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Monetary anchor for East Asia: Japan or United States?

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In this paper we apply the optimum currency area (OCA) criteria to assess the suitability of whether the United States or Japan would best serve as monetary anchor country for East Asian countries. The criteria used are trade openness, business cycle synchronisation, exchange rate volatility, inflation convergence, and interest rate cycle synchronisation. The 'performance' of these two potential monetary anchor countries is compared for three different economic periods: the pre-crisis, the crisis, and the post- crisis period. Based on ratings of 16 countries in the region, results suggest that the United States might be the more fitting candidate to be the anchor country.

Key words: Optimum currency area, Asia, monetary union, business cycle, Japan, anchor currency.

INTRODUCTION

In East Asia, there has been a resurgence of interest in reforming monetary arrangements in the aftermath of the regional crisis in the late 1990s and monetary union is one of the options being considered. Among academics and policymakers, the idea of establishing a regional currency has attracted increasing attention (Crowley and Quah, 2009; Swofford, 2008; Kuroda, 2004; Kwack, 2004; Dutta, 2000; Kwan, 1998). Several factors favour forming a single currency bloc in East Asia: first is the continued progression toward openness and interdependence among the East Asian economies; second that individually these countries are vulnerable to economic disturbances from abroad, especially those caused by the high degree of international capital mobility; and lastly, those disturbances have appeared to be substantially symmetric among many individual countries. Indeed, in May, 2007, as an initial step, the ASEAN + 3 (ASEAN plus Japan, Korea, and China) agreed in the Chiang Mai Initiative[1] to a network of bilateral swap agreements that

allows East Asian countries to borrow funds from one another. The issuance of an Asian currency unit (ACU) has been proposed and the recent liberalisation of cur-rency exchange, immigration, and trade between China and Taiwan (The China Post, 2008) has further sup-ported the development of region-wide integration. The remainder of this paper contains three further sections. The second section gives a brief summary of the literature in this area. The third section outlines the OCA criteria and the particular interpretations given to them as well as examining each of the criterion for the East Asian countries to assess the suitability of the dollar or the yen as the anchor currency. Finally, in the fourth section, a conclusion is presented.

CURRENT LITERATURE

The question that is rarely addressed in the literature on East Asian monetary integration is: which currency should East Asian economies anchor their currencies to? To date, the Japanese yen, the Chinese yuan and the U.S. dollar are the currencies that the current literature focuses on when considering monetary integration in East Asia.

For instance, Kwan (1998) evaluated the feasibility of a Japanese bloc in Asia but the empirical evidence used did not support it. Many Asian countries display less dependence on Japan, as their relationships have been undermined by the rise of China as a major trading

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[1] Chiang Mai Initiative (CMI) is a collaboration amongst ASEAN+3 countries which strives for creation of a network of Bilateral Swap Arrangements (BSAs). After 1997 Asian crisis, member countries started this initiative to manage regional short-term liquidity difficulties and to coordinate the work of international financial organisations like IMF and World Bank.

partner and the emergence of the Asian Newly Industrialised Economies (NIEs) as major investors in these countries. As noted by Kwack (2004), besides Japan, China continues to play a leadership role in the push for greater regional monetary integration and cooperation. Nevertheless, Hefeker and Nabor (2005) argued that even though China would eventually become a more important destination for Asian products than Japan, it is rather unlikely that the yuan will assume a dominant role immediately; the Chinese financial markets are still underdeveloped and its foreign capital flows are still heavily controlled. The second piece of evidence against Japan being the anchor for a monetary union is based on the criterion of homogeneity in economic structure. Finally, the inflation rate in Japan has been much lower than in other East Asian countries, which is partly due to the prolonged downturn in the Japanese economy during the 1990s and 2000s.

Lim (2005), in a related study found that co-movements of prices could support a common dollar or yen area for Hong Kong, South Korea, Malaysia, the Philippines, Singapore, and Thailand. It was also found that countries whose exchange rates had diverged significantly from the Japanese rate are South Korea, Malaysia, and Thailand. Apart from Hong Kong, none of the East Asian currencies had a long-run cointegrating relationship with the Japanese yen. In spite of this, in the empirical optimum currency area (OCA) literature, several authors have designated Japan as the appropriate anchor country when assessing the feasibility of East Asian monetary union. Font- Vilalta and Costa-Font (2006), for instance, analyzed the synchronisation of exchange rates, synchronisation of business cycles, synchronisation of interest rates, and trade linkages with Japan for five East Asian countries. Meantime, Ibrahim (2008) studied the feasibility of monetary union in East Asia by using Japan as the anchor and two sets of convergence criteria. These studies are supported by Bowman (2004) who claimed that the US dollar has already declined in importance in the post-crisis East Asia whilst Australia and Japan are becoming increasingly important regional influences.

