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by

Peter Wilson

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Peter Wilson

Associate Professor, Economics Department, National University of Singapore

1. INTRODUCTION

In the aftermath of the Asian financial crisis, the issue of the choice of exchange rate regime for East Asian (EA) countries re-emerged. The crisis had demonstrated, amongst other things, that unilateral exchange rate regimes (including de facto dollar pegging) hadn't coped very well in the 1990s faced with massive capital inflows into the region (Kwan et al., 1998), with the possible exceptions of Singapore and Taiwan.

The immediate response to the crisis was that a 'corner' solution might be better. Either keep convertibility and fix the currency, preferably backed up with a currency board, but abandon monetary independence; or keep monetary policy and convertibility but abandon currency management and adopt a free float. But a hard peg is perceived to be too rigid for most countries in EA and the potential costs of a clean float are seen to be too great for emerging economies with weak financial infrastructure because of the risks of serious currency misalignment and destabilising speculation.

Recognition that the corner solutions may be unattractive or not feasible for many emerging countries in EA has, therefore, put the emphasis back on intermediate exchange rate regimes, such as managed floating, some mixture of inflation targeting and exchange rate management, and unilateral basket regimes.² In the post-crisis period average currency volatility, both in effective terms and bilaterally against the US\$, dropped substantially compared to the crisis period but was still higher than in the pre-crisis period, with significant increases for Indonesia and Thailand (Figure 1) and to some extent this has been a consequence of the move towards greater exchange rate flexibility,³ with the notable

¹ My thanks to the Department of East Asian Studies at the University of Leeds for inviting me as a Visiting Fellow in February 2006 and to my colleagues at the Singapore Centre for Applied and Policy Economics (SCAPE) at the National University of Singapore for their helpful comments. The usual disclaimer applies.

² This includes variations on the basket, band and crawl (Dornbusch and Park, 1998), crawling pegs and bands and monitoring bands (Williamson 1998b).

³ The average standard deviations of monthly exchange rate changes for the nine EA countries in Figure 1 increased from 0.70 to 1.10 bilaterally against the dollar, from 1.19 to 1.60 in nominal effective terms and from 1.32 to 2.07 in real effective terms.

exception of Malaysia which joined the hard dollar peggers in September 1998 but reverted to a managed float in 2005. Korea (1998), Thailand (2000), Indonesia (2000) and the Philippines (2002) all adopted de jure inflation targeting regimes over this period and Singapore was prepared to widen its target exchange rate policy band when necessary to adjust to external shocks.

An underlying problem for EA from the exchange rate point of view is that the diversity of exchange rate regimes in the region transmits fluctuations in major currencies into fluctuations in bilateral regional exchange rates and alters relative competitiveness. In particular, a country which de facto pegs more tightly against the US dollar compared to its export competitors finds itself unable to compete when the dollar appreciates strongly against the yen and the euro.⁴

There is an interesting parallel here with European experience, since it was only after the breakdown of the Bretton Woods system in the early 1970s and the move to generalized floating, which presented a choice between returning to a dollar peg or pegging to a regional anchor, that serious consideration was given to monetary cooperation. The social costs of floating exchange rates together with the perceived costs of intra-bloc instability produced first the 'snake in the tunnel', the European Monetary System in 1979, and a de facto anchor to the Deutsche mark in the 1980s to capture the benefits of the low German inflation rate. In the early stages of exchange rate cooperation, the desire to anchor price levels was probably not the key driving force. More important was the perceived threat that intra-European exchange rate fluctuations posed to the broader process of trade and financial integration which had been proceeding well since 1960

A relatively simple solution is for each country to adopt a unilateral basket peg (UBP). This would automatically provide some insulation against movements in the major currencies, especially the dollar/yen rate, and reduce volatility in the nominal effective exchange rate (NEER) and real effective exchange rate (REER). It is also relevant to countries with reasonably diversified trade patterns and thus no obvious single candidate for an exchange rate anchor.⁵ However, insofar as trade structures, and therefore the baskets, would differ amongst the nine EA countries (EA9), UBPs will not necessarily reduce intra-EA exchange rate volatility caused by fluctuations in the currencies of their respective trading partners,

⁴ A classic case of this 'third currency' effect was in April 1995 when the dollar appreciated sharply against the yen thereby reducing the competitiveness of Asian countries relative to Japan and the European Union (EU).

⁵ As Rajan (2002) has argued, the weakness of pegging to one currency is not the same thing as the weakness of pegging in general. If soft pegging to the US dollar is sub-optimal then it would be better to adopt a more

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with consequences for exports if the EA countries concerned are close competitors. This is, therefore, one empirical question which can be addressed through counterfactual analysis.

A second, and closely related question, is the trade-off between the benefits of a UBP in reducing effective exchange rate volatility for a specific country and the potential increase in volatility against a particular major currency, such as the US dollar, and therefore against other competitors in the EA bloc. The outcome is hard to predict *ex ante* since it depends on the composition of the baskets for each country and on the magnitude of actual exchange rate fluctuations.

