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Monetary Integration in East Asia: Evidence from Real Effective Exchange Rates

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This paper investigates the feasibility of forming a monetary union in East Asia by examining the cointegration and causality of the real effective exchange rates of local currencies. A "pentagon" group of five countries is found—South Korea, the Philippines, Thailand, Indonesia, and Malaysia—which may have potential for success for further monetary integration. Singapore is loosely tied to this group. The Greater China area—China, Hong Kong and Taiwan—does not show any significant degree of integration either internally or externally. Neither a yen bloc nor a US dollar bloc is forming in East Asia.

1. Introduction

Over the past decades (1980–2006), regionalism has been enhanced in East Asia in trade and investment, and money and finance (Rana, 2007). It is believed that policies directed towards the stability of intra-regional exchange rates will help promote trade, investment and growth in the region given the similarities in trade composition and the high degree of intra-regional trade (Kawai and Takagi, 2005; Kawai, 2008). The 1997–98 Asian financial crisis and the successful launch of the euro in 1999 have triggered a debate among economists and policy makers on the feasibility of establishing a similar arrangement in East Asia to guard against future crises and to further economic growth.

At the Association of Southeast Asian Nations' (ASEAN) December 1998 summit, the heads of state directed that a study be conducted on the feasibility of an ASEAN currency union. In May 2000 the establishment of the Chiang Mai Initiative (CMI) marked another solid breakthrough in East Asia's efforts towards monetary cooperation. Under the CMI, the ASEAN+3 countries (ASEAN, China, Japan and South Korea) agreed on a system of bilateral swap arrangements between each nation's local currency and the US dollar in times of balance of payments and liquidity problems.

In 2003, after considering the findings of their study on an ASEAN currency union, the ASEAN members agreed that greater currency cooperation should be their short run focus prior to creating a common currency. In 2006 ASEAN+3 announced that it would conduct another study on the feasibility of a single Asian currency, and the topic was again discussed at the ASEAN summit in October 2009, with support for the idea coming from both Japan and China. In December 2009 ASEAN+3 extended the CMI and established the Chiang Mai Initiative Multilateralization (CMIM) Agreement. With a launch date in March 2010, the CMIM draws on a foreign reserve pool of US$120 billion, and further establishes the countries' commitment to greater financial integration. Although many remain skeptical that an East Asian currency union will exist anytime soon, there is clearly growing interest in the possibility and potential of such a union.

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An important question to consider is what currency might be adopted in an East Asian currency union? New currencies have often been anchored to existing ones. Prior to the introduction of the euro, for example, the German mark was the dominant currency in the region and it served as an anchor for the new currency. Some studies have suggested that a common currency area in East Asia would be more successful if it were based on the Japanese yen (Kwan, 2001), the Chinese yuan (Shirono, 2009), or the US dollar (Mundell, 2003), with these existing currencies being used either as a permanent choice or as an intermediate step prior to the creation of an entirely new currency. Others have proposed basing a common currency area on a weighted basket of existing currencies, with suggestions including regional currencies only (such as the Asian Monetary Unit proposed by the Asian Development Bank as an accounting measure) or based on multiregional currencies, such as a combination of the US dollar, euro, and yen (Ogawa and Kawasaki, 2003).

The choice of common currency is fraught with political tension and regional leaders have been deliberately vague about the form that such a currency might take, although various Japanese officials have publicly pushed for "internationalizing" the yen. Currently, several East Asian nations stabilize their currencies against the US dollar, creating a *de facto* dollar bloc. As a result, studies concerning the possibility of an East Asian currency union generally consider the options of a yen- or US-dollar based union (Frankel and Wei, 1994; McKinnon and Schnabl, 2004; Bowman, 2005).

