman (2004) who document an emerging yen influence more generally in the region during the 1990s. We also find an increasing yen influence on the Singapore dollar and the Thai baht. In contrast to Bowman (2004) we also identify a significant German mark influence (a euro influence since 1 January 1999) on the Singapore dollar and the Thai baht rates. In addition, we provide an unprecedented, robust and comprehensive account of the declining importance of the UK pound sterling to exchange rate determination in the region.

The paper is organised as follows. Section 2 inquires after the extent and nature of trade integration in the region. It also reviews previous related research on exchange rate determination in North and Southeast Asia. Section 3 describes the dataset used in this study, sets up the empirical model and presents the formal hypotheses, which are tested. Section 4 presents the results. The final Section brings together the main findings of the paper and concludes that, on the basis of modelling yen bilateral exchange rates in respect to movements in effective exchange rate indices, there is substantial evidence of a yen influence emerging in a subset of North and Southeast Asian exchange rates, but not of an emerging *de facto* yen block.

2. Previous Related Research & Trade Integration

The degree of regional trade integration amongst the countries included in this study over the past two decades is presented in Table 1, which is drawn from the IMF's *Direction of Trade Statistics*. The Table shows each country's trade (measured as the sum of its exports to, and its imports from the other country as a percentage of its total exports and imports) with each other country in the region. The 'country' denoted 'NSA' stands for

‘North and Southeast Asia minus Japan’, ie, it includes China, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. Taiwan trade data is not available from the IMF. This shows how much trade is done between the countries in the region excluding Japan which obviously dominates the region’s trade. The column figures for ‘NSA’ are totals, and the row figures for ‘NSA’ are averages. The Table also shows the proportions of trade that the region and its countries conduct with Germany, the UK and the US. This comparison is useful insofar as it casts light on the trade linkages between the region and the world’s other major currencies in addition to the yen which are the focus of the econometric analysis presented in the next section. Panel A of the Table shows the trading patterns in 1981, and Panel B shows the same data in 2000. Inspection of the Table reveals a number of salient features of the region’s trading patterns.

[Insert Table 1 here]

First, looking down the column labelled ‘NSA’ in Panel B of the Table, we can see that the regional countries are highly integrated with respect to trade: Hong Kong shows the highest degree of trade integration at 50.4% while Korea is the least integrated at 23.6%. *Second*, when trade with Japan is included in our measure of regional trade integration (which can be seen by adding the ‘Ja’ column and the ‘NSA’ column in Panel B of the Table), the degree of trade integration is almost 40 percent or higher in all of the region’s countries (excluding Japan). The average figure for the 8 countries is 49.04 percent. *Third*, looking at how the degree of trade integration has changed over the 20 years from 1981 to 2000 by comparing the figures from Panel B with those from Panel A of the Table, reveals that the degree of regional trade integration has risen over time. When trade with Japan is included, the same 8 countries mentioned in the previous point which together averaged 49.04 percent of their trade within the region in 2000, averaged 42.18 percent in 1981. It follows that trade integration amongst these countries within the region has risen by 16 percent over the last two decades of the 1990s. *Fourth*, looking at Japan’s trade within the region (by reading across the row for Japan in panels A and B of the Table) reveals that it has risen from a fifth (20.8 percent) to over a third (33.4 percent) during the period. In contrast the region’s trade integration with Japan has declined by

28% from 22.1% in 1981 to 15.9% in 2000. Although the importance of Japanese trade to the other countries in the region has declined, it remains a very important trading partner nonetheless. *Fifth*, trade between the region (excluding Japan) and Germany, the UK and the US has remained broadly stable over time, from 3.7 percent, 2.8 percent and 17.6 percent respectively in 1981 to 3.0 percent, 2.4 percent and 17.2 percent in 2000. The dominant position of the United States economy in the region in addition to that of Japan is beyond question, with the relative importance of both Germany and the United Kingdom being minor in comparison to these.

Overall, therefore, the direction of trade statistics reveal that the region's trade is heavily dependent on Japan. The trade data also reveals that the United States economy is important to the region, and that Germany and the United Kingdom are of lesser importance to international trade in North and Southeast Asia. These findings motivate an investigation of the possibility of an emerging yen block in the region.

Previous research on Asian exchange rates includes the work of, *inter alia*, Frankel (1991), Frankel and Wei (1994), Aggarwal and Mougoue (1996), Kwan (1996), Tse and Ng (1997), Zhou (1998), Aggarwal et al. (2000), Gan (2000), McKinnon (2000), Hernandez (2002) and Bowman (2004). Frankel (1991) examines the influence of the yen in Asia-Pacific foreign exchange markets. He estimates the weights given to the British pound, the French franc, the mark, the yen and the US dollar by Asia-Pacific monetary authorities in their exchange rate management policies. Using monthly data from 1974 to 1990, he breaks the dataset into 7 sub-periods of 36 months each and reports *inter alia* the following findings. For the Hong Kong dollar, the US dollar weight is highly significant and close to unity, with a significant weight on the yen during 1979-81. For Malaysia, the US dollar weight is also significant, but not the yen. For Singapore, the dollar weight diminishes and the yen weight increases until 1985, with only the dollar being significant from 1986-1990. For Thailand, the dollar weight is the highest, but diminishes slowly, with the yen and British pound showing significant weights from 1986. The Korean won is dollar-dominated from 1980-1988, and yen-dominated after this time.

Frankel and Wei (1994) also examine the influence of the US dollar, the yen and the mark on the exchange rates of smaller economies. Using monthly data from 1979 to 1990 broken into three sub-samples, they report that the Asian countries in their sample (China, Singapore, South Korea and Thailand) place no special weight on the yen, which was statistically significant only in Singapore and occasionally in the other countries. The US dollar, on the other hand, was highly significant for all countries in all sub-periods. Weak links between the yen and the Malaysian, Singapore and Thai currencies are found in the final 2 years of the study. In contrast to previous research, this paper reported heteroscedastic-consistent standard errors. Kwan (1996) examines the same issue using data from the 1995 period. The results suggest considerable increases in the weightings of the yen across the East Asian currencies during this period. Another approach to the possibility of a yen block is to examine whether a long run relationship exists between currencies. Using daily data from 1988 to 1992, Aggarwal and Mougoue (1996) found that both the yen and the ASEANs (Malaysian, Philippine, Thai and Singapore currencies) and the yen and the 'Tigers' (Hong Kong dollar, South Korea, Singapore and Taiwan) are co-integrated, implying the existence of a long-run relationship between the currencies that prevents any one from getting too far out of line for an extended period of time. Tse and Ng (1997) find a co-integrating relationship between the Japanese, Philippine, Malaysian, Singapore, Thailand, Korean and Taiwan currencies that is contingent on the inclusion of the Korean and Taiwan currencies. Although co-integration analysis does not imply the existence of a regional yen block, it constitutes evidence consistent with it. Zhou (1998) concludes that there is a 'notable influence of the Japanese yen in the region' particularly on the Korean won and the Singapore and the Taiwan dollar currencies. Finally, Aggarwal et al. (2000) undertake a purchasing power parity analysis of Asian currencies and find significant relationships with the yen and the German mark but not with the US dollar.