An alternative approach, which gained support after the Asian financial crisis, is for EA to pursue closer monetary and exchange rate cooperation by adopting a common peg to the U. S. dollar, the yen, or a basket of major currencies (Williamson, 1998a), or by reproducing an Asian analogue of the European Monetary System's multilateral currency grid. A common basket peg (CBP) is particularly attractive since by using both common weights and a basket it would minimize the effects of fluctuations in major currencies for countries which have reasonably diversified trade patterns and thus no obvious candidate for an anchor, and at the same time minimize intra-EA exchange rate instability. The basket can be used to stabilize the NEER or REER with a band to adjust for misalignments, and the collective weights would obviate the problem of 'beggar-thy-neighbour' competitive devaluations.⁶

Of course for a CBP to be workable in a world of high capital mobility there will have to be sufficient convergence of economic fundamentals and policy objectives and there are technical considerations in the choice of common weights.⁷ These weights are unlikely to match exactly the optimal weights in a country's own basket, so the common NEER or REER may be too strong or too weak for some countries and have different outcomes for effective and bilateral volatility.⁸ Again, the trade-off between the UBP and the CBP is an empirical question which can also be examined through counterfactual analysis.

The objective of this paper is to address some of these counterfactuals by looking at the impact of alternative exchange rate regimes on the volatility of the NEER and the bilateral

flexible peg against a diversified basket with suitable variability in the width of the band or in the precise operation of the regime to suit the needs of individual countries.

⁶ For a discussion of collective solutions in the context of closer monetary and exchange rate cooperation in EA, see Wilson (2005, 2006) and for the basket peg, in particular, Williamson (2005). The progress in EA monetary and financial cooperation is reviewed in Rajan (2006).

⁷ Even if there is insufficient enthusiasm for a fully-fledged CBP in EA in the near future, this does not rule out the use of a common basket as a monitoring device or the creation of a basket-based Asian Currency Unit as a 'parallel currency' to encourage intra-regional trade and investment and eventual monetary unification, as suggested by Eichengreen (2006).

⁸ See Bird and Rajan (2002).

rate against the US\$ for nine EA countries after the Asian financial crisis.⁹ Our counterfactuals include a UBP, a CBP, and a hard peg against the US\$, but in contrast to previous counterfactual exercises, such as Williamson (1998a) and Ohno (1999) which compute the weights for effective exchange rates on the basis of simple bloc aggregates, we apply a more disaggregated methodology using a larger number of trade partners. We also utilize ARCH/GARCH techniques to obtain estimates of heteroskedastic variances to better capture the time-varying characteristics of volatility for the actual and simulated exchange rate regimes.

Our results confirm that mean exchange rate volatility for EA countries after the Asian financial crisis is substantially higher than pre-crisis, about twice for the NEER and almost four times for bilateral rates against the dollar. A UBP would minimize effective exchange rate volatility for all countries and provides the highest regime gains compared to actual. Although the gains for a CBP are always less than those for a UBP the absolute differences between the two regimes appear to be small. In terms of bilateral exchange rates against the dollar the gains from a UBP or CBP could also be quite significant for the non-dollar peggers since a fall in effective instability would be accompanied by a fall in bilateral instability.

We begin in 2 with some background on the literature focusing on the choice of exchange rate regime in the context of exchange rate volatility. This is followed in 3 with a discussion of the methodology which underpins our counterfactual experiments in relation to previous work. Our empirical results are presented in 4 and our key findings are then brought together in the form of a conclusion.

2. EXCHANGE RATE VOLATILITY AND THE CHOICE OF REGIME

One aspect of the choice of exchange rate regime is its implications for the magnitude of exchange rate volatility and the transmission of this volatility into the domestic economy.¹⁰ There is now a substantial literature looking at the impact of exchange rate volatility on trade and capital flows. For comprehensive surveys see Cote (1994), Bachetta and Van Winloop (2000) and more recently, McKenzie (1999). The evidence appears to be very mixed, but according to McKenzie, recent empirical studies have had “greater success in deriving a statistically significant relationship between volatility and trade” (p. 100). Calvo and Reinhart (2002) reach a similar conclusion. The application of trade gravity models (Rose 2000) also

⁹ Singapore, Malaysia, Indonesia, Thailand, Philippines, China, Hong Kong, Taiwan and Korea.

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suggests that exchange rate volatility might have a negative, albeit small, effect on trade. On the other hand, a comprehensive study by the International Monetary Fund (Clark et. al, 2004) found no robust negative effect between exchange rate volatility and trade flows. Indeed, tying up exchange rates prematurely could even increase instability if EA has not reached a sufficient level of economic convergence according to the standard optimum currency criteria.

A related issue is whether exchange rate volatility varies systematically across exchange rate regimes. According to Flood and Rose (1999) it does not.¹¹ This does not rule out, however, the possibility that a particular regime has worked well for a given country. Khor et al. (2007), for example, make the case that Singapore's exchange rate-centred monetary policy since 1981, based on a basket, band and crawl, has been successful in preventing short-term external shocks, including financial instability, from adversely affecting real domestic variables and at the same time has left sufficient flexibility to prevent misalignment.

The starting-point for our analysis is the counterfactuals carried out on EA countries for the period before the Asian financial crisis by Williamson (1998a) and Ohno (1999).

Williamson conducted an experiment for nine EA countries, which he assumed to be close competitors, between the end of 1994 and April 1995 when the yen appreciated sharply against the dollar. Most EA countries stayed with the dollar and so experienced a large actual fall in their NEER, more than they would have wanted. A UBP, by definition would have meant zero variation in the NEER but significant instability (cumulative sum of the monthly percentage change) bilaterally against the dollar and thus relative to each other. A CBP, on the other hand, with weights based on common extra-regional trade would have meant an identical 9.8 per cent appreciation of all EA currencies against the dollar and modest changes in NEERs, and the exact composition of the basket was not crucial for obtaining the benefits of insulation. He concluded that a CBP which reflects the EA countries' average trade patterns, would produce the same result as UBPs in terms of stabilizing the NEER against volatility in third currency exchange rates, but with the advantage of eliminating intra-EA exchange rate volatility.