On the other hand, some scholars have stressed the supremacy of the dollar in East Asia. For example, Chow et al. (2007) have confirmed Frankel and Wei's (1994) finding that the dollar plays a prominent role in the exchange rate policies of East Asian economies beyond the short run. Moreover, as McKinnon and Schnabl (2004) point out, the dollar is widely used as the invoice currency for most East Asian trade even though Japanese trade in the region is as large as that of the US; only about half of Japan's overall exports are invoiced in yen, while three quarters of its imports are invoiced in dollars. Also, Rogoff (2005) has shown that many developing countries in East Asia still have high levels of debt dollarisation in the post-crisis era. Given the above, this paper attempts to assess the appropriateness of whether the US or Japan should be the monetary anchor for any potential East

Asian monetary standard. The evaluation is based on five OCA criteria that are dependent on a reference country, and are defined here as trade openness, synchronisation in business cycles, volatility of the real exchange rate, inflation convergence, and synchronisation in real interest rates. Also, while the mainstream OCA literature has rarely included the less 'popular' countries, namely Brunei, Cambodia, Laos, Myanmar, Vietnam, Macau, and India, this paper extends the investigation of the OCA criteria to these countries bringing the number of countries to a total of 16. [2] The inclusion is crucial because the more the participants in a monetary union, the larger the pooled stock of reserves, and so the greater the sustainability of that union. Besides, any study of East Asian monetary integration would not be complete if any of the 10 ASEAN member countries were omitted from the sample.

OPTIMUM CURRENCY AREA CRITERIA

The foundations of the OCA theory were laid out by Mundell (1961) and McKinnon (1963), before being refined by, among others, Kenen (1969) and Krugman (1990). The OCA theory outlines criteria under which a country can reap large benefits and/or substantially reduce the cost of joining a currency area. In this section, five reference-dependent criteria are interpreted and assessed for 16 countries across three economic periods, the 'pre-crisis' period, the (financial) 'crisis' period, and the 'post-crisis' period. Due to data constraints, the pre-crisis period is set to be 1981 - 1996[3], the crisis period, 1997 - 2000, and the post-crisis period, 2001 - 2007.[4]

Trade openness

The OCA theory suggests that countries which trade a great deal with each other are good candidates for monetary integration as the benefits in terms of transaction cost savings will be enhanced (McKinnon, 1963). Accordingly, Bayoumi and Eichengreen (1997) have detected that European countries which have the greatest levels of bilateral trade have also experienced the greatest increase in their readiness for monetary integration. In effect, as suggested by Edison and Melvin (1990), in choosing which currency to peg to, a country should use a bilateral trade criterion.

A bilateral trade intensity measure, as used by Artis

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[2] Countries examined here are China, Hong Kong, Korea, Taiwan, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, India, Macau, and Brunei. Candidate reference countries are the United States and Japan. India is included to reflect its growing dominance in the region and the world. The country codes used are displayed in Table A.1, Appendix.

[3] 1981–1996 is part of the period prior to the Asian crisis when the region experienced high economic growth—coined by the World Bank as the "East Asian Miracle" (Calomiris and Beim, 2000). Therefore, it is worth to analyze this period separately.

[4] See Table A.1, Appendix for data definitions and sources.

and Zhang (2001), Boreiko (2003), and Nguyen (2007) is adopted here to measure a country's trade openness with the reference country. For any country i, trade openness with the reference country is measured by bilateral trade intensity, $\left(x_{i,r} + m_{i,r}\right)/\left(x_i + m_i\right)$ where x_i and m_i are the exports and imports of goods of a country in question and subscript r indicates destination to or source from the reference country. For ease of comparison, the trade openness differential subtraction of the bilateral trade intensity with Japan from that with US is used here. A positive differential shows that the trade with the US is more substantial than that with Japan while a negative differential shows that the trade with Japan is more significant than that with the US. Period averages are used.

Figure 1 shows the trade openness differentials for the pre-crisis period, the crisis period, and the post crisis period. The countries can actually be classified into two groups: the US group those that depend more on thee US than on Japan for trade (positive differential), and the Japan group-those that depend more on Japan than on the US for trade (negative differential). The findings reveal that majority of them belong to the US group. In this group, Cambodia has the highest trade dependence on the US, while Hong Kong, Korea, Taiwan, and the Philippines can be seen shifting their trade dependence from the US towards Japan. As for the Japan group, Brunei has the highest trade dependence on Japan and whilst the countries in this group still rely more on Japan for their trade, their trade dependence has been shifting towards the US. These shifts are especially high from the pre-crisis to the crisis period. Whilst all countries in the Japan group appear to have reduced their reliance on Japan in the crisis period, only half of those in the US group seem to have done the same in terms of their trade with the US. In light of this, the US group is more resilient than the Japan group in time of economic crisis.

To conclude, there is reason to believe that East Asia has been relying more on the US than on Japan for trade. Out of the 16 countries, only five have maintained a greater trade reliance on Japan across all periods. As far as the bilateral trade linkage criterion is concerned, the US is most probably more dominant than Japan.

Business cycle synchronisation

It is clearly understood that when business cycles are synchronised between two countries, the argument for flexible exchange rates which serve as a shock absorber to resolve asymmetric recessionary or inflationary pressures becomes largely irrelevant. In light of this, the higher the business cycle synchronisation of an East Asian country with the reference country (US or Japan), the stronger the argument that that reference country should be the anchor.

In terms of measurement, it has become popular to

implement this OCA criterion according to the synchronicity of business cycles by evaluating the cross-correlation of the cyclical component of output at business cycle frequencies. In this paper, the method of Gerlach (1988) and Baxter and Stockman (1989) is adopted where synchronicity in output is identified by cross-correlation of the cyclical components of annual real GDP series detrended by applying Hodrick-Prescott (H-P) filter[5].