This paper investigates if it is feasible for East Asia to form a monetary union by examining the long-run co-movements and the long-run and short-run causality relationships of the real effective exchange rates of regional currencies using data from 1981 to 2007. Our main findings are as follows. First, a uniform monetary union for the entire area is not yet feasible; however, there may be potential for success for a sub-group, comprising South Korea, the Philippines, Thailand, Indonesia, and Malaysia, for further monetary integration. Singapore is loosely tied to this group. Second, the Greater China area—China, Hong Kong, and Taiwan—does not show any significant degree of monetary integration either internally or externally. Third, neither the US dollar nor the yen seem to be influential enough to form a monetary bloc in East Asia. These findings are loosely in agreement with some of the existing literature regarding the ASEAN countries but not for the Southeast Asian newly industrializing countries (NIEs).

The rest of the paper is organized as follows. Section 2 reviews the main literature. Section 3 discusses the empirical methodology. Section 4 describes the data and the results of the preliminary analysis. Section 5 presents the empirical results. Section 6 concludes.

2. Literature Review

The development of both theoretical and empirical studies of the optimum currency area (OCA) theory, based on the seminal works of Mundell (1961) and McKinnon (1963), has provided the foundation for this study. An optimum currency area is an economic domain in which member countries benefit from pegging their exchange rates rigidly to each other or using one common currency while allowing joint flexibility against currencies outside the domain. Symmetry of macroeconomic shocks, among others, is the key to the success of a monetary union. Countries that are subject to similar macroeconomic shocks will find it less costly to adopt common monetary policies.

Empirical research has provided mixed evidence for the degree of symmetry of shocks in East Asia. Most use structural vector authoregression (VAR) models to identify the correlations in macroeconomic shocks among countries. Using data for 1969–89, Bayoumi and Eichengreen (1994, BE hereafter) found one potential Northern bloc made up of Japan, South Korea, and Taiwan, and another group of Hong Kong, Indonesia, Malaysia, Singapore, and possibly Thailand as potential candidates for a currency union. They argued that on an economic basis, East Asia has satisfied the criteria for an optimum currency area almost as well as the countries in the European Monetary Union. Chow and Kim (2003) examined the relative exposure of an East Asian country's output to global, regional, and country-specific shocks, for the period of 1971–97. Using the USA as the global proxy and Japan as the regional proxy, they found that most countries are subject mainly to country-specific shocks and thus an optimum currency area would be difficult to sustain. Kwack (2004) extended the BE study on data for 1975–2001. Kwack found that correlations of supply shocks and demand shocks were higher in the period 1990–2001 than those in 1975–89 and concluded that East Asian countries have become more similar in their responses to external shocks. Zhang et al. (2004) studied the East Asian countries in comparison with an estimated benchmark of the European Union and found that subregions of East Asia, such as some NIE countries (Hong Kong, South Korea, Taiwan, and Singapore) and some ASEAN countries (Malaysia, Indonesia, and Thailand), are becoming better candidates for an OCA for the post-financial crisis period.

More recent studies have provided more positive evidence on East Asia becoming more economically integrated. Using data for 1971–2003, Shin and Sohn (2006) documented that trade integration enhances co-movements of output and deeper financial integration weakly improves price co-movements across countries. Sato and Zhang (2006) found that an OCA arrangement is feasible for ASEAN countries consisting of Singapore, Thailand, and Indonesia; a Northeast Asian region consisting of Hong Kong, South Korea, and Mainland China, and Japan and Taiwan, as a result of both long-run and short-run synchronous movements of real output for the period of 1978–2004. Rana (2007) found that business cycle synchronization has been enhanced in East Asia for the period 1989–2004, which strengthens the case for further macroeconomic integration in the region.

3. Empirical Methodology

The empirical methodologies used for this paper are cointegration and Granger causality. Enders and Hurn (1994) examined the cointegration relationship among real exchange rates to investigate the degree of symmetry in macroeconomic shocks. They argued that: (1) the real fundamental macroeconomic variables (or forcing variables) that drive changes in real exchange rates are nonstationary, implying that the real exchange rates are also nonstationary; and (2) within an optimum currency area, the forcing variables (macroeconomic fundamentals) share common stochastic trends, hence the real exchange rates that are driven by these variables also share common stochastic trends; thus, testing if the real exchange rates are cointegrated is one way to determine the presence of symmetry of macroeconomic shocks.