Ohno's (1999) counterfactuals were based on 10 EA countries using monthly data over the period January 1990 to June 1997. He finds that there are hardly any differences between a CBP and a UBP in terms of the standard deviation of the level of the CPI based REER.

¹⁰ For a discussion of the spectrum of exchange rate regimes, see Frankel (1999).

¹¹ Although Rose (2006) finds that inflation targeting countries typically (though insignificantly) have lower exchange rate volatility between 1990 and 2005 than for other regimes.

Furthermore, only Singapore, Malaysia, Hong Kong and Taiwan would benefit from either a UBP or a CBP in terms of reducing instability compared to actual.

Both the Williamson and Ohno counterfactuals use simple trade weights (exports plus imports). For Williamson the weights for his NEER and UBPs are based on three blocs: the United States, Japan and Western Europe, and he computes his common basket peg using the weighted average of the extra-regional trade of the EA countries, assigning the weights to the 3 blocs in a fashion similar to the unilateral basket pegs. Ohno uses a larger number (30) of trading partners which are common to all the EA countries to calculate his REER instead of just 3 blocs. But his computations of the unilateral and common basket pegs contain only three currencies: the U.S dollar, yen and the European Currency Unit.

Our analysis will apply a more detailed methodology for calculating the weights for the NEER and basket pegs, cover the post-crisis period, and utilize a more time sensitive measure of volatility. In addition, we will include a hypothetical hard peg to broaden the spectrum of exchange rate regimes considered.

3. METHODOLOGY

a. Sample and Time Period

Our sample comprises China, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand. The counterfactuals are computed between February 1998 and March 2003 which enables us to go beyond the 4 months used in the Williamson (1998a) experiments and to extend Ohno's (1999) study of the pre-crisis period to the post crisis era. A problem is how to interpret the results for Malaysia in the post crisis period given its decision to peg the ringgit to the US dollar in September 1998 (reverting to a managed float in 2005) following a period of high volatility. Clearly, if the whole post-crisis period is used Malaysia is a relatively high volatility country but after September 1998 it effectively joined the dollar peggers and the results would be more akin to those for China and Hong Kong. Since the purpose of the present paper is to compare exchange rate regimes across the country sample and there is no good reason to begin the post-crisis period to coincide with a regime change in any one country, we decided to stick with our original periods, but the results for Malaysia need to be interpreted in this light.

b. Effective Exchange Rates

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The NEER for a country measures the value of that country's currency against a basket of other currencies and is a weighted average exchange rate against the other currencies in the basket, expressed as an index relative to a base date. The REER is corrected for relative inflation between the home country and its trading partners. The weights used are often based on trade flows, thus enabling the REER to act as an indicator of competitiveness, in the sense that a rise indicates an appreciation of the home country's real exchange rate relative to its trading partners.¹² Import weights are fairly easy to compute since they are based on bilateral imports. However, export weights are more complex and can be computed in a number of ways.¹³ The bilateral export weighting system used by Williamson (1998a) and Ohno (1999) is the simplest but does not account for indirect competition between trading partners in third markets. A multilateral export weighting system computes the weights on the basis of a competing country's share of exports in world trade, thus factoring in competition in third markets, but ignores the specific export markets of individual countries and may lead to an overestimation of the importance of small economies which trade amongst themselves, but have large export sectors.

The weights used for the computations of the NEER and REER in this paper were kindly supplied by Dominique Desruelle and are based on geometric averages and follow the methodology set out in the International Monetary Fund's Information Notice System (see Zanello and Desruelle, 1997). A double weighting system is employed to capture both direct and third-market competition and the weights are calculated separately for trade in manufactures, non-oil primary commodities, and tourism services and are then aggregated.¹⁴ The impact of seasonal variation in prices on the computed REER was removed by adjusting the CPI using the X-12-ARIMA approach. Despite its well-known drawbacks, we use the CPI to compute the monthly REER for the graphics in Figure 1 since CPI data is easily obtained and can be used as a basis for REER comparison across the different EA countries.¹⁵ Both the NEER and REER are computed using July 1995 as the base month, and the weights

¹² Note that from the point of view of an 'optimal basket' for a country with significant capital inflows, a trade-weighted basket need not be optimal. See Yoshino et al. (2004).

¹³ For a discussion of these problems, see Lafrance et al. (1998).

¹⁴ The geometric average is preferred to the arithmetic average as there could be distortions in the arithmetic index when the base period is changed, and percentage changes in an arithmetic index will differ in size depending on whether bilateral exchange rates are defined in units of home currency per foreign currency unit or vice versa (Ellis, 2001).