Figure 2 exhibits the business cycle correlations of the countries vis-à-vis the reference cycles of the US and Japan in the pre-crisis period. Clearly, the East Asian region can be divided almost equally into two mutually exclusive groups; the US group which has positive correlations with the US cycle but negative or zero correlations with the Japanese cycle, and the Japan group which has positive association with the Japanese cycle but is negatively or not associated with the US cycle. Among them, however, there are three outliers. Vietnam has an almost equal linkage with both the US and Japanese cycles. Conversely, the relatively closed economies of Myanmar and Cambodia do not have their cycles synchronised with either the US or the Japanese cycle.

For the crisis period (Figure 3), the Japan group enlarges to include most of the East Asian countries. Except for Taiwan, Cambodia, India, and Myanmar, all countries have correlation coefficients of at least 0.5 with the Japanese cycle. On the other hand, only three countries are in the US group whose coefficients are more than 0.6 each. As in the pre-crisis period, Myanmar is isolated, having an affiliation with neither the US nor the Japan group. In short, the business cycle of the region is highly synchronised with the Japanese cycle in the crisis period.

In the post-crisis period configuration presented in Figure 4, a systematic gravitation of all the countries toward the diagonal can be observed. With the exception of Myanmar, Brunei and Korea, the countries that are located above the diagonal have business cycles in phase slightly more often with the Japanese cycle than with the US cycle. Only the cycles of Hong Kong, Singapore, China, the Philippines, and Thailand are more synchronous with the US cycle. Korea and Brunei have joined Myanmar in possessing a negative business cycle association with both the US and Japan. In brief, the following observations can be made. For the pre-crisis period, the region is polarised into two mutually exclusive groups, that is, the US and the Japan group. In the crisis period, the whole region is virtually a Japan group. Finally, in the post-crisis period, the region can again be divided almost equally into two groups but instead of mutually

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[5] Artis and Zhang (1997) have assessed the robustness/sensitivity of widely used filters and found no evidence that conclusions are sensitive to the choice of filter. For the dampening parameter, Ravn and Uhlig (2002) suggest 6.25 for annual data and 129600 for monthly data. These parameters are used in this paper.
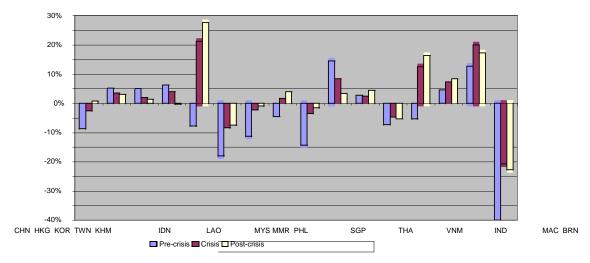
Figure 1. Trade openness differential.
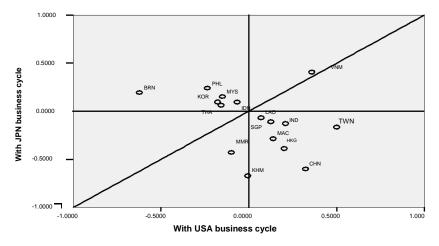Source: See Appendix for data description.

Figure 2. Contemporaneous correlations in the pre-crisis period.
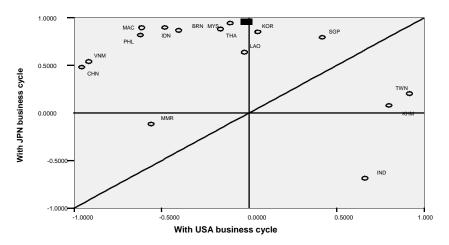Source: See Appendix for data description.

Figure 3. Contemporaneous correlations in the crisis period.
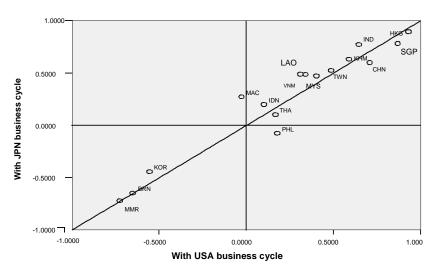Source: See Appendix for data description.

Figure 4. Contemporaneous correlations in the post-crisis period.
Source: See Appendix for data description.

exclusive groups, akin to those in the pre-crisis period, the groups are now overlapping. To some extent, these countries have synchronised their business cycles to both the US and Japanese cycles. Considering the post-crisis period as most relevant for this study, the US and Japan could be equally significant to the region with respect to business cycle synchronisation.

Exchange rate volatility

Real exchange rate variability is a good indicator of synchronicity of economic forces between countries. The level of a country's need for real exchange rate changes is an important determining factor for joining a monetary union because real exchange rate changes are clearly measurable and automatically give the appropriate weights to the economic forces of which they are the result (Vaubel, 1978). These economic forces pertain to inflation rates, openness, economy size, prices, wage flexibility, factor mobility, commodity diversification, goods market integration, and fiscal integration (Tavlas, 1993). Artis and Zhang (1997) have suggested that low real exchange rate volatility might indicate absence of asymmetric shocks and presence of business cycle conformity that may strengthen the case for a currency area.