Regarding the post-crisis exchange rate patterns Gan (2000) finds evidence of substantial re-weighting in the East Asian currencies' currency baskets. Particularly, the study suggests an increased weighting upon the Japanese yen in the East Asian region

excluding Malaysia. In contrast, McKinnon (2000) finds that both the crisis and non crisis East Asian countries have returned to a *de facto* policy of dollar pegging that is indistinguishable to what they were doing before the crisis. Hernandez (2002) corroborates the Gan (2000) findings by suggesting that the crisis countries (Indonesia, Korea, Malaysia, the Philippines and Thailand) are floating more than they did prior to the crisis, except for Malaysia, which imposed capital controls and adopted a hard peg. Finally, Bowman (2004) notes the emerging importance of the Japanese yen to the region and investigates whether the Australian dollar might also be emerging alongside the Japanese yen. She carefully uses a variety of the methodologies found in the literature and finds that the US dollar is declining in importance in the post-crisis period and that the Australian dollar and the Japanese yen are emerging as important currencies in the region.

In summary, therefore, although previous related research provides good insight into the regional influences of the world's major currencies it neglects to consider the equilibrium responses (lagged effects) of the Asian rate returns to innovations in the important world currencies. The model specification procedures used in the received literature are *ad hoc*, concentrating exclusively on contemporaneous interactions. Our paper seeks to fill this gap. Also the variety of numeraires used in the literature can obscure the results. We use important world currencies expressed as effective exchange rate indices, this circumvents the difficulty of selecting an individual numeraire currency. Overall the literature suggests significant and strengthening trade, investment and financial linkages throughout North and Southeast Asia and while the yen is not as strong as the US dollar in terms of its dominance in regional financial markets, it may be gaining influence over time.

3. Model Specification, Hypothesis Tests and Data

The model which forms the basis of our empirical tests is described in equation (1).

$$\begin{aligned}
 S^i_t = & \alpha_0 + \sum_{j=1}^N \alpha_j S^i_{t-j} + \sum_{j=0}^N \beta_j S^{US}_{t-j} + \sum_{j=0}^N \delta_j S^{DM}_{t-j} + \sum_{j=0}^N \gamma_j S^{ST}_{t-j} \\
 & + D^{Plaza}_t + D^{Louvre}_t + D^i_{j,t} + \varepsilon^i_t
 \end{aligned} \tag{1}$$

Here, S^i denotes the log change in the bilateral yen exchange rates of the 9 currencies included in the sample, S^{US} denotes the log change in the US effective exchange rate index, S^{DM} denotes the log change in the German mark effective exchange rate, S^{ST} denotes the log change in the pound sterling effective exchange rate, D^{Plaza} denotes a dummy variable for the sharp fall in the US dollar which occurred during October 1985 as a result of the intervention by the G5 central banks, D^{Louvre} denotes the louvre Accord of March 1987 which aimed at stabilising the US dollar's value in terms of other important world currencies, $D^i_{j,t}$ denotes currency-specific dummy variables for each country. The $D^i_{j,t}$ variables reflect the fact that a number of the currencies in our sample have been subjected to periodic interventions by the relevant monetary authorities which may have caused influential outliers or possibly structural breaks in the series. In short, dummies are provided for all extreme price changes during the initial estimation procedure. The details of the individual country dummy variables included in the parsimoniously derived models are provided in Table 2.

[Insert Table 2 here]

Table 3 provides a detailed description of all variables used in the econometric modelling. The bilateral yen exchange rates for the Hong Kong dollar, Chinese yuan, the Indonesian rupiah, the Malaysian ringgit, the Philippine peso, the Singapore dollar, the

Taiwan dollar and the Thai baht were extracted from the *Datastream International Ltd.* and checked for consistency. The effective exchange rates for the US dollar (*US*), the deutschemark (*DM*) and the UK pound sterling (*ST*) were also obtained from the same source. These are Bank of England trade-weighted indices, and their use in the study overcomes the need to define a numeraire currency for the US dollar, the deutschemark and the pound sterling rates. The weights used are constant over time. The overall data period is from 19 November 1976 to 26 December 2003 inclusive, although the starting periods vary somewhat depending upon data availability. Figure 1 plots the 9 bilateral yen exchange rates. It clearly shows the devastating effects of the Asian financial crisis on the Indonesian rupiah. Figure 2 plots the effective exchange rate indices, and shows that while the German mark tended to depreciate from the mid-1970s until the mid-1990s, the pound sterling and the US dollar tend to follow a similar path, particularly during and since the mid-1980s.

[Insert Table 3 and Figures 1 and 2 here]

The models are couched in logarithmic difference form which is suitable for exchange rates (see Enders (1995)), and because this induces stationarity. The legitimacy of doing this was tested using the augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests. Table 4 presents the results, which confirm that the log changes are all without trend. Covariance stationary series have finite, time-invariant variances, diminishing theoretical correlograms, and a tendency towards mean reversion. The models have consequently been estimated in logarithmic first difference form using the general-to-specific dynamic estimation strategy (see Hendry (2001)). The latter is implemented by including up to 4 lags of each variable in the models, and sequentially testing down using Newey-West derived t-statistics until parsimonious specifications are obtained. This procedure is repeated for each bilateral yen exchange rate, for the full period and for each of the sub-periods.

[Insert Table 4 here]

The resulting dynamic models are solved to obtain both the short- and the long-run multipliers for the effects of variations in the German mark, the UK pound sterling and the US dollar effective exchange rates on the yen bilateral rates. The short run multipliers (*SRMs*) are obtainable directly from the lagged dependent coefficients in each model, and the long run multipliers (*LRMs*) are obtained from the estimated versions of equation (1) as follows.

$$LRM_{DME}^{S^i} = \frac{\sum_{j=0}^N \delta_j}{(1 - \sum_{j=1}^N \alpha_j)} \quad LRM_{STE}^{S^i} = \frac{\sum_{j=0}^N \gamma_j}{(1 - \sum_{j=1}^N \alpha_j)} \quad LRM_{USE}^{S^i} = \frac{\sum_{j=0}^N \beta_j}{(1 - \sum_{j=1}^N \alpha_j)} \quad (2)$$

The *LRMs* provide useful insights into the behaviour of the models. Specifically, they tell us the equilibrium response of each of the yen bilateral rates to variations in the German mark, the UK pound sterling and the US dollar effective exchange rates.