¹⁵ For the pros and cons of different price indices, see Kipici and Kesriyeli (1997), Lafrance et al. (1998) and Abeysinghe and Wilson (2002).

were derived from data between 1988 and 1990.¹⁶ A rise in the NEER and REER signifies an appreciation of the home country's nominal and real exchange rate respectively.

c. Volatility Measures

There is no unique measure of volatility but the ARCH (Engle, 1982) and the GARCH (Bollerslev, 1986) estimates specifically allow heteroskedasticity in the variance to capture periods of tranquillity and volatility in a time series.¹⁷ Hence to measure volatility in the actual and hypothetical regimes we compute the conditional (heteroskedastic) variance (CV) in logs of first differences using an ARCH-GARCH modelling strategy.¹⁸ More details of the procedures adopted are given in an appendix.

d. Counterfactuals

Counterfactual exercises are carried out for all EA9 countries using the methodology originally set out by Takagi (1986). The hypothetical regimes include a UBP, a CBP and a hard peg (HP) against the US dollar. The hard peg is assumed to have no band width and the rate to peg a country's currency to the dollar is based on the average bilateral exchange rate with the dollar from January to June 1994. Since we are concerned with volatility in the NEER and bilateral exchange rates and not the optimal rate to peg to the dollar, pegging at an arbitrary rate will not affect the volatility of the NEER since it is expressed in terms of an index (July 1995=100), and the volatility of bilateral exchange rates will be zero regardless of the rate at which the currency is pegged. The currency weights for the UBPs are chosen be the same as those used in the compilation of the NEER and REER based on the individual trading partners of the respective countries. The computations for the common basket peg are carried out in a similar fashion but the weights are obtained by taking the weighted average of the weights assigned to the common trade partners of all the EA9 countries.

Of course these counterfactuals capture only one dimension of the choice of exchange rate regime insofar as they focus on the effects of alternative regimes on the stability of nominal exchange rates compared to actual in 'normal' times. They are not concerned with the

¹⁶ The weights here are fixed and ideally they should be updated regularly, but empirical work by Chinn (2002) suggests that fixed weight and variable weight REERs tend to move closely together.

¹⁷ Using standard deviations of changes in exchange rates tends to capture short-term instability, especially if high frequency data is used, while standard deviations of levels of exchange rates are more indicative of medium term instability. See the review by McKenzie (1999).

¹⁸ We also computed the unconditional (homoskedastic) variance (UV) as a robustness check and the ratios of the means of the UVs to the means of the CVs. Since the ratios for both the NEER and bilateral exchange rates are all close to unity, the results are robust to both measures.

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'optimal basket' based on a range of macroeconomic variables, such as the level of foreign debt or imported inflation (see Bird and Rajan, 2002), or are sufficient to ensure stability in exchange rate competitiveness in the absence of additional policies to adjust for the gap between domestic and foreign inflation. In addition, the hypothetical exchange rate regimes operate under *ceteris paribus* conditions which rule out endogenous responses, such as the change in domestic prices due to exchange rate pass-through effects or changes in the structure of the economy arising from changes in the direction of trade (fixed trade weights) or inward foreign direct investment, which may be exogenous or endogenous to exchange rate changes.

4. RESULTS

Table 1 presents annualized conditional standard deviations (ACSD) from the ARCH/GARCH daily conditional variances for the actual and hypothetical exchange rate regimes. The regimes with the lowest ACSD are highlighted in bold. The regime gains are simply the difference between the hypothetical regime and the actual. A large negative value signifies a high degree of volatility reduction.

a. NEER Volatility

In terms of the NEER the hypothetical UBP minimizes volatility for all countries and provides the highest regime gains compared to actual. The countries which gain most from the UBP are those which have higher actual volatility, such as Indonesia, Korea, Philippines, Malaysia and Thailand. On the other hand, the gains are lowest for China, Hong Kong, Singapore and Taiwan because their actual volatility is relatively low.

Although the gains for the CBP are always less than those from the hypothetical UBP, the absolute differences between the two regimes appear to be very small. Singapore would give up the most gains by switching from a UBP (-5.09) to a CBP (-2.76). The mean for the UBP is -11.34 and -10.57 for the CBP and this confirms previous work by Ohno (1999) and Williamson, (1998a) and suggests that in volatility terms, at least, the extra costs of a CBP may not be substantial and this strengthens the case for a common basket peg for EA countries in the longer run.

The gains from a hard peg, by contrast, are negligible and zero by definition for the dollar peggers. Although there is a gain in mean volatility reduction across the EA9, it is small

compared to the basket pegs at -0.41. There might be some benefit to Thailand but it is less than half the gains from the basket pegs.

b. Bilateral Volatility

In terms of bilateral exchange rates against the dollar, volatility is zero by definition for the hypothetical HP, so the focus is on the basket pegs. Of course under the CBP, since all countries peg their currencies to the same set of countries in the basket with the same weights, volatility will be the same for all countries so intra-EA9 exchange rates are constant. But the gains compared to actual can still differ between the two regimes. If EA9 adopt UBPs, their own NEERs will be stabilized but intra-EA9 exchange rates will continue to fluctuate.¹⁹ The question then arises as to whether EA countries gain an *additional* or net benefit of relatively stable intra-bloc exchange rates against the dollar if they were to adopt a UBP. In other words, is there a trade-off between reducing instability in the NEER with a UBP but simultaneously increasing instability against the dollar and thus against other EA countries?

For the dollar peggers, China and Hong Kong which, by definition, have low bilateral instability but relatively high instability in their NEERs there would be little to gain if they were to adopt a UBP to stabilize the NEER net of the effect this would have on bilateral instability (Table 2 and Figure 2). Apart from the dollar peggers, there appears to be no obvious trade-off between the two since high (low) volatility in bilateral terms tends to be closely associated with high (low) volatility in the NEER. China and Hong Kong would gain little if they were to adopt a UBP (or CBP) to stabilize the NEER net of the effect this would have on bilateral instability but for the rest of the sample the gains from the baskets could be quite significant since a fall in effective instability would be accompanied by a fall in bilateral instability. Moreover, these results also apply to a CBP.

