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North and Southeast Asia

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Abstract

Using weekly observations on 9 Asian currencies from November 1976 to December 2003, we re-examine the evidence of an emerging yen block in North and Southeast Asia. In contrast to previous research that assumes instantaneous adjustment of exchange rates by the region's Central Banks to variations in the world's main global currencies, we use a dynamic general-to-specific Newey-West estimation strategy that allows gradual adjustment and calculation of both short and long run equilibrium responses. We find that there is no *de facto* yen block, but although the US dollar remains dominant throughout the region, the yen's influence is rising amongst a subset of the currencies, particularly since the Asian crisis of the late 1990s.

Key Words: Exchange rate systems, yen block.

JEL Classification Codes: 110203, 110211

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Abstract

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1. <u>Introduction</u>

The Asian financial crisis of the late 1990s raised many questions about the appropriateness of the region's exchange rate systems. Economic and financial researchers have argued that a more coordinated system of regional exchange rates might have mitigated or even prevented the crisis, and that such a system could benefit the region in the future. Spurred on by the success of the European Monetary System (EMS) prior to the introduction of the euro in January 1999, it is interesting to ask whether Europe's EMS might have implications for the design of an Asian exchange rate system. In examining this possibility, it is important to consider whether the Japanese yen could perform a central role in a more coordinated Asian exchange rate system like that played by the German mark in the EMS. Previous research on the role of the yen in Asian exchange rate determination includes the work of Frankel (1991, 1993), Aggarwal and Mougoue (1993, 1996), Frankel and Wei (1994), Kwan (1994), Tse and Ng (1997), Zhou (1998), Ohno (1999), Gan (2000), McKinnon (2000), Hernandez and Montiel (2002) and Bowman (2004). These studies employ standard least squares regression and cointegration techniques alongside a variety of model specifications to determine the extent to which the region's currencies tend to follow the yen rather than other global currencies such as the euro (or the German mark prior to the euro), the UK pound sterling and the US dollar. The researchers have included in their datasets an extensive list of countries over different time periods, varying degrees of time aggregation (including daily, weekly, monthly and quarterly data), and different numeraires to overcome the 'n-1' problem in exchange rate modelling (including the inverse of the consumer price index, the European currency unit (ECU), the Swiss franc and the US dollar). The more recent studies have also compared the post-crisis and the pre-crisis periods to examine whether there has been any discernible shift in exchange rate setting practices in the region. Overall, the literature suggests that although the yen is a significant currency in the region, the US dollar continues to be the most influential currency, and there is limited evidence of an emerging yen block over time.

In this paper, we re-examine the evidence of an emerging yen block in North and Southeast Asia. Our motivation stems from shortcomings in the model specification and parameter estimation procedures that have been employed in the literature to date

that have the potential to lead to incorrect inferences. By excluding any dynamic adjustment in their models, previous researchers have implicitly assumed that the monetary authorities in North and Southeast Asia instantaneously align their exchange rates to their preferred levels in relation to the world's main currencies. This assumption is questionable, especially in studies that use low time-aggregated data that is observed either daily or weekly. Central bankers throughout the world meet at discrete intervals of at least a week to discuss and implement their foreign exchange policies. They are always concerned to achieve smooth exchange rate movements, and they consequently tend to adjust their exchange rates gradually to their preferred levels. By failing to differentiate between short- and long-run multipliers, the existing models are mis-specified with possibly non-spherical errors. We overcome this by specifying a set of dynamic models that differentiate between the short- and long-run equilibrium responses of the monetary authorities. We model time variations in 9 Asian currencies (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) in response to the German mark, the Japanese yen, the UK pound and the US dollar. All our exchange rates are expressed in terms of the Swiss franc. We estimate our models using a general-to-specific estimation strategy (see Hendry and Krolzig (2001)) with Newey-West heteroscedastic- and autocorrelation-consistent significance tests (see Newey and West (1987)). In addition to estimating our models over the whole period from November 1976 to December 2003, we also present estimates for two contiguous sub-periods, the first prior to and including 25th May 1990, and the second thereafter to the end of the period.

Our models acquit themselves well in providing a high degree of explanatory power together with clear results about the responsiveness of the region's exchange rates to variations in the world's leading currencies over the 27 years of our data period. Amongst our main findings are that the US dollar has been, and continues to be the most important and influential currency in the region throughout our sample period. This is consistent with most previous researchers, a notable exception being Aggarwal and Mougue (1996) who use cointegration techniques to conclude that the yen's influence exceeded that of the US dollar during the late 1980s and early 1990s.

Importantly, however, we also find that there has been a noticeable and significant rise in the influence of the US dollar on some of the region's currencies, combined with a decline in its influence on some others since the Asian financial crisis of the late 1990s. This finding is at odds with McKinnon (2000) who describes a reversion to the pre-crisis regime after the Asian crisis. *Second,* we find that the Japanese yen was not a very influential regional currency during the decade prior to the Asian financial crisis. This contrasts with the findings of Frankel and Wei (1994), Kwan (1994), Zhou (1998) and Bowman (2004) among others who noted an emerging and significant yen influence as early as the late 1980s. Subsequent to the Asian crisis, however, the yen has become an important influence on all Asian currencies except the Chinese yuan, the Hong Kong dollar and the Malaysian ringgit. This corroborates the findings of Gan (2000), Hernandez and Montiel (2002) and Bowman (2004), but is at odds with those of McKinnon (2000). *Third*, we find that the influence of the German mark on the region's currencies has grown significantly over time, which is not surprising in light of the growing trade linkages between Asia and Europe, while the influence of the UK sterling has diminished to almost zero from a low base. Overall, therefore, we find that the region continues to behave more like a US dollar block than a yen block, but that the declining influence of the US dollar since the late 1990s has been replaced by a growing influence of the German mark and the Japanese yen.

The remainder of our paper is organised as follows. In Section 2, we describe our dataset, present the model to be estimated, and establish a number of hypotheses to be tested. Section 3 presents our results. The final Section brings together our main findings and draws together our conclusion that if these trends continue into the future, the region will begin to look more like a euro-yen-US dollar block rather than a yen block.