We adopt this approach and use the real effective exchange rate instead of the bilateral real exchange rate. Real effective exchange rates contain richer information for East Asia. Most East Asian countries have followed export-oriented growth strategies since the mid 1970s. They share similar patterns of trade and trade composition. They import parts and capital equipment from countries like Japan and the USA, trade

parts and intermediate goods back and forth with each other, and export the final goods to Japan or the USA. In this process, they are both competitors and interdependent with each other (Kamada and Takagawa, 2005). Accordingly, there is a need for East Asian countries to direct their policies towards the relative stability of their real competitiveness in the world market, proxied by the real effective exchange rates. Hence, identification of any long-run co-movements and short-run and long-run causality relationships shed light on the policy coordination and economic integration among the East Asian countries.

Cointegration

If the real effective exchange rates are $I(1)$, we can test for cointegration. We denote the bivariate cointegration between the real effective exchange rates of any two East Asian currencies as $R = (r_i, r_j)'$, where $i \neq j$.[1] Following the Johansen and Juselius (1990) maximum likelihood method, we first estimate the following vector autoregressive model:

$$R_t = A_0 + A_1 R_{t-1} + A_2 R_{t-2} + \ldots + A_p R_{t-p} + \varepsilon_t \tag{1}$$

where R_t is the vector of the two real effective exchange rates; A_0 is the 2×1 vector of constants; A_k, $k = 1, \ldots, p$, is the 2×2 coefficient matrix of R_t lagged by k periods; and ε_t, the 2×1 vector of residuals, is assumed to be bivariate normal with mean vector zero and covariance matrix Σ, and independent across time periods. We then rewrite the VAR(p) in (1) in the following vector error-correction form when all series are $I(1)$:

$$\Delta R_t = A_0 + \sum_{k=1}^{p-1} \pi_k \Delta R_{t-k} + \pi R_{t-p} + \varepsilon_t \tag{2}$$

where $\pi = -\left(I - \sum_{k=1}^{p} A_k \right)$ and $\pi_k = -\left(I - \sum_{l=1}^{k} A_l \right)$ are 2×2 matrices of coefficients. Two likelihood ratio test statistics developed to test the rank of the π matrix are the trace test statistic, λ-*trace*, and the maximum eigenvalue test statistic, λ-*max*:

$$\lambda\text{-}trace = -T \sum_{i=c+1}^{2} \log(1 - \lambda_i) \tag{3}$$

$$\lambda\text{-}max = -T \log(1 - \lambda_{c+1}) \tag{4}$$

where T denotes the length of the time series, and λ_i is the eigenvalue obtained from the reduced rank regression problem. If $Rank(\pi) \geq 1$, the two real effective exchange rates are cointegrated and thus share long-run common trends.

Granger Causality

Granger causality analysis (Granger, 1980; Engle and Granger, 1987) examines whether lagged values of the real effective exchange rate of one currency enter the equation for that of the other currency in our bivariate systems. When the real exchange rate of currency A is found to Granger cause that of currency B (i.e. past values of the real exchange rate of A help explain the current value of the real exchange rate of B), it is likely that country B takes the value of currency A into account when making its exchange rate policy. This may happen when the two countries are close competitors in

trade in the world market or when currency B is pegged to currency A. It is also likely that Granger causality runs in both directions, from A to B and from B to A. In either case, it reveals a close interdependence between the two economies in terms of monetary policy coordination.[2]

Consider the model of $R = (r_i, r_j)'$. If the pair of real effective exchange rates is found to be $I(1)$ and non-cointegrated, we estimate the following VAR model:

$$\Delta r_{i,t} = \alpha_{0,i} + \sum_{k=1}^{p} \alpha_{11,k} \Delta r_{i,t-k} + \sum_{k=1}^{p} \alpha_{12,k} \Delta r_{j,t-k} + \varepsilon_{i,t} \tag{5a}$$

$$\Delta r_{j,t} = \alpha_{0,j} + \sum_{k=1}^{p} \alpha_{21,k} \Delta r_{i,t-k} + \sum_{k=1}^{p} \alpha_{22,k} \Delta r_{j,t-k} + \varepsilon_{j,t} \tag{5b}$$