5. CONCLUSION

The objective of this paper has been to carry out a counterfactual analysis of the impact of alternative exchange rate regimes on the volatility of the NEER and the bilateral rate against the US\$ for nine East Asian countries after the Asian financial crisis. Our counterfactuals include a UBP, a CBP, and a hard peg against the US\$, but in contrast to previous

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counterfactual exercises, such as Williamson (1998a) and Ohno (1999) which compute the weights for effective exchange rates on the basis of simple bloc aggregates, we apply a more disaggregated methodology using a larger number of trade partners. We also utilize ARCH/GARCH techniques to obtain estimates of heteroskedastic variances to better capture the time-varying characteristics of volatility for the actual and simulated exchange rate regimes.

Our counterfactuals suggest that, as far as exchange rate volatility is concerned, a basket is 'best' insofar as the hypothetical UBP minimizes NEER volatility for all countries and provides the highest regime gains compared to actual. In terms of bilateral rates against the dollar there are also gains for the non-dollar peggers since a fall in effective instability would be accompanied by a fall in bilateral instability. These gains also follow through for the CBP. Although the gains are always less than those from the hypothetical UBP the absolute differences between the two regimes appear to be very small. This confirms previous work by Ohno (1999) and Williamson, (1998a) and suggests that in volatility terms, at least, the extra costs of a CBP may not be substantial and this strengthens the case for a common basket peg for EA countries in the longer run

Of course the counterfactuals in this paper operate under highly restrictive conditions and in practical terms a common currency peg in EA seems unlikely in the immediate future. Although there is now a significant amount of intra-bloc trade and investment, financial integration has tended to lag behind and the economic and political preconditions for a common monetary policy are not sufficiently present, and it is not at all clear empirically that the benefits would outweigh the costs. A CBP is also made more difficult by the greater openness of international capital markets today compared to the situation facing Europe in the past. Some policymakers in the region do, however, appear to be concerned about the effects of exchange rate changes and intra-bloc currency instability on their competitive positions²⁰ and this should provide some scope for a continuing dialogue about exchange rate issues which might lead to a common exchange rate mechanism in the future.

APPENDIX

¹⁹ These can be calculated from the bilateral exchange rates since all the EA9 exchange rates are expressed in relation to the U.S dollar.

²⁰ At the annual ADB meeting in South Korea in May 2004 it was accepted that a monetary union was a long way off but there was some concern about the damage that intra-bloc currency fluctuations were having on regional trade and investment flows and that more research needed to be done on this issue.

a. ARCH-GARCH Estimates

The procedure involved estimating the mean equation and the conditional variance simultaneously using the maximum likelihood method. The first step was to select the best fitting autoregressive integrated moving average (ARIMA) model for the mean equation using the Schwartz Bayesian criterion (SBC) and to test for the presence of serial autocorrelation in the residuals using the Ljung-Box Q statistic. The ARIMA model was chosen since the coefficients of the lag terms in the autoregressive moving average (ARMA) model are close to unity. Having determined the best fitting ARIMA model, the Lagrange multiplier (LM) test was used to check for ARCH disturbances by regressing the squared residuals ε_t^2 on a constant and q lagged values:

$$\varepsilon_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + u_t \quad (1)$$

where u_t is a white noise process. If ARCH or GARCH disturbances are non-existent, the

estimated values of $\sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2$ should be zero, indicating a constant variance of α_0 .

An ARCH (q) process models the conditional variance as an autoregressive (AR) process using the square of the estimated residuals:

$$E_{t-1}(\varepsilon_t^2) = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + v_t \quad (2)$$

Where v_t is a white noise process and is independent of u_t . Equation (2) implies that the conditional variance of ε_t is dependent on the realized values of all the ε_{t-i}^2 . Thus volatility in previous periods tends to persist and influence the conditional variance in the present period.

The GARCH (p,q) model differs from the ARCH (q) model in that it allows for both autoregressive and moving average components in the conditional variance h_t . For example, a GARCH (p,q) model based on the log of first differences of the exchange rate series R and an ARIMA (1,1,0) would take the form:

$$\Delta \ln R_t = a_0 + a_1 \Delta \ln R_{t-1} + \varepsilon_t, \text{ where } \varepsilon_t \sim N(0, h_t) \quad (3)$$

$$E_{t-1}(\varepsilon_t^2) = h_t = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^p \beta_i h_{t-i} + z_t$$

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where z_t is a white noise process, α_0 is the mean, $\sum_{i=1}^q \alpha_i \varepsilon_{t-1}^2$ (the ARCH terms) are interpreted

as news about volatility from previous periods, and $\sum_{i=1}^p \beta_i h_{t-1}$ (the GARCH terms) are last

period's forecast variance, implying a form of adaptive learning behaviour.

ARCH and GARCH processes were then compared using the SBC, and the best fitting model was selected to obtain the mean conditional variance.

b. Data and Sources

Average monthly exchange rates and CPI data to calculate the monthly NEER and REER figures for graphical purposes were taken from the IMF's *International Financial Statistics*. China's CPI was downloaded from the Asian Development Bank's *Asia Recovery Information Centre* and Taiwan's exchange rate and CPI figures were obtained from the *Monthly Bulletin of Statistics, the Republic of China*. All the CPI figures are spliced together with July 1995 as the base month. Unfortunately Australian CPI data is published only on a quarterly basis so the quarterly figures were interpolated using a cubic spline with the last observation matched to the source data. Average daily exchange rate data for the ARCH and GARCH estimates were downloaded using DataStream International 2000 *DataStream Advance 3.5*.