2. Data, Model Specification and Hypothesis Tests

Our North and Southeast Asian currencies includes the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the Philippine peso, the Singapore dollar, the Taiwan dollar and the Thai baht. Our world currencies comprises the German mark, the Japanese yen, the UK pound and the US

dollar. All data is obtained from *Datastream International Ltd.,* and all exchange rates are expressed as units of domestic currency in 1 Swiss franc. Table 1 provides a full description of all variables used in our empirical analysis. Figures 1 and 2 depict the evolution of the bilateral Swiss franc Asian and important world rates over the whole sample period.

[Insert Figures 1 & 2 and Table 1 here]

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

$$S^i_t = \alpha_0 + \sum_{j=1}^{N} \alpha_j S^i_{t-j} + \sum_{j=0}^{N} \beta_j S^{DM}_{t-j} + \sum_{j=0}^{N} \gamma_j S^{YEN}_{t-j}$$

$$+ \sum_{j=0}^{N} \delta_j S^{UK}_{t-j} + \sum_{j=0}^{N} \zeta_j S^{US}_{t-j} + \sum_{j=0}^{N} D^i_{j,t} + \varepsilon^i_t \quad (1)$$

Here, S^i denotes the log change in the bilateral Swiss franc exchange rates of the 9 currencies included in the sample. S^{DM}, S^{YEN}, S^{UK} and S^{US} denote the log changes in the exogeneous German mark, Japanese yen, UK pound sterling and US dollar bilateral Swiss franc rates respectively. The $D^i_{j,t}$ variables denote the jth currency-specific dummy variable for currency i at time t, and they capture episodes of periodic interventions by the relevant monetary authorities that might have caused influential outliers or structural breaks in the series (including the coordinated interventions of the Plaza and Louvre accords). Table 2 provides details of the individual country dummy variables that are statistically significant in the parsimoniously derived models.

[Insert Table 2 here]

Our specification is an improvement on the specifications of Frankel (1991a, 1991b, 1993) and Frankel & Wei (1994), which assume instantaneous interaction between the regional currencies and the important exogeneous exchange rates. We couch our model in logarithmic difference form, which is suitable for exchange rates (see Enders (1995)) and induces stationarity. The legitimacy of this is established using the

augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests. These results are presented in Table 3 and they confirm that the log changes are all without trend. We estimate our models using the general-to-specific dynamic estimation strategy (see Hendry and Krolzig (2001)) by including up to 4 lags of each variable in the models and sequentially testing down using Newey-West (1987) t-statistics until parsimonious specifications are obtained. This process is repeated for each regional exchange rate, for the full period, and for each of the sub-periods.

[Insert Table 3 here]

The resulting dynamic models are solved to obtain both the short run and the long run multipliers for the effects of variations in the mark, the yen, the pound sterling and the US dollar on the regional currencies. The short run multipliers are obtainable directly from the contemporaneous independent coefficients in each model, and the long run multipliers are obtained from the estimated versions of equation (1) as follows,

$$LRM_k^{S^i} = \frac{\sum_{j=0}^{N} \psi_j}{(1 - \sum_{j=1}^{N} \alpha_j)} \qquad (2)$$

where k = DM, YEN, UK and US, and ψ = $\beta, \gamma, \delta,$ and ζ in equation (1). Equation (2) tells us the equilibrium responses of each regional exchange rate to variations in the exogeneous rates. We test eight hypotheses about the coefficients of the model for each regional exchange rate.

Hypothesis 1:
H_0^1: $LRM_{DM}^{S^i} = 0$, which implies that changes in the value of the German mark exchange rate do not impact significantly upon the regional exchange rate;
H_1^1: $LRM_{DM}^{S^i} \neq 0$, which implies that changes in the value of the German mark exchange rate do impact significantly upon the regional exchange rate.

Hypothesis 2:
H_0^2: $LRM_{YEN}^{S^i} = 0$, which implies that changes in the value of the Japanese yen exchange rate do not impact significantly upon the regional exchange rate;

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H_1^2: $LRM_{YEN}^{S^i} \neq 0$, which implies that changes in the value of the Japanese yen exchange rate returns do impact significantly upon the regional exchange rate.

Hypothesis 3:

H_0^3: $LRM_{UK}^{S^i} = 0$, which implies that changes in the value of the UK pound sterling exchange rate do not impact significantly upon the regional exchange rate;

H_1^3: $LRM_{UK}^{S^i} \neq 0$, which implies that changes in the value of the UK pound sterling exchange rate do impact significantly upon the regional exchange rate.

Hypothesis 4:

H_0^4: $LRM_{US}^{S^i} = 0$, which implies that changes in the value of the US dollar exchange rate do not impact significantly upon the regional exchange rate;

H_1^4: $LRM_{US}^{S^i} \neq 0$, which implies that changes in the value of the US dollar exchange rate do impact significantly upon the regional exchange rate.

Hypothesis 5:

H_0^5: The $LRM_{DM}^{S^i}$ which is estimated from the second sub-period is less than that which is estimated from the first sub-period, which implies that changes in the value of the German mark exchange rate are impacting less over time on the regional exchange rate;

H_1^5: The $LRM_{DM}^{S^i}$ which is estimated from the second sub-period is equal to or greater than that estimated from the first sub-period, which implies that changes in the value of the German mark exchange rate are impacting the same or greater over time on the regional exchange rate.

Hypothesis 6:

H_0^6: The $LRM_{YEN}^{S^i}$ which is estimated from the second sub-period is less than that which is estimated from the first sub-period, which implies that changes in the value of the Japanese yen exchange rate are impacting less over time on the regional exchange rate;

H_1^6: The $LRM_{YEN}^{S^i}$ which is estimated from the second sub-period is equal to or greater than that estimated from the first sub-period, which implies that changes in the value of the Japanese yen exchange rate are impacting the same or greater over time on the regional exchange rate.

Hypothesis 7:

H_0^7: The $LRM_{UK}^{S^i}$ which is estimated from the second sub-period is less than that which is estimated from the first sub-period, which implies that changes in the value of the pound sterling exchange rate are impacting less over time on the regional exchange rate;

H_1^7: The $LRM_{UK}^{S^i}$ which is estimated from the second sub-period is equal to or greater than that estimated from the first sub-period, which implies that changes in the value of the pound sterling exchange rate are impacting the same or greater over time on the regional exchange rate.