$\alpha_{lm,k}$ is the coefficient of the kth lag of variable m on equation l; α_0's are the intercept terms; and ε_t's are the white noise residuals. Using equation (5b), the equation of the real exchange rate of currency j, we test whether the real exchange rate of currency i Granger causes the real exchange rate of currency j. The null hypothesis $H_0 : \alpha_{21}(k) = 0$, $\forall\ k,\ k = 1, 2, \ldots p$, states that i does not Granger cause j. If an estimated F-test statistic is greater than the critical value, the null hypothesis is rejected, indicating the existence of Granger causality from i to j.

If the system is cointegrated we follow the Dolado and Lutkepohl (1996) method which leads to Wald tests with asymptotic χ^2 distributions. This approach avoids possible pre-test biases associated with the usual procedure of estimating a first order differenced VAR if variables are known to be $I(1)$ with no cointegration, and an error correction model if they are known to be cointegrated. Using this method we can directly apply Wald tests to the least squares estimators of the coefficients of the VAR specified in levels of the variables.[3]

Applying the Dolado and Lutkepohl (1996) method, we first estimate the system in (1) and find the appropriate p using Wald tests. We then refit the data with a VAR(p+1) as shown in system (6):

$$r_{i,t} = \alpha_{0,i} + \sum_{k=1}^{p+1} \alpha_{11,k} r_{i,t-k} + \sum_{k=1}^{p+1} \alpha_{12,k} r_{j,t-k} + \varepsilon_{i,t} \tag{6a}$$

$$r_{j,t} = \alpha_{0,j} + \sum_{k=1}^{p+1} \alpha_{21,k} r_{i,t-k} + \sum_{k=1}^{p+1} \alpha_{22,k} r_{j,t-k} + \varepsilon_{j,t}. \tag{6b}$$

Because all equations have the same lag length, the least squares estimators of the coefficients are consistent and asymptotically efficient (Enders, 2010). To test Granger causality, we use (6b) and apply Wald tests on the first p coefficients for each variable. For example, to see if r_i Granger causes r_j, test $H_0 : \alpha_{21,k} = 0, \forall\ k, k = 1, \ldots, p$.

4. Data and Preliminary Analysis

We use monthly observations for the eleven real effective exchange rate series for 1981–2007. They are: the Chinese yuan (RCN), the Hong Kong dollar (RHK), the Indonesian rupiah (RIN), the South Korean won (RKO), the Malaysian ringgit (RMA), the Philippine peso (RPH), the Singaporean dollar (RSI), the Thai baht (RTH), the new Taiwan dollar (RTW), the Japanese yen (RJP), and the US dollar (RUS). Data for RCN, RMA, RPH, RSI, RJP, and RUS are obtained from the *Inter-*

national Financial Statistics (IFS) of the International Monetary Fund (IMF). Data for RHK, RIN, RKO, RTH, and RTW are not provided in the IFS database. To generate the five series that are unavailable, we construct each real effective exchange rate series as the trade-weighted average of the bilateral nominal exchange rates deflated by the price ratios against the country's 15 largest trading partners, using data from the IFS and the IMF's *Direction of Trade Statistics*.[4] An increase in the real effective exchange rate indicates an appreciation of the currency. The series are indices with 2000 as the base year. We then take the natural logarithms for estimation.

