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RATE COOPERATION IN EAST ASIA: SOME
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Peter Wilson and Keen Meng Choy

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Peter Wilson and Keen Meng Choy

Address for Correspondence:

Peter Wilson
Associate Professor, Department of Economics
National University of Singapore
1 Arts Link
Singapore 117570
Tel 65-68743997
Fax 65-62344985
Email: ecspeter@nus.edu.sg

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ABSTRACT

The Asian financial crisis increased economic disparities in the East Asian region, thus making monetary integration more difficult, but rekindled political interest in Asian monetary and exchange rate cooperation. This paper applies the theory of Generalized Purchasing Power Parity (G-PPP), which looks at the behavior of long-run real exchange rates, to assess the potential for an optimum currency area (OCA) among a subset of East Asian countries based on five of the more advanced members of the Association of Southeast Asian Nations (ASEAN5). Our findings suggest little support for an OCA for ASEAN5 as a bloc prior to the Asian financial crisis and mixed results in the post-crisis period. In particular, asymmetries in the way countries adjust to shocks and low or insignificant speeds of adjustment were found. Thus, although the application of single OCA criteria is notoriously demanding and our tests apply to only one of the many criteria for the successful formation of an OCA, we cannot find persuasive evidence that ASEAN5 as a group constitute a potential currency area with either the USA or Japan, even when the 'noisy' period of the Asian financial crisis is omitted.

PROSPECTS FOR ENHANCED EXCHANGE RATE COOPERATION IN EAST ASIA: SOME PRELIMINARY FINDINGS FROM GENERALIZED PPP THEORY¹

1. Introduction

The Asian financial crisis of 1997 increased economic disparities in the East Asian (EA) region, thus making monetary integration more difficult, but rekindled political interest in Asian monetary and exchange rate cooperation. The crisis highlighted the difficulties of managing exchange rates unilaterally for an open economy faced with substantial international capital inflows and increased the attraction of a common exchange rate arrangement and a common currency in the longer term.

Although a fully-fledged currency union or common exchange rate mechanism is not on the immediate horizon, it is likely that EA countries will continue to pursue more limited goals in monetary cooperation. In which case it is pertinent to ask *how far* EA or a subset of EA countries, such as the five most advanced members of the Association of Southeast Asian Nations (ASEAN5)², satisfy the economic criteria for a monetary union. This is important not simply because it will affect the political agenda for countries contemplating further monetary integration, but because some *minimum* prerequisites in terms of economic integration are necessary for the development of common monetary institutions. Advocates of a common EA exchange rate policy, such as Williamson (1998) and McKinnon (2000), do assume that EA countries are sufficiently close as trading partners and competitors in world markets to justify a common monetary arrangement. If this is not so, the case for giving up unilateral exchange rate regimes is significantly weaker.

The objective of this paper is to complement the existing empirical literature on the feasibility of monetary integration in EA. To date, this literature has relied largely on a mixture of ad hoc proxies to see if groups of countries satisfy standard optimum currency

¹ A first draft of this paper was presented at the Western Economic Association International Pacific Rim Conference, Taipei in January 2003. We would also like to thank the Staff of the Regional Economic Monitoring Unit (REMU) at the Asian Development Bank in Manila for their helpful comments on an earlier draft.

² ASEAN5 consists of Singapore, Malaysia, Indonesia, Thailand and the Philippines.

area (OCA) criteria³, or the use of a structural vector autoregression methodology to establish whether potential members of a currency union experience symmetric or asymmetric demand and supply shocks, which is a critical factor in deciding whether a common monetary policy is feasible.⁴ Our approach complements the ‘shocks’ literature by applying the Enders and Hurn (1994) theory of Generalized Purchasing Power Parity (G-PPP), to assess the potential for an OCA amongst the ASEAN5 countries, by looking at the behavior of their long-run real exchange rates, both before and after the Asian financial crisis. Although there are multiple, and often conflicting criteria for judging the feasibility of a currency union, an important consideration is whether the macroeconomic fundamentals which drive the real exchange rates of the ASEAN5 are sufficiently integrated, so they share the same kind of real disturbances. In contrast to Enders and Hurn, who were more concerned with testing G-PPP in general, using a large bloc of industrialized and developing countries from the Pacific Rim, we apply the theory directly to the ASEAN5 countries which are, in principle, committed to further monetary and exchange rate integration.

We begin in 2 with some background on monetary integration in EA. This is followed in 3 by a review of the theory of G-PPP and its relevance to the OCA issue. Our empirical analysis and results are then discussed in 4 and 5, and the paper is completed with a short conclusion. Although the application of OCA criteria is notoriously demanding, we cannot find convincing evidence that ASEAN5 constitute a potential currency area with the USA or Japan, even when the ‘noisy’ period of the Asian financial crisis is omitted.

2. Monetary integration in East Asia⁵

Before the Asian financial crisis of 1997-8 there existed only rudimentary monetary and exchange rate cooperation between EA countries (Chan and Rajan, 2001). There had been some discussion about the development of a yen bloc but there was little evidence that such a bloc had emerged. There was also a notable absence of any collective defence against currency crises apart from a limited network of bilateral repurchase agreements

³ For example, the ‘OCA index’ produced by Eichengreen and Bayoumi (1998).

⁴ As in Bayoumi and Eichengreen (1994) and Chow and Kim (2000).

⁵ For more views on the progress of Asian monetary and exchange rate cooperation, see Kwack, (2004, 2005), Stevensen (2004), Kohsaka (2004), Pomfret (2005), Nasution (2005) and Wilson (2005a, 2005b).

(repos), some currency swap arrangements and some informal cooperation between regional central banks.