Hypothesis 8:

H_0^8: The $LRM_{US}^{S^i}$ which is estimated from the second sub-period is less than that which is estimated from the first sub-period, which implies that changes in the value of the US dollar exchange rate are impacting less over time on the regional exchange rate;

H_1^8: The $LRM_{US}^{S^i}$ which is estimated from the second sub-period is equal to or greater than that estimated from the first sub-period, which implies that changes in the value of the US dollar exchange rate are impacting the same or greater over time on the regional exchange rate.

These hypotheses are sequenced logically and performed across all 9 regional currencies to examine the extent to which there exists evidence of an emerging yen block. All our hypotheses are couched in terms of the equilibrium responses, rather than the instantaneous responses that have been used in past studies. By allowing for dynamic adjustment over time of each regional currency to variations in the world's leading currencies, our tests provide a richer investigation of the extent to which the region's currencies tend to follow the yen rather than the other global currencies. If H_0^1 is upheld, it implies that variations in the German mark do not impact upon the regional bilateral Swiss franc exchange rates under consideration. This constitutes evidence that is consistent with a possible *de facto* yen block amongst the currencies in the region. The same applies to H_0^3 and H_0^4 which concern the responses of the regional exchange rates to variations in the pound sterling and the US dollar. If H_0^2 is upheld, however, it implies that the regional currencies do not respond to variations in the yen, and this would be inconsistent with a *de facto* yen block. The nulls of the last four hypotheses, H_0^5, H_0^6, H_0^7 and H_0^8 repeat the first four hypotheses on the sub-samples, and are designed to shed light on whether there is evidence of an emerging yen block over time. The long run multiplier estimates must be significantly distinguishable from zero in at least one of the sub-periods for the corresponding hypothesis to contribute to the analysis. If hypotheses 5, 7 and 8 are upheld and hypothesis 6 is rejected, we conclude that there does exist evidence of an emerging *de facto* yen block in the region. Otherwise, we conclude that there is not evidence of the emergence of such a bloc.

Following Hernandez and Monteil (2002), we acknowledge that regression estimates of currency basket weights may increase due to (a) a higher weight in the underlying basket the central bank is targeting, or (b) tighter economic links and a consequently greater coincidence of economic shocks. For example, in the case where the estimated weights are increasing over time, we do not imply that it is self-evident that (a) is responsible but rather that either (a) or (b) is responsible, or both. We note, however, that an increased incidence of common shocks is in itself evidence

suggestive of economic integration, and the latter is requisite to the construction of a sustainable currency block.

3. Results

Table 4 presents our results for the full sample period, and Tables 5 and 6 do likewise for the first and second sub-periods, respectively. The top part of the Tables present the short-run coefficient estimates together with the long run multipliers (*LRM*) with their heteroscedastic- and autocorrelation- consistent t-statistics in brackets, and the bottom part of the Tables present the equation diagnostics. All printed coefficients are statistically significant at the 5 percent level or better. The diagnostics include the R^2 statistics, the standard errors of the estimates (*SEE*), the *Chow* test for structural stability, the Durbin Watson (*DW*) statistics which test 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 which tests for higher order autocorrelation, and the *ARCH* test for heteroscedasticity.

Full Sample Period

Looking firstly at the results for the full sample period in Table 4, 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 exchange rates of all 9 countries, and they average over 0.72. The *SEE*s are correspondingly small. The *DW* statistics, the *LM* statistics and the *KS* statistics indicate that although first order autocorrelation appears not to be evident, there is evidence of higher order autocorrelation, and the *ARCH* tests indicate the existence of heteroscedastic error structures. These non-spherical properties, however, are anticipated in our use of heteroscedastic and autocorrelation consistent t-statistics. The *Chow* statistics indicate the presence of structural breaks in most models, and this motivates our re-estimation of the models in the two sub-periods. Looking next at the individual coefficient estimates, the constant terms in all but two models (the Hong Kong dollar and the Philippine peso) are insignificantly different to zero, confirming that the Swiss franc exhibits no systematic trends *vis-a-vis* the

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majority of the regional currencies in our sample. The statistically significant lagged dependant coefficients in each model are negatively signed which contributes stability, but the presence of two or more lags in some currencies indicates complex adjustment dynamics in response to variations in the leading global currencies.

[Insert Table 4 here]

The responses of the Asian currencies to variations in the German mark in Table 4 shows that only the Singapore dollar exhibits a short run significant coefficient, while the Indonesian rupiah, the Korean won, the Singapore dollar and the Taiwan dollar exhibit significantly positive long run multipliers with a mean of 0.12. This tells us that for each 1 percent appreciation in the German mark, the mean equilibrium response of these currencies is an appreciation of 0.12 percent. We therefore reject H_0^1 and accept H_1^1 for 4 of our 9 currencies. Looking next at the yen, we see that 6 of the regional currencies' short run coefficients are positive and significant with a mean value of 0.14, and the same number of long run multipliers is also positive and significant with the same mean value. This leads us to reject H_0^2 and accept H_1^2 for 6 of the regional rates. Although the UK pound sterling looks to be influential from an inspection of its short run coefficients (of which all but the Hong Kong dollar are positive and significant), allowing for lagged adjustment reveals that only 3 currencies (the Korean won, the Malaysian ringgit and the Singapore dollar) exhibit significant long run coefficients with a mean value of 0.09. We therefore reject H_0^3 and accept H_1^3 for 3 of our 9 currencies. The influence of the UK pound sterling in the region is relatively weak. Looking finally at the US dollar, all the short run coefficients are positively signed and statistically significant with a mean value of 0.56, varying from a low of 0.28 for the Indonesian rupiah to a high of 0.92 for the Hong Kong dollar. The long run coefficients are also all positively signed and significant with a mean value of 0.82, and they vary from a low of 0.66 for the Singapore dollar to a high of 0.98 for the Chinese yuan. This indicates that for each 1 percent appreciation in the US dollar exchange rate, the mean equilibrium response of the regional currencies is an appreciation of 0.82 percent. We therefore reject H_0^4 and accept H_1^4 for all 9 currencies. In summary, it appears from our full sample

estimates that the region's currencies form a US dollar block rather than a yen block, with the Chinese yuan, the Philippine peso, and the Hong Kong dollar all having long run multipliers above 0.90, followed by Taiwan with a long run multiplier of 0.85. The Malaysian ringgitt, the Singapore dollar and the Thai baht are most independent from the US dollar insofar as they all have long run multipliers less than 0.75. Interestingly, these same three currencies all have statistically significant long run multipliers in response to the yen, the first two have statistically significant long run multipliers in response to the pound sterling, while the Singapore dollar also has a significant long run response to the mark.