We first check the stationarity of the real exchange rates. For both the Augmented Dickey–Fuller (1979) test and the Phillips and Perron (1988) test, the null hypothesis of a unit root cannot be rejected for all series in levels but can be rejected for all in their first differences at the 1% level of significance. Thus, these real exchange rate series are integrated of order 1, or $I(1)$.[5]

5. Empirical Results

Cointegration

Bivariate cointegration tests for 36 pairs of East Asian currencies (excluding Japan) are conducted using six or twelve lags.[6] One practical issue is the 1997/98 financial crisis in East Asia, as the structural break in the data may lead toward cointegration biases. To account for this possibility, we include impulse dummies in our VAR estimation for 1997/98 following the Doornik et al. (1998) method. Table 1 reports the *λ-trace* or the *λ-max* test results. The hypothesis of no cointegration is rejected by either test at least

Table 1. Cointegration between Each Pair of East Asian Currencies

	Test	*RHK*	*RIN*	*RKO*	*RMA*	*RPH*	*RSI*	*RTH*	*RTW*
RCN	*λ-max*	5.63	**7.22**	**7.59**	6.71	6.47	6.67	**6.75**	5.92
	λ-trace	8.28	**13.35****	**11.63**	11.28	12.09	9.77	**10.44**	6.90
RHK	*λ-max*		11.52	**7.46**	6.31	9.26	6.21	**8.59**	13.50*
	λ-trace		13.87*	**9.63**	8.53	11.27	7.96	**10.79**	16.60
RIN	*λ-max*			**5.19**	14.24**	7.02	5.05	**7.56**	**5.64**
	λ-trace			**9.33**	16.90**	9.15	8.92	**11.96**	**7.10**
RKO	*λ-max*				**7.56**	**10.73**	**17.10****	**15.95****	**5.35**
	λ-trace				**10.09**	**19.31****	**24.87*****	**20.38****	**6.56**
RMA	*λ-max*					6.73	3.46	**5.66**	2.41
	λ-trace					7.62	5.00	**8.69**	3.28
RPH	*λ-max*						8.90	9.37	6.38
	λ-trace						12.47	14.29*	7.56
RSI	*λ-max*							**8.02**	6.37
	λ-trace							**10.33**	9.24
RTH	*λ-max*								**4.50**
	λ-trace								**6.01**

Note: The estimation follows the Johansen and Juselius (1990) method. Lag length is 6 or 12. The test statistics are for the test of $H_0 : r \leq 0$ vs the alternative. Critical values are: for *λ-max*: at 1%, 18.63; at 5%, 14.07; and at 10%, 12.07; for *λ-trace*: at 1%, 20.04; at 5%, 15.41; and at 10%, 13.33 (see Osterwald-Lenum, 1992). *,**,*** Denote significance at 10%, 5%, and 1%, respectively. The results in bold are estimated from 12 lags while the rest are estimated from 6 lags.

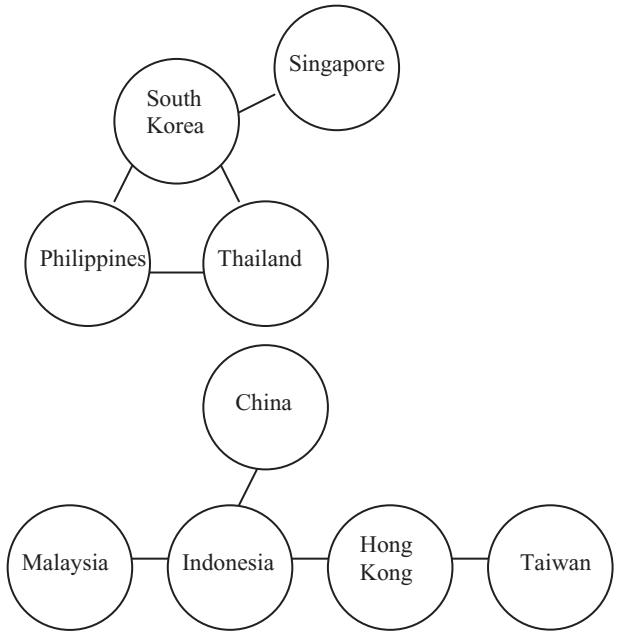

Figure 1. Cointegration—the "Triangle" and the "Link"

Note: A line section links two countries that are cointegrated.

at the 10% significance level in eight out of 36 cases. Figure 1 summarizes these relationships.