We test six hypotheses about the *LRMs* for each regional exchange rate. These hypotheses are sequenced logically in order to examine the extent to which there exists evidence of an emerging yen block in North and Southeast Asia. The first three tests investigate the absolute importance of the German mark, the UK pound sterling and the US dollar effective exchange rates to exchange rate determination in the region while the latter three tests investigate the change in the importance of these effective exchange rates over time. If H_0^1 is upheld, it implies that variations in the German mark do not impact upon the regional bilateral yen exchange rates. This constitutes evidence in favour of a yen block, because it implies that the regional currencies tend to follow the yen rather than the mark. The same applies to H_0^2 and H_0^3 which concerns the response of the yen bilateral rates to variations in the UK pound sterling and the US dollar respectively. The nulls of the second three hypotheses, H_0^4 , H_0^5 and H_0^6 , repeat the first three hypotheses on the sub-samples, and are designed to cast light on whether there is evidence of an emerging yen block over time. Specifically, the nulls of these latter hypotheses indicate a decline in the importance of the pertinent effective exchange rate

while the alternates suggest no change or an increase in its importance. The long run multiplier estimates must be significantly distinguishable from zero in at least 1 of the sub-periods for the corresponding hypothesis to contribute to the analysis. If the nulls of the second three hypotheses are upheld, we conclude that there does exist evidence of an emerging yen block in the region. If they are not upheld, we conclude that there is no evidence of the emergence of such a currency block.

4. Econometric Modelling Results

In addition to specifying a series of dynamic models for each exchange rate over the full sample period, we also solve for contiguous half period long run multipliers. The full sample runs from November 1976 to December 2003. Data availability, however, has constrained the start date for 2 exchange rates: the Taiwan dollar starts on 4 January 1985, and the Chinese yuan starts on 11 January 1985. Sub-period 1 runs from 19 November 1976 to 25 May 1990 (with the later starts just mentioned), and sub-period 2 runs from 1 June 1990 to 26 December 2003. We derive parsimonious models for each sub-period as described in the previous section. Table 5 presents the results for the full sample period, and Tables 6 and 7 do likewise for the earlier and later sub-periods respectively. The top part of the Tables present the short- and long run- coefficient estimates (with their heteroscedastic-and autocorrelation consistent t-statistics in brackets), and the bottom part of the Tables present the equation diagnostics. The coefficient estimates are presented only if they are statistically significant at the 5% level. The diagnostics include the R^2 statistic, the standard error of the estimate statistic (*SEE*), the Chow test for structural stability, the Durbin Watson (*DW*) statistic which tests for first order autocorrelation, the Kolmogorov statistic (*KS*) which is a general test for whether an empirical distribution comes from an hypothesized distribution – in this case the normal distribution, the *LM* statistic tests for higher order autocorrelation, and the *ARCH* test for heteroscedasticity.

Looking firstly at the results for the full sample period in Table 5, the explanatory power of the models is quite good, given that we are modelling the log differences of exchange rates. The R^2 statistics indicate that the models explain at least half the variation in the bilateral yen exchange rates in 7 of the 9 countries (except in the instances of the Indonesian rupiah and the Malaysian ringgit), and they average over .64. The standard errors of the estimates (*SEE*) are correspondingly respectable. The *DW* statistics, the *KS* statistics and the *LM* statistics indicate that although first order autocorrelation seems not to be evident, there is some evidence of higher order autocorrelation. The *ARCH* tests indicate the existence of heteroscedastic error structures. These latter properties are anticipated in our use of autocorrelation and heteroscedastic consistent standard errors. The Chow statistics indicate the presence of structural breaks in 7 of the 9 models (all but the Malaysian ringgit and the Singapore dollar), which contributes to our motivation to re-estimate the models in the two sub-periods.

Looking next at the individual coefficient estimates, notwithstanding the Hong Kong and Philippine models, the constant term in each model is indistinguishable from zero. Interestingly, the Plaza and Louvre Accord dummies generally indicate that the Asian rates tended to appreciate relative to the yen on these occasions. Only in the instance of the Malaysian ringgit is neither the Plaza nor the Louvre dummy indistinguishable from zero. The lagged dependant coefficients in each model are all negatively signed which contributes stability and the presence of at least two lags in some countries indicates more complex adjustment dynamics in response to variations in the German mark, the UK pound sterling and the US dollar.

Turning now to the effect of changes in the US dollar effective exchange rate on the yen bilateral rates, the short run coefficients are all positively signed. The mean of the short run coefficients is 0.56, and they vary from a low of 0.34 for the Chinese yuan to a high of 0.90 for the Hong Kong dollar. The long run multipliers are shown adjacent to the short-run multipliers. The mean of the long run multipliers is 0.82, and they vary from a low of 0.66 for the Singapore dollar to a high of 0.99 for the Chinese yuan. This indicates that for each 1 percent appreciation in the US dollar, the mean equilibrium

response of the regional bilateral yen exchange rates is an appreciation *vis-à-vis* the yen of 0.82 percent. These findings imply rejection of H_0^3 and acceptance of H_1^3 , and are consistent with a regional US dollar block rather than a yen block, because it shows that the regional currencies are tending to follow the US dollar rather than the yen. This is not surprising in light of the exchange rate policy arrangements suggested by the literature in this area. Interestingly, however, the range of responses is quite large, with the appreciation of the Chinese yuan *vis-à-vis* the yen being almost 1.5 times that of the Singapore dollar. This, of course, implies that variations in the US dollar have significant effects on the cross-bilateral yen exchange rates in the region. The results also underline the importance of inspecting the short-run and the long-run multipliers, particularly in the instance of the Chinese yuan.

Looking next at the response of the regional bilateral yen rates to variations in the German mark effective exchange rate, Table 5 shows that only 2 of the short run coefficients are distinguishable from zero, that is the Hong Kong dollar and the Singapore dollar with coefficients of 0.08 and 0.13 respectively. The long run multipliers are also only printed for these rates. This indicates that for each 1 percent appreciation in the German mark, the mean equilibrium response of these regional bilateral yen exchange rates is an appreciation *vis-à-vis* the yen of approximately 0.1 percent. This finding implies a failure to reject H_0^1 for 7 of the 9 Asian yen rates.