Sub-Periods

Our results for the sub-periods, obtained by dividing our full sample in half, are presented in Tables 5 and 6. In these Tables, we use heteroscedastic consistent t-statistics to test the significance of the difference between the long-run multipliers between the sub-periods. The first point to note from these Tables is that the overall behaviour of the models as measured by their diagnostic statistics remains comparable to the full sample behaviour. The explanatory power of the models remains similar over the sub-periods, ranging from a mean R^2 of 79 percent in the first sub-period to 74 percent in the second sub-period. There is, however, a preponderance of dummy variables in the first sub-period (34) in contrast to the second (21), and the *Chow* tests indicate that structural breaks are apparent in all currencies except the Thai baht in the first sub-period while in the second sub-period structural breaks are found only in the Thai baht, the Hong Kong dollar and the Korean won rates. Taken together, the dummy variables and structural break tests point to smoother currency adjustments in the region since May 1990, and this may indicate the emergence of a more sophisticated set of exchange rate policies in the region. This is despite the Asian financial crisis in the latter period.

As before, we first examine the influence of the German mark. Only the Singapore dollar has a significant short-run coefficient in the first sub-period, and in the second sub-period, the Singapore dollar, the Taiwan dollar and the Thai baht are significant. The mean of the long run multipliers is 0.09 in the first sub-period (with only the Singapore dollar being significant) and 0.22 in the second sub-period (with the

Korean won, the Malaysian ringgitt and the Taiwan dollar being significant). This implies a rise in both the extent and the magnitude of the German mark's influence in the region, and we reject H_0^5 and accept H_1^5 for 3 currencies, the Korean won, the Malaysian ringgit and the Taiwan dollar. The Japanese yen has 3 significant short run coefficients in the first sub-period (the Malaysian ringgit, the Singapore dollar and the Thai baht which is negatively signed), but it has 7 significant short run coefficients in the second sub-period (all currencies except the Chinese yuan and the Hong Kong dollar). The mean of the long run multipliers is 0.10 in the first sub-period (ignoring the negative sign on the Chinese yuan) and 0.16 in the second sub-period, and the increases are significant for the Korean won, the Philippine peso and the Singapore dollar. In the cases of the Chinese yuan and the Malaysian ringgit, the declines in the mean equilibrium responses are also significant. We therefore reject the null hypothesis, H_0^6, and accept the alternate hypothesis, H_1^6, for 4 currencies, the Korean won, the Philippine peso, the Singapore dollar and the Taiwan dollar. Looking next at the UK pound sterling, all short run coefficients except the Hong Kong dollar are significant in the first sub-period, but only the Chinese yuan, the Korean won and the Malaysian ringgitt are significant in the second sub-period. The mean of the short run coefficients in the first sub-period is 0.58, and this falls to less than half it value at 0.26 during the second sub-period. The mean of the 4 statistically significant long run multipliers in the first sub-period is 0.13, and no long run multipliers are significant in the second sub-period. We therefore reject H_0^7 and accept H_1^7 for all currencies in our sample.

Looking finally at the sub-period responsiveness of the regional bilateral rates to variations in the US dollar, all short run coefficients are positively signed and statistically significant in both the first and second sub-periods, except for the Chinese yuan in the first sub-period. 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 0.75 during the later sub-period, varying from a low of 0.57 for the Chinese yuan to a high of 0.97 for the Hong Kong dollar. It is noticeable that while the average of the estimated short run coefficients on the impact of the US dollar on the regional bilateral rates rises by 60 percent

between the sub-periods, the short run coefficients also rise for each individual exchange rate. Interestingly, all the long-run multipliers are also positive and statistically significant in both sub-periods, with a mean of 0.81 in the first period and 0.86 in the second period. The long run multipliers rise significantly for the Hong Kong dollar, the Korean won, the Singapore dollar and the Malaysian ringgit, and they decline significantly for the Indonesian rupiah and the Taiwan dollar. We therefore reject H_0^8 and accept H_1^8 for 7 currencies.

[Insert Tables 5 & 6 here]

We can summarise the findings of our sub-period investigations as showing an increase in the influence of the mark, the yen and the US dollar, combined with the virtual ending of any influence from the pound sterling. With regard to the role of the yen in the region, its influence on the Korean won, the Philippine peso and the Singapore dollar has increased over time. Of these, the Korean won also exhibits significant increases in both its mark and US dollar influences, the Singapore dollar indicates increased influence from the US dollar, and only the Philippine peso exhibits an increased yen influence without an increase in influence from other world currencies. The other Asian currencies show no significant increase in the importance of the yen over the sub-periods investigated. The Malaysian ringgit shows a decline in the yen's importance while also showing an increase in the importance of the US dollar and the German mark.

4. Conclusions

A significant body of literature has emerged over the past decade that investigates the extent to which the more important regional currencies in North and Southeast Asia tend to follow the Japanese yen rather than the other important global currencies such as the German mark (more recently the euro), the UK pound sterling and the US dollar. Researchers have investigated different datasets for different currencies, and understandably, they have obtained different results. Overall, however, this literature suggests that the yen is a significant currency in the region, that the US dollar continues to be the most influential currency, and that there is limited evidence of an emerging yen block over time. In this paper, we have re-examined the evidence of an

emerging yen block in North and Southeast Asia, allowing for a more dynamic adjustment process through which the region's Central Banks adjust their exchange rates in response to movements in the important global currencies. We estimated a set of dynamic models that differentiate between the short- and long-run equilibrium responses of the region's 9 most important currencies (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) to movements in the German mark, the Japanese yen, the UK pound and the US dollar. We estimated our models using a general-to-specific estimation strategy with Newey-West heteroscedastic- and autocorrelation-consistent significance tests. In addition to estimating our models over the whole period from November 1976 to December 2003, we also presented estimates for two contiguous sub-periods, the first prior to and including 25th May 1990, and the second thereafter to the end of the period.

