Feasibility of Currency Unions in Asia

— An Assessment Using Generalized Purchasing Power Parity —[1]

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Abstract

This paper examined the economic feasibility of forming a regional currency block in Asia, by adopting a generalized purchasing power parity (G-PPP) approach to identify the existence of common trends in real exchange rates among a group of countries. To be specific, we conducted both bilateral and multilateral co-integration estimation on real exchange rates with the samples of 17 Asian countries covering south Asia during the post- 1997-98 crisis period. Our findings are as follows; First, Japan, China and Korea are shown to be little candidate for any optimum currency areas. Second, ASEAN and south Asia, as a group, passed the G-PPP condition. Third, some co-integrating interactions were interestingly found between ASEAN and south Asian members. Our strategic implication emphasizes on the significance of a smaller local subgroup multi-speed strategy toward a long-run goal of currency union in Asia.

Key words: optimum currency area, generalized purchasing power parity, co-integrating relationship, ASEAN, south Asia
JEL Classification Codes: F31, F33

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1. Introduction

The question on the exchange rate arrangement for Asia has recently given increasing importance. There seem to be the following backgrounds under the growing concerns with the currency regime in Asia. First, Asia has created a continuous trend of growing economic integration. Kawai (2009) indicates, for example, that the ratio of intra-regional trade relative to trade against the world in East Asia has gone up from 35 percent in 1980 towards 56 percent in 2004, which would be comparable to the peak ratio of EU (66 percent in 1990) and that of NAFTA (49 percent in 2001). The growing trade and investment flows and economic integration within the region have triggered the idea that Asia might as well prepare for a fixed exchange rate system or even a common currency. The other background is some progress in intra-governmental monetary cooperation, motivated by the lesson of the 1997-98 Asian currency crises. The region has already taken some steps to boost monetary cooperation, typically shown as the "Chiang Mai Initiative" in May 2000, through which the government of the region agreed to plan for closer monetary and financial cooperation. In line with these visible developments in the regional backgrounds, the academic research interest in the issue of monetary cooperation in Asia has recently been revived widely –see Section 2 below.

This paper aims at assessing the economic feasibility of forming a regional currency block in Asia, by adopting a generalized purchasing power parity (G-PPP) approach to identify the existence of common trends in real exchange rates among a group of countries. The paper is organized as follows. Section 2 review previous studies and clarify this paper's position. Section 3 presents empirical analyses introducing the methodology and data and discussing the estimate results. Section 4 summarizes the results and concludes.

2. Previous Studies, Our Position

The desirability of forming currency union has been discussed at length in the literature on "optimum currency area". The criteria to judge whether a common currency zone is preferable or not was described as factor mobility (Mundell, 1961), trade integration (McKinnon, 1963), and similarities in national economic structures and in responses to common shocks. The issue of these similarities has been examined mainly through the following three approaches. The first one is a structural vector auto-regression (S-VAR) approach to identify the symmetry of macroeconomic shocks

among a group of countries. The second one is a generalized purchasing power parity (G-PPP) approach to identify the existence of common trends in economic fundamentals among a group of countries. The third one is a cluster analysis approach to group the targeting countries through investigating the homogeneities of several economic elements. We here pick up representative previous studies by each approach, focusing on the studies targeting Asian region.

As for S-VAR approach, Eichengreen and Bayoumi (1999) demonstrated, on the basis of the symmetry of the supply shock, the possibility that two subgroups — a Northeast Asian subgroup (Japan, Korea, and Taiwan) and a Southeast Asian subgroup (Hong Kong SAR, Indonesia, Malaysia, and Singapore) — should form respective common currency areas. Subsequent studies using the same method produced similar results as well. Ling and Yuen (2001) supported the formation of common currency areas in the same Northeast Asian subgroup, whereas Bayoumi et al. (2000) did in the same Southeast Asian subgroup.

The idea of G-PPP approach was pioneered by Enders and Hurn (1994), who applied it to Pacific Rim countries and proved that the Pacific Rim nations were found not to constitute an optimum currency area by the rejection of G-PPP. Subsequently, Liang (1999) found that Hong Kong SAR and China as a subgroup are not eligible for an OCA, whereas they are only if joined together by Japan and the United States. Ogawa and Kawasaki (2003), using a common currency basket as the base currency, showed that ASEAN 5 (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) plus China could form a common currency basket area. Choudhry (2005) provided an evidence of G-PPP between the real exchange rates of the five Far East countries – Thailand, Malaysia, Indonesia, the Philippines and South Korea, regardless of the base currency, after the Asian crisis, and interpreted this evidence as a result of the increased link in the economic and exchange rate policies among these countries during the post-crisis period. Ahn et al. (2006), by using G-PPP approach as well as S-VAR approach, found that a larger group of appropriately selected East Asian economies – four ASEAN countries (Indonesia, Malaysia, Singapore, and Thailand) and four Northeast Asian economies (Hong Kong SAR, Japan, Republic of Korea, and Taiwan) – does satisfy the macroeconomic conditions for forming an optimum currency area. This finding seems to be a contrast to most of the existing research results to support the formation of a small subgroup currency area in East Asia.