In this paper, volatility in real exchange rate is repre-sented by the standard deviation of the log-difference of monthly real bilateral exchange rates against the reference country (US or Japan), where the deflator is relative consumer prices. For ease of comparison, the volatility differential is used - this is the difference in volatility in real exchange rates against the US dollar from that against the yen, as shown in Figure 5. A positive differential means that the volatility with the Japanese currency is more than against the US currency, and a

negative differential means that the volatility with the dollar is more than against the yen.

From Figure 5, except for Indonesia, the volatility differentials of all the countries are positive for all periods. This indicates that the real exchange rate movements of all the countries are more erratic against the yen than against the dollar, with the exchange rates of Hong Kong, Vietnam, and Macau being the most volatile vis-à- vis the Japanese currency. Distinctive groupings can be ident-ified. Looking at the pre-crisis and post-crisis periods, the countries can be neatly divided into two groups. The first group consists of Korea, Taiwan, Indonesia, the Philippines, Singapore, Thailand, Macau, and Brunei, which all exhibit a relative fall in exchange rate volatility with the yen. In contrast, the other group of countries shows a relative rise in volatility against the yen. Interestingly, between the two changes, the relative reduction is more substantial than the relative increase. As for the crisis period, half of the countries have their relative exchange rate volatility with Japan reduced.[6]

Inflation convergence

The traditional OCA literature originated during the era of 'fix -price' economics, so introducing inflation convergence as a criterion could be regarded simply as an appropriate normalisation (Artis and Zhang, 2001). Since similar inflation rates result from similarities in monetary and fiscal policy stance and economic structure, the cost of joining a currency area is presumably low when inflation rates are similar across members (Nguyen, 2007).

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[6] It is not surprising to note that the volatility differentials in the crisis period are lower for countries that are affected by the financial crisis, namely Korea, Malaysia, Thailand, the Philippines, and Indonesia since their exchange rates against the dollar fluctuated more in the crisis period than in other periods.
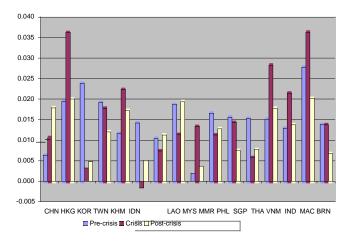
Figure 5. Volatility differential.
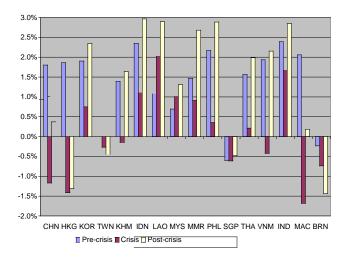Source: See Appendix for data description.

Figure 6. Difference of Inflation Differentials (DID).
Source: See Appendix for data description.

Moreover, convergence of inflation rates, both actual and political, is the central theme of the Maastricht Treaty criteria and a prerequisite prior to accession into the EMU.

This criterion is measured by the absolute inflation differential, $|x_i - x_r|$ where x_i and x_r is the rate of inflation in country i and the reference country, the US or Japan, respectively. Absolute value is used since the magnitude is of concern here.[7] Differentials are averaged over relevant period-the smaller the differential, the higher the inflation convergence. For convenience, the difference of inflation differential (DID)-deduction of inflation differential with the US from that with Japan is

computed (Figure 6) . A positive DID implies that the inflation convergence with the US is higher than that with Japan and a negative DID means that the inflation convergence with Japan is higher than that with the US.

At first glance, most of the countries have at least two periods with a positive DID. This shows that in general, the inflation rates of these countries are more aligned with the US inflation rate than with the Japanese rate. However, among those countries whose inflation rates are more similar to the US rate, China and Macau have their relative inflation differentials with the US increased significantly. At the same time, among the minority whose inflation rates are more aligned with the Japanese rate, Hong Kong and Singapore have their relative differentials with Japan increased marginally.

In the crisis period, almost all inflation rates have either become more similar with the Japanese rate or more dissimilar with the US. Even so, those that are more aligned with the US are resilient- their alignments with US rates have rebounded to higher levels after a significant fall in the crisis period.

Real interest rate synchronisation

Though not listed as one of the criteria based on the traditional OCA theory (Tavlas, 1993), this factor is indicated by a 'revealed preference' argument (Artis and Zhang, 2001). In fact, if the monetary policy of an OCA candidate country historically has differed little from that of the reference country, the cost of relinquishing monetary independence is accordingly low, so that syn-chronisation in real interest rates may be interpreted as an indicator of coordination in monetary policy. It is measured by the cross-correlation of the real interest rate cycle of a country with that of the reference country. Detrending is accomplished by applying the H-P filter as in the synchronisation in the business cycle criterion. The more synchronised the real interest rate cycle to that of the reference country, the more coordinated the monetary policy with that country.

Figure 7 shows the cross-correlation of the real interest rate of each country[8] with the US and with the Japanese real interest rate in the pre- crisis period. The majority of the countries are located at the corner of the lower-right quadrant, implying very high positive affiliation with the US cycle but very high negative association with the Japan.