Our results point to a pervasive and dominant influence of the US dollar throughout the region, particularly regarding the Chinese yuan, the Hong Kong dollar and the Malaysian ringgit, but also with respect to the other currencies in our sample. This is accompanied by an emerging role for the mark, and a marked decline in the influence of the pound sterling. We also find that the yen remains an important currency in the region, with the long run multipliers of the Korean won, the Philippine peso, the Singapore dollar and the Taiwan dollar all suggesting a significant yen influence in the latter sub-period. It is interesting to note how the results of our analysis incorporating lagged adjustment of the region's exchange rates to variations in the world's leading currencies differs from the existing literature that assumes instantaneous adjustment of the region's currencies to movements in the important global currencies. Considering only the short-run multipliers tends to underestimate the importance of the German mark and the US dollar in the region, because the short run effects are often augmented by the long run multipliers. In contrast to this, however, considering only the short-run multipliers tends to overestimate the influence of the UK pound sterling because the lagged effects tend to erode the short run influence.

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Table 1

Variables Used and Data Sources

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S^i: Weekly bilateral exchange rates *vis-a-vis* the Swiss franc for the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the Philippine peso, the Singapore dollar, the Thai baht and the Taiwan dollar. These exchange rates are defined as the domestic currency price of 1 unit Swiss franc. They are sampled at the close of trading on the last trading day in the week.

The full sample period is 19 November 1976 – 26 December 2003 for the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the Philippine peso, the Singapore dollar and the Thai baht. The Taiwan dollar and the Chinese yuan commence on the 4th and 11th January 1985, respectively. The first sub-period is from the above starting dates until 25 May 1990, and the second sub-period is from June first 1990 - 26 December 2003 for all exchange rates.

S^{STE}:   The weekly UK exchange rate denominated in terms of the Swiss franc, set to 100 over the period November to December 1976.

S^{DME}:   The weekly German DM exchange rate denominated in terms of the Swiss franc, set to 100 over the period November to December 1976. Since 1st January 1999 the German DM has been irrevocably fixed to the Euro.

S^{USE}:   The weekly US dollar exchange rate denominated in terms of the Swiss franc, set to 100 over the period November to December 1976.

S^{YEN}:   The weekly Japanese Yen exchange rate denominated in terms of the Swiss franc, set to 100 over the period November to December 1976.

D^i: Various dummy variables for each country as described in Table 2. Included are the Plaza and Louvre dummy variables to capture, respectively, the coordinated currency market interventions during October 1985 and March 1987.

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The source for all data is *Datastream International Ltd*.