The crisis itself renewed political interest in Asian monetary and exchange rate cooperation, not least because it demonstrated the extent to which EA economies had become integrated into global goods and factor markets in the 1990s. The counterpart of this increased interdependence with each other and with the rest of the world was greater exposure to spillover effects across national boundaries, including financial contagion. Insofar as these effects were externalities which could not be internalized by any one country individually, there were calls to supplement national policies with cooperative solutions at the regional level. The attractiveness of a regional solution had also been enhanced by the *perception* that international organizations, such as the IMF, had failed to anticipate the crisis, had wrongly diagnosed it as a 'Latin-American' style structural crisis, had been slow to disburse funds, and imposed excessive conditionality on the loans that were eventually given.

Although the 1997 Japanese proposal for an Asian Monetary Fund did not materialize, largely due to opposition from the IMF and Washington, there have been a number of regional initiatives in monetary and exchange rate cooperation since the crisis. The Manila Framework Group was set up in November 1997 to enhance trans-Pacific monetary cooperation and following the 'Chiang Mai Initiative' of May 2000 and the Asian Development Bank (ADB) meeting in Honolulu the following year, the ASEAN+3⁶ have created a regional network of bilateral repos and currency swaps. The sums involved are quite small and are complementary to IMF lending but constitute the beginnings of a regional financing facility and a symbolic first step towards monetary cooperation. ASEAN and ASEAN+3 are also pressing ahead with a regional bond market and their own IMF-style surveillance and monitoring machinery supported by a new Regional Economic Monitoring Unit (REMU) at the ADB.⁷

There is widespread agreement that an EA monetary union is not on the horizon in the absence of a sufficiently strong political commitment to develop the requisite institutional structure and pool of sovereignty to have any chance of success (Nicolas, 1999, Bayoumi

⁶ ASEAN plus Korea, China and Japan.

and Mauro, 2001, Wilson 2005b). But this does not preclude further steps towards closer regional monetary and exchange rate cooperation and there is more disagreement as to *how far* EA or a subset of EA countries, such as ASEAN5, satisfy the economic preconditions for an OCA.

A number of criteria have been put forward to help decide whether a group of countries constitute an OCA. In the original Mundellian (1961) sense an OCA exists when the benefits of fixing exchange rates in a geographical area exceed the costs. This need not necessarily be defined by contiguous geographical boundaries, since it could take the form of a common anchor to a specific currency, and thus a common monetary policy. A monetary union would then be an extreme form of monetary integration where there is a common currency and central bank.

Mundell (1961) himself stressed the need for sufficient factor mobility (particularly labour) to enable countries to adjust to asymmetric output shocks without resort to the exchange rate.⁸ McKinnon (1963) emphasised the importance of openness (high proportion of traded to non-traded goods) so that giving up the exchange rate instrument would be no cost since the expenditure switching effects of depreciation would in any case quickly pass through to higher domestic prices and wages and offset any competitive advantage from the original devaluation or depreciation. Kenen (1969) pointed out that a high degree of product diversification would be a positive factor since OCA members would be more likely to have a diversified portfolio of jobs and be less susceptible to industry-specific shocks.

From the exchange rate point of view, Melitz (1995) showed that the net benefits of giving up the nominal exchange rate if there is some wage-price stickiness, depends on a country's trade weighted covariance of real exchange rates with its trading partners. A high covariance means that a change in the nominal rate will move the real rate in the

⁷ Both REMU and ARIC can be found at <http://aric.adb.org>. For an update on the commitment to monetary integration, see ADB.org.

⁸ Although Mundell worried in 1961 that countries which were dissimilar would not be able to have a common monetary policy in the face of asymmetric shocks, he later (Mundell, 1973) realized that this doesn't make sense for highly diversified industrial countries producing a wide range of goods. *Heterogeneous* economies could share the risks from asymmetric shocks better within a common currency area as long as there is international portfolio diversification in capital markets, so a country which suffered an adverse shock could easily borrow from other countries in the currency area and so share the risks of asymmetric shocks. Mundell's own views on the prospects for an Asian currency area can be found in Mundell (2003).

desired direction in terms of each partner so devaluation/depreciation is effective. But if the covariance is low, devaluation/depreciation may be appropriate for some partners, but not for all, so the exchange rate weapon becomes less effective and the costs of joining a monetary union are reduced.

The problem with single OCA criteria is that they may conflict (Tavlas, 1994)⁹: a country may be very open to trade but at the same time have a low level of labour mobility. Moreover, they are not strictly necessary as prerequisites for monetary integration providing there is sufficient endogenous convergence and political will (Frankel and Rose, 1998). Countries are more likely to satisfy the criteria *ex post* and historical extrapolation can be misleading. High inflation countries, for example, may be more willing to join a monetary union precisely because it will enable them to by-pass domestic political constraints and gain the credibility of the common central bank. Nonetheless, the consensus view is that OCAs are more likely to be feasible if member countries are closely linked by trade in goods and services and by factor mobility, or there is evidence of convergence in the levels and behaviour of key macroeconomic indicators relevant to a common monetary policy, such as inflation, unemployment, budget deficits (indicating fiscal sustainability), interest rates, and exchange rates. An OCA is also more likely to succeed where there is evidence of small and synchronised supply and demand shocks between the potential members, fast adjustment to shocks, and common business cycles.