REFERENCES

- Abeysinghe, T. and P. Wilson (2002), 'International Competitiveness, in Chng M.K., W. T. Hui, A. T. Koh, K. L. Lim, and B. Rao (eds), *The Singapore Economy in the 21st Century: Issues and Strategies* (Singapore: McGraw-Hill).
- Asian Development Bank, *Asia Recovery Information Center*, <http://aric.adb.org/default.asp>
- Bachetta, P. and E. Van Wincoop (2000), 'Does Exchange Rate Stability Increase Trade and Welfare?' *American Economic Review*, 90, 1093-1109.
- Bird, G. and R. Rajan (2002), 'Optimal Currency Baskets and the Third Currency Phenomenon: Exchange Rate Policy in Southeast Asia', *Journal of International Development*, 14, 8.
- Bollerslev, T. (1986), 'Generalized Autoregressive Conditional Heteroskedasticity', *Journal Of Econometrics*, 31, 3.
- Calvo, G. and C. Reinhart (2002), 'Fear of floating', *Quarterly Journal of Economics*, 117,

379-408.

- Chinn, M.D. (2002) 'The Measurement of Real Effective Exchange Rates: A Survey and Applications to East Asia, paper presented at a conference on Deepening Financial Arrangements in East Asia organized by the Australia-Japan Research Centre and China Centre for Economic Research, Beijing, China, May 24 – 25.
- Clark, P., N. Tamirisa and Shang-Jin Wei (2004), "A New Look at Exchange Rate Volatility and Trade Flows", Washington, DC., International Monetary Fund, Occasional Paper 235.
- Cote, A. (1994), '*Exchange Rate Volatility and Trade: A Survey*', Bank of Canada Working Paper No. 94-5.
- DataStream International Limited (2000), *DataStream Advance 3.5*.
- The Republic of China, *Monthly Bulletin of Statistics the Republic of China*, Various Issues.
- Dornbusch, R. and Y. C. (1998), 'Flexibility or Nominal Anchors?' In Collignon, P.F. and Park (eds.), *Exchange Rate Policies in Emerging Asian Countries* (London: Routledge).
- Eichengreen, B. (2006), "The Parallel Currency Approach to Asian Monetary Integration", *American Economic Association Papers and Proceedings*, May.
- Ellis, L. (2001), 'Measuring the Real Exchange Rate: Pitfalls and Practicalities', *Reserve Bank of Australia Research Discussion Paper No. 2001-04*.
- Engle, R. F. (1982), 'Autoregressive Conditional Heteroskedasticity with Estimates of The Variance of United Kingdom Inflation', *Econometrica*, 50, 4.
- Flood, R. and A. Rose (1999), '*Understanding Exchange Rate Volatility Without the Contrivance of Macroeconomics*', Mimeo.
- Frankel, J. A. (1999), 'No Single Currency Regime Is Right for All Countries or At All Times', *National Bureau of Economic Research Working Paper no. 7338*.
- Frankel, J. and A. Rose (2002), 'An Estimate of the Effects of Currency Unions on Trade and Growth', *Quarterly Journal of Economics*, **117**, 1009-1025.
- Glick, R. and A. Rose (2001), '*Does a Currency Union Affect Trade?: The Time-Series Evidence*', NBER Working Paper N0. 8396.
- International Monetary Fund. *International Financial Statistics*, various issues (Washington).
- Khor, H. E., J. Lee, E. Robinson and S. Saktiandi (2007), '*Managed Float Exchange Rate System: The Singapore Experience.*'
- Kipici, A. N. and M. Kesriyeli (1997), 'The Real Exchange Rate Definitions and Calculations', *Central Bank Of The Republic Of Turkey Working Paper No. 97/1*.
- Kwan, C. H., D. Vanderbrink and S. Y. Chia (1998), '*Coping with Capital*

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- Flows in East Asia*' (Singapore: Nomura Research Institute and Institute of Southeast Asian Studies).
- Lafrance, R., P. Osakwe and P. St-Amant (1998), 'Evaluating Alternative Measures Of The Real Effective Exchange Rate', *Bank of Canada Working Paper 98-20*.
- McKenzie, M (1999), 'The Impact of Exchange Rate Volatility on International Trade Flows', *Journal of International Surveys*, 13, 71-103.
- Ohno, K. (1999), 'Exchange Rate Management in Developing Asia', *Asian Development Bank Institute Working Paper no 1*.
- Rajan, R. (2002), 'Exchange Rate Policy Options For Post-Crisis Southeast Asia: Is There a Case for Currency Baskets?' *The World Economy*, 25, 1.
- Rajan, R. (2006), "Monetary and Financial Cooperation in Asia: Emerging Trends and Prospects", RIS Discussion Paper, RIS-DP # 107.
- Rose, A. (2000), 'One Money, One Market: Estimating the Effect of Common Currencies on Trade', *Economic Policy*, 15, 7-46.
- Rose, A. (2006), "A Stable International Monetary System Emerges: Bretton Woods, Reversed", Centre for Economic Research Discussion Paper, DP5854, September.
- Takagi, S. (1986), 'Pegging To A Currency Basket', *Finance & Development*, 23, 3.
- Williamson, J (1998a), 'The Case for a Common Basket Peg', In Collignon, P.F. and Y. C. Park (eds.), '*Exchange Rate Policies In Emerging Asian Countries*' (London: Routledge).
- Williamson, J. (1998b), 'Crawling Bands or Monitoring Bands: How to Manage Exchange Rates in a World of Capital Mobility' *International Finance*, 1, 1.
- Williamson, J. (2005), "A Currency Basket for East Asia, Not Just China" Institute for International Economics, Policy Briefs, # PB05-1.
- Wilson, P. (2005), 'Prospects for Asian Monetary Cooperation after the Asian Financial Crisis: Pipedream or Possible Reality', in Sjöholm, F. and J. Tongzon (eds), *Institutional Change in Southeast Asia* (London: Routledge).
- Wilson, P. (2006), 'Prospects for Asian Exchange Rate Cooperation: Why an ERM Solution Might be the Most Palatable', *Journal of the Asia Pacific Economy*, 11(1), 1-34.
- Yoshino, N., S. Kaji and A. Suzuki (2004), 'The Basket-Peg, Dollar-Peg, and Floating: A Comparative Analysis', *Journal of the Japanese and International Economies*, 18, 183-217.
- Zanello, A. and D. Desruelle (1997), '*A Primer on the IMF's Information Notice System*', IMF Working Paper WP/97/71 (Washington).