The response of the regional bilateral yen rates to variations in the UK pound sterling are somewhat more ambivalent than the responses to variations in the US dollar and the deutschemark. All Asian rates present short-run multipliers except the Hong Kong dollar but only the Indonesian rupiah, the Malaysian ringgit, the Singapore dollar and the Thai baht present long-run multipliers. The mean of the short run coefficients is 0.36, however the 4 printed long-run multipliers have a mean value of only 0.08. The results indicate that although H_0^2 is rejected and H_1^2 is accepted for 4 of the 9 rates, the influence of the pound sterling in the region is significantly less than that of the US dollar.

[Insert Table 5 here]

Although the full sample period results reject the existence of a regional yen block, particularly in reference to the importance of the US dollar to the region, it is nevertheless interesting to examine the results for the sub-periods, which are presented in Tables 6 and 7 in order to see whether there is evidence of change over time. The first point to note from these Tables is that a number of features distinguish the overall behaviour of the models in the 1st and the 2nd sub-periods as measured by their diagnostic statistics. Specifically the explanatory power of the models declines except in the instances of the Hong Kong and the Taiwan dollars, structural breaks are markedly less prevalent in the 2nd sub-period and the nulls of homoscedasticity and zero autocorrelation are more frequently rejected in the 2nd sub-period. These findings are tentatively consistent with an emerging yen influence, the declining importance of the German mark, the UK pound and the US dollar to exchange rate determination in the region and also to increasingly sophisticated exchange rate management policies. Looking first at the effect of changes in the US dollar effective exchange rate on the yen bilateral rates during the first and second sub-periods, the short run coefficients remain positively signed. The mean of the short run coefficients is 0.47 during the first sub-period, varying from a low of 0.18 (for the Indonesian rupiah) to a high of 0.88 (for the Hong Kong dollar). This rises to a mean of 0.77 during the later sub-period, varying from a low of 0.56 (for the Chinese yuan) to a high of 0.96 (for the Hong Kong dollar). It is noticeable that while the average of the estimated short run coefficients of the impact of the US dollar on the regional yen bilateral rates rises by 63 percent between the sub-periods, the short run coefficients also rise for each individual exchange rate, except in the case of the Singapore dollar where no short-run multiplier is recorded in the 2nd sub-period. The mean of the long run multipliers for variations in the US dollar is 0.84 in the first period and 0.77 in the second period. All rates present long run multiplier estimates. This implies a mean fall in the US long run multiplier of 8%. Using a paired two sample for means t-test and assuming unequal variances we reject H_0^6 and accept H_1^6 in respect to the Chinese yuan, the Hong Kong dollar and the Indonesian rupiah, the Malaysian ringgit and the Philippine peso.

However, it is interesting to note in respect to these 5 rejections of the null hypothesis only the Hong Kong dollar exhibits an increased weighting of the US dollar. We fail to reject the null hypothesis in reference to the Korean won, the Taiwan dollar, the Singapore dollar and the Thai baht. Over-all this constitutes evidence consistent with the emergence of a yen block in the latter 4 rates in the North and Southeast Asian region.

Looking next at the sub-period responsiveness of the regional bilateral yen exchange rates to variations in the German mark effective exchange rate, all coefficients are again positively signed except for those of the Chinese yuan and the Taiwan dollar in the 1st sub-period. The mean of the short run coefficients in the first sub-period is 0.02, and this rises to a mean of 0.09 during the second sub-period. The mean of the long run multipliers is 0.08 in the first sub-period and 0.09 in the second sub-period. Specifically, in respect to hypotheses testing, and using the aforementioned t-tests, we fail to reject H_0^4 in the instances of the Chinese yuan, the Hong Kong dollar, the Malaysian ringgit and the Taiwan dollar. The null hypothesis is rejected in respect to the Thai baht and the Singapore dollar. In the instance of the Singapore dollar the importance of the German mark has remained approximately stable. Excluding the instances of the Singapore and Taiwan dollars and the Thai baht the importance of the German mark in the region in the second sub-period is virtually negligible.

In respect to the sub-period responsiveness of the regional bilateral yen exchange rates to variations in the UK pound effective exchange rate, all coefficients are again positively signed. The mean of the short run coefficients (all but the Hong Kong dollar) in the first sub-period is 0.59, and this falls to a mean of 0.18 during the second sub-period (China, Hong Kong, Korea and Malaysia). The mean of the long run multipliers is 0.12 in the first sub-period (China, Indonesia, Korea, Malaysia, Singapore and Thailand) and 0.14 in the second sub-period (Malaysia only). Using the usual t-statistic the results imply the rejection of H_0^6 and acceptance of H_1^6 in the case of the Malaysian ringgit only and in this instance the importance of the UK pound has remained approximately stable. In the other instances we fail to reject the null hypotheses.

Taken together, with the results concerning the US dollar and the German mark, it appears that there is considerable evidence consistent with the notion of an emerging yen influence on the Korean won and the Taiwan dollar. The Korean won exhibits a declining UK pound sterling and US dollar influence. It exhibits no German mark influence in either sub-period. The Taiwan dollar demonstrates both a declining US dollar and a declining German mark influence. The UK pound appears to show no influence on the Taiwan dollar in either sub-period. With respect to the other regional exchange rates the evidence gathered is less clear cut. The Thai baht exhibits an emerging German mark influence while it shows a simultaneous declining US dollar influence. It shows no UK pound influence throughout. This is consistent with the emerging importance of both the German mark and the Japanese yen to the Thai baht. The Singapore dollar demonstrates a declining US dollar and UK pound sterling influence while the influence of the German mark appears to be approximately stable over the sub-periods. This is consistent with an emerging Japanese yen influence on the Singapore dollar alongside a stable German mark effect. The remaining rates, namely the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Malaysian ringgit and the Philippine peso, demonstrate a strengthening US dollar influence (and UK pound influence in the instance of the Malaysian ringgit) which virtually precludes the likelihood of an emerging yen influence on these rates.