Empirical work on the feasibility of EA as an OCA is still very much in its infancy and has largely revolved around an ad hoc application of single OCA criteria and more formal modelling of the magnitude and characteristics of the supply and demand shocks affecting countries over time. For example, building on earlier work by Goto and Hamada (1994), Eichengreen and Bayoumi (1998), constructed an OCA index of

⁹ Bayoumi (1994) has neatly incorporated Mundell, McKinnon and Kenen criteria into a general equilibrium model of the OCA adding the key insight that the bloc's common external exchange rate is, by definition, some average of what would have been the equilibrium exchange rates of the members had they not been in a currency union. So if some members experience asymmetric shocks, the external exchange rate cannot move to satisfy them all. However, the net benefits of membership increase for a given country facing a negative asymmetric shock with the degree of openness representing a high level of 'cross' or diversified consumption (McKinnon), the degree of international labour mobility (Mundell), and the degree of industrial diversification which reduces the size of aggregate shocks (Kenen).

exchange rate variability predicted by proxies for standard OCA arguments: the asymmetry in output disturbances, dissimilarity in the export composition of pairs of trading partners, the magnitude of bilateral trade, and the size of the economy (the net costs of giving up unilateral exchange rates may be lower for small economies). This was supplemented by a more formal testing procedure based on Blanchard and Quah (1989) and Bayoumi and Eichengreen (1994) which utilises a structural vector autoregression methodology to identify disturbances with temporary and permanent impacts on output, which can then be attributed to aggregate demand and supply shocks and correlated across countries to compare the size and speed of adjustment to disturbances. In practice, the emphasis has been on supply shocks on the grounds that demand disturbances largely reflect macroeconomic policy decisions, including exchange rate policy, and are not likely to be invariant to the choice of exchange rate regime. Supply shocks, on the other hand, are considered to be more structural in nature and less sensitive to the choice of exchange rate regime.¹⁰

Bayoumi and Eichengreen (1994) and Eichengreen and Bayoumi (1998) came to the surprising conclusion that 9 EA countries satisfied the standard economic criteria for an OCA almost as well as Western Europe. Bayoumi and Mauro (2001) also found that, although ASEAN was less suitable for monetary integration than Europe just prior to the Maastricht Treaty, the economic differences were not that large.

Later empirical work has, however, been less supportive. This has been complicated by the use of changing samples of countries. Unlike in Europe, it is not at all clear what would constitute a reasonable 'core' of Asian countries suitable for closer monetary integration.¹¹

One persistent theme is the lack of similarity in levels of economic development and convergence in income per capita. EA is geographically quite disparate (Indonesia is a vast country while Singapore and Hong Kong are small) and there are significant differences in basic economic indicators. Japan and Korea are now fully developed countries. Agriculture is dominant in Laos, Myanmar, Vietnam, and still important in the

¹⁰ For a discussion of this issue, see Chow and Kim (2000).

¹¹ Artis and Zhang (2002), for example, found quite distinct 'core' and 'peripheral' groups in the European Union using fuzzy clustering techniques and Park (2002) finds clear evidence that Europe became a 'convergence club' between 1960 and 2000.

Philippines and Indonesia, but is negligible in oil-rich Brunei and service-oriented Singapore and Hong Kong.

Even if more formal statistical techniques are applied, it is not at all obvious what would constitute a distinct economic grouping in East Asia. Yuen (2000), for example, using hierarchical cluster analysis over the period 1990 to 1997 placed Japan with a group of mature developed countries with high income per capita, low GDP growth and moderate inflation (Australia, New Zealand, USA). Further clusters included a high growth Asian group comprising Korea, Malaysia and Thailand, characterized by moderate income per head, inflation and interest rates; a group of emerging economies (Indonesia, Philippines) with moderate growth, low income per capita and high inflation; and the small open economies of Hong Kong and Singapore which share the characteristics of the highest income per capita, the lowest interest rates, the highest value-added in services and the lowest value-added in agriculture. A fifth cluster consisted solely of China which was distinctly different from the rest of the Asian sample!

Recent work on 'shocks' has also been more guarded. Chow and Kim (2000) found that country specific shocks dominated the determination of output in EA, in stark contrast to Europe where regional shocks predominated. If the shocks facing countries are largely country-specific, rather than regional or global, the case for an OCA is weakened since it is predicated on the basis of similar or highly correlated shocks among members which, by definition would be global or regional in origin.¹² Similarly, Zhang et al. (2004) could not find strong support for an OCA among 10 Asian countries, although there were some small subgroups with correlated and small disturbances and generally the speed of adjustment to shocks was higher than in the European Union.

ASEAN5, as a subset of EA, is a more manageable sample to deal with and can be justified on the grounds that the countries concerned are part of a de jure trade bloc with established institutions. Its policymakers have expressed interest in establishing closer

¹² Country-specific shocks might include changes in monetary or fiscal policy, in productivity, or in the terms of trade, while regional shocks from the EA point of view could arise from changes in the yen-dollar rate or China's accession to the World Trade Organization. Good examples of global shocks would be an oil price hike, cycles in global electronics demand or supply and the terrorist attacks in the USA in September 2001.

monetary ties, and it has a history of commitment to trade integration.¹³ The problem with the enlarged ASEAN10 is that there is a significant disparity between the richer members in terms of income per capita, such as Singapore and Malaysia,¹⁴ followed by Thailand, the Philippines, and Indonesia, and the newer members (Laos, Cambodia, Myanmar, Vietnam) and there is little evidence that the gap in income per capita among ASEAN countries has been narrowing (Park, 2000).¹⁵

Between 1983 and 2003 ASEAN5 exports grew at an annual rate of 9.7 percent, outpacing that of most developed and developing economies.¹⁶ As a result, the bloc's share of global trade rose to over 5.1% in 2003. Intra-ASEAN5 trade based on the origin of imports and destination of exports had also increased to around 20 percent by 2003, but is heavily dominated by flows between Singapore and other ASEAN5 members, especially Malaysia. The share of bilateral trade between Singapore and Malaysia was 40 percent of total intra-ASEAN5 trade in 2003. Moreover, much of ASEAN5 trade is with other countries in East Asia, such as Japan, China and Korea. Thus whilst intra-ASEAN5 exports accounted for only 17% of total ASEAN+3 exports in 2003, ASEAN+3 exports to ASEAN+3 countries amounted to over 40%.