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Figure 1

**Bilateral Swiss Franc Exchange Rates of 11 Currencies
Weekly, January 1985 - December 2003**

Notes. Source is *Datastream International Ltd*. The exchange rates are units of domestic currency per 1 Swiss franc, re-based to 100 at the 19th November 1976. The bilateral Swiss franc rates included in the Figure are the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the New Zealand dollar, the Philippino peso, the Singaporean dollar, the Taiwan dollar and the Thai baht. The Chinese yuan and Taiwan dollar are rebased and included at the 1st available dates, 4th January and 11th January 1985 respectively.
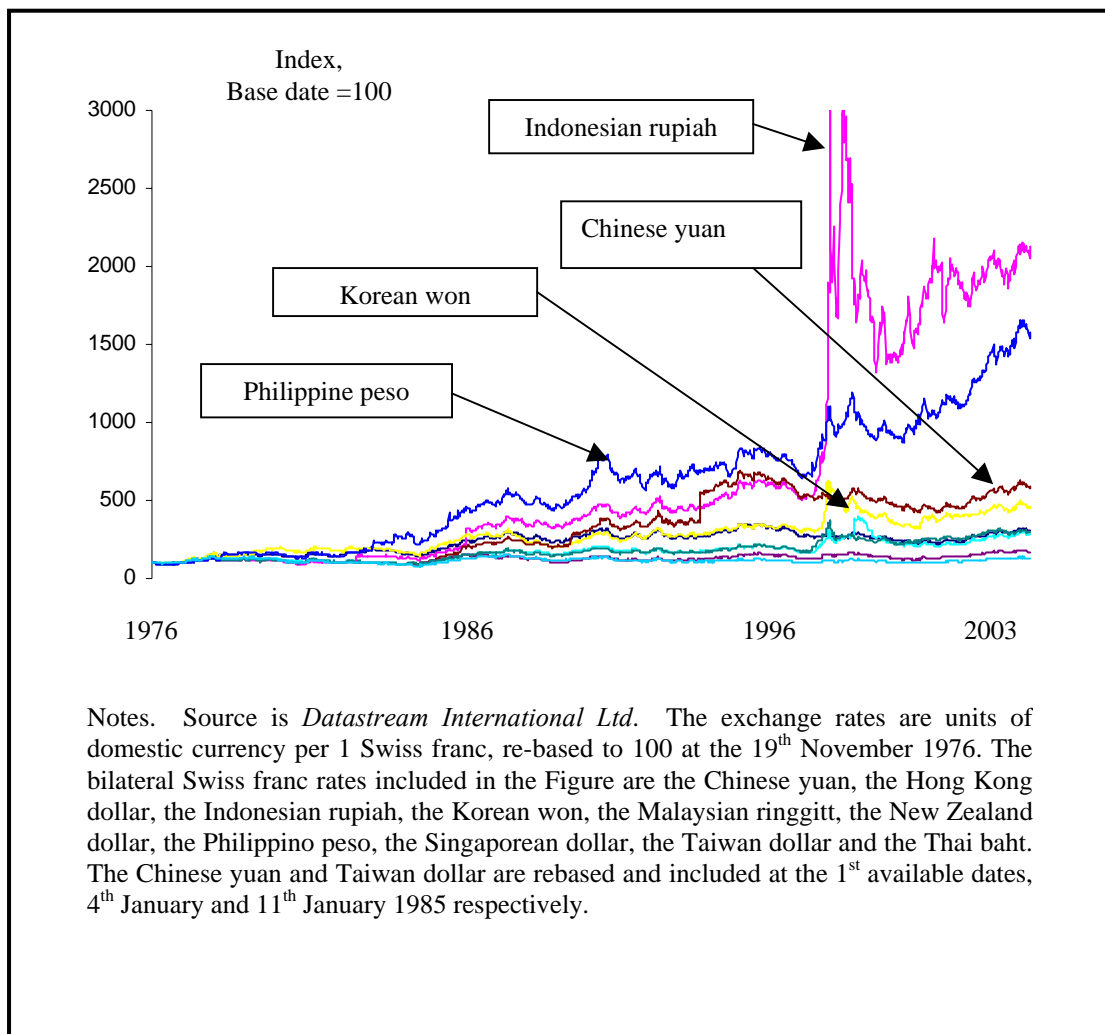
Figure 2
Exogeneous Rates, November 1976 – December 2003.
The US Dollar, the German Deutschemark and the Pound Sterling
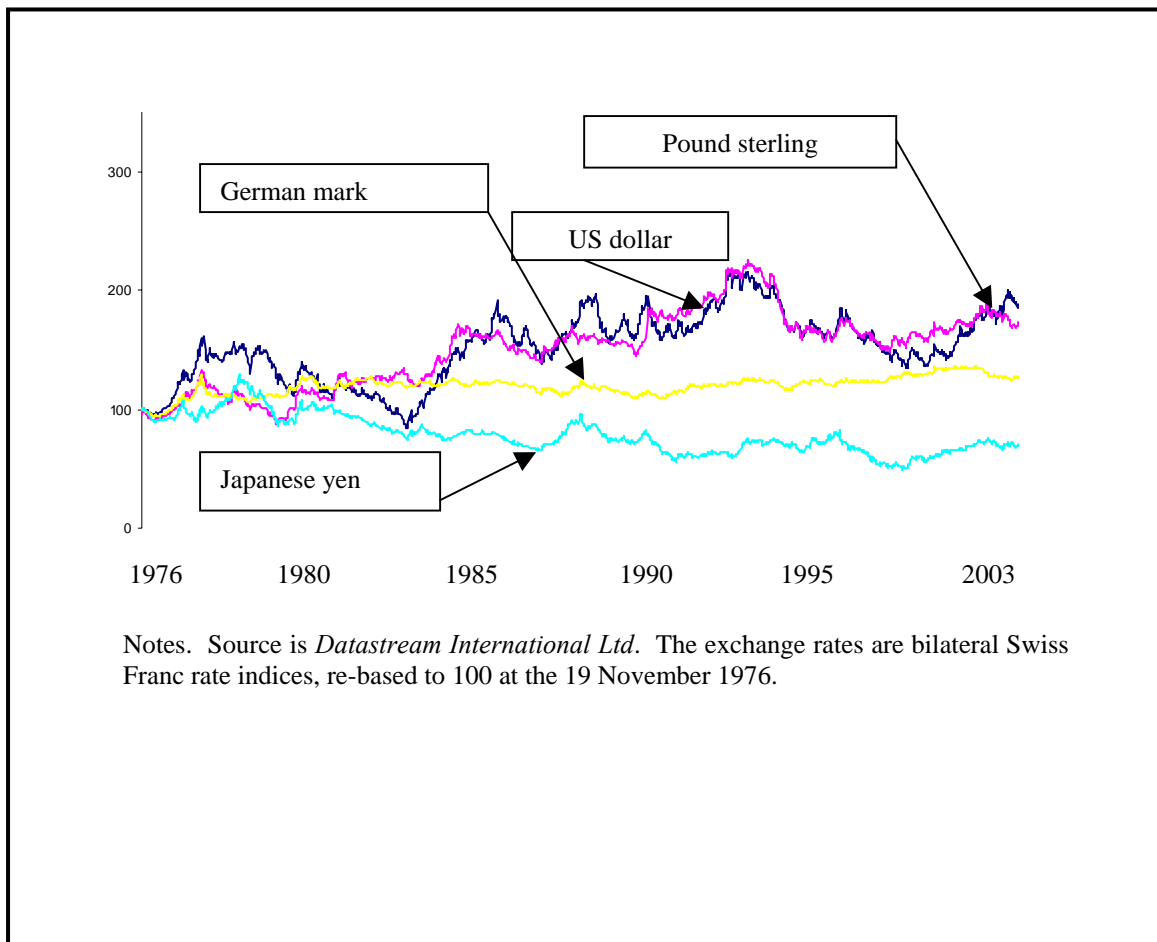**Swiss Franc Bilateral Rates**

Notes. Source is *Datastream International Ltd*. The exchange rates are bilateral Swiss Franc rate indices, re-based to 100 at the 19 November 1976.

Table 2

Dummy Variables used in the Exchange Rate Models

	D1	D2	D3	D4	D5	D6	Plaza	Louvre
Panel A: Full Sample Period								
China	05/03/85	07/18/86	12/22/89	01/07/94				03/06/87
Hong Kong	09/23/83	05/12/95	09/22/95				10/04/85	03/06/87
Indonesia	04/08/83	09/19/86	01/30/98	01/23/98	01/09/98		10/04/85	03/06/87
Korea	02/01/80	03/29/85	08/02/85				10/04/85	03/06/87
Malaysia	02/20/81	10/10/97	01/09/98	01/23/98	01/30/98	10/30/98		03/06/87
Philippines	01/12/79	10/14/83	06/15/84	02/28/86	07/11/97		10/04/85	03/06/87
Singapore	02/20/81	06/19/98						03/06/87
Taiwan	05/03/85	09/13/85	09/27/85	04/28/89	05/12/95	11/07/97	10/04/85	
Thailand	11/09/84	09/27/85	10/31/97	01/09/98	03/13/98		10/04/85	03/06/87
Panel B: Sample Period 1								
China	05/03/85	10/04/85	07/18/86	12/22/89				
Hong Kong	09/23/83						10/04/85	03/06/87
Indonesia	04/08/83	09/19/86					10/04/85	
Korea	02/01/80	03/29/85	08/02/85				10/04/85	03/06/87
Malaysia	02/20/81						10/04/85	
Philippines	01/12/79	10/14/83	06/15/84	02/28/86			10/04/85	03/06/87
Singapore	02/20/81							03/06/87
Taiwan	09/13/85	09/27/85	04/28/89				10/04/85	03/06/87
Thailand	11/09/84	09/27/85					10/04/85	03/06/87
Panel C: Sample Period 2								
China	01/07/94							
Hong Kong	05/12/95							
Indonesia	01/30/98	01/23/98	01/09/98					
Korea	12/12/97	01/09/98	01/30/98					
Malaysia	10/10/97	01/09/98	01/23/98	01/30/98	10/30/98			
Philippines	07/11/97							
Singapore	06/19/98							
Taiwan	05/12/95							
Thailand	10/31/97	01/09/98	03/13/98					

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 and is aimed at stabilising the foreign exchange value of the US dollar. Significant dummies are also included in the Malaysian dollar equations for the 2nd April, the 28th May and the 3rd September 1999. All printed dummies are statistically significant at the 5% level.