[Insert Tables 6 and 7 here]

5. Summary and Conclusions

We examine the determination of 9 North and Southeast Asian Japanese yen exchange rates with respect to innovations in the German mark, the UK pound and the US dollar trade weighted exchange rate indices during the period 1976 to 2003. Our examination of exchange rate determinants in the region accounts for central bankers' preferences to

gradually change their exchange rates to preferred levels. It accounts for lagged effects in exchange rate determination. As anticipated by the literature in this area we find a predominant US dollar influence however this is found to vary across currencies and over time. It is this variation that motivates our investigation of the influence of the Japanese yen in the region. Our results do not point to an emerging *defacto* yen block but rather they suggest an emerging yen influence particularly with respect to the Korean won and the Taiwan dollar rates. The Singapore dollar and the Thai baht also demonstrate an emerging yen importance although this latter effect is combined with a significant and stable German mark weighting in the case of the Singapore dollar and an emerging German mark impact in the case of the Thai baht. The remaining rates considered provide virtually no evidence of an emerging yen influence. The importance of capturing lagged effects is evident specifically with respect to the role played by the UK pound sterling in the region where its short run multipliers are heavily eroded by lagged effects in both sub-periods. In contrast, lagged effects tend to augment the estimated US dollar influence captured by the short run multipliers alone, particularly in the first sub- and whole- period. The German mark short- and long- run multipliers do not systematically differ. Overall there is ample evidence in support of our use of long-run multipliers and these equilibrium responses suggest a significant but secondary emerging yen influence in the region.

The yen is, by most measures, the third most important currency in the world, and it has the potential to play a more significant international role, particularly in North and Southeast Asia. The evidence presented here indicates that this is happening only to a marginal extent. In order to make it happen, it seems that a more active approach is required on the part of the Japanese government. Amongst the measures, which would contribute positively, would be the establishment of more active primary and secondary financial markets in which a wide array of yen-denominated instruments can be traded at low transaction costs and without excessive regulation.

References

- Aggarwal, R. and M. Mougoue. 1996. Cointegration among Asian currencies: evidence of the increasing influence of the Japanese yen. *Japan and the World Economy*, 8: 291-308.
- Aggarwal, R., Montanes, A., Ponz, M., 2000. Evidence of long-run purchasing power parity: analysis of real Asian exchange rates in terms of the Japanese yen. *Japan and the World Economy* 8, 291-308.
- Artis, MJ. 1986. International Monetary and Financial Integration - The European Dimension: External Aspects of the EMS. *Society Universitaire Europeenne de Recherches Financieres*, October 1986.
- Bayoumi, T. and B. Eichengreen. 1999. Is Asia an Optimum Currency Area? Can it become one? Regional, Global and Historical Perspectives on Asian Monetary Relations. S.Collignon et al (eds), *Exchange Rate Policies in Emerging Asian Countries*, Routledge, London, 347-367.
- Bayoumi, T., B. Eichengreen and P. Mauro. 2000. On regional Monetary Arrangements for ASEAN. *Journal of the Japanese and International Economies*, 14: 121-148.
- Bewley, R. and C. Kearney. 1989. A Systems Approach to Modelling the EMS ERM. *The Economic and Social Review*. 20, 2, 111-120.
- Bowman, C. 2004. Yen block or Koala block? Currency relationships after the East Asian crisis. *Japan and the World Economy*, forthcoming.
- Enders W. 1995. *Applied Econometric Time-Series* John Wiley & Sons.
- Frankel, J.A. 1991. Is a Yen Block Forming in Pacific Asia? in AMEX Bank Review, *Finance and the International Economy 5 : the AMEX Bank Review Prize, Essays in Memory of Robert Marjolin*, Oxford University Press.
- Frankel, J. and S. Wei. 1993. *Trade Blocks and Currency Blocks*, NBER Working Paper No.4335.
- Frankel, J. and S. Wei. 1994. Yen block or dollar block? Exchange rate policies of the East Asian economies in T. Ito and A.O. Krueger, eds, *Macroeconomic linkages: savings, exchange rates and capital flows*, University of Chicago Press, Chicago 295 – 329.
- Gan, W.B. 2000. Exchange-rate policy in East Asia after the fall: how much have things changed? *Journal of Asian Economics*, 11 (4), 403 – 430.
- Giavazzi, F. and A. Giovannini. 1986. The EMS and the Dollar. *Economic Policy*, 2, 456-485.
- Hendry, D. and H. Krolzig. 2001. Computer automation of general-to-specific model selection procedures. *Journal of Economic Dynamics and Control*, 25 831 – 866.
- Huang, D. and J. Tu. 1994. On the Feasibility of Economic Cooperation in East-Asia: Perspectives from Trade Creation and Trade Diversion. *Journal of Economic Integration* 9, 291-311.
- Hernandez, L., and P. Montiel. 2002. Post-crisis exchange rate policy in five Asian countries: filling in the ‘hollow middle’? *IMF Working Paper*, code: WP/01/170.
- International Monetary Fund. 1998. *World Economic Outlook*, Washington, various issues.

Johnson, C. 1998. Economic Crisis in East Asia: The Clash of Capitalisms. *Cambridge Journal of Economics*, 22, 653-661.

Kwan, C. H. 1996. A yen block in Asia: an integrative approach, *Journal of the Asia Pacific Economy*, 1, 1-21.

McKinnon, Ronald I. 2000. The East Asian dollar standard: life after death? *Economic Notes*, 29, 1, 31 – 82.

Meltzer, A.H. 1991. *US Leadership and Post-War Progress in Policy Implications of Trade and Currency Zones*. Federal Reserve Bank: Kansas.

Newey, W.K. and K.D. West 1987.. A simple, positive semi-definite, heteroscedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3): 703-708.

Tse, Y.K. and L.K. Ng 1997. The cointegration of Asian currencies revisited. *Japan and the World Economy*, 9, 109-114.

Zhou, S. 1998. Exchange rate systems and linkages in the Pacific Basin. *Atlantic Economics Journal*, 26 (1), 66 - 84.