On the positive side, there is increasing evidence of a strengthening of cross-border production networks in ASEAN5, particularly in electronics and automobiles, based on networks of complementary production by different companies leading to integration of production chains across the region (Monetary Authority of Singapore, 2005). Certainly if there exists the potential for closer monetary integration in EA, a good starting point is the ASEAN5.

¹³ Since the establishment of the ASEAN Free Trade Agreement in 1992 some progress has been made in tariff reductions but significant institutional and non-tariff barriers remain. Nonetheless in November 2002 ASEAN leaders agreed to work towards an ASEAN Economic Community. For some background on ASEAN trade integration, see Tongzon (2003).

¹⁴ Although Brunei is one of the older members of the bloc and is relatively advanced in terms of income per capita, this is largely a result of its oil and gas resources. There are also data problems since it is not a member of the International Monetary Fund.

¹⁵ Mcleer and Lee (2004) also found little evidence of income convergence between pairs of ASEAN5 countries using time series tests.

¹⁶ The data on regional trade integration is taken from the Monetary Authority of Singapore (2005).

3. Generalized Purchasing Power Parity and the Optimum Currency Area

One way to establish whether there is a natural currency area among a group of countries is to see if its currencies are cointegrated since this might be broadly indicative of similarities in the economic forces which drive the member exchange rates or commonalities in exchange rate policy. Aggarwal and Mougoue (1993), for example, found evidence of such currency interdependence for Japan, Hong Kong, Malaysia, Philippines and Singapore. In a later study, Tse and Ng (1997) confirmed this only if Korea and Taiwan were added to the sample, especially if the time period were extended up to 1994. But it is not clear why movements in *real* exchange rates (RERs) should be similar between countries even if nominal rates move in harmony and it is real rates which are more relevant to OCA fundamentals and a common monetary policy. If, however, each currency was de facto pegged to a common major currency, such as the US dollar, then real exchange rates would be constant across the currency bloc and the focus would be purely on inflation differentials.¹⁷ Indeed, there is evidence that many countries in EA, including the ASEAN5, were implicitly dollar pegging before the crisis, and returned to a looser ‘dollar bloc’ in the immediate post-crisis period (McKinnon, 2000). But dollar pegging is consistent with a substantial amount of variation in real rates since the extent of dollar pegging varied among ASEAN5 countries, the pegging coefficients are less prominent at lower data frequencies, and the extent of pegging varied over time. In the period immediately before the Asian crisis when dollar pegging was popular, the Indonesian and Thai currencies were relatively stable against the US dollar but experienced greater variation in their nominal and real effective exchange rates (Table 1). The Malaysian ringgit was also quite stable in nominal dollar terms but with much greater effective variation. The Singapore dollar, on the other hand, was quite stable in bilateral dollar terms and had the lowest variation on the basket measures. The Philippine peso, which was officially free floating, exhibited the highest volatility against the dollar and in basket terms.

In the post-crisis period, average currency volatility was more than twice that of the pre-crisis period (Table 1), with a substantial increase for Indonesia. To some extent this reflected a move towards greater exchange rate flexibility, with the notable exception of

Malaysia which joined the hard dollar peggers in September 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. Some amount of dollar pegging and exchange rate targeting is thus compatible with the move towards greater exchange rate flexibility in the EA region and Ho and McCauley (2003) conclude that emerging market economies have responded more to exchange rate changes than would be required for inflation targeting but they have not been pre-occupied with exchange rate stabilization to the extent that inflation targeting has been compromised.

G-PPP theory (Enders and Hurn, 1994) was developed ‘to explain the stylized facts of real exchange rate behavior’ consistent with standard open economy models, in response to the empirical evidence that purchasing power parity theory (PPP), both in its absolute and relative forms, was inadequate to explain price and exchange rate movements for low inflation countries after the Second World War. This is not surprising if the fundamental variables which lie behind real exchange rates do not converge to a stable long-run mean or share any common trends.

The empirical failure of PPP is also consistent with many structural models of exchange rate behavior, such as the Dornbusch (1976) overshooting model. In this model nominal shocks can induce short-run deviations from PPP even if long-run money neutrality guarantees that these shocks have no long-run effects on real variables. On the other hand, real shocks, such as output shocks, can affect real variables and permanent real shocks can produce permanent changes in the RER. PPP fails, therefore, because the fundamental macroeconomic variables which determine RERs, such as real output levels or expenditure patterns, are themselves nonstationary variables, so the RERs are also nonstationary.

The importance of fundamentals in determining equilibrium RERs is now well established in the literature. See, for example, Edwards (1994), MacDonald (1998), Clark and MacDonald (1999) and the review by Driver and Westaway (2001). G-PPP, which is consistent with models of RER behavior which incorporate ‘fundamental’ variables, provides a useful vehicle to examine the case for an OCA in the original Mundellian

¹⁷ We are grateful to an anonymous referee for pointing out the significance of this point.

