IS AUSTRALASIA, NORTH AND SOUTHEAST ASIA BECOMING A YEN BLOCK?

Colm Kearney,
Professor of International Business,
School of Business Studies,
Trinity College Dublin.

and

Cal Muckley,
Research Fellow,
School of Business Studies,
Trinity College Dublin.

Contact details:
(Tel): 353-1-6082688
Email: colm.kearney@tcd.ie

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Abstract

We use up to 24 years of weekly data on 11 bilateral yen exchange rates to examine the evidence of an emerging yen bloc in Australasia, North and Southeast Asia. The logarithmic first differences of these exchange rates are modelled in response to variations in their US dollar, German marc, and UK pound counterparts using a general-to-specific dynamic Newey-West estimation strategy. We find strong evidence contrary to the notion of a *de facto* yen bloc. Each 1 percent rise in the US dollar (German marc, UK pound) effective exchange rate causes a mean 1.27 (1.8, 0.18) percent appreciation in the regional currencies *vis-à-vis* the yen. Moreover we find convincing evidence inconsistent with the postulate of an emerging yen bloc in these multipliers over time.

Key Words

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

JEL Classification Codes

110203, 110211

1. Introduction

The economies of North and Southeast Asia progressed markedly over the most recent three decades of the last century. China, Indonesia, Japan, Malaysia and Thailand grew at annual average rates of between 3 and 5 percent, while Hong Kong SAR, Singapore, South Korea and Taiwan each achieved annual average growth rates in excess of 6 percent. This remarkable performance over a sustained period without significant interruption attracted attention from economists and policymakers. The fastest growing countries in the region became known as the 'Asian tigers'. They delivered unprecedented rises in income per head with virtually continual full employment. They spawned a renewed interest in growth economics throughout the world as analysts endeavoured to understand the underlying principles behind 'the Asian growth model' with a view to emulating it in their own economies. It is not our purpose here to summarize the latest thinking on the 'Asian growth model' (see for example, the World Bank (1993), Krugman (1994) and Sarel (1996)). Suffice is to say that with the benefit of hindsight gained from witnessing the collapse in performance of these economies following the Asian crisis during the late 1990s, many questions have since been raised about the appropriateness of the exchange rate systems operated by these countries, and about whether some form of coordinated regional exchange rate system could have prevented or mitigated its ill-effects.

A voluminous literature has sprung up which attempts to explain what caused the Asian financial crisis, and there are two broad explanations (see for example, Johnson (1998), Krugman (1998) and Hutson and Kearney (1999)). The first asserts that it resulted mainly from international financial market failures such as informational asymmetries and moral hazard. The second points to fundamental weaknesses in the Asian economies themselves, including crony capitalism, poor corporate governance, inadequate financial regulation, and inappropriate exchange rate policies. It is likely that the truth of the matter embodies some degree of each explanation. The region's foreign exchange markets, however, were central to the instigation and contagion of the crisis. When it commenced in May 1997 with the first speculative attack on the Thai baht, the crisis spread throughout the region with alarming speed. The

Philippine peso was attacked in June and the Indonesian rupiah along with the Hong Kong SAR dollar and the Malaysian ringgitt were attacked in July of the same year. The foreign exchange market turmoil spread to the stock markets in these countries and continued throughout the following three months. By October 1997, the IMF had been called in by Indonesia, the Philippines and Thailand, and the contagion reached Hong Kong SAR where the *Hang Seng* stock index lost a third of its value in 7 days. In November, Japan and South Korea' s currency and stock markets came under attack, and the IMF was called in by South Korea in December.

The devastating impact of the crisis on the US dollar and Japanese yen exchange rates of the worst affected countries during 1997 and 1998 is presented in Table 1. Looking first at the top part of the Table, the countries can be grouped into four sets. The Indonesian rupiah stands alone as having depreciated against the US dollar by over 330 percent by the end of 1998. The Malaysian ringgitt, the Philippine peso, the South Korean won and the Thai baht depreciated by an average of 65 percent, the Japanese yen, the Singapore dollar and the Taiwan dollar depreciated by an average of 20 percent, and the Chinese yuan along with the Hong Kong SAR dollar remained steady. The bottom part of the Table shows, as expected, that the depreciations against the Japanese yen were less than against the dollar. As before, the Indonesian rupiah stands alone as having depreciated against the Japanese yen by over 260 percent by the end of 1998. The Malaysian ringgitt, the Philippine peso, the South Korean won and the Thai baht depreciated by an average of 38 percent, the Singapore dollar and the Taiwan dollar remained steady on average, and the Chinese yuan along with the Hong Kong SAR dollar appreciated by an average of 17 percent.

The real economies of Hong Kong SAR, Indonesia, Malaysia, the Philippines, Singapore, South Korea and Thailand collectively collapsed from an average growth rate of 6.8 percent in 1996 to a contraction of 4.4 percent in 1998 (see IMF (1998)).
The financial turmoil that was initially confined to Asia spread across the world' s financial markets in late 1997. The United States *Dow Jones* index suffered a 7 percent decline on 27 October 1997 that forced the suspension of trading. In Russia, the authorities implemented a unilateral default on domestic debt, devalued the rouble and imposed severe capital controls. The Malaysian authorities also imposed capital

controls following a series of public statements by Prime Minister Mahathir condemning the role of speculators in generating the financial turmoil. These events caused international investors and lenders to become increasingly risk averse. They reassessed other potentially vulnerable emerging markets and turned their attention to Brazil and Latin America more generally. The Russian default along with its spillover to Latin America caused large losses for some western banks and leveraged hedge funds. The highly publicized Long Term Capital Management Ltd episode showed how Western financial institutions could be vulnerable to global turmoil, and it also drew attention to analysts' lack of knowledge about the extent of derivative risk that exists in today' s domestic and global financial markets.

In the wake of the Asian financial crisis, and spurred on the by the success of the European monetary system (EMS) prior to the introduction of the Euro in January 2001, 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 and 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 Australasia, North and Southeast Asia. In examining this question, we employ a large dataset of regional currencies, with almost 24 years of weekly data (from November 1976 to December 2000) on 12 currencies including the Australian dollar, the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Japanese yen, the Korean wan, the Malaysian ringgitt, the New Zealand dollar, 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*, the regional exchange rates are expressed as bilateral yen rates, and they are modelled in a dynamic fashion in relation to variations in the UK pound sterling, the German mark and the US dollar 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)). *Second*, 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 heteroscedastic error structures. Our empirical estimates are tested for this, and heteroscedastic-consistent significance tests are applied to our coefficient estimates in order to ensure valid statistical inference. Finally we consider the evolution of these long run multipliers solved over a 3-year moving window. This

final analysis sheds light on both the stability and trajectory of these multipliers through time.

The paper is organised as follows. Section 2 reviews previous related research on exchange rate determination in North and Southeast Asia. It also inquires into the extent and nature of trade integration in the region. 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, there is no evidence of an emerging yen block in Australasia, North and Southeast Asia.

2. Previous Related Research

The issue of what constitutes a yen block has received three main interpretations, ranging from the general notion of regional interdependence in trade and investment flows, to the more specific idea of the yen acting as an important regional invoicing currency for trade and financial transactions, to the stricter definition whereby regional exchange rates may be determined largely by movements in the yen. This latter view is the focus of this paper. It incorporates the possibility of the emergence of a regional exchange rate mechanism with the yen as its central currency, in an analogous fashion to the role played by the German mark in the EMS. This analogy is worthy of investigation because the EMS has been very successful in reducing intra-European exchange rate volatility. The likelihood of the emergence of a yen block in the region, however, is dependent upon a number of factors. The most important of these include: *first*, the growth in regional trade and investment linkages; *second*, the extent to which the region' s economic and financial structure is tending towards an optimum currency area; *third*, the degree of confidence in the value of the yen due to Japan's macroeconomic performance and political stability; *fourth*, low and stable inflation rates in Japan; *fifth*, a well established set of active primary and secondary financial markets in which a wide array of yen-denominated instruments can be traded at low transaction costs without excessive regulation; and *finally*, a willingness by the Japanese authorities to allow and encourage the yen to become more globalised.

In evaluating these factors, the regional and global importance of the yen together with Japan's historically low inflation is accepted internationally, although the economy's recent sluggish performance together with its vulnerable banking sector and enhanced political uncertainty during the past decade has curtailed the growth of its influence. The failure by the Japanese authorities to unwind historically excessive regulation has impeded the development of yen-denominated financial instruments and markets, and this has also impeded the growth of the yen 's regional and global influence. The Japanese authorities have been historically reluctant to internationalise the yen, but Das (1993) describes how this has changed over time. Although the yen does not perform a dominant role in the world or in the Asia-Pacific region as an invoicing currency, this is slowly changing. Japan itself invoices about one third of its exports and one sixth of its imports in US dollars, due largely to the fact that the US is a major market for Japanese exports, and Japanese firms invoice in foreign currency as a natural hedge against the consequences of trend appreciation. The yen is, on most measures, the third most important currency in the world behind the US dollar and the German mark. For example, approximately 50 percent of international bank assets are denominated in US dollars, with the corresponding figures for the mark and the yen being 14 percent and 12 percent respectively. The US dollar accounts for approximately 60 percent of the world's reserve currencies, with the corresponding figures for the mark and the yen being 19 percent and 8 percent respectively. The BIS (1989) reports that London, New York and Tokyo account for, respectively, 29 percent, 20 percent and 18 percent of the global net turnover of foreign exchange. The yen is therefore well placed to play a more significant regional role if the Japanese government is willing to allow it to happen.