Figure 1
Bilateral Yen Exchange Rates of 9 Currencies
Weekly, November 1976 - December 2003

Figure 2
Effective Exchange Rates, November 1976 – December 2003.
The US Dollar, the German Deutschemark and the Pound Sterling

Table 1
Direction of Trade Statistics for North and Southeast Asia

	<u><i>Panel A: Data for 1981</i></u>					<u><i>Panel B: Data for 2000</i></u>				
	<i>NSA</i>	<i>Ge</i>	<i>Ja</i>	<i>UK</i>	<i>US</i>	<i>NSA</i>	<i>Ge</i>	<i>Ja</i>	<i>UK</i>	<i>US</i>
<i>China</i>	19.6	5.0	25.4	1.5	14.4	27.3	4.3	18.3	2.2	16.4
<i>HongKong</i>	29.5	4.2	14.6	5.7	18.6	50.4	2.9	8.9	2.9	14.9
<i>Indonesia</i>	16.3	3.3	43.4	1.9	17.3	31.0	2.8	20.7	2.2	12.4
<i>Korea</i>	8.6	3.1	15.1	2.3	24.8	23.6	2.9	15.7	2.4	20.2
<i>Malaysia</i>	28.0	3.7	22.8	3.7	13.8	35.5	2.7	16.7	2.6	18.8
<i>Philippines</i>	14.1	4.1	20.3	2.6	26.2	25.5	2.8	15.8	2.5	22.7
<i>Singapore</i>	25.4	2.7	15.1	2.7	12.9	37.8	3.1	12.3	2.3	16.2
<i>Thailand</i>	19.2	3.8	20.1	2.2	13.0	33.6	2.6	19.1	2.5	16.3
<i>NSA</i>	20.1	3.6	22.1	2.8	18.1	33.1	3.0	15.9	2.4	17.2
<i>Germany</i>	3.0	-	2.3	7.0	7.1	6.1	-	3.5	7.7	9.5
<i>Japan</i>	20.8	2.8	-	2.5	21.8	33.4	3.8	-	2.5	25.2
<i>UK</i>	3.7	11.2	2.8	-	12.1	8.0	12.3	3.5	-	14.6
<i>US</i>	9.4	4.4	12.2	5.1	-	17.2	4.4	10.5	4.2	-

Notes. The source is the IMF Direction of Trade Statistics. Reading across the rows of the Table gives the sum of each country's exports and imports with each country named at the top of the column as a percentage of its total exports and imports. NSA denotes 'North and Southeast Asia minus Japan', i.e., China, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. The column figures for NSA are totals (e.g., China's trade integration with the NSA region in 1981 is 19.6%), and the row figures for NSA are averages (e.g., the NSA region's members average trade integration with Japan in 1981 is 22.1%). Taiwan trade data is not available from the IMF.

Table 2
Dummy Variables used in the Exchange Rate Models

	<u>D1</u>	<u>D2</u>	<u>D3</u>	<u>D4</u>	<u>D5</u>	<u>D6</u>	<u>Plaza</u>	<u>Louvre</u>
PANEL A: FULL SAMPLE PERIOD								
<i>China</i>	07/18/86	12/22/89	01/07/94					03/06/87
<i>Hong Kong</i>	09/23/83	10/07/83	09/27/85				10/04/85	03/06/87
<i>Indonesia</i>	04/08/83	04/15/83	09/27/85	09/19/86	07/27/01	04/20/01	10/04/85	03/06/87
<i>Korea</i>	12/01/78	02/01/80	12/12/97	01/30/98	10/09/98			03/06/87
<i>Malaysia</i>	09/27/85	01/09/98	01/30/98	04/02/99				
<i>Philippines</i>	01/12/79	10/14/83	06/15/84	09/27/85	07/11/97		10/04/85	03/06/87
<i>Singapore</i>								03/06/87
<i>Taiwan</i>	09/27/85	10/09/98					10/04/85	
<i>Thailand</i>	11/09/84	09/27/85	01/09/98				10/04/85	03/06/87
PANEL B: SAMPLE PERIOD 1								
<i>China</i>	07/18/86	12/22/89					10/04/85	
<i>Hong Kong</i>	09/23/83	10/07/83	09/27/85				10/04/85	03/06/87
<i>Indonesia</i>	04/08/83	04/15/83	09/27/85	09/19/86			10/04/85	
<i>Korea</i>	12/01/78	02/01/80						03/06/87
<i>Malaysia</i>	09/27/85						10/04/85	
<i>Philippines</i>	01/12/79	10/14/83	06/15/84	09/27/85			10/04/85	03/06/87
<i>Singapore</i>								03/06/87
<i>Taiwan</i>	09/27/85						10/04/85	03/06/87
<i>Thailand</i>	11/09/84	09/27/85					10/04/85	03/06/87
PANEL C: SAMPLE PERIOD 2								
<i>China</i>	01/07/94							
<i>Hong Kong</i>								
<i>Indonesia</i>	07/27/01	04/20/2001						
<i>Korea</i>	12/12/97	01/30/98	10/09/98					
<i>Malaysia</i>	01/09/98	01/30/98	04/02/99					
<i>Philippines</i>	07/11/97							
<i>Singapore</i>	10/09/98							
<i>Taiwan</i>	10/09/98							
<i>Thailand</i>	01/09/98							

Notes. The Plaza dummy variable takes account of the Plaza Accord on the 4th October 1985 aimed at halting the rise of the US dollar. The Louvre dummy takes account of the Louvre Accord on 6th March 1987. This accord sought to stabilise the foreign exchange value of the participating currencies relative to the US dollar.

Table 3
Variables Used and Data Sources

S^i :	Weekly bilateral exchange rates <i>vis-a-vis</i> the yen for the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgit, the Philippine peso, the Singapore dollar, the Taiwan dollar and the Thai baht. These exchange rates are defined as the domestic currency price of 1 yen. They are sampled at the close of trading on the last trading day in the week.
	The full sample period is 19 November 1976 to 26 December 2003 for all exchange rates except the Taiwan dollar and the Chinese Yuan which begin on the 4 th and 11 th of January 1985, respectively. The first sub-period is from the above starting date until 25 th May 1990, and the second sub-period is from subsequent week to the end of the sample period.
S^{sr} :	The weekly trade-weighted index, set to 19 November 1976=100, of the British pound sterling. This is a trade-weighted index compiled by the Bank of England.
S^{sm} :	The weekly trade-weighted index, set to 19 November 1976=100, of the German mark. This is a trade-weighted index compiled by the Bank of England.
S^{us} :	The weekly trade-weighted index, set to 19 November 1976=100, of the US dollar. This is a trade-weighted index compiled by the Bank of England.
D^{PLAZA} :	Dummy variable to capture the effects of the coordinated intervention by the G5 countries on 4 October 1985 to reduce the overvalued US dollar.
D^{LOUVRE} :	Dummy variable to capture the effects of the Louvre Accord on 6 March 1987. This attempted to stabilise the foreign exchange value of the US dollar.
D^i :	Various dummy variables for each country as described in Table 2.

Notes. The source is *Datastream International Ltd.* The trade-weighted indices measure the value of a currency against a trade-weighted 'basket' of other currencies, relative to a base date. The weights used are designed to measure, for an individual country, the relative importance of each of the other countries as a competitor to its manufacturing sector. The weights used are constant over time.

Table 4
Unit Root Tests of the Yen Bilateral Exchange Rates
and the Effective Exchange Rate Indices.