A small grouping-Thailand, Laos, Vietnam, Indonesia, and Cambodia are situated at the upper- left quadrant, indicating high positive real interest rate linkage with Japan but extreme negative real interest rate association with the US. In this pre-crisis period, the region is polarised into mutually exclusive US or Japan groups.

In the crisis period (Figure 8), the region is still divided into mutually exclusive groups, but the composition of the

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[7] In Artis and Zhang (2001), absolute value is not used. In a recent correspondence with Artis, however, he indicated that the absolute value may be a better option to avoid the problem of cancellation of values of the opposite sign.

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[8] For pre-crisis period, Brunei is not included due to unavailability of data.
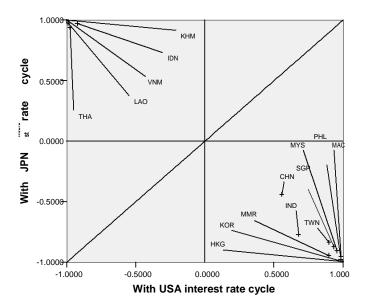
Figure 7. Contemporaneous correlations in the pre-crisis period.
Source: See Appendix for data description.

Figure 9: Contemporaneous correlations in the post-crisis period.
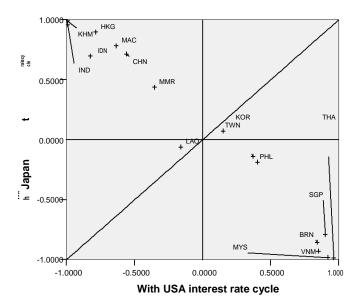Source: See Appendix for data description.

Figure 8. Contemporaneous correlations in the crisis period.
Source: See Appendix for data description.

groups has changed. The group that is more aligned with the US has shrunk from 10 - 8 countries whereas the Japan group has enlarged from 5 - 7 countries. Notice-ably, only Taiwan has partial positive linkage with both US and Japan whilst Laos is the only outlier with negative linkage with both the US and Japan. In Figure 9, the picture is totally different. For the post-crisis period, the Japan group almost encompasses the whole of East Asia. Real interest rate synchronisation of the countries in this group are highly positively linked to Japan but are
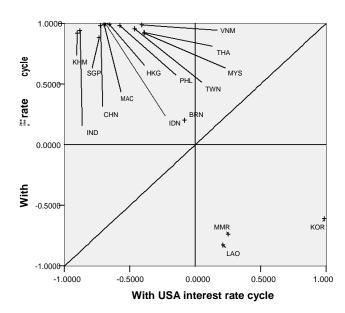
highly negatively affiliated with the US. In all, only three countries, Myanmar, Laos, and Korea remain in the US group. The region's monetary policy on the whole is most probably coordinated with the Japanese policy.

Throughout the three periods, the region's monetary policy seems to have shifted its synchronisation from the US monetary policy to the Japanese one. Rather sur-prisingly then, when real interest rate synchronisation is considered, Japan would appear to be the more appro-priate anchor country.

Even though in practice Hong Kong adopts a currency board system which effectively fixes its currency against the U.S. dollar and Macau closely ties its Pataca to the Hong Kong dollar, these two countries belong to the Japan group for the crisis and the post-crisis period. This suggests that inflation differentials appear to have influenced the real interest rate for these two territories during these two periods. As shown in Figure 6, their inflation rates have become more aligned with the Japanese rate since the crisis period.

SUMMARY

To summarise the results obtained above, a score is assigned depending on the variable value measuring a criterion. The scales are shown in Table A2 and the cor-responding scores are shown in Table A3 in Appendix. For each country, scores are averaged over all criteria by period. A score above 3 indicates a closer alignment with the US whilst a score below 3 corresponds to a closer alignment with Japan. The scorecard is shown in Table 1. Under 'equal weights' in Table 1, out of 16 countries, the

Table 1. Scorecard.

	Equal weights			Unequal weights		
	Pre-crisis	Crisis	Post-crisis	Pre-crisis	Crisis	Post-crisis
CHN	4.20*	2.40	3.00**	3.67*	2.44	3.00**
HKG	4.20*	2.40	3.00**	3.89*	2.44	2.78
KOR	3.60*	3.20*	3.20*	3.56*	3.11*	3.56*
TWN	4.20*	3.60*	2.60	3.89*	3.33*	2.78
KHM	2.20	3.60*	3.20*	2.56	3.78*	3.78*
IDN	2.40	2.20	2.60	2.67	2.56	3.00**
LAO	3.00**	2.40	3.80*	2.78	3.11*	3.89*
MYS	3.20*	3.40*	2.80	3.11*	3.44*	3.11*
MMR	2.60	2.20	3.20*	2.56	2.56	3.56*
PHL	4.00*	3.40*	3.60*	4.44*	3.44*	3.78*
SGP	4.00*	3.40*	2.80	3.56*	3.22*	2.89
THA	2.40	2.80	3.00**	2.67	2.67	3.22*
VNM	3.00**	3.80*	3.40*	3.22*	3.89*	4.11*
IND	4.40*	3.80*	3.20*	4.22*	3.89*	3.78*
MAC	5.00*	2.80	3.00**	5.00*	3.11*	3.44*
BRN	1.75	2.00	1.20	1.22	1.56	1.11

Note: *US is more appropriate than Japan, **Either US and Japan might be appropriate.
Source: Authors' calculations.