The cluster analysis was conducted by Ibrahim (2008), which revealed that homogeneities of ASEAN+3 are low and the immediate formation of a monetary union would entail serious potential costs, and furthermore suggested that grouping differ

between pre-crisis and post-crisis periods which could be due to the different impact of the crisis on the economic structure of these countries.

As far as the fore-mentioned existing studies are concerned, their outcomes appear to have provided inconclusive evidences totally; some evidences suggested a practical approach to start with a smaller local currency area, whereas others implied the urgent necessity for creating a larger currency area, or the prematurity to form a currency union on the contrary. This paper helps place the ongoing arguments in the context of observed facts in the whole area of Asia, and provides empirical evidence using recent data on the feasibility of forming a regional currency block in Asia, through a generalized purchasing power parity (G-PPP) approach.

This paper tries to extend the existing research outcomes in several directions. First, we examine the possibility of currency block in the whole area of Asia, including south Asia. Most of the previous studies have focused on East Asia, ASEAN, or ASEAN plus 3 (Japan, China and Korea), not covering south Asia. The south Asia initiated the regional agreement of the South Asian Association of Regional Cooperation (SAARC) in 1985, whose members are at present Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The SAARC has formed the Preferential Trading Arrangement (SAPTA) since 1995 and the South Asian Free Trade Area (SAFTA) since 2006. In a 1999 report (SAARC, 1999), following a call for "greater coordination of monetary and exchange rate policy", a tentative roadmap suggested goals of forming a South Asian Custom Union (SACU) as early as 2015, followed by a South Asian Economic Union as early as 2020. It is, thus, significant to examine the feasibility of a currency union in south Asia as well as to investigate the interactions between south Asia and the other Asian area such as ASEAN. Second, we conduct the estimation by focusing on the period after the 1997-98 Asian currency crises. Most of the previous researches have covered only the pre-crisis period or the period including the pre-crisis one. Since most ASEAN economies had adopted the de fact US dollar peg system before the Asian crisis, the G-PPP approach may produce a spurious correlation among real exchange rates of ASEAN. Third, for estimation technique for G-PPP, we take two-step procedures; we first test bilateral co-integration of real exchange rates comprehensively among all the sample countries, and then conduct multilateral co-integration test for the groups which include the countries with bilateral co-integration identified. The purpose is to settle the grouping of currency zone, depending not only on a priori institutional groupings like ASEAN and SAARC, but also on observed bilateral co-integration relationship.

3. Empirical Studies

We now proceed to the empirical analysis. We here take two-step estimation procedures in the framework of G-PPP approach: bilateral co-integration verification and multilateral co-integration one about real exchange rates of Asian countries. This section first clarifies the methodology and data, then shows the estimation results and interprets the results.

3.1 Methodology and Data

We here clarify the G-PPP model for estimation first, and then explain the data for estimation and the methodology in terms of two-step estimation procedures.

G-PPP Model

We here follow the theory of G-PPP developed by Enders and Hurn (1994). The idea is as follows. The real exchange rates are generally non-stationary because the fundamental macroeconomic variables, such as real output levels, which determine real rates are non-stationary. The real exchange rates will, however, exhibit common stochastic trends if the fundamental variables are sufficiently interrelated. Within an optimum currency area, the real fundamentals themselves will share common trends; thus, within a currency area there exists (at least one) linear combination of various bilateral real rates which is stationary; thereby the real rates will be co-integrated. Moreover, the coefficients in the co-integrating vector of bilateral real exchange rates are not arbitrary; instead, they are functions of the parameters in a goods market-clearing relationship.