Any discussion about the emergence of the yen as a dominant currency in the region should note that the US dollar continues to occupy its pivotal roles as the dominant international unit of account, medium of exchange and store of value. It remains the most internationally used currency, central banks still hold the largest proportion of their official international reserves in US dollar denominated assets, and they continue to use the US dollar as the chief vehicle of their exchange rate intervention policies. Indeed, many countries in the region continue to manage their exchange rates by

focusing on the US dollar value of their currencies to a greater or lesser extent. Although this constitutes strong evidence against the importance of the yen as a dominant regional currency, it does not imply that the influence of the yen is not rising over time in a manner consistent with an emerging yen block. The research reported here examines the extent to which this is occurring.

Research on the emergence of an Asian trade and investment block which necessitates a degree of interdependence and cooperation between member countries has been reported by, *inter alia*, Frankel (1991a), Meltzer (1991), Huang and Tu (1994) and Bowles and MacLean (1996). Frankel (1991a) reports an increasing amount of intra-Asian trade and investment, but his study cannot determine if this is at the expense of inter-Asian trade, and he finds no evidence that Japan has established a regional trading block to date. It is well documented, however, that many Asian trade agreements are more outwardly oriented than those of NAFTA and the EU, and such regional interdependence is still in its early stages with implicit rather than explicitly stated agreements. By contrast, Bowles and MacLean (1996) report on the foreign direct investment (FDI) strategies that have been pursued by East Asia, and they conclude that a process of regional integration is firmly established with Japan as a major source of FDI to most countries in the region.

The degree of regional trade integration amongst the countries included in this study over the past two decades is presented in Table 2, 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 'AA' stands for 'Australasia, North and Southeast Asia minus Japan', ie, it includes Australia, China, Hong Kong, Indonesia, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand. 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 'AA' are totals, and the row figures for 'AA' 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.

First, looking down the column labelled 'AA' in Panel B of the Table, we can see that 7 countries are *highly* integrated within the region. Using the data for 2000, between a half and a third of all their trade is with 'AA' countries – ie countries in the region excluding Japan. These are Hong Kong (51.6 percent), Singapore (40 percent), Malaysia (38.1 percent), New Zealand (37.5 percent), Japan (36.1 percent), Thailand (36 percent) and Indonesia (34.7 percent). The remaining 4 countries are *moderately* integrated within the region. Using the data for 2000, between a quarter and a third of all their trade is with 'AA' countries. These are Australia (31.8 percent), China (29.4 percent), the Philippines (27.3 percent) and Korea (26.5 percent).

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 'AA' column in Panel B of the Table), the degree of trade integration is almost 50 percent or higher in 8 of the region's countries. These are, in order of integration, Hong Kong (60.5 percent), Indonesia (55.4 percent), Thailand (55.1 percent), Malaysia (54.8 percent), Singapore (52.3 percent), New Zealand (49.7 percent), China (47.7 percent), and Australia (48.1 percent). The average figure for these 8 countries is 52.95 percent. The remaining two countries (excluding Japan) that are less integrated in the region are the Philippines (43.1 percent) and Korea (42.2 percent), with an average figure of 42.7 percent. Interestingly, these latter two countries (with the exception of Japan) are the most integrated with the United States, with which they conduct over a fifth of their total trade.

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 while the ordering has remained somewhat similar. When trade with Japan is included, the same 8 countries mentioned in the previous point which together

averaged 52.95 percent of their trade within the region in 2000, averaged 47.9 percent in 1981. It follows that trade integration amongst these countries within the region has risen by 10 percent over the last two decades of the 1900s. The remaining two countries, the Philippines (37.6 percent) and Korea (26.5 percent), averaged 32 percent of their trade within the region in 1981, so they have increased their degree of regional integration by 33 percent over the period, and are therefore 'catching up' on their neighbours. They are doing this largely at the expense of their trade with the United States, which has declined on average by 16 percent between 1981 and 2000.

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 quarter (25.6 percent) to over a third (36.1 percent) during the period. It has done this while also increasing its integration with the United States by almost 16 percent, increasing its integration with Germany from a low base, and maintaining its low degree of integration with the United Kingdom. By contrast, almost all countries in the region (the exception being Korea) have reduced their proportions of trade with Japan - by more than 30 percent, from an average of 20 percent to 14 percent. Although the importance of the Japanese economy to the other countries in the region has declined, it remains a very important trading partner nonetheless. Looking across the rows of Panel B of the Table shows that the most important trade dependencies in the region are Hong Kong on China (39 percent), New Zealand on Australia (20.8 percent), Indonesia on Japan (20.7 percent), Thailand on Japan (19.1 percent), China on Japan (18.3 percent), Singapore on Malaysia (17.6 percent), Malaysia on Japan (16.7 percent), Malaysia on Singapore (16.5 percent), Australia on Japan (16.3 percent), the Philippines on Japan (15.8 percent) and Korea on Japan (15.7 percent). Although there are some obvious dependencies that do not include Japan, it remains by far the most dominant country in the region. Excluding those already mentioned, the other 98 dependencies in the top right left matrix of Panel B of the Table average 3.4 percent.

Fifth, trade between the region (excluding Japan) and Germany, the UK and the US has remained broadly stable over time, from 3.7 percent, 3.6 percent and 17.4 percent respectively in 1981 to 3.1 percent, 2.8 percent and 16.9 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 most countries in the region (Australia, China, Indonesia, Malaysia, the Philippines, and Thailand) are heavily dependent on the Japanese economy. Although 3 countries in the region are less directly dependent on the Japanese economy (Hong Kong, New Zealand and Singapore), they are closely integrated with other countries that are themselves heavily dependent on Japan. For example, although Hong Kong conducts less than 9 percent of its total trade with Japan, it conducts almost 40 percent of its trade with China which in turn conducts over 18 percent of its trade with Japan. Similar relationships exist between New Zealand, Australia and Japan, and between Singapore, Malaysia and Japan. The trade data also reveals that the United States economy is the next most important to the region, and that Germany and the United Kingdom are of lesser importance to the economic welfare of Australasia, North and Southeast Asia.

It is not surprising that the US dollar is the most important currency outside the region for its member countries, and that as already mentioned, many countries in the region have therefore sought to manage their exchange rate largely in relation to the US dollar in addition to the Japanese yen. As the Asian crisis revealed, however, this is not necessarily an optimum policy, particularly when a strongly appreciating dollar induces the countries that are keen to follow closely end up appreciating their currencies sharply against the yen. Although this assists their trade with the United States, it renders them increasingly uncompetitive in their trade with Japan.

This naturally leads us to consider the role of exchange rates in regional trading blocks, and which of the world's leading currencies might be best suited to the trading patterns observed in Australia, North and Southeast Asia. Frankel and Wei (1993) have examined the behaviour of exchange rates within the world's major trading blocks using monthly data from 1980 to 1990. They find that exchange rate volatility (which they measure as the standard deviation of the first difference of the logarithmic changes) tends to be lower within groups than across groups, which provides some

evidence in favour of the existence of currency blocks. They report that the EC tends to have the lowest level of intra-regional exchange rate volatility and that intra-regional exchange rate volatility is higher when East Asia is considered separately from APEC. Although this evidence supports the regional dominance of the US dollar rather than the yen, it is not conclusive because both the USA and Japan are APEC members while only Japan is part of East Asia.

Engel and Rogers (1994) have examined stock price correlations between a number of country groups in the Asia and elsewhere, including Japan-Korea-Taiwan, Malaysia-Singapore-Thailand and Britain-France-Germany-Italy. The idea behind the tests is that economic and financial shocks that are common to the country groupings should be reflected in stock price comovements. They find that the Asian country groups experience common shocks to their economies to a greater extent than the European group, and they report that stock price correlations for the groups are, respectively, 0.83, 0.67 and 0.39. This constitutes evidence in support of a possible optimum currency area, particularly if labour and capital become more internationally mobile throughout the region.

The relative dominance of the US and Japan in determining Asian interest rates has been researched by, *inter alia*, Frankel (1991a), Chinn and Frankel (1994, 1995) and Zhou (1996). Using a series of OLS regressions, Frankel (1991a) relates Asia-Pacific (Australia, Canada, Hong Kong, Indonesia, Korea, Malaysia, New Zealand, Singapore, Taiwan and Thailand) interest rates to their US and Japanese counterparts using quarterly data over the period from 1982 to 1992. He finds a dominant role for US interest rates in Singapore and Taiwan, a dominant role for Japanese rates in Australia and Hong Kong, and strong roles for both the US and Japan in Korea. He also reports evidence that US interest rates are gaining in influence at the expense of Japanese rates in Australia, Canada and New Zealand, and *vice versa* for Indonesia, Hong Kong, Korea, Singapore and Malaysia. The estimated models are autocorrelated for all countries which indicates dynamic misspecification, and Frankel acknowledges that multicollinearity between the Japanese and US interest rates is also problematical insofar as it makes it difficult to differentiate between the effects of the two financial centres. In a development of this research, Chinn and Frankel (1994)

use quarterly data from 1982 to 1992 and employ recursive and rolling regression methods to produce similar results for nominal interest rates, while Chinn and Frankel (1995) do similarly for real interest rates. These researchers report that the US influence on Asia-Pacific interest rates increased at the expense of the Japanese influence in Australia, Canada and New Zealand, but that the reverse occurred in Indonesia and Korea, and less so in Hong Kong, Malaysia and Singapore. The covered and uncovered interest rate results showed a declining US influence in Australia and Canada and an increasing influence in Korea. Japan demonstrated an increasing influence on the determination of interest rates in all Asia-Pacific countries studied except Canada and Taiwan. In their analysis of real interest rates, Chinn and Frankel (1995) use multivariate cointegration tests to check for the presence of common stochastic trends in the region. They find that real interest rates in Australia, Canada, Hong Kong, Indonesia, Singapore and Taiwan are cointegrated with US rates, and that Japanese rates are cointegrated with those in Hong Kong, Korea, Malaysia, Taiwan and perhaps Indonesia and Thailand. Their results suggest the joint influence of Japan and the US in Hong Kong, Malaysia and Taiwan, the US alone influences Singapore, and Japan alone influences Korea and perhaps Indonesia and Thailand. Zhou (1996) has more recently examined the relative dominance of the US and Japan in determining Asia-Pacific interest rates, using quarterly data over the period 1973 to 1994. Using the cointegration methodology in combination with Granger causality testing, he concludes that although Japanese interest rates are not Granger-caused by any other rates, and although both the US and Japanese rates have regional influence, the US has greater influence than Japan.