US is the most appropriate anchor in the pre-crisis period with nine countries being more aligned with its monetary policy, and two being suited to either the US or Japan, equal appropriateness in the crisis period, but during the post-crisis period the US appears to be slightly better suited as a monetary anchor for the region. Obviously these results vary by country, for example, Indonesia's economic performance, is consistently more closely associated with Japan through all periods whereas the Philippines is consistently more closely associated with the US. The above results are obtained when the variables are weighted equally. However, as suggested by Artis and Zhang (2001), it is instructive to weight the 'benefit' criterion (trade openness) equally with the sum of the three 'cost' criteria (business cycle synchronisation, real exchange rate volatility, and interest rate cycle synchronisation) and the normalising criterion (inflation convergence) . The results with the explicit weighting are shown under the 'unequal weights' column in Table 1. With this weighting scheme, the US's suitability as a monetary anchor is enhanced.

Conclusion

Out of the five reference-dependent criteria, it appears that for the South East Asian countries the US is a more appropriate monetary anchor than Japan for trade openness, real exchange rate volatility, and inflation convergence; while for business cycle synchronisation the US and Japan would both be suitable candidates, but for real interest rate synchronisation Japan appears to be

the most appropriate monetary anchor. In light of these findings, the US appears to be a more suitable anchor country for monetary policy.

The results support Kwan's (1998) and Shirono's (2009) findings which indicate the lack of economic rationale for the formation of a yen bloc in the East Asian region. As Krugman (2009) states, this continued close association with the US economy might stem from the fact that many East Asian countries, (particularly China) are still locked in a "dollar trap" and cannot easily shift their reserve assets from the dollar to other currencies even in the wake of the global financial crisis.

REFERENCES

Artis M, Zhang W (1997). 'International Business Cycles and the ERM: Artis M, Zhang W (2001). 'Core and Periphery in EMU: A Cluster Analysis', Econ. Issues, 6: 39-60.
Baxter M, Stockman AC (1989). 'Business Cycles and the Exchange-rate Regime', J. Monet. Econ., 27: 377-400.
Bayoumi T, Eichengreen B (1997). 'Ever Closer to Heaven? An Optimum -currency-area Index for European Countries', Euro. Econ. Rev., 41: 761-770.
Boreiko D (2003). 'EMU and Accession Countries: Fuzzy Cluster Analysis of Membership', Int. J. Fin. Econ., 8: 309-325.
Bowman C (2005). 'Yen Bloc or Koala Bloc? Currency Relationships after the East Asian Crisis', Jpn. World Econ., 17: 83-96.

Chow H K, Kim YB, Sun W (2007). 'Characterising Exchange Rate Policy in East Asia: A Reconsideration', J. Asian Econ., 18: 448-465.

Crowley PM, Quah CH (2009). 'A single currency for Asia? Evaluation and comparison using hierarchical and model-based cluster analysis', paper presented at European Union Studies Association 11th Biennial International Conference. Marina Del Rey, California.

Dutta M (2000). 'The Euro and European Union: Monetary and Economic Cooperation in the Asia-Pacific Region', J. Asian Econ., 11: 65-88.

Edison H, Melvin M (1990). 'The Determinants and Implications of the Choice of an Exchange Rate Regime', in W. S. Haraf and T. D. Willett (eds.), Monetary Policy for a Volatile Global Economy (Washington: AEI Press).

Font-Vilalta M, Costa-Font J (2006). 'A Note on the Feasibility of a Monetary Area in the East Asia', Asia Europe, J. 4: 53-58.

Frankel J, Wei SJ (1994). 'Yen Bloc or Dollar Bloc: Exchange Rate Policies of the East Asian Economies', in T. Ito and A. O. Krueger (eds.), Macroeconomic Linkages (Chicago: University of Chicago Press).

Gerlach S (1988). 'World Business Cycles under Fixed and Flexible Exchange Rates', J. Money, Credit and Banking, 20: 621-632.

Hefeker C, Nabor AA (2005). 'China's Role in East-Asian Monetary Integration', Int. J. Finance Econ., 10: 157-166.

Ibrahim S (2008). 'A Study of Optimum Currency Area in East Asia: a Cluster Analysis', J. Econ. Integration, 23: 765-790.

Kenen P (1969). 'A Theory of Optimum Currency Areas: An Eclectic View', in R. A. Mundell and A. K. Swoboda (eds.), Monetary Problems of the International Economy (Chicago: University of Chicago Press).

Krugman P (1990). 'Policy Problems of a Monetary Union', in P. de Grauwe and L. Papademos (eds.), The European Monetary System in the 1990s (Harlow: Longman).

Kuroda H (2004). 'Transitional steps in the Road to a Single Currency in East Asia', paper presented at Conference on A Single Currency for East Asia–Lessons from Europe, Jeju, Korea.

Kwack SY (2004). An Optimum Currency Area in East Asia: Feasibility, Coordination, and Leadership Role, J. Monet. Econ., 17: 271-291.