Specifically, the G-PPP may be presented in the following form. Suppose that m countries in an n-country world constitute an optimum currency area; for these m countries, there exists a long-run equilibrium (co-integration) relationship between their $m - 1$ bilateral real rates such that

$$r_{12t} = \alpha_{13}\, r_{13t} + \alpha_{14}\, r_{14t} + \cdots + \alpha_{1m}\, r_{1mt} + \varepsilon_t\,, \qquad (1)$$

where the r_{1it} are the logarithmic bilateral real exchange rates in period t between country 1 and country i, the α_{1i} are the parameters of the co-integrating vector, and ε_t is a stationary stochastic disturbance term.[2] In that relationship, the choice of the base

[2] For the estimation later on, we will insert a constant term in equation, following Enders and Hurn (1994).

country (the U.S. in our empirical estimation) is unimportant, because using a different base country simply necessitates re-normalizing the parameters of the co-integrating vector. From Equation (1), when G-PPP holds, the real exchange rates between countries 1 and 2 can be expressed as a weighted average of the other real rates in the currency area. These weights not only reflect trade linkages, but also broader linkages such as technology transfers, immigration and financial resource movements. For the special case in which all α_{1i} are zero, Equation (1) becomes the familiar PPP relationship between domestic prices, foreign prices, and the exchange rate.

Data for Estimation

The real exchange rate series are calculated using the U.S. as the base country; for each country, we define the real bilateral exchange rate with the U.S. in the logarithm term to be the logarithm of the domestic consumer price index (CPI) plus the logarithm of the domestic currency price expressed by the U.S. dollars minus the logarithm of the U.S. CPI. All are normalized so that the real rates in 2005 are equal to be log (100.0) ≅ 4.605. We obtain all the data of CPI and nominal exchange rates from the International Financial Statistics of the International Monetary Fund (IMF).[3]

The sample countries are 17 in Asia: Japan, China, Korea, and member countries of ASEAN (Indonesia, Thailand, Malaysia, Singapore, the Philippines, Vietnam, Myanmar, Cambodia, and Lao PDR) and SAARC (India, Pakistan, Bangladesh, Sri Lanka and Nepal). Due to the lack of the availability of data of CPI for the period necessary for estimation, Brunei Darussalam is excluded from samples as ASEAN members, and Afghanistan, Bhutan and Maldives are excluded from samples as SAARC members.

The sample period is the one after the 1997-98 Asian currency crises, specifically, the period from April 1999 to August 2009. According to the chronologies of the exchange rate arrangements presented by Reinhart and Ilzetzki (2009), the turbulent periods of the Asian crises are shown in terms of the classification of the "Freely falling". Among the crisis-experienced countries, Indonesia terminated the period of the "Freely falling" latest on March 1999. We thus assume that the post-crisis period should start on April 1999 and continue until the present time (August 2009), where data is available.

[3] As a measure of the real exchange rate, the use of the wholesale price index (WPI) is generally favored, because, conceptually, the WPI is heavily weighted with tradable goods compared to the CPI, which measures price changes in both tradable and non-tradable items. We here use CPI due to the lack of data availability and, thus should notice that the usage of the CPI might provide some bias for the examination of co-integrating relationship of real exchange rates.

Estimation Procedures

We take the following two-step procedures for examining the existence of co-integration relationship among the real exchange rates in Asian countries in the framework of G-PPP approach: bilateral co-integration verification and multilateral co-integration one. When we examine an optimum currency area, we value not only a priori institutional groupings like ASEAN and SAARC, but also observations of de fact bilateral relationship within the whole Asian countries. That is why we first test bilateral co-integration about all of the combinations of real exchange rates among all of the sample countries regardless of institutional zones. Based on the observations in the first step, we then conduct multilateral co-integration test for the institutional groups which include at least one pair of the countries with bilateral co-integration identified in the observations.

The first step, following the idea of Engle and Granger (1987), applies two-stage estimation methods for testing the existence of the bilateral co-integration relationship. The first stage is to prove that real exchange rates are integrated of the same order of $I(1)$ process, i.e. a single unit root, since co-integration is a test for equilibrium between non-stationary time series. The ADF test confirmed that all the real exchange rates are non-stationary in levels but are stationary after first difference (the details of the test results are not reported here to conserve space). The second stage is test whether the real exchange rates are co-integrated. This can proceed by first regressing one real rate on another real rate using OLS, and then examining whether the estimated residuals are stationary process using the ADF test statistics. If the residual terms are stationary, bilateral co-integration relationship between real exchange rates is said to exist.

The second step, namely multilateral co-integration test for groups of countries, adopts the multivariate co-integration technique developed by Johansen and Juselius (1990). This method applies the maximum likelihood procedure to determine the presence of the number of co-integrating vectors in a Vector Autoregressive (VAR) system. This procedure is suitable for the second step of multilateral tests, because it is said to provide more robust results than other co-integration methods, especially when more than two variables are involved. The optimal order of lags required in the co-integration test is selected by the Akaike Information Criterion. We specify the test assumption in such a way that the level data of real exchange rates have no deterministic trends and the co-integrating equations have unrestricted intercepts without trends, following the model specification presented by Enders and Hurn (1994). This Johansen method provides two different tests, the trace and the maximum eigenvalue tests, to determine the number of co-integrating vectors. If a nonzero vector

is indicated by these tests, the existence of multilateral co-integration i.e. stationary long-run relationship among real exchange rates is implied.