Previous research on Asian exchange rates includes the work of, *inter alia*, Frankel (1991b), Frankel and Wei (1993), Aggarwal and Mougoue (1993, 1995). Following his work on interest-rate influences, Frankel (1991b) 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 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. Although this study provides good insight into the regional influences of the world's major currencies, no tests are reported for the existence of heteroscedastic errors. Such errors would corrupt the regression standard errors, and although the estimated coefficients would still be unbiased and consistent, the significance tests and confidence intervals would be unreliable which could lead to incorrect inference.

Frankel and Wei (1993) 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. In contrast to previous research, this paper reported heteroscedastic-consistent standard errors. Another approach to the possibility of a yen block is to examine whether a long run relationship exists between currencies. Using daily data from 1982 to 1990, Aggarwal and Mougoue (1995) found that the yen, the Hong Kong dollar, the Malaysian ringgit, the Singapore dollar and the Phillipines Peso are cointegrated, 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. Although this does not imply the existence of a regional yen block, it constitutes evidence consistent with it.

In summary, therefore, previous related research points to significant and strengthening trade, investment and financial linkages throughout North and Southeast Asia. The yen is not as strong as the US dollar in terms of its dominance in regional financial markets, but it may be gaining influence over time. The prior studies have tended to use either monthly or quarterly data, and they have used different numeraires

to measure the exchange rates. In the next section, we outline our approach to testing for a yen block using weekly data.

3. Model Specification, Hypothesis Tests and Data

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

$$S^{i}{}_{t} = \alpha_0 + \sum_{j=1}^{N} \alpha_j S^{i}{}_{t-j} + \sum_{j=0}^{N} \beta_j S^{USE}{}_{t-j} + \sum_{j=0}^{N} \delta_j S^{DME}{}_{t-j} + \sum_{j=0}^{N} \gamma_j S^{STE}{}_{t-j}$$

$$+ D_t^{Plaza} + D_t^{Louvre} + D_{j,t}^{i} + \varepsilon_t^{i} \qquad (1)$$

Here, S^i denotes the log change in the bilateral yen exchange rates of the 11 currencies included in the sample, S^{USE} denotes the log change in the US effective exchange rate index, S^{DME} denotes the log change in the German mark effective exchange rate, S^{STE} 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 February and March 1985 as a result of the intervention by the G5 central banks, D^{Louvre} denotes the louvre Accord of March 1987, $D^{i}_{j,t}$ 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.

Table 3 provides a detailed description of all variables used in the econometric modelling. The bilateral yen exchange rates for the Australian dollar, the Hong Kong dollar, Chinese yuan, the Indonesian rupiah, the Malaysian ringgitt, the New Zealand dollar, the Philippino peso, the Singaporen 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 (*USE*), the deutschemark (*DME*) and the UK pound sterling (*STE*) 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 overall data period is from 19 November 1976 to 29 December 2000, although the starting periods vary somewhat depending upon data availability. The details of the individual country dummy variables are provided in Table 4. Figure 1 plots the 11 bilateral yen exchange rates. It clearly shows the devastating effects of the Asian financial crisis on the Indonesian rupiah, as mentioned previously in the discussion of Table 1. Figure 2 plots the effective exchange rate indices, and shows that while the Deutschemark tended to appreciate from the mid-1970s until the mid-1990s, the pound sterling tended to follow the US dollar, particularly during and since the mid-1980s.

Since international financial theory suggests no reason for nominal exchange rates to have a deterministic component, it is appropriate to treat them as difference stationary. The model is therefore 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 5 presents these 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 Mizon (1995)). 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 the 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.

The resulting dynamic models are solved to obtain both the short run and the long run multipliers for the effects of variations in the US dollar, the German mark and the UK pound sterling 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.

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

These *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 US dollar, the German mark and the UK pound sterling effective exchange rates.

Hypothesis Tests

We test six hypotheses about the coefficients of the model in equation (1).

Hypothesis 1:

H_0^1: $\beta_j = 0$ for all $j = 0 \ldots N$, which implies that changes in the value of the US dollar do not impact significantly upon the yen bilateral exchange rates;

H_1^1: $\beta_j \neq 0$ for at least some $j = 0 \ldots N$, which implies that changes in the value of the US dollar do impact significantly upon the yen bilateral exchange rates.

Hypothesis 2:

H_0^2: $\delta_j = 0$ for all $j = 0 \ldots N$, which implies that changes in the value of the German mark do not impact significantly upon the yen bilateral exchange rates;

H_1^2: $\delta_j \neq 0$ for at least some $j = 0 \ldots N$, which implies that changes in the value of the German mark do impact significantly upon the yen bilateral exchange rates.

Hypothesis 3:

H_0^2: $\gamma_j = 0$ for all $j = 0 \ldots N$, which implies that changes in the value of the pound sterling do not impact significantly upon the yen bilateral exchange rates;

H_1^2: $\gamma_j \neq 0$ for at least some $j = 0 \ldots N$, which implies that changes in the value of the pound sterling do impact significantly upon the yen bilateral exchange rates.

Hypothesis 4:

H_0^4: The β_j which are estimated from the second sub-period are less than those which are estimated from the first sub-period, which implies that changes in the value of the US dollar are impacting less over time on the yen bilateral exchange rates;

H_1^4: The β_j which are estimated from the second sub-period are equal to or greater than those estimated from the first sub-period, which implies that changes in the value of the US dollar are impacting the same or greater over time on the yen bilateral exchange rates.

Hypothesis 5:

H_0^5: The δ_j which are estimated from the second sub-period are less than those which are estimated from the first sub-period, which implies that changes in the value of the German mark are impacting less over time on the yen bilateral exchange rates;

H_1^5: The δ_j which are estimated from the second sub-period are equal to or greater than those estimated from the first sub-period, which implies that changes in the value of the German mark are impacting the same or greater over time on the yen bilateral exchange rates.

Hypothesis 6:

H_0^5: The γ_j which are estimated from the second sub-period are less than those which are estimated from the first sub-period, which implies that changes in the value of the pound sterling are impacting less over time on the yen bilateral exchange rates;

H_1^5: The γ_j which are estimated from the second sub-period are equal to or greater than those estimated from the first sub-period, which implies that changes in the value of the pound sterling are impacting the same or greater over time on the yen bilateral exchange rates.

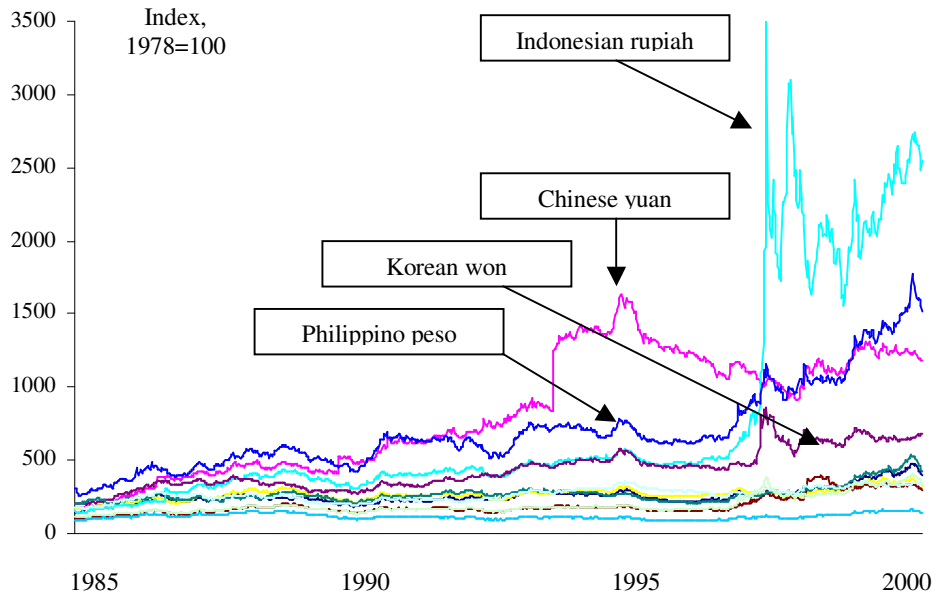
These hypotheses are sequenced logically in order to examine the extent to which there exists evidence of an emerging yen block in Australasia, North and Southeast Asia. If H_0^1 is upheld, it implies that variations in the US dollar do not impact upon the regional bilateral yen exchange rates. This constitutes evidence in favour of a yen block, because it implies that the regional currencies tend to follow the yen. The same applies to H_0^2 and H_0^3 which concerns the response of the yen bilateral rates to variations in the German mark and the pound sterling 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. If these 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.