Table 3

Unit Root Tests of the Swiss Franc Bilateral Exchange Rates and the Exogenous Exchange Rate Indices.

Level of Variable	ADF	PP	First Difference	ADF	PP
Swiss franc bilateral rates					
CH	-1.51	-2.82	ΔCH	-32.76	-1064.87
HK	-1.64	-3.90	ΔHK	-37.50	-1465.77
IN	-1.09	-3.13	ΔIN	-23.54	-1777.54
KO	-1.45	-3.84	ΔKO	-12.92	-1574.05
MA	-0.96	-3.36	ΔMA	-40.43	-1599.28
PH	1.35	1.98	ΔPH	-39.95	-1563.65
SI	-2.17	-10.12	ΔSI	-38.74	-1497.17
TA	-1.79	-7.88	ΔTA	-31.96	-1021.61
TH	-0.60	-1.44	ΔTH	-40.27	-1563.65
Exogeneous exchange rates					
GE	-2.67	-10.81	ΔGE	-38.61	-1523.69
UK	-1.52	-3.54	ΔUK	-37.59	-1456.55
US	-1.83	-6.59	ΔUS	-37.26	-1453.81
YEN	-1.77	-5.44	ΔYEN	-38.59	-1480.86

ADF and PP Critical Values

1%	5%	10%
-3.43	-2.86	-2.57

Notes: All variables are as defined in Table 1. The full sample period from 19th November 1976 to the 26th December 2003 is assessed except for in the cases of the Taiwan dollar and the Chinese yuan, which are assessed from 4th January and 11th January 1985, respectively. The Augmented Dickey Fuller and the Philips Perron statistics are denoted ADF and PP respectively. Optimal lag length for the ADF test is selected using the AIC and the BIC criteria. The PP test is used with four lags and includes an intercept.

Table 4
Empirical Results: Full Sample Period, November 1976 – December 2003

	Constant	Dummies	S_i	S_i	S^{DM}_{SR}	S^{DM}_{LR}	S^{YEN}_{SR}	S^{YEN}_{LR}	S^{UK}_{SR}	S^{UK}_{LR}	S^{US}_{SR}	S^{US}_{LR}
China		5	-0.116_1	-0.368_4					0.649		0.348	0.984
			(1.99)	(2.22)					(11.87)		(9.28)	(21.87)
Hong Kong	0.000	5									0.919	0.919
	(2.21)										(91.48)	(91.48)
Indonesia		7				0.152	0.203	0.203	0.525		0.283	0.788
						(1.98)	(2.12)	(2.12)	(8.41)		(4.39)	(10.42)
Korea		5	-0.141_1	-0.118_2		0.124	0.119	0.147	0.429	0.113	0.464	0.788
			(3.92)	(2.98)		(2.99)	(3.53)	(4.74)	(7.63)	(2.09)	(10.58)	(19.39)
Malaysia		10	0.043_3				0.145	0.152	0.101	0.105	0.698	0.731
			(2.18)				(4.38)	(4.34)	(4.06)	(4.08)	(25.26)	(20.89)
Philippines	0.001	7	-0.162_1						0.426		0.591	0.944
	(2.72)		(3.54)						(8.49)		(14.78)	(23.02)
Singapore		3	-0.158_1		0.128	0.111	0.140	0.149	0.051	0.044	0.663	0.660
			(3.27)		(4.28)	(4.19)	(10.74)	(9.04)	(2.89)	(2.75)	(42.49)	(39.36)
Taiwan		6	-0.225_1			0.110	0.108	0.121	0.224		0.662	0.846
			(3.71)			(2.03)	(4.01)	(4.96)	(4.83)		(17.00)	(25.64)
Thailand		7	-0.159_1				0.110	0.093	0.427		0.421	0.739
			(2.42)				(3.27)	(3.15)	(7.97)		(9.89)	(19.64)

Equation Diagnostics

	R^2	SEE	Chow	DW	K-S	LM	ARCH
China	0.79	0.011	14.46 (.00)	2.54	0.1918***	161.15 (.00)	3.70 (.05)
Hong Kong	0.89	0.006	4.39 (.00)	2.19	0.0771***	19.14 (.00)	143.69 (.00)
Indonesia	0.62	0.023	10.30 (.00)	2.01	0.0878***	65.34 (.00)	64.75 (.00)
Korea	0.63	0.014	7.59 (.00)	1.92	0.0514***	17.39 (.00)	138.62 (.00)
Malaysia	0.81	0.009	1.08 (.37)	2.13	0.0725***	61.98 (.00)	29.39 (.00)
Philippines	0.63	0.015	12.13 (.00)	2.19	0.0930***	35.92 (.00)	64.77 (.00)
Singapore	0.84	0.006	1.17 (.31)	1.91	0.0680***	29.65 (.00)	88.80 (.00)
Taiwan	0.71	0.009	14.76 (.00)	2.15	0.0893***	31.55 (.00)	51.05 (.00)
Thailand	0.56	0.013	24.65 (.00)	2.02	0.0348	17.28 (.01)	132.80 (.00)

Notes. Variables are as defined in Table 1. 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 R^2s 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 5
Empirical Results: First Half of Sample Period, November 1976 – May 1990