As seen in Figure 1, two interesting groups that exhibit long-run co-movements are identified. The first group is a triangle composed of South Korea, the Philippines, and Thailand, to which Singapore is related via South Korea; the second group resembles a link in which cointegration is found between Malaysia and Indonesia, Indonesia and Hong Kong, and Hong Kong and Taiwan, where China is related to the "link" with Indonesia. Of the two, the first group appears to be a stronger relationship given that the majority of countries share long-run ties with each other. Between the two groups, there seems to be no bridge to bring them together.

One implication of our findings is that a uniform monetary union for all of East Asia may be hard to sustain given that not all countries share long-run co-movements with each other in their real effective exchange rates. However, long-run co-movements do exist among sub-groups of countries, suggesting that recent deepening of economic cooperation may have pushed them closer onto the path of further monetary integration in the future.

Because they are major export markets and/or important anchor currencies for the East Asian countries, we must also consider the influence of Japan and the USA. Therefore, we also examine whether there exists any cointegration between an East Asian currency and the US dollar or the yen. The results are given in Table 2. The US dollar real exchange rate is found to share long-run co-movements with the Chinese yuan, the Philippine peso, and the Singapore dollar. We do not find any cointegration between the Japanese yen and the East Asian currencies. Thus, our results lend no support to either a yen bloc or a US dollar bloc for the region.

Table 2. Cointegration and Causality with the US Dollar and Yen

East Asian Currency	*Anchor Currency*	*λ-max*	*λ-trace*	*Cointegrated?*	*Causality test statistic*	*Causality?*
RCN	RUS	10.45	18.56**	Yes	0.35	No
	RJP	5.63	9.32	No	0.64	No
RHK	RUS	6.52	7.87	No	1.06	No
	RJP	**9.63**	**12.74**	No	**1.57**	No
RIN	RUS	6.46	8.90	No	1.70	No
	RJP	6.42	9.14	No	1.70	No
RKO	RUS	**9.41**	**12.70**	No	**1.01**	No
	RJP	**5.84**	**10.87**	No	**0.79**	No
RMA	RUS	3.48	5.68	No	0.60	No
	RJP	4.69	5.79	No	1.66	No
RPH	RUS	9.76	14.07*	Yes	0.40	No
	RJP	6.22	7.99	No	0.66	No
RSI	RUS	17.34**	24.50***	Yes	0.21	No
	RJP	5.06	6.29	No	1.46	No
RTH	RUS	**7.13**	**10.56**	No	**0.91**	No
	RJP	**5.53**	**8.91**	No	**0.26**	No
RTW	RUS	5.43	7.94	No	1.60	No
	RJP	7.67	8.33	No	1.13	No

Notes: Cointegration estimation follows the Johansen and Juselius (1990) method. Lag length is 6 or 12. The test statistics are for the test of $H_0 : r \leq 0$ vs the alternative. Critical values are: for *λ-max*: at 1%, 18.63; at 5%, 14.07; and at 10%, 12.07; for *λ-trace*: at 1%, 20.04; at 5%, 15.41; and at 10%, 13.33 (see Osterwald-Lenum, 1992). *,**,*** Denote significance at 10%, 5%, and 1%, respectively. Causality tests report the *F*-statistics for non-cointegrated systems and χ^2-statistics for the cointegrated systems, which are underlined. For both the cointegration and causality tests, the results in bold are estimated with 12 lags, the rest are estimated with 6 lags.

Granger Causality

Granger causality analysis for each pair of East Asian currencies (excluding Japan) is conducted first. We test to see whether lagged values of one East Asian real exchange rate Granger cause the current value of another. If currency A is found to Granger cause currency B, there may be two explanations: first, country B may have adjusted its monetary policy to maintain competitiveness after observing the changes in country A's real exchange rate, implying policy coordination; and second, country B may have encountered similar macroeconomic shocks to country A, which require similar stabilization policies, so that changes in real exchange rates in the two countries are similar. Table 3 presents the results. Figure 2 summarizes these relationships.