<i>Level of Variable</i>	<i>ADF</i>	<i>PP</i>	<i>First Difference</i>	<i>ADF</i>	<i>PP</i>
<i>Yen bilateral rates</i>					
<i>CH</i>	-1.543	-2.721	ΔCH	-33.751	-1046.364
<i>HK</i>	-1.397	-2.398	ΔHK	-37.800	-1491.218
<i>IN</i>	-0.106	-2.557	ΔIN	-23.661	-1747.263
<i>KO</i>	-1.087	-2.005	ΔKO	-40.631	-1543.793
<i>MA</i>	-1.007	-2.258	ΔMA	-19.342	-1613.569
<i>PH</i>	1.039	1.342	ΔPH	-41.454	-1584.410
<i>SI</i>	-1.503	-4.056	ΔSI	-37.683	-1464.648
<i>TA</i>	-1.754	-5.025	ΔTA	-34.208	-1049.606
<i>TH</i>	-0.469	-0.996	ΔTH	-42.338	-1633.190
<i>Effective exchange rates</i>					
<i>GE</i>	-1.747	-3.132	ΔGE	-36.695	-1412.865
<i>UK</i>	-1.739	-6.578	ΔUK	-37.203	-1430.564
<i>US</i>	-1.296	-4.215	ΔUS	-36.246	-1426.401
ADF & Phillips Perron Critical Values					
	1%	5%	10%		
	-3.43	-2.86	-2.57		

Notes: All variables are as defined in the Table 3. The Augmented Dickey Fuller critical values are denoted ADF and the Phillips Perron critical values are denoted PP.

Table 5
Empirical Results: Full Sample Period, November 1976 – December 2003

	<i>Constant</i>	<i>Dummies</i>	<i>Dum_{PI}</i>	<i>Dum_{Lo}</i>	<i>S_i</i>	<i>S_i</i>	<i>S^{DM}_{SR}</i>	<i>S^{DM}_{LR}</i>	<i>S^{UK}_{SR}</i>	<i>S^{UK}_{LR}</i>	<i>S^{US}_{SR}</i>	<i>S^{US}_{LR}</i>
<i>China</i>		3		-0.002 (4.98)	-0.117 ₁ (1.98)	-0.042 ₄ (2.39)			0.643 (15.42)		0.338 (8.53)	0.993 (26.22)
<i>Hong Kong</i>	0.001 (2.08)	3	0.004 (11.58)	-0.001 (7.23)			0.080 (7.12)	0.080 (7.12)		-0.022 (2.03)	0.897 (71.18)	0.897 (71.18)
<i>Indonesia</i>		6	-0.016 (4.36)	-0.003 (2.39)					0.497 (6.29)		0.331 (3.46)	0.801 (5.65)
<i>Korea</i>		5		0.002 (3.12)	-0.138 ₁ (2.98)	-0.131 ₂ (3.13)			0.424 (8.88)		0.477 (10.48)	0.830 (7.43)
<i>Malaysia</i>		4							0.155 (4.92)	0.155 (4.92)	0.689 (22.85)	0.689 (22.85)
<i>Philippines</i>	0.000 (2.90)	5	-0.013 (8.41)		-0.153 ₁ (3.45)				0.395 (9.46)		0.550 (13.33)	0.911 (22.82)
<i>Singapore</i>		0		0.001 (4.69)	-0.162 ₁ (3.30)		0.130 (6.15)	0.112 (6.34)	0.062 (3.29)	0.054 (3.92)	0.648 (30.53)	0.661 (43.45)
<i>Taiwan</i>		2	-0.006 (4.00)						0.233 (5.58)		0.676 (17.29)	0.852 (35.83)
<i>Thailand</i>		3	-0.021 (16.12)	-0.009 (15.50)	-0.152 ₁ (3.27)				0.457 (10.38)	0.126 (3.59)	0.419 (9.73)	0.725 (20.45)

	<i>R²</i>	<i>SEE</i>	<i>Chow</i>	<i>DW</i>	<i>K-S</i>	<i>LM</i>	<i>ARCH</i>
<i>China</i>	0.82	0.005	17.32 (.00)	2.55	0.1944***	163.99 (.00)	3.84 (.05)
<i>Hong Kong</i>	0.88	0.002	4.62 (.00)	2.06	0.0461**	10.56 (.10)	41.31 (.00)
<i>Indonesia</i>	0.29	0.013	5.85 (.00)	2.31	0.1544***	167.68 (.00)	162.81 (.00)
<i>Korea</i>	0.61	0.006	7.55 (.00)	1.95	0.0538***	28.71 (.00)	219.74 (.00)
<i>Malaysia</i>	0.49	0.006	0.32 (.93)	2.21	0.1077***	31.14 (.00)	0.08 (.77)
<i>Philippines</i>	0.63	0.007	13.97 (.00)	2.19	0.0932***	35.91 (.00)	81.29 (.00)
<i>Singapore</i>	0.80	0.003	1.48 (.18)	2.01	0.0326	10.64 (.10)	74.13 (.00)
<i>Taiwan</i>	0.69	0.004	25.71 (.00)	2.09	0.0878***	24.05 (.00)	41.35 (.00)
<i>Thailand</i>	0.56	0.006	30.89 (.00)	2.03	0.0426**	25.29 (.00)	178.22 (.00)

Notes. Variables are as defined in Table 3. The 'i' subscript denotes the lag length and the 'SR' and 'LR' subscripts denote the relevant short- and long-run multipliers. No more than 2 lagged dependent regressors are presented. Only coefficients statistically significant at the 5% level or higher are presented. The R²s are adjusted for degrees of freedom. The figures in brackets below coefficient estimates are robust t-statistics, and those in brackets next to the equation diagnostics are P-values. The K-S *, ** and *** superscripts correspond to statistical significance at the 10%, 5% and 1% levels.