Once at least one co-integrating vector is identified, Engle and Granger (1987) suggested as the representation theorem that the relationship of economic series can be turned into an (vector) error-correction model (VECM) which combines both the short-run dynamics and the long-run equilibrium relations among the series. Specifically, the following equation can be estimated.

$$\begin{aligned} \Delta r_{12t} &= \alpha_{13}\,\Delta r_{13t} + \cdots + \beta_{12}(r_{12t-1} - \lambda_{13} r_{13t-1} - \cdots) + \varepsilon_t\,, \\ \Delta r_{13t} &= \alpha_{12}\,\Delta r_{12t} + \cdots + \beta_{13}(r_{12t-1} - \lambda_{13} r_{13t-1} - \cdots) + \varepsilon_t\,, \qquad (2) \\ &\cdots \end{aligned}$$

In this equation, "$r_{12t-1} - \lambda r_{13t-1} - \cdots$" indicates the normalized co-integrating relationship. The co-integrating vector of the various λ reflects the long-run interrelationships among real exchange rates. It can also be interpreted as long-run elasticity of the change in normalized real exchange rate relative to one percent change of the concerned real rate. According to Enders and Hurn (1994), the more similar are a country's demand parameters, the smaller are the parameters of the co-integrating vector, since the magnitudes of the coefficients in the co-integrating vector depend on the aggregate demand parameters. The β can be interpreted as the "speed of adjustment" toward long-run equilibrium. In other words, the coefficients show how quickly any deviation of real exchange rate from G-PPP tends to correct itself. The β is usually expected to have opposite sign against that of co-integrating vector of independent real exchange rate.

3.2 Estimation Results

We first see the results of the first step's examination – the tests for verifying the existence of bilateral co-integration relationship on all of the combinations of real exchange rates among all of the sample countries during the post-crisis period. Table 1 report the results of the ADF test on residuals estimated by bilateral regression of real exchange rates. We find the stationarity of estimated residual, i.e. bilateral co-integration relationship in several specific areas collectively. Within ASEAN block, the combination of the Philippines and Malaysia at the one percent significant level, and some other combinations at more than the five percent levels, indicate bilateral co-integration. As for south Asian area, the pair of India and Pakistan and that of Pakistan and Nepal is co-integrating respectively. It is an interesting observation that some interactions between ASEAN and south Asian members are confirmed in terms of

the co-integration between Thailand and Nepal, the one between Indonesia and Pakistan, and some others. It is also noteworthy that Japan, China and Korea have no co-integration within themselves as well as with other areas except for the combination between China and Cambodia.

We next look at the results of the second step's investigations – the Johansen multivariate co-integration test for identifying the existence of the multilateral co-integrating vectors among the concerned real exchange rates in those institutional areas where more than one bilateral co-integration were verified in the previous co-integration test. Table 2 reports the hypothesized numbers of co-integrating vectors and the outcomes of the trace and the maximum eigenvalue test in each Asian block. For the estimation, we divide ASEAN into advanced ASEAN (Indonesia, Thailand, Malaysia, Singapore and the Philippines) and developing ASEAN (Vietnam, Myanmar, Cambodia, and Lao PDR). We find the rejection of the null hypothesis that co-integrating vector is zero at the 5 percent significant level in all of the specified Asian area: ASEAN, advanced ASEAN, developing ASEAN, south Asia, south Asia plus advanced ASEAN, and south Asia plus developing ASEAN (in case of advanced ASEAN, only the trace test support the rejection). It tells us that those areas might possess more than one multilateral co-integrating vector, thereby enabling us to conduct the VECM estimations.

For the VECM estimations, we here focus on those areas where only one co-integrating vector was identified among the related real exchange rates: advanced ASEAN, developing ASEAN and south Asia. In Table 3, the first column of each area denotes the normalized co-integrating vector, and the second column represents the speed of adjustment toward long-run equilibrium. Looking at the magnitude of co-integrating vectors, all of those of south Asia are less than unity, relatively smaller than those of the other areas. It may mean that countries within south Asia have more similar demand parameters than in the other areas. The highest speed of adjustment is recorded in each area as follows: Thailand in advanced ASEAN, Vietnam in developing ASEAN, and Sri Lanka in south Asia.