TABLE 1
Post-Crisis Volatility and Regime Gain

Country		Actual	UBP	CBP	HP
NEER					
China	Volatility	4.94	0.51	0.77	4.94
	Gain	-	-4.43	-4.17	0
Hong Kong	Volatility	4.23	0.49	0.81	4.23
	Gain	-	-3.74	-3.42	0
Indonesia	Volatility	31.34	0.50	1.51	31.32
	Gain	-	-30.84	-29.83	-0.02
Korea	Volatility	11.69	0.54	1.20	11.69
	Gain	-	-11.15	-10.49	0
Malaysia	Volatility	21.91	0.56	1.21	22.58
	Gain	-	-21.35	-20.7	0.67
Philippines	Volatility	10.83	0.55	1.09	10.77
	Gain	-	-10.28	-9.74	-0.06
Singapore	Volatility	5.94	0.85	3.18	5.83
	Gain	-	-5.09	-2.76	-0.11
Taiwan	Volatility	6.19	0.52	0.78	6.08
	Gain	-	-5.67	-5.41	-0.11
Thailand	Volatility	10.07	0.51	1.46	5.99
	Gain	-	-9.56	-8.61	-4.08
Mean	Volatility	11.9	0.56	1.33	11.49
	Gain	-	-11.34	-10.57	-0.41
BILATERAL:					
China	Volatility	0.07	4.51	4.82	-
	Gain	-	4.44	4.75	-
Hong Kong	Volatility	0.19	3.81	4.82	-
	Gain	-	3.62	4.63	-
Indonesia	Volatility	30.76	5.79	4.82	-
	Gain	-	-24.97	-25.94	-
Korea	Volatility	10.63	5.39	4.82	-
	Gain	-	-5.24	-5.81	-
Malaysia	Volatility	23.23	4.96	4.82	-
	Gain	-	-18.27	-18.41	-
Philippines	Volatility	10.50	4.89	4.82	-
	Gain	-	-5.61	-5.68	-
Singapore	Volatility	6.74	5.21	4.82	-
	Gain	-	-1.53	-1.92	-
Taiwan	Volatility	4.52	5.02	4.82	-
	Gain	-	0.5	0.3	-
Thailand	Volatility	10.57	5.93	4.82	-
	Gain	-	-4.64	-5.75	-
Mean	Volatility	10.8	50.57	4.82	
	Gain		-5.74	-5.98	