(1961) meaning that within an OCA, real output levels and possibly expenditure patterns will share common trends. Note that this is only one (necessary but not sufficient) criterion for the formation of an OCA. In the two-country case, to see if they constitute an OCA is tantamount to testing if PPP holds between them, which will be true if their bilateral RER measured in terms of one of the countries is stationary. However, even if individual RER series are nonstationary, as the empirical evidence suggests, certain groupings of them in a multicountry setting may be stationary if their real fundamentals are sufficiently interrelated such that they share a reduced number of common trends. One can then use cointegration analysis to establish whether this is true. Following Enders and Hurn (1994), suppose that $m+1$ of the countries in an n -country world constitute the domain of a currency area, then there exists a long-run equilibrium relationship between their m bilateral real rates such that:

$$r_{12t} = \beta_{13} r_{13t} + \beta_{14} r_{14t} + \dots + \beta_{1m} r_{1mt} + e_t \quad (1)$$

where the r_{it} are the logarithmic real exchange rates in period t between country 1 (base country) and country i . The β_{1i} are the parameters of the cointegrating vector and e_t is a stationary stochastic disturbance term. If a vector of bilateral real rates share common trends, there will exist at least one linear combination of the real rates which is stationary. Thus the RERs will be cointegrated, which is a reflection of sufficient interrelationship among their underlying economies, G-PPP will hold and the set of countries can be construed as satisfying one of the necessary conditions for forming a potential OCA. Enders and Hurn (1994) further show that G-PPP depends on the interrelationships between the underlying fundamentals and how the values of the β coefficients in equation (1) are related to the various behavioral parameters of the aggregate demand functions derived from a market-clearing model. So the coefficients in the cointegrating vector of bilateral RERs are not arbitrary but are functions of the parameters in a goods market-clearing relationship. If the RERs are nonstationary then there must be at least one of the income processes which is nonstationary, which is likely, since the macroeconomic variables are themselves likely to be nonstationary. The real income processes are linked through technology transfers, immigration, capital movements etc.

Enders and Hurn were more concerned with overcoming the limitations of PPP theory than identifying blocs of countries suitable for monetary integration based on the behavior of their long-run real exchange rates, but a positive finding for G-PPP does imply the latter. More specifically, they found that G-PPP did not hold for the industrialized countries (Germany, Japan, UK, USA) but did hold for a sample of Pacific Rim countries (except India)¹⁸ together with the industrialized countries. However, only Australia, Korea and the Philippines formed a coherent group based on bilateral RERs and they were more heavily influenced by the exchange rates of the industrialized countries so there was little evidence of any subgroup of Pacific Rim countries which constituted a currency area.

Other work testing G-PPP has been scant. Mkenda (2001) found mixed results for the East African Community (Kenya, Uganda, Tanzania) using a variety of OCA criteria but found cointegration between their RERs (using Kenya as the base currency) over the period 1981-98 and over one of the sub-periods (1990-98). Grandes (2003) comes to similar conclusions for the Common Monetary Area (CMA) in Southern Africa or 'rand zone' over the period 1990 to 2001.¹⁹

For East Asia specifically, Ogawa and Kawasaki (2003) carried out an exhaustive battery of 398 Johansen cointegration tests for all combinations of 3 to 7 East Asian countries before the Asian financial crisis. When the US dollar is used as the base currency only one grouping passed their robustness tests: Singapore, Malaysia, Thailand and Indonesia, but when a common currency basket consisting of the US dollar, the yen and the German mark (equally weighted) is used as the numeraire, they find 12 potential OCA combinations, including groups of three ASEAN countries and some combinations of three ASEAN countries with either the Korean won or the Chinese yuan. Choudhry (2005) also tested G-PPP for five East Asian countries (Indonesia, Malaysia, Philippines, Thailand, South Korea) both before and after the crisis using the US dollar, yen, and Thai Baht as base currencies. He found no support for an OCA pre-crisis but significant cointegration for all base currencies post-crisis and suggested that this might be explained by a higher level of policy coordination and linkages between exchange rate policies.

¹⁸ Australia, Korea, Philippines, Thailand, Singapore.

The objective of this paper is to apply G-PPP directly to assess the potential for a currency union between the ASEAN5 countries, which are committed in principle to further monetary integration. Our approach complements the ‘shocks’ literature by looking at the behavior of long-run RERs to establish whether the differences in macroeconomic fundamentals which drive the RERs of the ASEAN5 are sufficiently integrated, so they share the same kind of real disturbances. If they do not share the same kind of real disturbances, or the speed of adjustment to these disturbances is very different or very slow, then from the G-PPP perspective, at least, they do not constitute an OCA.

4. Testing G-PPP in East Asia

Sample and data

Using the US dollar as the base currency or numeraire, monthly data was collected between 1975(1) and 2004(2) for each country’s nominal exchange rate against the US dollar, and price level, represented by the consumer price index (cpi), from the International Monetary Fund *International Financial Statistics* CD-Rom database. All nominal exchange rates against the US dollar and price indices were normalized, with January 1975 as the initial observation set to zero, and dollar-based RERs computed according to the following formula:

$$q_t = s_t + p_t^* - p_t \quad (2)$$

where q_t is the real exchange rate, s_t is the domestic currency price of the base currency (US dollar), p_t^* is the base country (US) price level, and p_t is the domestic price level. All variables are in natural logarithms and are normalized on $1975(1) = 0$.

Unit Root Testing

For G-PPP to hold, all RERs must be individually nonstationary and there should be evidence of cointegration among the set of RERs of the countries constituting the

¹⁹ The CMA was formed in 1974 and by 1990 consisted of Lesotho, Namibia and Swaziland, with Botswana as a de facto member.

potential OCA. Initial pre-testing involved inspection of the sample autocorrelation functions (ACFs) to check for the level of integration of the series and plots of all the RER variables to check for structural breaks, the presence or otherwise of drift and/or a deterministic time trend.