Granger causality tests have uncovered richer interactions among the ASEAN core countries plus South Korea. Causality is found for the cointegrated triangle of South Korea, the Philippines, and Thailand. Two bi-directional and one uni-directional causality relationships can be found for this triangle. For the non-cointegrated pairs we have found bi-directional causality for almost any pair of countries among Indonesia, Malaysia, the Philippines, South Korea, and Thailand. A "pentagon" of the five countries shown in Figure 2 has illustrated the strong short-run ties among these countries.

The real exchange rate of Singapore is found to be Granger caused by three countries in the pentagon above (Indonesia, South Korea, and Thailand), and one outside

Table 3. Causality between Each Pair of East Asian Currencies

	RCN	*RHK*	*RIN*	*RKO*	*RMA*	*RPH*	*RSI*	*RTH*	*RTW*
RCN		0.67	**0.30**	**0.43**	0.34	0.17	0.86	0.40	0.49
RHK	0.13		0.82	**1.00**	0.90	1.58	1.99*	**0.56**	1.08
RIN	**0.34**	0.40		**1.59***	3.80*	**1.97***	1.91*	**3.93***	**0.95**
RKO	**0.54**	**1.00**	**17.6***		9.59*	**2.00***	**1.89***	**9.01***	**0.62**
RMA	0.12	0.25	3.22*	**3.75***		1.25	1.37	**4.08***	1.19
RPH	0.98	0.80	**1.63***	**1.74***	0.97		0.31	2.66*	0.93
RSI	1.26	0.91	1.25	**0.77**	1.74	1.08		**0.92**	2.02*
RTH	**0.39**	**0.84**	**8.88***	**7.40***	**3.49***	1.44	**1.84***		**1.11**
RTW	1.19	1.12	**1.36**	**1.79***	1.74	0.64	0.13	**2.07***	

Notes: The table reports the F-statistics for non-cointegrated systems and χ^2-statistics for the cointegrated systems, which are underlined. The direction of causality runs from the row currency to the column currency. For example, for the row for RTH and column for RIN, the test statistic is significant. It reads as "the Thai real exchange rate Granger causes the Indonesian real exchange rate". * Denotes the test statistic is at least significant at the 10% level, implying causality. The results in bold are estimated from 12 lags, while the rest are estimated from 6 lags.

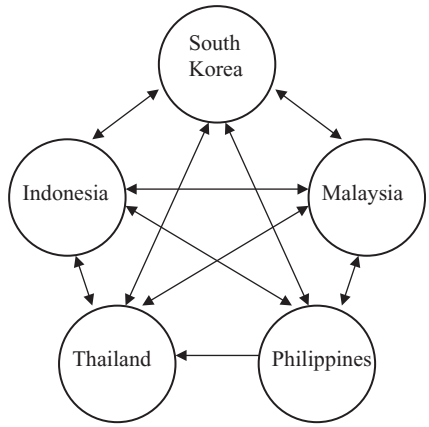

Figure 2. Granger Causality—the "Pentagon"

Note: The arrows indicate the direction of Granger causality.

(Hong Kong)—but causality does not run the other way. This may suggest a loose tie between Singapore and the pentagon countries, with Singapore being the one adjusting policies in response to changes in the pentagon.

The Greater China area—China, Hong Kong, and Taiwan—does not show many Granger causality interactions either internally or externally, implying relative independence from the pentagon plus Singapore region.

Our results with Granger causality analysis have similar implications as those from the cointegration analysis. A uniform monetary union for all of East Asia may be hard to sustain given insufficient policy coordination or lack of similarity in macroeconomic shocks among all of the countries. However, a sub-region, namely South Korea and core ASEAN countries, may have become better aligned with each other in policy coordination both in the short run and in the long run and thus further monetary integration may be possible.