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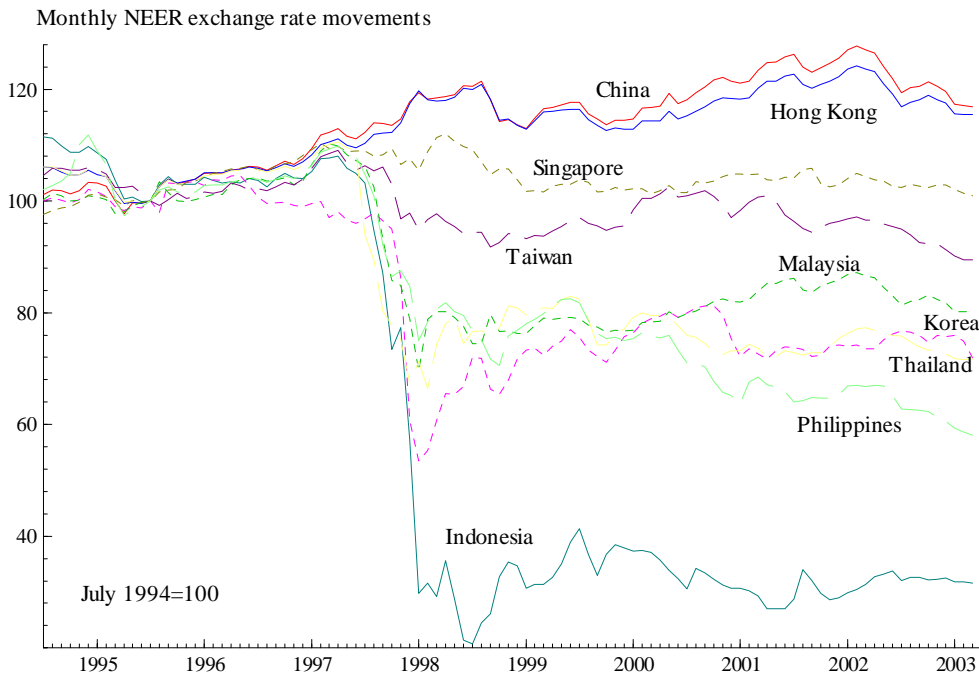
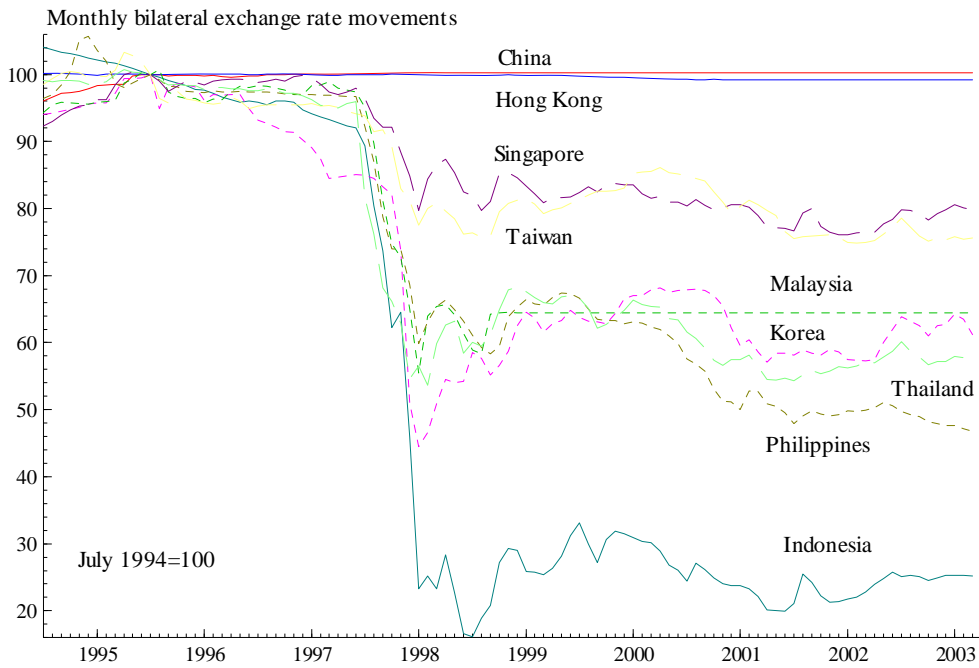
TABLE 2

The Trade-Off between Basket Pegs and Bilateral Volatility

Net Gain	UBP	CBP
China	0.01	0.58
Hong Kong	-0.12	1.21
Indonesia	-55.81	-55.77
Korea	-16.39	-16.3
Malaysia	-39.62	-39.11
Philippines	-15.89	-15.42
Singapore	-6.62	-4.68
Taiwan	-5.17	-5.11
Thailand	-14.2	-14.36
Mean	-17.09	-16.55

Note: the net gain is the reduction in volatility (ACSD) from the basket peg compared to actual plus the gain or loss in bilateral volatility compared to actual. A negative sign implies a gain.

FIGURE 1
Pre- and Post-Crisis East Asian Exchange Rates



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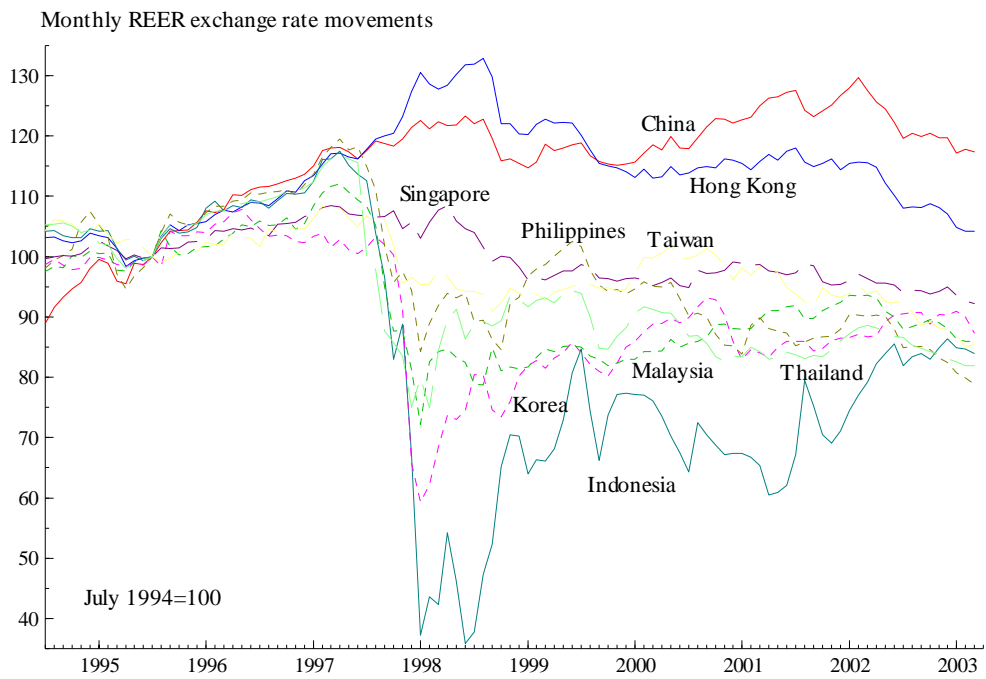


FIGURE 2

The Trade-Off in Gains from Basket Pegs