Before considering the results obtained from the econometric modelling, it is instructive to see how the correlations between the yen bilateral exchange rates have behaved over time. Table 6 presents the correlations for the first half of the sample in Panel A, and for the whole sample in Panel B. At the bottom of each Panel, the mean correlation of each country's bilateral yen exchange rate with the other countries is provided. Overall, the average correlation coefficient for the first half of the sample is 0.40, and this rises to 0.45 during the full sample period. This indicates some tendency for the yen bilateral rates to move closer together over time. Within this, however, a number of observations also suggest themselves. In the first half of the sample, 6 countries (Hong Kong, Malaysia, the Philippines, Singapore, Taiwan and Thailand) have mean yen bilateral exchange rate correlations with all the other countries greater than 0.40 and 1 country (Singapore) has a mean correlation greater than 0.50 The countries with the lowest correlations are China, Indonesia and Korea, which together have an average correlation of 0.26. In the full sample, 8 countries

(Australia, Hong Kong, Malaysia, New Zealand, the Philippines, Singapore Taiwan and Thailand) have mean yen bilateral exchange rate correlations with all the other countries greater than 0.40 and 4 countries (Hong Kong, Malaysia, Singapore and Thailand) have mean correlations greater than 0.50. The countries with the lowest correlations in the full sample are the same as those for the first period, namely, China, Indonesia and Korea, with an average correlation of 0.33. These three countries seem to operate their exchange rates less in relation to the other countries in an overall sense, and the mean correlations for two of them (China and Indonesia) have declined slightly. Some country pairs (Hong Kong – Malaysia, Korea – Taiwan and Malaysia – Singapore) have experienced significant declines in their yen exchange rate correlations, and these probably reflect tendencies towards greater dispersion in their trading relations over time. By contrast, the mean correlations for all other countries have increased over time. Overall, therefore, the correlation analysis suggests that the yen bilateral exchange rates in the region are tending to converge somewhat over time, with a 'core' of more closely related countries including Hong Kong, Malaysia, Singapore and Thailand, followed by Taiwan, Australia and New Zealand. This finding is not surprising, and it suggests interest in the econometric modelling exercise to determine if it is consistent with any evidence of an emerging yen block.

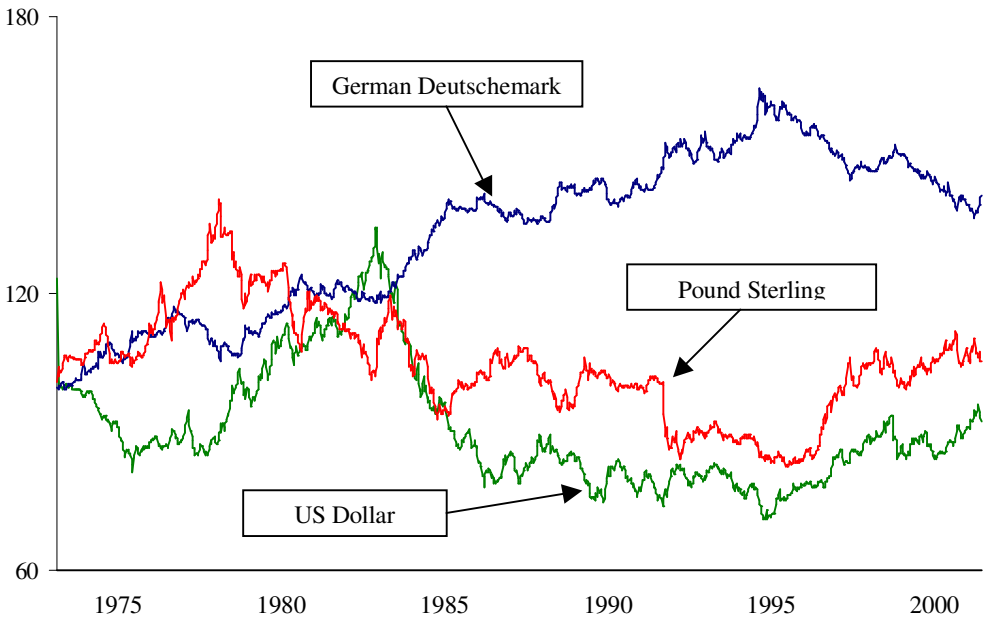
Figure 1

Bilateral Yen Exchange Rates of 11 Currencies
Weekly, January 1985 - December 2001



Notes. Source is *Datastream International Ltd.* The exchange rates are units of domestic currency per 1 yen, re-based to 100 at the average rate for 1973. The bilateral yen rates included in the Figure are the Australian dollar, the Chinese yuan, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the New Zealand dollar, the Philippino peso, the Singaporen dollar, the Taiwan dollar and the Thai bath. For currencies not available at January 1978, the re-basing is done at the average of the available rates during the first month of availability.

Figure 2
Effective Exchange Rates, January 1973 – December 2001.
The US Dollar, the German Deutschemark and the Pound Sterling



Notes. Source is *Datastream International Ltd.* The exchange rates are Bank of England effective exchange rate indices, re-based to 100 at the average rate for 1973.

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 and over-lapping moving average long run multipliers in order to examine whether the influence of the yen in the region is growing over time. The full sample runs from November 1976 to December 2000. Data availability, however, has constrained the start date for 2 exchange rates; the Taiwan dollar starts on 11 January 1985, and the Chinese yuan starts on 18 January 1985. Sub-period 1 runs from 19 November 1976 to 6 January 1989 (with the later starts just mentioned), and sub-period 2 runs from 13 January 1989 to 29 December 2000. We derive the parsimonious models for each sub-period as described in the previous section. Table 7 presents the results for the full sample period, and Tables 8 and 9 do likewise for the earlier and later sub-periods respectively. The top part of the Tables present the coefficient estimates (with their heteroscedastic-consistent t-statistics in brackets), and the bottom part of the Tables present the equation diagnostics together with the long run multipliers (*LRM*). The diagnostics include the R^2 statistics, the standard errors of the estimates (*SEE*), the residual sums of squares (*RSS*), the Durbin Watson (*DW*) statistics which test for first order autocorrelation, the *LM* statistic tests for higher order autocorrelation, and 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 *ARCH* test for heteroscedasticity, and the Chow test for structural stability.

Looking firstly at the results for the full sample period in Table 7, 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 8 of the 11 countries, and they average over .55. The standard errors of the estimates (*SEE*) are respectable relative to the residual sums of squares (*RSS*). The *DW* statistics, the *LM* statistics and the *KS* 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, which is anticipated in our use heteroscedastic consistent t-statistics. The Chow statistics indicate the presence of structural breaks in some models, which contributes to our motivation to re-estimate the models in the two sub-periods (Tables 8 & 9) and to solve for moving average multipliers across overlapping samples (Figure 3).

Looking next at the individual coefficient estimates, notwithstanding the Taiwanese model, the constant terms in each model are positively signed and statistically significant at the 5 percent level. This illustrates the tendency for the yen to appreciate *vis-a-vis* each of the currencies over the full sample period. Interestingly, the Plaza and Louvre Accord dummies are significant in only 2 countries, China and Taiwan, and they indicate that the local currency depreciated vis-à-vis the yen on both occasions. The statistically significant lagged dependant coefficients in each model are all negatively signed at the first lag which contributes stability, but the presence of up to two lags in some countries indicates more complex adjustment dynamics in response to variations in the US dollar, the German mark and the pound sterling.

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 negatively signed and statistically significant at the 5 percent level. The mean of the short run coefficients is -1.09, and they vary from a low of –0.775 for the Indonesian rupiah to a high of -1.423 for the Hong Kong dollar. The long run multipliers are shown at the bottom of the Table in the third column from the right. The mean of the long run multipliers is –1.27, and they vary from a low of –0.83 for the New Zealand dollar to a high of –1.53 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 just less than 1.3 percent. This finding implies rejection of H_0^1 and acceptance of H_1^1, and it is 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 that have been in place for much of the time. Interestingly, however, the range of responses is quite large, with the appreciation of

the Chinese yuan *vis-à-vis* the yen being almost twice that of the New Zealand dollar. This, of course, implies that variations in the US dollar have significant effects on the cross-bilateral yen exchange rates in the region.

Looking next at the response of the regional bilateral yen rates to variations in the German mark effective exchange rate, Table 7 shows that all of the short run coefficients are negatively signed and statistically significant at the 5 percent level. The mean of these short run coefficients is –1.88, and they vary from a low of –1.513 (for the Taiwan dollar) to a high of -2.234 (for the Thai baht). The long run multipliers, which are shown at the bottom of the Table in the furthest right hand column, are all negatively signed with a mean of –1.80, from a low of –1.25 (for the Taiwan dollar) to a high of –2.14 (for the Singapore dollar). This indicates that for each 1 percent appreciation in the German mark, the mean equilibrium response of the regional bilateral yen exchange rates is an appreciation *vis-à-vis* the yen of 1.8 percent. This finding implies rejection of H_0^2 and acceptance of H_1^2.

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 deutchemark. All but two (Korea and China) of the short run coefficients are negatively signed and all printed coefficients are statistically significant at the 5 percent level. The mean of the short run coefficients is –0.065. All but three (China, Korea and Taiwan) of the long run multipliers are negatively signed with a mean of –0.18. These results indicate that although H_0^3 is rejected and H_1^3 is accepted, the influence of the pound sterling in the region is significantly less than that for the US dollar or the deutchemark.