Kwan CH (1998). 'The Theory of Optimum Currency Areas and the Possibility of Forming a Yen Bloc in Asia', J. Asian Econ., 9: 555-580.

Lim LK (2005). 'A Dollar or Yen Currency Union in East Asia?', Math. Comput. Simulation, 68: 509-518.

McKinnon R (1963). 'Optimum Currency Areas', Am. Econ. Rev., 53: 717-725.

McKinnon R, Schnabl G (2004). 'The Return to Soft Dollar Pegging in East Asia: Mitigating Conflicted Virtue', Int. Finance 7: 169–201.

Mundell R (1961). 'A Theory of Optimum Currency Areas', Am. Econ. Rev. 51: 657-664.

Mundell R (2003). 'Prospects for an Asian Currency Area', J. Asian Econ. 14: 1-10.

Nguyen T (2007). 'East Asian Currency Area: A Fuzzy Clustering Analysis of Homogeneity', Development and Policies Research Center Working Paper No. 10, DPRC, Vietnam.

Rogoff K (2005). 'Fiscal Conservatism, Exchange Rate Flexibility, and the Next Generation of Debt Crises', Cato J., 25: 33-39.

Shirono K (2009). 'Yen bloc or yuan bloc: An analysis of currency arrangements in East Asia', IMF Working Paper No. 09/03, IMF, Washington D. C.

Swofford J (2008). 'Tests of Microeconomic Foundations of Asian Common Currency Areas', J. Asian Econ., 19: 254-258.

Tavlas G (1993). 'The "New" Theory of Optimum Currency Areas', World Econ., 16: 663-685.

The China Post (2008). 'NT$-RMB Exchange Begins Islandwide'. The China Post, http://www.chinapost.com.tw/taiwan/%20business/2008/06/30/163242/ NT%24%2DRMB%2Dexchange.htm.

Vaubel R (1978). Strategies for Currency Unification (Tubingen: J. C. B. Mohr).

Krugman P (2009). 'China's Dollar Trap', New York Times, April 3, downloaded from http://www.nytimes.com/2009/04/03/opinion/03krugman.html?_r=1. Is there a European Business Cycle?'. Int. J. Finance Econ., 2: 1-16.

APPENDIX

Table A1. Data definitions and sources[1].

Country	Code	Trade[2]	GDP, GDP deflator[3]	Exchange rate[4], CPI[5]	Interest rate	Period[6]
China	CHN	81Q1-07Q4	81-06	87:1-08:4	Discount rate	92:6-08:3
Hong Kong	HKG	81Q1-07Q4	81-06	81:1-08:3	Discount rate	92:6-08:3
Korea	KOR	81Q1-07Q4	81-07	81:1-08:4	Discount rate	92:6-08:2
Taiwan[7]	TWN	81-88, 89:1-07:12	81-07	81:1-08:4	Discount rate	92:6-08:6
Cambodia	KHM	81Q1-07Q4	88-07	94:10-07:12	Lending rate	95:10-07:12
Indonesia	IDN	81Q1-07Q4	81-07	81:1-08:4	Discount rate	92:6-08:3
Laos	LAO	81Q1-07Q4	82-07	87:12-01:12, 03:5-08:3	Discount rate	92:6-08:3
Malaysia	MYS	81Q1-07Q4	81-07	81:1-08:3	Interbank rate	92:6-08:4
Myanmar	MMR	81Q1-07Q4	81-03	81:1-07:12	Discount rate	92:6-07:12
Philippines	PHL	81Q1-07Q4	81-05	81:1-08:4	Discount rate	92:6-08:4
Singapore	SGP	81Q1-07Q4	81-06	81:1-08:3	Interbank rate	92:6-08:4
Thailand	THA	81Q1-07Q4	81-07	81:1-08:4	Discount rate	92:6-08:4
Vietnam	VNM	81Q1-07Q4	90-07	90:1-08:4	Discount rate	96:1-06:12
India	IND	81Q1-07Q4	81-07	81:1-08:3	Discount rate	92:6-08:3
Macau	MAC	81Q1-07Q4	82-07	88:1-08:3	Interbank rate	92:6-08:4
Brunei	BRN	81Q1-07Q4	81-04	83:1-08:3[8]	Lending rate	98:1-08:3
Japan	JPN	n.a.[9]	81-07	81:1-08:4	Discount rate	92:6-08:3
United States	US	n.a.[9]	81-07	81:1-08:4	Discount rate	92:6-08:3

1. Series are from IMF-IFS database except stated otherwise.
2. Trade data are from IMF-DOTS database.
3. GDP for gross domestic product
4. Original exchange rate series are rates against the US dollar; exchange rates against the yen are derived assuming triangular arbitrage. Data range of exchange rate is tied to data range of CPI since CPI is needed to compute real exchange rate.
5. CPI for consumer price index. For China, Vietnam, and Brunei, CPIs are sourced from ILO-LABORSTA database whenever not available on IMF-IFS database. Cross-validation shows that both data are equal.
6. The following starting point is selected to cover most of the countries with the most similar range possible.
7. Taiwan data are sourced from Bureau of Foreign Trade, Directorate-General of Budget, Accounting, and Statistics (DGBAS) and central bank databases.
8. CPI data after 2005 are sourced from Department of Economic Planning and Development (DEPD) website, retrieved July 17, 2008, from http://www.depd.gov.bn/archive.html. Data should be consistent since data from IFS are sourced from DEPD as well.
9. n.a. for not applicable.