	Constant	Dummies	S_i	S_i	S^{DM}_{SR}	S^{DM}_{LR}	S^{YEN}_{SR}	S^{YEN}_{LR}	S^{UK}_{SR}	S^{UK}_{LR}	S^{US}_{SR}	S^{US}_{LR}
China		4	-0.126_1 (1.97)					-0.178 (3.18)	1.025 (19.26)			0.939 (21.47)
Hong Kong	0.000 (2.41)	3									0.879 (55.05)	0.879 (55.05)
Indonesia		3	-0.052_1 (2.02)						0.784 (20.06)		0.179 (5.86)	0.949 (20.06)
Korea		5	-0.166_1 (3.92)	-0.107_2 (2.98)				0.062 (2.04)	0.679 (12.71)	0.201 (3.08)	0.265 (5.62)	0.740 (13.73)
Malaysia		2	-0.181_1 (3.59)	0.041_3 (2.00)			0.098 (4.71)	0.064 (1.93)	0.114 (5.01)	0.099 (4.79)	0.686 (32.07)	0.707 (25.95)
Philippines		6	-0.123_1 (2.41)	-0.072_2 (2.44)					0.639 (10.44)		0.378 (7.80)	0.889 (12.75)
Singapore		2	-0.183_1 (3.79)		0.104 (2.48)	0.088 (2.93)	0.105 (5.89)	0.089 (5.56)	0.069 (3.16)	0.059 (3.27)	0.666 (33.22)	0.563 (28.19)
Taiwan	-0.002 (2.72)	5	-0.391_1 (6.17)	-0.183_2 (3.22)				0.117 (2.99)	0.584 (7.60)		0.461 (8.48)	0.935 (18.80)
Thailand		4	-0.364_1 (4.42)	-0.170_2 (2.95)				-0.089 (2.12)	0.739 (14.54)	0.144 (3.26)	0.253 (5.61)	0.738 (17.70)

Equation Diagnostics

	R^2	SEE	RSS	Chow	DW	LM	K-S	ARCH
China	0.87	0.009	0.026	4.40 (.00)	2.19	44.51 (.00)	0.2137***	11.05 (.00)
Hong Kong	0.83	0.007	0.038	5.70 (.00)	1.82	04.80 (.57)	0.0525	65.86 (.00)
Indonesia	0.90	0.008	0.053	2.12 (.03)	2.56	80.34 (.00)	0.1948***	3.49 (.06)
Korea	0.63	0.013	0.107	2.28 (.00)	2.12	18.33 (.00)	0.0590*	0.008 (.93)
Malaysia	0.85	0.006	0.024	2.37 (.01)	1.99	8.32 (.22)	0.0345	30.33 (.00)
Philippines	0.73	0.014	0.142	2.47 (.00)	2.37	40.28 (.00)	0.131***	40.72 (.00)
Singapore	0.88	0.005	0.019	4.19 (.00)	1.99	9.04 (.17)	0.0521	55.63 (.00)
Taiwan	0.71	0.012	0.036	5.81 (.00)	2.14	18.67 (.01)	0.0876**	2.62 (.11)
Thailand	0.73	0.011	0.078	1.07 (.38)	2.19	26.21 (.00)	0.0889***	68.91 (.00)

Notes. Variables are as defined in Table 1. See Notes to Table 4 for other explanatory details.

Table 6
Empirical Results: Second Half of Sample Period, June 1990 – December 2003

	Constant	Dummies	S_i	S_i	S^{DM}_{SR}	S^{DM}_{LR}	S^{YEN}_{SR}	S^{YEN}_{LR}	S^{UK}_{SR}	S^{UK}_{LR}	S^{US}_{SR}	S^{US}_{LR}
China		1							0.434		0.568	0.914
									(5.11)		(9.67)	(14.06)
Hong Kong		1	-0.678[1]	-0.412[2]							0.973	0.992
			(8.64)	(4.38)							(127.43)	(199.59)
Indonesia		3					0.347				0.584	0.584
							(2.65)				(5.28)	(5.28)
Korea		3	0.137[1]			0.312	0.208	0.242	0.146		0.719	0.951
			(2.03)			(3.06)	(5.56)	(2.16)	(2.10)		(13.53)	(19.41)
Malaysia		7	0.064[3]			0.168	0.171		0.183		0.772	0.824
			(2.23)			(2.43)	(3.23)		(3.17)		(16.06)	(11.94)
Philippines	0.001	1	-0.180[1]	0.152[3]			0.127	0.123			0.893	0.904
	(2.33)		(2.37)	(3.42)			(4.01)	(3.64)			(23.93)	(13.18)
Singapore		1			0.184		0.164	0.164			0.674	0.639
					(4.38)		(8.72)	(8.95)			(30.70)	(29.11)
Taiwan		1	0.119[2]	0.039[3]	0.152	0.180	0.115	0.137			0.822	0.763
			(2.74)	(2.03)	(2.72)	(2.64)	(4.36)	(4.35)			(33.32)	(17.02)
Thailand		3			0.277		0.191				0.700	0.700
					(3.30)		(4.57)				(18.68)	(18.68)

Equation Diagnostics

	R^2	SEE	RSS	Chow	DW	K-S	LM	ARCH
China	0.81	0.010	0.071	0.88 (.49)	2.59	0.2058***	121.84 (.00)	12.91 (.00)
Hong Kong	0.98	0.002	0.004	3.89 (.00)	2.04	0.0678**	33.50 (.00)	82.85 (.00)
Indonesia	0.57	0.029	0.609	1.71 (.12)	1.97	0.0977***	39.19 (.00)	30.87 (.00)
Korea	0.69	0.014	0.135	3.62 (.00)	1.96	0.0562*	14.14 (.03)	98.09 (.00)
Malaysia	0.79	0.011	0.089	.74 (.71)	2.09	0.0824***	30.24 (.00)	13.04 (.00)
Philippines	0.58	0.014	0.133	1.12 (.35)	1.91	0.0556*	22.02 (.00)	58.25 (.00)
Singapore	0.81	0.006	0.028	1.42 (.21)	2.16	0.0868***	23.84 (.00)	85.95 (.00)
Taiwan	0.81	0.007	0.035	1.02 (.42)	2.33	0.139	33.41 (.00)	42.11 (.00)
Thailand	0.58	0.013	0.114	2.81 (.01)	1.84	0.0861***	40.91 (.00)	30.55 (.00)

Notes. Variables are as defined in Table 1. See Notes to Table 4 for other explanatory details.