Although the full sample period results reject the existence of a regional yen block, it is nevertheless interesting to examine the results for the sub-periods, which are presented in tables 8 and 9 in order to see whether there is evidence of change over time. 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. 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 negatively signed and statistically significant at the 5 percent level in each case. The mean of the short run coefficients is –0.909 during the first sub-period, varying from a low of –0.569 (for the Chinese yuan) to a high of -1.281 (for the Hong Kong dollar). This rises to a mean of -1.266 during the later sub-period, varying from a low of –0.951 (for the Indonesian rupiah) to a high of -1.473 (for the Taiwan Dollar). It is noticeable that while the average of the estimated short run coefficients on the impact of the US dollar on the regional yen bilateral rates rises by 40 percent between the sub-periods, the short run coefficients also rise for each individual exchange rate. The mean of the long run multipliers for variations in the US dollar is –1.27 in the first period and –1.18 in the second period. This implies a mean fall in the US long run multiplier of some 7%. Given the volatility inherent in the USD long run multiplier sequence (see Figure 3), it is felt that this difference is not in a qualitative sense significant and so we reject H_0^4 and accept H_1^4 because the influence of variations in the value of the US dollar on the regional bilateral yen exchange rates is not decreasing over time. This constitutes evidence against the emergence of a yen block over time.

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 negatively signed and statistically significant at the 5 percent level. The mean of the short run coefficients in the first sub-period is –1.836, and this rises to a mean of –1.918 during the second sub-period. The mean of the long run multipliers is –1.81 in the first sub-period and –1.89 in the second sub-period. This implies rejection of H_0^5 and acceptance of H_1^5. Taken together, with the results concerning the US dollar, this also implies rejection of H_0^6 and acceptance of H_1^6.

As the long run multiplier estimates for the first and second sub periods and the full sample period are consistent with an infinite variety of long run multiplier trajectories through time, it is of some interest to inquire further after this evolution. To this end we have estimated the sequence of US dollar, UK pound and German DM long run multipliers re each of the bilateral yen rates over a moving window of 156 weeks

commencing on the 25th of January 1985. The windows are overlapping in the sense that each consecutive window involves the dropping of the first observation in the preceding window and the inclusion of the incremental observation. Our results are presented in Figure 3 in terms of 52 week moving averages of these statistics.

The volatility of the German DM long run multiplier evolution is considerably greater than its UK pound and US dollar counterparts. The German DM long run multiplier evolution varies between extremes of -3.5% and –0.3% for the Chinese yuan, whilst the USD and UK£ equivalents vary between extremes of 1.0 (Chinese yuan) and -0.72 (Thai baht) and –2.2 (Chinese yuan) and –0.2 (Indonesian rupiah), respectively. Moreover, the USD and GDM long run multiplier evolutions are tightly clustered relative to the UK pound multipliers evolution in a qualitative sense. In fact, the UK pound multiplier evolutions appear to be delineated into two separate strands. The Korean Won, Chinese yuan and Taiwanese dollar exhibiting positive multipliers while the remaining multipliers are almost entirely negative for the full length of their evolutions. In short, the German DM long run incidence on the bilateral yen rates is not only greater in magnitude than its US dollar and UK pound counterparts as revealed by our earlier analysis but also exhibits greater volatility over time. Finally, the German DM Long run multipliers, in contrast to its counterparts, has been increasing in importance since approximately 1995. In contrast, the UK pound and US dollar long run multipliers have remained qualitatively stationary over this recent period. Overall, therefore, the results presented in this Section provide strong evidence against the emergence of a yen block in Australasia, North and Southeast Asia.

5. Summary and Conclusions

The recent turmoil in Asian currency markets has focused worldwide attention on exchange rate management in this part of the world. This paper has examined one aspect of this issue, namely, the extent to which there is evidence of an emerging yen block that could be exploited in designing a regional exchange rate system. We employed up to 24 years of weekly data on 11 bilateral yen exchange rates *vis-à-vis* the Australian dollar, the Hong Kong dollar, the Indonesian rupiah, the Malaysian

ringgitt, the New Zealand dollar, the Philippino peso, the Singapore dollar, the Thai baht, the Chinese yuan, the Korean won and the Taiwan dollar. We modelled these exchange rates in a dynamic fashion to determine whether they follow the yen in response to external shocks over the full sample period and the two sub-periods, as would be the case in a yen block, and we estimated the US dollar, German DM and UK pound long run multiplier evolutions for each of the bilateral yen rates.

The estimated models performed quite well in explaining between 40 and 71 percent of the variation in the yen bilateral exchange rates over the full sample period. We tested six hypotheses about the coefficients of the models in order to cast light on how the regional bilateral yen exchange rates respond to variations in the US dollar, the German mark and the UK pound. The null hypothesis in each test was couched in order to be consistent with an existing or emerging yen block, and this was rejected in all six cases. We also examined the long run multipliers, which relate the regional bilateral yen exchange rates to variations in the US dollar, the German mark and the UK pound. In the full sample period, the mean of the long run multipliers was found to be approximately –1.27 for the US dollar, approximately -1.8 for the German mark and –0.18 for the UK pound. This implies that a 1 percent rise in the US dollar (German mark or UK pound) effective exchange rate causes an approximate 1.27% (1.8% or 0.18%) appreciation of the regional exchange rates *vis-à-vis* the yen. Also the evidence gleaned in estimating our dynamic models on the first and second halves of the data set is inconsistent with the postulate of an emerging yen bloc in these multipliers over time. Finally our long run multiplier evolutions are by and large consistent with this conclusion, particularly in recent times. The evidence presented here, therefore, strongly rejects any notion of the existence, or tendency towards the emergence of a yen block.

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 Australasia, North and Southeast Asia. The evidence presented here indicates that this is not happening to a discernible 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 without excessive regulation.

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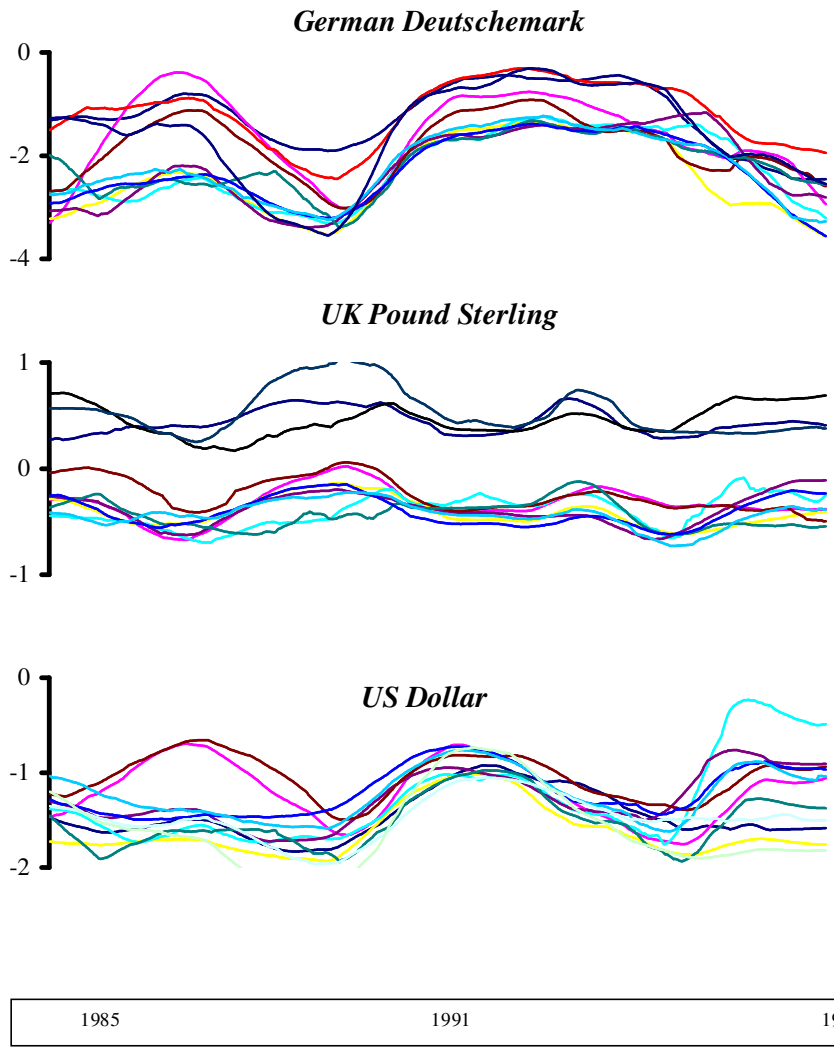
Figure 3
Long Run Multiplier Evolution



Notes. The long run multipliers are overlapping 52 week moving averages of 3-year moving window long run multiplier statistics. These multipliers are solved directly from parsimoniously derived equations. The windows in the construction of both averages perfectly over lap but for the dropping of the initial observation in the preceding window and the inclusion of the incremental observation. Thus the first observation above is the 52 weeks mean of the long run multiplier sequence solved for the 3-year periods commencing on the 25th January 1985.

Table 1
Currency Movements During the Asian Crisis

Currency	Domestic currency per unit of foreign currency 1996	1996=100 1997	1998
US dollar exchange rates			
Chinese yuan	8.3	99.7	99.6
Hong Kong SAR dollar	7.7	100.1	100.2
Indonesian rupiah	2328	123.6	438.1
Japanese yen	108.9	111.1	120.2
Korean won	805	117.9	173.8
Malaysian ringgitt	2.5	111.8	166.8
Philippine peso	26.2	112.8	156.2
Singapore dollar	1.4	105.4	118.5
Taiwan dollar	27.5	100.2	121.9
Thai baht	25.4	122.4	162.7
Japanese yen exchange rates			
Chinese yuan	0.076	89.8	83.2
Hong Kong SAR dollar	0.071	90.1	83.6
Indonesian rupiah	21.4	110.7	361.9
Korean won	7.4	105.1	145.2
Malaysian ringgitt	0.023	100.4	140.1
Philippine peso	0.241	101.3	130.3
Singapore dollar	0.013	94.8	98.9
Taiwan dollar	0.252	94.0	101.7
Thai baht	0.233	109.8	135.7

Notes. The data source is Datastream International. The first column of data gives the raw annual average exchange rates for 1996. The next two columns give the exchange rate indices for 1997 and 1998 with 1996 = 100.