We also test for causality between any East Asian currency and the US dollar or the yen, with results also presented in Table 2. No causality is found from the US dollar or the yen to any East Asian real exchange rate, implying that East Asian economies may not consider the dollar or the yen as important parameters in their policy functions. Rather, they look more at each other to secure their competitiveness in the world market. Lack of policy coordination implies that a yen bloc or a US dollar bloc is not forming.

6. Conclusions

In this paper, we have assessed the feasibility of forming a monetary union in East Asia by applying the Johansen and Juselius (1990) cointegration analysis and Granger causality (1980) analysis to examine the long-run and short-run interactions among the real effective exchange rates in East Asia on monthly data from 1981 to 2007.

Our results support the following conclusions. First, a uniform monetary union for the entire area is not yet feasible; however, there may be potential for success for a sub-group comprised of South Korea, the Philippines, Thailand, Indonesia, and Malaysia, for further monetary integration. Singapore is loosely tied to this group. Second, the Greater China area (China, Hong Kong, and Taiwan), does not show any significant degree of monetary integration either internally or externally. Third, neither the US dollar nor the yen is forming a monetary bloc in East Asia.

Some caveats remain. The European experience has suggested that formation of a monetary union cannot happen without a desire for further political unification. The supranational institutions in Europe—the European Commission, the European Court of Justice, the European Parliament, and the European Central Bank—all require members to transfer some of their national sovereignty. Such a tradition is currently absent in Asia (De Grauwe and Zhang, 2006). Even though the European approach may not be the only way toward monetary unification, their experience is valuable for East Asia in its quest for further monetary integration.

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Notes

1. Bivariate models are chosen over the multivariate models for two reasons. First, whether to join a monetary union is by far a country-level decision. Bivariate models provide straightforward evidence for whether one country shares co-movements with another potential member.

Second, although the bivariate approach investigates a country-to-country correlation, this approach is useful when it is hard to specify possible candidate groups in a multivariate model. As Enders (2010) pointed out, as a practical matter, if multiple cointegrating vectors are found in a multivariate setting it may not be possible to identify the behavioral relationships from what may be reduced-form relationships.

2. Using Granger causality, MacDonald and Taylor (1991) found German leadership among the EMS economies during the ERM (Exchange Rate Mechanism) period in that the German mark was found to strongly Granger cause the French franc and the Italian lira, but not vice versa.

3. The argument for the Dolado and Lutkepohl (1996) method is that the non-standard asymptotic properties of the Wald test on the coefficients of cointegrated VAR systems are due to the singularity of the asymptotic distribution of the least square estimators. This method gets rid of the singularity by fitting a VAR process whose order exceeds the true order. They show that this device leads to a non-singular distribution of the relevant coefficients.

4. Take the Thai Baht as an example. We first take the average of trade volume data (imports + exports) for 1991–2000 to determine the 15 largest trading partners and the trade weights, ω_i's, $i = 1, 2, \ldots, 15$, with i being a trading partner, for Thailand. Then, the real bilateral exchange rates of the Thai Baht against each of the 15 currencies of the trading partners are computed as follows: $R_i = \left(\frac{E_i}{E}\right)\left(\frac{P}{P_i}\right)$, where R_i is the real bilateral exchange rate of the Thai Baht against currency i, expressed in country i's units per Thai unit; E_i is the nominal exchange rate in units of currency i per US dollar; E is the nominal exchange rate in units of Thai Baht per US dollar; P is the price index for Thailand; and P_i is the price index for country i. Then, the 15 real bilateral exchange rates are used to create the real effective exchange rate for the Thai Baht as follows: $R = \prod_{i=1}^{15}(R_i)^{\omega_i}$, ω_i as defined before. Finally, R is normalized so that (2000:1–2000:12) = 100, to be consistent with the other series from the IFS. Detailed data are available upon request.

5. The unit root test results are not reported to save space but are available upon request.

6. The selection of six or 12 lags has passed the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SBC), and the Likelihood Ratio (LR) tests for lag length and the residuals passed the Durbin–Watson and the Ljung–Box tests for white noise. Detailed results are not shown for space reasons but are available upon request.