Table A2. Categorical scale for variables.

Variable	Neither Japan nor USA	Strongly Japan	Moderately Japan	Either Japan or USA	Moderately USA	Strongly USA
Score	0	1	2	3	4	5
Trade openness differential, δ	-	$\delta \le -10\%$	$-10\% < \delta \le -5\%$	$|\delta| < 5\%$	$5\% \le \delta < 10\%$	$\delta \ge 10\%$
Cross-correlation with the JPN/US business cycle: $\Gamma_{JPN}, \Gamma_{USA}$	$\Gamma_{JPN} \le 0$, $\Gamma_{USA} \le 0$	$\Gamma_{JPN} > 0$, $\Gamma_{USA} \le 0$	$\Gamma_{JPN}, \Gamma_{USA} > 0$, $\Gamma_{JPN} > \Gamma_{USA}$	-	$\Gamma_{JPN}, \Gamma_{USA} > 0$, $\Gamma_{JPN} < \Gamma_{USA}$	$\Gamma_{JPN} \le 0$, $\Gamma_{USA} > 0$
Volatility differential, Δ	-	$\Delta \le -.02$	$-.02 < \Delta \le -.01$	$|\Delta| < .01$	$.01 \le \Delta < .02$	$\Delta \ge .02$
Difference of inflation differentials, DID	-	$DID \le -2\%$	$-2\% < DID \le -1\%$	$|DID| < 1\%$	$1\% \le DID < 2\%$	$DID \ge 2\%$
Cross-correlation with the JPN/US interest rate: P_{JPN}, P_{USA}	$P_{JPN} \le 0$, $P_{USA} \le 0$	$P_{JPN} > 0$, $P_{USA} \le 0$	$P_{JPN}, P_{USA} > 0$, $P_{JPN} > P_{USA}$	-	$P_{JPN}, P_{USA} > 0$, $P_{JPN} < P_{USA}$	$P_{JPN} \le 0$, $P_{USA} > 0$

Table A3. Score by reference criterion.

		Preference for anchor country																			
	GA[3]	Trade openness				Synchronisation in business cycle				Volatility in real exchange rate				Inflation convergence				Synchronisation in real interest rate cycle			
P[1]		1	2	3	A[2]	1	2	3	A[2]	1	2	3	A[2]	1	2	3	A[2]	1	2	3	A[2]
CHN	3.20	2	3	3	2.67	5	1	4	3.33	5	5	4	4.67	4	2	3	3.00	5	1	1	2.33
HKG	3.20	3	3	3	3.00	5	1	4	3.33	4	5	5	4.67	4	2	2	2.67	5	1	1	2.33
KOR	3.33	3	3	3	3.00	1	2	0	1.00	5	3	3	3.67	4	3	5	4.00	5	5	5	5.00
TWN	3.47	4	3	3	3.33	5	4	2	3.67	4	4	4	4.00	3	3	3	3.00	5	4	1	3.33
KHM	3.00	2	5	5	4.00	0	4	2	2.00	4	5	4	4.33	4	3	4	3.67	1	1	1	1.00
IDN	2.40	1	2	2	1.67	1	1	2	1.33	4	3	3	3.33	5	4	5	4.67	1	1	1	1.00
LAO	3.07	1	3	3	2.33	5	1	2	2.67	4	3	4	3.67	4	5	5	4.67	1	0	5	2.00
MYS	3.13	3	3	3	3.00	1	1	2	1.33	4	4	4	4.00	3	4	4	3.67	5	5	1	3.67
MMR	2.67	1	3	3	2.33	0	0	0	0.00	3	4	3	3.33	4	3	5	4.00	5	1	5	3.67
PHL	3.67	5	4	3	4.00	1	1	5	2.33	4	4	4	4.00	5	3	5	4.33	5	5	1	3.67
SGP	3.40	3	3	3	3.00	5	2	4	3.67	4	4	3	3.67	3	3	3	3.00	5	5	1	3.67
THA	2.73	2	2	2	2.00	1	1	4	2.00	4	3	3	3.33	4	3	5	4.00	1	5	1	2.33
VNM	3.40	2	5	5	4.00	2	1	2	1.67	5	5	4	4.67	5	3	5	4.33	1	5	1	2.33
IND	3.80	3	4	4	3.67	5	5	2	4.00	4	5	4	4.33	5	4	5	4.67	5	1	1	2.33
MAC	3.60	5	5	5	5.00	5	1	1	2.33	5	5	5	5.00	5	2	3	3.33	5	1	1	2.33
BRN	1.53	1	1	1	1.00	1	1	0	0.67	4	4	3	3.67	1	2	1	1.33	-	-	1	1.00
A[2]		2.56	3.25	3.19		2.69	1.69	2.25		4.19	4.13	3.75		3.94	3.06	3.94		3.67	2.73	1.75	

P for period: 1 for pre-crisis, 2 for crisis, and 3 for post-crisis.
A for average.
GA for grand average which covers all criteria for all periods.