Table 2
Direction of Trade Statistics for Australasia, North and Southeast Asia

Panel A: Data for 1981

	Au	*Ch*	*HK*	*In*	*Ja*	*Ko*	*Ma*	*NZ*	*Ph*	*Si*	*Th*	*AA*	*US*	*Ge*	*UK*
Australia	-	2.2	2.1	2.1	23.9	2.3	1.6	4.2	0.7	2.6	0.5	18.2	17.5	3.9	5.5
China	1.7	-	15.1	0.3	25.4		0.7	0.5	0.9	1.8	0.9	21.7	14.4	5.0	1.5
HongKong	2.0	15.5	-	2.0	14.6	2.7	0.8	0.3	1.2	6.0	1.2	31.9	18.6	4.2	5.7
Indonesia	2.3	0.7	0.6	-	43.4	2.2	0.3	0.9	1.9	10.0	0.5	19.5	17.3	3.3	1.9
Japan	4.1	3.5	2.0	5.9	-	3.1	1.8	0.6	1.2	2.2	1.1	25.6	21.8	2.8	2.5
Korea	2.5	na	2.9	1.6	15.1	-	1.7	0.3	0.8	1.0	0.6	11.4	24.8	3.1	2.3
Malaysia	3.6	1.6	1.7	0.5	22.8	2.5	-	0.6	1.2	18.0	2.5	32.3	13.8	3.7	3.7
New Zealand	16.6	1.4	1.3	2.7	15.2	1.1	1.4	-	0.7	3.0	0.4	28.6	15.3	2.7	10.8
Philippines	2.6	2.0	3.2	2.6	20.3	2.2	2.0	0.6	-	1.7	0.4	17.3	26.2	4.1	2.6
Singapore	2.9	2.0	4.8	na	15.1	1.2	13.8	0.8	0.8	-	2.8	29.0	12.9	2.7	2.7
Thailand	1.6	3.0	2.5	0.9	20.1	1.7	3.5	0.4	0.2	7.3	-	21.1	13.0	3.8	2.2
AA	4.0	3.6	3.8	1.6	21.6	2.0	2.9	1.0	0.9	5.7	1.1	23.1	17.4	3.7	3.6
US	1.6	1.1	1.7	1.5	12.2	2.1	0.8	0.3	0.8	1.0	0.4	11.3	-	4.4	5.1
Germany	0.5	0.5	0.6	0.4	2.3	0.4	0.3	0.1	0.2	0.3	0.2	3.7	7.1	-	7.0
UK	1.2	0.3	1.5	0.2	2.8	0.5	0.4	0.7	0.2	0.6	0.1	5.6	12.1	11.2	-

Panel B: Data for 2000

	Au	*Ch*	*HK*	*In*	*Ja*	*Ko*	*Ma*	*NZ*	*Ph*	*Si*	*Th*	*AA*	*US*	*Ge*	*UK*
Australia	-	6.8	2.0	2.5	16.3	5.6	2.9	4.8	1.0	4.2	2.1	31.8	15.0	3.2	4.6
China	1.9	-	11.8	1.6	18.3	7.6	1.8	0.2	0.7	2.4	1.5	29.4	16.4	4.3	2.2
HongKong	1.0	39.0	-	0.6	8.9	3.4	1.6	0.2	1.0	3.5	1.3	51.6	14.9	2.9	2.9
Indonesia	3.4	5.0	2.0	-	20.7	6.7	3.2	0.4	1.0	10.8	2.2	34.7	12.4	2.8	2.2
Japan	2.3	10.0	3.4	2.8	-	6.0	3.3	0.4	2.0	3.2	2.8	36.1	25.2	3.8	2.5
Korea	2.6	9.4	3.6	2.6	15.7	-	2.5	0.3	1.6	2.8	1.1	26.5	20.2	2.9	2.4
Malaysia	2.2	3.5	3.7	2.2	16.7	3.8	-	0.4	2.1	16.5	3.7	38.1	18.8	2.7	2.6
New Zealand	20.8	4.6	1.6	1.5	12.2	3.2	2.3	-	0.8	1.7	1.1	37.5	15.8	3.3	4.5
Philippines	1.5	1.9	4.2	1.2	15.8	4.8	3.4	0.3	-	7.1	2.8	27.3	22.7	2.8	2.5
Singapore	2.0	4.6	5.3	na	12.3	3.6	17.6	0.2	2.5	-	4.3	40.0	16.2	3.1	2.3
Thailand	2.1	8.9	4.8	1.9	19.1	2.6	4.7	0.3	1.6	9.2	-	36.0	16.3	2.6	2.5
AA	4.2	9.3	4.3	1.8	15.6	4.6	4.4	0.8	1.4	6.5	2.2	35.3	16.9	3.1	2.8
US	0.9	6.0	1.3	0.7	10.5	3.3	1.8	0.2	1.1	1.8	1.2	18.4	-	4.4	4.2
Germany	0.4	2.4	0.6	0.3	3.5	0.9	0.5	0.1	0.2	0.7	0.4	6.6	9.5	-	7.7
UK	1.0	1.6	2.2	0.4	3.5	1.2	0.8	0.2	0.4	1.0	0.5	9.3	14.6	12.3	-

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. AA denotes 'Australasia, North and Southeast Asia minus Japan', ie, Australia, China, Hong Kong, Indonesia, Korea , Malaysia, New Zealand, the Philippines, Singapore and Thailand. The column figures for AA are totals, and the row figures for AA are averages.

Table 3
Variables Used and Data Sources

S^i: Weekly bilateral exchange rates *vis-a-vis* the yen for the Australia dollar, the Hong Kong dollar, the Indonesian rupiah, the Korean won, the Malaysian ringgitt, the New Zealand dollar, the Philippino peso, the Singaporean dollar, the Thai bath, the Chinese yuan and the Taiwanese dollar. 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 – 29 December 2000 for all exchange rates except the Taiwanese dollar and the Chinese Yuan which begin on the 11th and 18th of January 1985, respectively. The first sub-period is from the above starting date until 11th January 1985, and the second sub-period is from subsequent week to the end of the sample period.

S^{STE}: The weekly trade-weighted index, set to 1976=100, of the British pound sterling. This is a trade-weighted index compiled by the Bank of England. The source is *Datastream International Ltd*.

S^{DME}: The weekly trade-weighted index, set to 1976=100, of the German mark. This is a trade-weighted index compiled by the Bank of England. The source is *Datastream International Ltd*.

S^{USE}: The weekly trade-weighted index, set to 1976=100, of the US dollar. This is a trade-weighted index compiled by the Bank of England. The source is *Datastream International Ltd*.

D^{PLAZA}: Dummy variable to capture the effects of the coordinated intervention by the G5 countries in February/March 1985 to reduce the overvalued US dollar.

D^{LOUVRE}: Dummy variable to capture the effects of the Louvre Accord on 6 March 1987.

D^i: Various dummy variables for each country as described in Table 4.

Table 4
Dummy Variables used in the Exchange Rate Models

	D1	*D2*	*D3*	*D4*	*D5*	*D6*	*Plaza*	*Louvre*
			Panel A: Full Sample Period					
Australia	10/30/87	09/25/92	03/03/89					
China	07/11/86	12/22/89	10/16/98	10/02/98			10/04/85	03/06/87
Hong Kong	09/30/83	10/20/98	06/26/98					
Indonesia	04/08/83	09/26/86	01/16/98	01/30/98	02/06/98			
Korea	02/08/80	12/11/97	02/06/98					
Malaysia	01/16/98	11/06/98	04/02/99					
New Zealand	07/11/84	11/06/87						
Philippines	01/19/79	10/21/83	06/22/84	06/13/86	07/18/97	10/16/98		
Singapore	10/16/98							
Taiwan	04/28/89	10/23/98					10/04/85	03/06/87
Thailand	09/28/79	11/16/84	07/11/97	11/14/97	01/16/98	10/16/98		
			Panel B: Sample Period 1					
Australia	10/30/87							
China	07/11/86						10/04/85	
Hong Kong	09/30/83							
Indonesia	04/08/83	09/26/86						
Korea	02/08/80							
Malaysia								
New Zealand	07/11/84	11/06/87						
Philippines	01/19/79	10/21/83	06/22/84	06/13/86				
Singapore								
Taiwan							10/04/85	
Thailand	09/28/79	11/16/84						
			Panel C: Sample Period 2					
Australia			03/03/89					
China		12/22/89	10/16/98	10/02/98				
Hong Kong		10/20/98	06/26/98					
Indonesia			01/16/98	01/30/98	02/06/98			
Korea		12/11/97	02/06/98					
Malaysia	01/16/98	11/06/98	04/02/99					
New Zealand	07/11/84	11/06/87						
Philippines							10/04/85	
Singapore	10/16/98							
Taiwan	04/28/89	10/23/98						
Thailand			07/11/97	11/14/97	01/16/98	10/16/98		

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.

Table 5

Unit Root Tests of the Yen Bilateral Exchange Rates

and the Effective Exchange Rate Indices.