Figure 1 plots the ASEAN country RERs (in levels and first differences) over the whole sample period. The visual evidence and ACFs suggest the RERs are nonstationary in levels but stationary in first differences, with no obvious tendency to mean reversion. But there is a clear-cut structural break during the Asian financial crisis, roughly between 1997(6) and 1998(2) which would have the effect of biasing the unit root tests towards non-rejection. Consequently, we decided to omit the ‘noisy’ period of the crisis and test G-PPP both pre-crisis from 1975(1) to 1997(5) and post crisis from 1998(2) to 2004(2). Since the visual evidence in Figure 1 suggests that trends are present in both periods, unit root tests are carried out with trends included, though similar results were obtained when only constant terms are included. Two tests were performed. The first is an asymptotically more powerful variant of the Dickey-Fuller test developed by Elliot et al. (1996), which they called the DF-GLS test on account of the generalized least squares detrending procedure that is involved. Since the improvement in the power of the test comes mostly from the detrending procedure, the gain from using the DF-GLS test is potentially large when a trend is present, as in our RERs. Critical values are computed from the response surface analysis of Cheung and Lai (1995). Since standard information criteria, such as the AIC, tend to underestimate the cost of a low order model when the unit root process has a negative moving average root and, hence, tend to select a lag length that is too small, we use the modified AIC (MAIC) of Ng and Perron (2001) for lag selection. This offers substantial size improvements over the usual information criteria when applied to DF-GLS tests.

The second unit root test we carried out is the well-known semi-parametric procedure of Kwiatkowski et al. (1992), popularly known as the KPSS test after the initials of its originators. This test reverses the ‘burden of proof’ by testing the null hypothesis of stationarity against the alternative of a unit root in order to overcome the low power of Dickey-Fuller tests and reduce the ambiguity surrounding the unit root properties of RERs. Within the classical testing framework, the KPSS test is intended to complement

the DF-GLS test. The lag order for this test is derived from an automatic data-based bandwidth selection routine and the estimates of the long-run variances of RERs are obtained from the quadratic spectral kernel, as described in Andrews (1991).

The unit root test results in Table 2 confirm the I(1) nature of the RER series with the sole exception of the KPSS test for Malaysia in the post-crisis period, but even in this case the DF-GLS test does not reject a unit root.²⁰

Cointegration Analysis

The econometric strategy is to estimate the system initially as an unrestricted reduced form multivariate model with the relevant RERs included as endogenous stochastic variables and with the constant entered unrestrictedly to allow for non-zero drift in the time series:

$$y_t = \sum_{i=1}^m \pi_i y_{t-i} + \sum_{j=0}^r \pi_{m+j+1} z_{t-j} + v_t \quad \text{for } t=1, \dots, T, \quad (3)$$

where y_t , z_t are respectively $n \times 1$ and $q \times 1$ vectors of observations at time t on the endogenous and non-modelled variables, the $\{\pi_i\}$ are unrestricted parameters and m and r are the orders of the lags used. Since all y variables have the same lag length and there are no non-modelled variables in the system (z) except for a deterministic constant, (6) can be reparameterized as a vector error-correction model (VECM). The VECM is estimated via multivariate least squares for the pre and post-crisis periods with all variables entered in logs, and was followed by a formal cointegration analysis using the maximum likelihood method proposed by Johansen (1988).

Since parsimony was not crucial at this stage we selected the optimal VECM lag length using the AIC criterion subject to a maximum of 12 lags. We also ensured that data congruency was maintained as indicated by vector test analogues of those used for single equation diagnostics. As is not uncommon, the vector normality test widely rejects but

²⁰ Although we have taken some care to confirm the nonstationarity of the RER series, since this is fundamental to the G-PPP theory, there remains the possibility that the series may be nonstationary locally but globally mean reverting. A number of recent studies, such as Sarno (2000) and Taylor and Peel (2000), have suggested that the behaviour of the exchange rate for industrial countries is indeed nonlinear in nature,

was not taken as a binding constraint in the lag selection process. As a final check, we re-ran the unit root tests and cointegration analysis using the yen as the numeraire currency in place of the US dollar. Again some of the pairwise trace tests were significant, but we could find no robust evidence that ASEAN5 constitutes an OCA with Japan.

4. Empirical Results

Although the Enders and Hurn model provides some guidance on the interpretation of the cointegration results, it is difficult to establish a benchmark for interpreting the coefficients, especially when the results are sensitive to the econometric strategy, including the appropriate choice of lag length in the VECM and the presence of significant multiple cointegration vectors.²¹ In particular, it is not clear a priori whether the sign on the beta coefficients in the normalized cointegration vector should be positive or negative. Cointegration is supportive of an OCA insofar as the macroeconomic fundamentals which drive the RERs of the countries concerned are sufficiently integrated so they share the same kind of real disturbances, but a negative sign suggests an asymmetry in the way the countries adjust to shocks. The implication is that the currencies concerned might still co-move in the short term, as one would expect if they are competitors, but not in long-run equilibrium. This would make a common monetary policy more difficult.

The trace test results for cointegration between pairs of ASEAN5 RERs are presented in Table 3. The null hypothesis is that the number of cointegrating vectors is zero against the alternative that it is greater than zero. Of course, the presence or absence of cointegration for a pair of countries does not necessarily imply anything about the cointegrating relationships for groups of countries measured against a base currency. To see whether ASEAN5 *as a group* constitutes an OCA, the Johansen multivariate cointegration results are listed in Table 4, together with a further test of restrictions in the form of a likelihood ratio (LR) test under the null hypothesis that a specific beta

further reducing the power of the standard ADF test. We are grateful to an anonymous referee for pointing this out. For the Asian context, see Chortareas et. al (2002) and Liew et al. (2004).

²¹ It appears to be quite easy to find significant cointegration when testing G-PPP but difficult to select meaningful cases on the basis of standard robustness tests (Ogawa and Kawasaki, 2003).

coefficient is zero and the associated country could be excluded from the cointegrating vector. The LR test is distributed as a χ_1^2 variate.