Table 6
Empirical Results: First Half of Sample Period, November 1976 – May 1990

	<i>Constant</i>	<i>Dummies</i>	<i>Dum_{PL}</i>	<i>Dum_{Lo}</i>	<i>S_i</i>	<i>S_i</i>	<i>S^{DM}_{SR}</i>	<i>S^{DM}_{LR}</i>	<i>S^{UK}_{SR}</i>	<i>S^{UK}_{LR}</i>	<i>S^{US}_{SR}</i>	<i>S^{US}_{LR}</i>
<i>China</i>		2	-0.006 (3.44)		-0.136 ₁ (2.09)		-0.139 (2.26)	-0.123 (2.62)	1.048 (20.94)	0.174 (3.12)		1.003 (22.11)
<i>Hong Kong</i>		3	0.003 (14.90)	-0.001 (6.03)			0.129 (5.62)	0.129 (5.62)			0.879 (55.05)	0.879 (55.05)
<i>Indonesia</i>		4	-0.018 (12.46)		-0.084 ₁ (2.85)				0.821 (26.09)	0.092 (2.50)	0.179 (5.86)	0.886 (25.28)
<i>Korea</i>		2		0.005 (5.02)	-0.192 ₁ (3.74)	-0.127 ₂ (3.09)			0.713 (11.67)	0.133 (2.27)	0.265 (5.62)	0.836 (19.06)
<i>Malaysia</i>		1	0.003 (4.44)		-0.157 ₁ (3.45)		0.129 (4.03)	0.158 (4.85)	0.097 (3.87)	0.084 (4.49)	0.686 (32.07)	0.671 (26.29)
<i>Philippines</i>		4	-0.016 (6.86)	0.004 (5.99)	-0.105 ₁ (2.22)				0.663 (13.22)		0.378 (7.80)	0.953 (15.20)
<i>Singapore</i>				0.001 (4.16)	-0.170 ₁ (3.72)		0.155 (6.03)	0.132 (6.68)	0.073 (3.28)	0.062 (3.81)	0.666 (33.22)	0.670 (38.35)
<i>Taiwan</i>	-0.001 (3.15)	1	-0.006 (2.05)	0.004 (4.22)	-0.426 ₁ (6.79)	-0.173 ₂ (2.90)		-0.188 (4.61)	0.550 (8.15)		0.461 (8.48)	0.931 (26.01)
<i>Thailand</i>		2	-0.021 (12.52)	-0.005 (6.15)	-0.368 ₁ (4.43)	-0.155 ₂ (2.82)			0.794 (17.85)	0.181 (7.90)	0.253 (5.61)	0.726 (29.71)
<i>Equation Diagnostics</i>												
			<i>R²</i>	<i>SEE</i>	<i>Chow</i>	<i>DW</i>	<i>LM</i>	<i>K-S</i>	<i>ARCH</i>			
<i>China</i>			0.89	0.004	6.02 (.00)	2.66	45.95 (.00)	0.236***	11.05 (.00)			
<i>Hong Kong</i>			0.79	0.003	5.56 (.00)	1.94	4.49 (.61)	0.047	65.86 (.00)			
<i>Indonesia</i>			0.91	0.004	2.21 (.02)	2.57	82.86 (.00)	0.198***	3.49 (.06)			
<i>Korea</i>			0.63	0.006	2.78 (.00)	2.12	32.39 (.00)	0.066**	0.008 (.93)			
<i>Malaysia</i>			0.80	0.003	3.36 (.00)	2.03	12.14 (.06)	0.037	30.33 (.00)			
<i>Philippines</i>			0.74	0.007	1.41 (.16)	2.39	47.90 (.00)	0.147***	40.72 (.00)			
<i>Singapore</i>			0.83	0.002	5.37 (.00)	1.99	8.86 (.18)	0.053	55.63 (.00)			
<i>Taiwan</i>			0.70	0.005	6.95 (.00)	2.01	10.80(.09)	0.070	2.62 (.11)			
<i>Thailand</i>			0.77	0.005	1.21 (.26)	2.20	26.45 (.00)	0.092***	68.91 (.00)			
Notes. Variables are as defined in Table 3. See Notes to Table 5 for other explanatory details.												

Table 7
Empirical Results: Second Half of Sample Period, June 1990 – December 2003

	<i>Constant</i>	<i>Dummies</i>	S_i	S_i	S_i	S^{DM}_{SR}	S^{DM}_{LR}	S^{UK}_{SR}	S^{UK}_{LR}	S^{US}_{SR}	S^{US}_{LR}
<i>China</i>		1						0.434 (6.74)		0.566 (8.99)	0.906 (13.96)
<i>Hong Kong</i>		0	-0.702 ₁ (9.19)	-0.419 ₂ (4.52)	-0.259 ₃ (3.37)		0.005 (5.70)	0.033 (2.56)		0.958 (71.50)	0.995 (326.58)
<i>Indonesia</i>		2								0.726 (5.02)	0.726 (5.02)
<i>Korea</i>		3						0.107 (2.09)		0.733 (12.46)	0.733 (12.45)
<i>Malaysia</i>		3						0.139 (2.43)	0.139 (2.43)	0.709 (12.20)	0.709 (12.20)
<i>Philippines</i>	0.001 (2.45)	1	-0.180 ₁ (2.37)							0.883 (30.08)	0.850 (17.19)
<i>Singapore</i>							0.147 (7.66)				0.596 (18.15)
<i>Taiwan</i>		1	-0.181 ₁ (2.32)			0.065 ₀ (3.05)	0.098 (4.63)			0.844 (37.22)	0.769 (27.07)
<i>Thailand</i>		1	0.150 ₂ (2.04)			0.110 ₀ (3.22)	0.123 (2.68)			0.717 (17.93)	0.634 (12.06)

Equation Diagnostics

	R^2	<i>SEE</i>	<i>Chow</i>	<i>DW</i>	<i>K-S</i>	<i>LM</i>	<i>ARCH</i>
<i>China</i>	0.83	0.004	0.82 (.54)	2.59	0.206***	122.99 (.00)	12.81 (.00)
<i>Hong Kong</i>	0.98	0.001	5.50 (.00)	2.02	0.069**	37.64 (.00)	83.68 (.00)
<i>Indonesia</i>	0.09	0.018	0.71 (.55)	2.27	0.149***	96.29 (.00)	73.34 (.00)
<i>Korea</i>	0.63	0.006	1.37 (.22)	1.99	0.064**	19.15 (.00)	176.58 (.00)
<i>Malaysia</i>	0.41	0.008	1.05 (.39)	2.20	0.109***	15.15 (.02)	0.02 (.88)
<i>Philippines</i>	0.56	0.006	0.68 (.69)	1.91	0.057***	22.74 (.00)	56.73 (.00)
<i>Singapore</i>	0.77	0.003	4.50 (.00)	2.24	0.089***	17.56 (.01)	49.89 (.00)
<i>Taiwan</i>	0.80	0.003	7.18 (.00)	1.97	0.081***	22.90 (.00)	41.84 (.00)
<i>Thailand</i>	0.52	0.006	2.03 (.07)	1.95	0.067**	32.78 (.00)	40.49 (.00)

Notes. Variables are as defined in Table 3. See Notes to Table 5 for other explanatory details.