Level of Variable	*ADF*	*PP*	*First Difference*	*ADF*	*PP*
			Yen *bilateral rates*		
AU	-0.36	-0.98	ΔAU	-38.45	-1366.0
CH	-1.44	-2.35	ΔCH	-31.22	-888.7
HK	-1.52	-3.76	ΔHK	-34.70	-1289.6
IN	-0.55	-1.65	ΔIN	-21.79	-1494.6
KO	-0.96	1.75	ΔKO	-38.41	-1384.0
MA	-0.86	2.31	ΔMA	-18.32	-1403.5
NZ	-0.31	0.89	ΔNZ	-36.30	-1340.0
PH	1.55	0.53	ΔPH	-37.70	-1364.8
SI	-1.95	9.13	ΔSI	-35.07	-1293.0
TA	-1.99	0.82	ΔTA	-31.56	-894.2
TH	0.15	0.11	ΔTH	-36.94	-1368.3
			Effective exchange rates		
GE	-2.05	2.71	ΔGE	-34.35	-1252.0
UK	-1.60	5.68	ΔUK	-34.92	-1282.4
US	-1.38	0.00	ΔUS	-34.07	-1260.9

ADF Critical Values			**Philip Perron Critical Values**		
1%	**5%**	**10%**	**1%**	**5%**	**10%**
-3.43	-2.86	-2.57	-3.43	-2.86	-2.57

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

Table 6
Correlations of Yen Bilateral Exchange Rates

Panel A: First sample half, November 1976 – January 1986

Exchange rate	*Au*	*Ch*	*HK*	*In*	*Ko*	*Ma*	*NZ*	*Ph*	*Si*	*Ta*	*Th*
Australia	1.00										
China	0.05	1.00									
Hong Kong	0.59	0.02	1.00								
Indonesia	0.22	0.40	0.33	1.00							
Korea	0.17	0.54	0.20	0.28	1.00						
Malaysia	0.64	0.07	0.84	0.38	0.19	1.00					
New Zealand	0.63	0.05	0.54	0.23	0.14	0.56	1.00				
Philippines	0.28	0.39	0.31	0.43	0.32	0.37	0.25	1.00			
Singapore	0.64	0.41	0.86	0.35	0.18	0.93	0.58	0.35	1.00		
Taiwan	0.22	0.62	0.32	0.47	0.73	0.30	0.17	0.69	0.29	1.00	
Thailand	0.31	0.52	0.42	0.58	0.38	0.46	0.30	0.60	0.46	0.62	1.00
Mean	0.38	0.31	0.44	0.37	0.31	0.47	0.35	0.40	0.51	0.44	0.47

Panel B: Full sample, November 1976 – December 2000

Exchange rate	*Au*	*Ch*	*HK*	*In*	*Ko*	*Ma*	*NZ*	*Ph*	*Si*	*Ta*	*Th*
Australia	1.00										
China	0.23	1.00									
Hong Kong	0.70	0.30	1.00								
Indonesia	0.27	0.20	0.30	1.00							
Korea	0.30	0.38	0.32	0.40	1.00						
Malaysia	0.54	0.16	0.65	0.42	0.30	1.00					
New Zealand	0.74	0.20	0.66	0.26	0.24	0.50	1.00				
Philippines	0.42	0.32	0.49	0.41	0.40	0.41	0.40	1.00			
Singapore	0.71	0.23	0.88	0.40	0.32	0.73	0.68	0.51	1.00		
Taiwan	0.46	0.50	0.58	0.32	0.61	0.37	0.40	0.61	0.50	1.00	
Thailand	0.47	0.30	0.57	0.51	0.41	0.52	0.47	0.64	0.64	0.54	1.00
Mean	0.48	0.28	0.55	0.35	0.37	0.51	0.46	0.46	0.56	0.49	0.51

Notes. The data source is Datastream International Ltd. It is the correlations of nominal yen bilateral exchange rates for the various

Table 7
Empirical Results: Full Sample

	Constant	Dummie	DUMPL	DUMLO	S^{i}_{t-1}	S^{i}_{t-2}	S^{USE}_{t}	S^{USE}_{t-1}	S^{USE}_{t-2}	S^{USE}_{t-3}	S^{DME}_{t}	S^{DME}_{t-1}	S^{UKE}_{t}	S^{UKE}_{t-1}	S^{UKE}_{t-2}
Australia	6.00E-04	3			-0.050		-1.067				-1.681		-0.395		
	(3.41)				(2.97)		(20.90)				(15.16)		(9.04)		
China	5.90E-04	4	0.011	0.002	-0.143	-0.046	-0.925	-0.738	-0.163		-1.661		1.135	-0.46	-0.134
	(2.80)		(5.91)	(2.99)	(2.56)	(2.03)	(8.74)	(10.62)	(2.12)		(6.92)		(13.83)	(5.60)	(2.03)
Hong Kong	5.00E-04	0				0.026	-1.423				-2.032		-0.479		
	(4.53)					(2.04)	(40.19)				(26.69)		(16.94)		
Indonesia	9.00E-04	5					-0.775	-0.563			-2.049			-0.456	
	(3.03)						(9.35)	(8.34)			(12.05)			(7.09)	
Korea	8.00E-04	3			-0.151	-0.095	-1.156	-0.383	-0.216		-1.528	-0.291	0.885		-0.154
	(4.06)				(8.03)	(4.92)	(19.6)	(6.95)	(4.77)		(12.01)	(2.79)	(18.28)		(3.45)
Malaysia	5.00E-04	3			-0.102		-1.152	-0.167			-1.922	-0.381	-0.453		
	(3.35)				(6.52)		(24.65)	(3.84)			(19.05)	(4.47)	(12.06)		
NewZealand	6.60E-04	2			-0.068		-1.006			0.11	-1.856		-0.314		
	(3.69)				(4.02)		(20.05)			(3.58)	(17.00)		(7.25)		
Philippines	9.00E-04	6			-0.112		-1.123	-0.461			-2.132			-0.459	
	(4.17)				(7.26)		(18.61)	(9.78)			(17.26)			(10.34)	
Singapore	3.90E-04	1			-0.074		-1.155	-0.063			-2.113	-0.176	-0.454		
	(3.15)				(4.77)		(33.64)	(2.15)			(28.76)	(3.02)	(17.74)		
Taiwan		2	0.032	0.001	-0.211		-1.306	-0.416			-1.513		0.684	-0.155	-0.159
			(21.67)	(2.51)	(5.43)		(18.40)	(5.53)			(9.14)		(8.61)	(2.72)	(2.63)
Thailand	6.00E-04	0			-0.111		-0.939	-0.398			-2.234			-0.411	
	(3.22)				(6.94)		(16.96)	(9.52)			(19.68)			(10.44)	

Equation Diagnostics and Long-Run Multipliers

	R^2	SEE	RSS	K-S	DW	LM	ARCH	Chow	LRM_{USE}	LRM_{UK}	LRM_{DM}
Australia	0.40	0.0062	0.050	0.045**	2.05	13.69 (.03)	11.23 (.00)	3.24 (.00)	-1.05	-0.39	-1.65
China	0.71	0.0065	0.035	0.032	2.36	4.66 (.59)	0.02 (.88)	2.55 (.01)	-1.53	0.45	-1.40
Hong Kong	0.69	0.0042	0.024	0.056***	2.15	16.39 (.01)	33.58 (.00)	6.70 (.00)	-1.46	-0.49	-2.09
Indonesia	0.59	0.0103	0.140	0.091***	2.09	67.16 (.00)	85.92 (.00)	3.60 (.00)	-1.34	-0.46	-2.05
Korea	0.50	0.0071	0.067	0.098***	1.95	35.42 (.00)	6.34 (.01)	6.5 (.00)	-1.41	0.48	-1.46
Malaysia	0.62	0.0057	0.043	0.069***	2.09	18.92 (.00)	0.12 (.73)	0.55 (.80)	-1.20	-0.41	-2.09
NewZealand	0.44	0.0061	0.048	0.029	2.02	4.35 (.63)	0.12 (.73)	1.58 (.15)	-0.83	-0.30	-1.74
Philippines	0.55	0.0074	0.072	0.058***	2.18	11 (.09)	0.09 (.77)	7.24 (.00)	-1.41	-0.41	-1.92
Singapore	0.63	0.0042	0.023	0.032	2.08	8.21 (.22)	0.94 (.33)	1.85 (.07)	-1.12	-0.42	-2.14
Taiwan	0.53	0.0060	0.030	0.101***	2.03	16.49 (.01)	1.86 (.17)	16.85 (.00)	-1.43	0.31	-1.25
Thailand	0.45	0.0068	0.061	0.045**	2.13	6.75 (.35)	1.61 (.21)	18.84 (.00)	-1.20	-0.37	-2.01

Notes. Country names denote the log change in their yen bilateral exchange rates as defined in the text. S^{USE}_{t}, S^{UK}_{t} and S^{DM}_{t} denote the log change in the US dollar, UK pound and German mark effective exchange rates. The figures in brackets are heteroscedastic consistent t-statistics except for the dummy variables. The K-S star , double star, and triple star superscripts correspond to statistical significance at the 10%, 5% and 1% levels respectively. Dum^{PL} and Dum^{LO} are dummy variables for the Plaza & Louvre Accords respectively, as explained in table 3.