In the pre-crisis period there are only three significant pairs from the bilateral trace tests (Table 3): Indonesia-Malaysia, Singapore-Malaysia and Thailand-Philippines, and the positive sign holds only in the Singapore-Malaysia case. Furthermore, there is no evidence of cointegration for ASEAN5 at the 5% probability level, only Malaysia and Singapore reject in terms of the LR test of restrictions, and the alpha coefficients, which represent the speed of adjustment to long-run equilibrium are extremely small and in some cases not significantly different from zero (Table 4a).²²

Post-crisis, six out of ten pairs are now significantly cointegrated but only Indonesia-Malaysia has a positive sign. At the group level there is cointegration for ASEAN5 (Table 4b) and no individual country can be excluded on the basis of LR tests, but there are multiple cointegration vectors which makes interpretation of the coefficients difficult. When a Johansen normalization restriction is imposed on the first vector and the beta coefficients are interpreted as long-run ‘elasticities’ between the RERs, there are some asymmetries in exchange rate adjustment: a one percent rise in the Indonesian RER (real depreciation) induces an 8 percent depreciation of the real value of the ringgit and a 6 percent depreciation in the real value of the Singapore dollar, but a 4 percent *appreciation* in the real Thai baht and a 0.6% *appreciation* in the Philippine peso. Moreover, some of the beta coefficients look rather large, signaling dissimilarity in aggregate demand parameters between pairs of countries, as suggested in the Enders and Hurn (1994) model (see Section 3 above).

As far as the speed of adjustment is concerned, only the coefficient for Thailand is significant at conventional levels. For Indonesia and Thailand, adjustment appears to be quick, while for the Philippines the error-correction process is very slow.

A more clear-cut group result post-crisis is for Malaysia, Singapore and Thailand (ASEAN3) where there is a significant single cointegrating vector and all tests of restrictions reject at low significance levels (Table 4c). In this case a one percent Malaysian real depreciation induces a 0.4 percent depreciation of the real Thai baht but a

²² This implies that the relevant exchange rate is weakly exogenous i.e. the cointegration relationship does not enter into the equation.

0.8 percent *appreciation* of the real Singapore dollar. The negative sign for Singapore again suggests an asymmetry in exchange rate adjustment but is consistent with the long-term historical tendency for the Singapore dollar to appreciate in real terms against the US dollar while the opposite is more likely for the ringgit and Thai baht.²³ A possible interpretation of this is that ASEAN3 as a group share some common trends in their RERs but that this is offset by asymmetries in their exchange rate policies.

As far as a comparison with previous studies is concerned, it is difficult to make a direct comparison. Ogawa and Kawasaki (2003) looked at East Asia but only pre-Asian crisis and provide no details on the cointegration coefficients. When the US dollar is used as the base currency (as in our case), out of a large number of group combinations, there is only one significant result (multiple cointegration vectors) which passes their robustness criteria, namely an ASEAN4 bloc comprising Singapore, Malaysia, Thailand and Indonesia. Much more supportive are the cointegration results using a currency basket containing the US dollar, the yen and the German mark. Although ASEAN5 as a group is not significant, there are 12 other significant combinations of two or three ASEAN countries, both with and without one other East Asian currency (Chinese yuan or Korean won).

As in our case, Choudhry (2005) was unable to find cointegration between a sample of East Asian countries (Indonesia, Malaysia, Philippines, Thailand, South Korea) pre-crisis using the US dollar, yen, and Thai baht as base currencies, but surprisingly excludes Singapore and did not test for ASEAN5. Post-crisis there is a single cointegration vector for all base currencies, and this is taken as evidence in favour of an OCA, but the asymmetry in the signs of the beta coefficients is not discussed.

Conclusion

The objective of this paper has been to apply the theory of Generalized Purchasing Power Parity, which looks at the behavior of long-run real exchange rates, to re-assess the potential for an OCA among a subset of East Asian countries based on five members of the Association of Southeast Asian Nations. Our findings suggest little support for an OCA for ASEAN5 as a bloc prior to the Asian financial crisis and mixed results in the

²³ See, for example, Peebles and Wilson (2002).

post-crisis period. In particular, asymmetries in the way countries adjust to shocks and low or insignificant speeds of adjustment were found. Thus, although the application of single OCA criteria is notoriously demanding and our tests apply to only one of the many criteria for the successful formation of an OCA, we cannot find persuasive evidence that ASEAN5 as a group constitute a potential currency area with either the USA or Japan, even when the ‘noisy’ period of the Asian financial crisis is omitted.

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Table 1: ASEAN5 exchange rate volatility July 1994 to March 2003

	Standard deviation of monthly changes:		
	Bilateral against the US\$	NEER	REER
Pre-crisis			
Indonesia	0.26	1.37	1.47
Malaysia	0.90	1.26	1.45
Philippines	1.21	1.84	1.97
Singapore	0.73	0.67	0.74
Thailand	0.41	0.97	1.13
Average	0.70	1.22	1.35
Post-crisis			
Indonesia	3.61	4.28	5.63
Malaysia	2.08	2.22	2.41
Philippines	1.90	2.19	2.55
Singapore	1.35	1.02	1.05
Thailand	2.27	2.52	2.75
Average	2.24	2.45	2.88

Note: The standard deviations are calculated from changes in the exchange rate indexes with March 1995=100; pre-crisis covers the period from July 1994 to June 1996 and post crisis is from February 1998 to March 2003.

Sources: Calculated from International Monetary Fund, International Financial Statistics; Asian Development Bank, Asia Recovery Information Centre.