Table 8
Empirical Results:1st Sub-Period

	Constant	Dummies	DUM^{PL}	S^i_{t-1}	S^i_{t-2}	S^i_{t-3}	S^i_{t-4}	S^{USE}_t	S^{USE}_{t-1}	S^{USE}_{t-2}	S^{USE}_{t-3}	S^{USE}_{t-4}	S^{DME}_t	S^{DME}_{t-1}	S^{DME}_{t-2}	S^{UKE}_t	S^{UKE}_{t-1}	S^{UKE}_{t-2}	S^{UKE}_{t-3}
Australia	7.00E-04	1					0.055	-0.843					-1.383			-0.489			
	(3.05)						(2.25)	(12.27)					(9.33)			(8.27)			
China	9.00E-04	1	0.016					-0.569	-0.869				-1.724			1.368	-0.828		
	(2.58)		(5.48)					(3.66)	(11.83)				(3.75)			(11.92)	(9.97)		
Hong Kong	9.00E-04	1						-1.281					-1.802			-0.547		-0.068	
	(4.77)							(22.95)					(14.97)			(11.39)		(2.16)	
Indonesia	8.00E-04	2						-0.678	-0.837				-2.121			0.278	-0.706		
	(3.15)							(9.83)	(18.29)				(14.26)			(4.69)	(16.16)		
Korea	1.30E-03	1		-0.189	-0.100	-0.093	-0.117	-0.879	-0.534	-0.315	-0.204	-0.258	-1.585	-0.546		1.122		-0.212	-0.171
	(4.59)			(6.77)	(3.35)	(3.21)	(4.33)	(10.53)	(7.09)	(5.12)	(3.36)	(4.24)	(8.82)	(3.65)		(15.73)		(3.33)	(2.70)
Malaysia	8.00E-04	0		-0.087				-1.061	-0.138				-1.784	-0.437		-0.489			
	(4.62)			(3.76)				(21.27)	(3.12)				(16.56)	(5.12)		(11.42)			
NewZealand	7.00E-04	2						-0.843					-1.609			-0.299			
	(2.74)							(11.43)					(10.10)			(4.70)			
Philippines	1.00E-03	4		-0.084	-0.045			-0.896	-0.665	-0.212			-2.053		-0.409	0.213	-0.659		
	(3.47)			(4.58)	(2.44)			(10.25)	(10.52)	(3.14)			(10.87)		(3.07)	(2.85)	(10.96)		
Singapore	6.00E-04	0		-0.088				-1.090	-0.119				-1.947	-0.287		-0.476			
	(3.76)			(3.96)				(23.38)	(2.88)				(19.34)	(3.54)		(11.89)			
Taiwan		0	0.031	-0.519	-0.194			-1.117	-1.012	-0.465			-1.931	-0.685		1.071		-0.330	-0.186
			(8.42)	(10.23)	(3.40)			(6.16)	(8.48)	(4.74)			(4.04)	(2.13)		(7.24)		(2.85)	(2.22)
Thailand	7.00E-04	2		-0.164	-0.034			-0.741	-0.651	-0.109			-2.262			0.353	-0.646	-0.166	
	(3.01)			(8.39)	(1.99)			(10.24)	(13.38)	(2.75)			(14.49)			(5.71)	(13.9)	(4.23)	

Equation Diagnostics & Long Run Multipliers

Equations	R^2	SEE	RSS	K-S	DW	LM	Chow	ARCH	LRM_{USE}	LRM_{UK}	LRM_{DM}
Australia	0.400	0.0055	0.021	0.0949***	2.14	20.67 (0.00)	0.59 (0.74)	11.35 (0.00)	-0.89	-0.52	-1.46
China	0.750	0.0060	0.007	0.1062	2.67	6.10 (0.41)	2.23 (0.04)	0.01 (0.93)	-1.44	-2.20	-1.73
Hong Kong	0.630	0.0045	0.014	0.094***	2.12	14.69 (0.02)	2.29 (0.05)	22.28 (0.00)	-1.28	-0.62	-1.80
Indonesia	0.770	0.0055	0.021	0.0212	2.68	0.27 (0.99)	0.81 (0.56)	.00 (0.97)	-1.52	-0.43	-2.12
Korea	0.490	0.0067	0.030	0.1112*	2.07	9.92 (0.13)	1.41 (0.14)	1.42 (0.23)	-1.47	0.50	-1.42
Malaysia	0.610	0.0040	0.011	0.0874***	2.13	14.61 (0.02)	1.02 (0.42)	1.67 (0.20)	-1.10	-0.45	-2.04
NewZealand	0.480	0.0059	0.024	0.0503	2.08	3.65 (0.72)	1.58 (0.18)	0.01 (0.97)	-0.84	-0.30	-1.61
Philippines	0.670	0.0070	0.034	0.0609**	2.33	5.76 (0.45)	1.08 (0.38)	0.01 (0.90)	-1.57	-0.40	-2.18
Singapore	0.640	0.0037	0.010	0.0838***	2.14	12.85 (0.05)	1.10 (0.36)	1.46 (0.23)	-1.12	-0.44	-2.07
Taiwan	0.660	0.0063	0.007	0.193***	1.97	15.99 (0.01)	7.10 (0.00)	0.21 (0.65)	-1.52	0.32	-1.53
Thailand	0.580	0.0059	0.023	0.085***	2.43	9.015 (0.17)	1.95 (0.04)	0.01 (0.94)	-1.25	-0.38	-1.89

Notes. Country names denote the log change in their yen bilateral exchange rates as defined in the text. S^{USE}_t, S^{UK}_t and S^{DM}_t denote the log change in the US dollar, UK pound and German mark effective exchange rates. The K-S star, double star, and triple star superscripts correspond to statistical significance at the 10%, 5% and 1% levels respectively. The figures in brackets are heteroscedastic consistent t-statistics except for the dummy variables. Dum^{PL} is the dummy variable for the Plaza Accord, as explained in table 3.

Table 9
Empirical Results: 2nd Sub Period

	Constant	Dummies	S^{j}_{t-1}	S^{j}_{t-2}	S^{USE}_{t}	S^{USE}_{t-1}	S^{USE}_{t-2}	S^{DME}_{t}	S^{DME}_{t-1}	S^{DME}_{t-2}	S^{DME}_{t-3}	S^{UKE}_{t}	S^{UKE}_{t-1}
Australia		1			-1.279			-1.924				-0.313	
					(17.14)			(11.51)				(4.33)	
China		3	-0.102		-1.081	-0.586		-1.555				0.964	-0.415
			(2.27)		(7.82)	(6.52)		(6.00)				(8.82)	(4.52)
Hong Kong		2	-0.099		-1.570	-0.183		-2.259	-0.255			-0.379	
			(4.53)		(36.13)	(4.23)		(23.41)	(3.33)			(9.19)	
Indonesia		3			-0.951			-2.141					
					(6.41)			(7.00)					
Korea		2			-1.441			-1.319				0.601	
					(17.98)			(7.37)				(7.89)	
Malaysia		3			-1.240			-2.088				-0.359	
					(15.60)			(11.79)				(4.84)	
NewZealand		0	-0.077		-1.142			-2.033	-0.167			-0.315	
			(3.76)		(16.56)			(13.16)	(1.98)			(4.69)	
Philippines		2			-1.346			-2.039				-0.309	
					(16.29)			(11.15)				(4.09)	
Singapore		1	-0.063		-1.203		0.066	-2.296				-0.385	
			(4.18)		(23.65)		(2.65)	(20.41)				(8.37)	
Taiwan		2			-1.473		0.141	-1.398			0.234	0.469	
					(20.92)		(2.94)	(8.90)			(2.48)	(7.33)	
Thailand		4		0.051	-1.195		0.158	-2.046				-0.419	
				(2.33)	(16.03)		(3.02)	(12.41)				(6.19)	

Equation Diagnostics and Long-Run Multipliers

	R^2	SEE	RSS	K-S	DW	LM	Chow	ARCH	LRM_{USE}	LRM_{UK}	LRM_{DM}
Australia	0.41	0.0065	0.028	0.0589*	2.16	6.44 (.38)	1.63 (.18)	2.49 (.11)	-1.28	-0.31	-1.92
China	0.71	0.0066	0.027	0.0478	2.36	4.23 (.65)	11.49 (.00)	0.021 (.89)	-0.53	0.50	-1.41
Hong Kong	0.76	0.0037	0.009	0.0755***	2.03	9.77 (.14)	8.64 (.00)	10.38 (.00)	-1.60	-0.35	-2.29
Indonesia	0.52	0.0198	0.117	0.1234***	1.95	63.13 (.00)	0.59 (.56)	59.35 (.00)	-0.95	*NA*	-2.14
Korea	0.56	0.0070	0.033	0.1278***	2.09	37.13 (.00)	0.31 (.82)	4.75 (.03)	-1.44	0.60	-1.32
Malaysia	0.62	0.0069	0.033	0.1060***	2.32	14.84 (.02)	0.10 (.96)	0.023 (.88)	-1.24	-0.36	-2.09
NewZealand	0.41	0.0059	0.024	0.0937***	2.05	10.78 (.10)	1.02 (.40)	5.99 (.01)	-1.06	-0.29	-2.04
Philippines	0.43	0.0070	0.033	0.0591*	2.22	12.18 (.06)	4.63 (.00)	28.1 (.00)	-1.35	-0.31	-2.04
Singapore	0.62	0.0044	0.013	0.0502	2.06	4.30 (.64)	2.11 (.63)	0.185 (.67)	-1.07	-0.36	-2.16
Taiwan	0.57	0.0048	0.014	0.0595*	2.2	5.17 (.52)	2.70 (.02)	3.20 (.07)	-1.33	0.47	-1.17
Thailand	0.50	0.0065	0.028	0.0531	1.97	6.14 (.41)	1.87 (.10)	5.98 (.02)	-1.09	-0.44	-2.16

Notes. Country names denote the log change in their yen bilateral exchange rates as defined in the text. S^{USE}_{t}, S^{UK}_{t} and S^{DM}_{t} denote the log change in the US dollar, UK pound and German mark effective exchange rates. The figures in brackets are heteroscedastic consistent t-statistics except for the dummy variables. The K-S star , double star, and triple star superscripts correspond to statistical significance at the 10%, 5% and 1% levels respectively. Some details with respect to the dummy variables are provided in table 3.