Table 2: Unit root tests for the real exchange rate variables (base currency=US\$)

Pre-crisis 1975(1) to 1997(5)				
Country	Test statistic DF-GLS	Lag	Test Statistic KPSS	Lag
Indonesia	-1.678	2	0.814**	4
Malaysia	-1.220	1	0.741**	4
Philippines	-1.326	9	0.774**	4
Singapore	-0.556	1	1.140**	4
Thailand	-1.284	1	0.876**	4
Post-crisis 1998(2) to 2004(2)				
Country	Test statistic DF-GLS	Lag	Test Statistic KPSS	Lag
Indonesia	-1.837	2	0.158*	3
Malaysia	-2.547	3	0.074	3
Philippines	-1.893	1	0.156*	3
Singapore	-1.158	2	0.307**	3
Thailand	-2.019	1	0.257**	3

All the variables are monthly in logs. A * indicates significance at the 5 percent probability level, ** at 1 percent. DF-GLS is the generalized Dickey-Fuller test from Elliot et al. (1996) with critical values from Cheung and Lai (1995). The optimal lag for this test is based on the modified Akaike Information Criterion (MAIC) of Ng and Perron (2001). KPSS is the semi-parametric procedure from Kwiatkowski et al. (1992) with the lag order derived from the automatic data-based bandwidth selection routine and estimates of long-run variances described in Andrews (1991).

Table 3: Pairwise trace test results (base currency=US\$)

Pre-crisis:

Values of λ_{trace} for $H_0: \text{rank} = 0$

	Indonesia	Malaysia	Philippines	Singapore
Indonesia				
Malaysia	23.882(2)**			
Philippines	3.866(10)	12.484(2)		
Singapore	11.064(3)	16.826(2)*	12.811(2)	
Thailand	7.588(2)	14.603(2)	30.811(12)**	11.332(2)

Post-crisis:

Values of λ_{trace} for $H_0: \text{rank} = 0$

	Indonesia	Malaysia	Philippines	Singapore
Indonesia				
Malaysia	15.254(12)			
Philippines	25.604(10)**	36.766(12)**		
Singapore	36.985(10)**	50.924(12)**	34.209(12)**	
Thailand	13.479(12)	7.501(11)	2.647(9)	30.873(10)**

λ_{trace} is the trace test statistic for the number of cointegrating vectors under the null hypothesis that the number of cointegrating vectors is zero against the alternative that it is greater than zero. A * indicates significance at the 5 percent probability level and ** at the 1 percent level. Figures in parentheses are the optimal lag length selected by AIC.

Table 4a Pre-crisis: cointegration test results for ASEAN5 (base currency=US\$)

Maximum rank	Eigenvalue	Trace statistic	5% critical value	1% critical value	Lags	obs
0		68.439	68.52	76.07	2	267
1	0.1169	35.233	47.21	54.46		
2	0.0555	19.980	29.68	35.65		
3	0.0382	9.587	15.41	20.04		
4	0.0196	4.302	3.76	6.65		
5	0.0159					
Normalized coefficients	Beta	Std error	Prob	Alpha	Std error	Prob
Indonesia	1			-0.0002	0.0054	0.974
Malaysia	-5.5072	0.7707	0.000	0.0088	0.0022	0.000
Philippines	0.9691	0.8131	0.233	-0.0033	0.0042	0.431
Singapore	-2.5768	0.8552	0.003	0.0114	0.0021	0.000
Thailand	3.3665	1.4367	0.019	0.0004	0.0024	0.857
Constant	1.5016					
Test of restrictions	χ_1^2	Prob				
Indonesia	3.160	0.076				
Malaysia	15.19**	0.000				
Philippines	0.906	0.341				
Singapore	5.018*	0.025				
Thailand	2.787	0.095				

Table 4b: Post-crisis cointegration test results for ASEAN5 (base currency=US\$)

Maximum rank	Eigenvalue	Trace statistic	5% critical value	1% critical value	Lags	obs
0		342.424**	68.52	76.07	12	73
1	0.9169	160.789**	47.21	54.46		
2	0.6759	78.519**	29.68	35.65		
3	0.5649	17.770*	15.41	20.04		
4	0.2111	0.454	3.76	6.65		
5	0.0062					
Normalized coefficients	Beta	Std error	Prob	Alpha	Std error	Prob
Indonesia	1			1.0222	1.0909	0.349
Malaysia	8.2255	0.2804	0.000	-0.1230	0.0949	0.195
Philippines	-0.5934	0.0632	0.000	0.0617	0.4231	0.884
Singapore	5.9303	0.0699	0.000	0.3736	0.2981	0.210
Thailand	-4.4499	0.0555	0.000	0.8262	0.4055	0.042
Constant	-7.6074					
Test of restrictions	χ_1^2	Prob				
Indonesia	97.463**	0.000				
Malaysia	97.558**	0.000				
Philippines	64.307**	0.000				
Singapore	95.140**	0.000				
Thailand	93.677**	0.000				

Table 4c: Post-crisis cointegration test results for ASEAN3 (base currency=US\$)

Maximum rank	Eigenvalue	Trace statistic	5% critical value	1% critical value	Lags	obs
0		79.156**	29.68	35.65	12	73
1	0.5834	15.230	15.41	20.04		
2	0.1430	3.962	3.76	6.65		
3	0.0528					
Normalized coefficients	Beta	Std error	Prob	Alpha	Std error	Prob
Malaysia	1			-0.3373	0.0499	0.000
Singapore	-0.7845	0.1389	0.000	0.1066	0.1111	0.337
Thailand	0.3742	0.0880	0.000	-0.2650	0.1783	0.137
Constant	-0.7419					
Test of restrictions	χ_1^2	Prob				
Malaysia	16.975**	0.000				
Singapore	35.640**	0.000				
Thailand	18.112**	0.000				

Note: all variables are monthly in logs. The normalized coefficients are obtained after a Johansen normalization restriction is imposed. The test of restrictions is a likelihood ratio test of the null that the specified beta coefficient is zero. A * indicates significance at the 5 percent probability level and ** at 1 percent.

Figure 1: ASEAN5 real exchange rates in levels and first differences (base currency=US dollar)