3.4 Summary and Interpretation

We summarize and interpret the estimation results above in the following way.

First, Japan, China and Korea are shown to be little candidate for any optimum currency areas. The bilateral co-integration test results tell us that Japan, China and Korea have no co-integration within themselves as well as with other areas except for the combination between China and Cambodia. The result seems to be rather reasonable

since the three countries are standing at different development stages with different economic structure, and are also different in developing stage from ASEAN and south Asia. Second, ASEAN and south Asia might as well get started with the preparation towards local currency union respectively. The bilateral and multilateral co-integration tests represent that ASEAN, advanced ASEAN, developing ASEAN and south Asia pass the G-PPP condition. The results appear to be consistent with the previous works such as Ogawa and Kawasaki (2003) and Choudhry (2005). Third, it is quite interesting to note that some interactions are found between ASEAN and south Asian members. The bilateral co-integration tests confirmed the existence of co-integration between Thailand and Nepal, the one between Indonesia and Pakistan, and some others. The multilateral test also identified the existence of co-integrating vectors in the area of south Asia plus advanced ASEAN and south Asia plus developing ASEAN. Considering that the trade relationships between south Asia and ASEAN are not so large, we should investigate the backgrounds behind these interactions in further details.

Finally, the policy implication in our findings above is that the immediate and comprehensive formation of currency union in Asia appears to be premature in the sense of lack of similarity in fundamental variables among member countries. The implication supports the significance of a smaller local subgroup multi-speed strategy toward a long-run goal of currency union in Asia. This suggestion is in line with the usual policy recommendation of the extent literature (e.g., Ling and Yuen 2001 and Kawai 2009).

4. Concluding Remarks

This paper examined the economic feasibility of forming a regional currency block in Asia, by adopting a generalized purchasing power parity (G-PPP) approach to identify the existence of common trends in real exchange rates among a group of countries. To be specific, we conducted both bilateral and multilateral co-integration estimation on real exchange rates with the samples of 17 Asian countries covering south Asia during the post- 1997-98 crisis period.

Our findings are as follows; First, Japan, China and Korea are shown to be little candidate for any optimum currency areas. Second, ASEAN and south Asia, as a group, passed the G-PPP condition. Third, some co-integrating interactions were interestingly found between ASEAN and south Asian members. Our strategic implication emphasizes on the significance of a smaller local subgroup multi-speed strategy toward a long-run goal of currency union in Asia.

Table 1 Results of ADF test for residuals created by bilateral estimation of real exchange rates

	Japan	Korea	China	Singapore	Malaysia	Thailand	Philippines	Indonesia	Cambodia	Lao PDR	Myanmar	Vietnam	India	Pakistan	Nepal	Sri Lanka
Korea	-2.36															
China	-1.94	-1.36														
Singapore	-1.86	-1.25	-2.69*													
Malaysia	-1.99	-1.63	-1.18	-2.10												
Thailand	-1.99	-1.24	-1.08	-2.05	-2.53											
Philippines	-1.95	-1.32	-1.38	-3.04**	-3.51***	-2.72*										
Indonesia	-1.74	-1.54	-0.55	-1.40	-1.88	-2.34	-1.97									
Cambodia	-1.98	-1.24	-3.65***	-3.18**	-3.02**	-2.17	-2.76*	-2.01								
Lao PDR	-1.83	-0.33	-1.31	-2.17	-1.78	-2.35	-2.20	-2.49	-3.06**							
Myanmar	-2.34	-0.52	-0.25	-1.56	-1.87	-2.31	-2.20	-2.63*	-1.39	-0.79						
Vietnam	-1.98	-1.19	-1.91	-2.64*	-1.92	-1.64	-1.78	-2.24	-2.67*	-2.02	-0.81					
India	-2.23	-1.44	-0.02	-1.93	-2.05	-2.66*	-2.50	-2.84*	-1.38	-3.15**	-1.21	-0.49				
Pakistan	-2.03	-1.47	-0.23	-1.76	-2.08	-3.12**	-1.63	-4.13***	-1.17	-2.02	-3.48**	-0.63	-3.83***			
Nepal	-2.18	-1.48	-0.59	-2.27	-2.50	-4.10***	-3.00**	-2.64*	-1.61	-2.30	-1.29	-1.60	-2.32	-3.89***		
Sri Lanka	-2.11	-0.74	-1.45	-2.14	-1.87	-1.85	-2.29	-2.13	-2.25	-3.06**	-2.39	-2.66*	-1.24	-2.08	-1.93	
Bangladesh	-2.22	-1.70	-1.01	-2.60*	-1.92	-1.59	-1.58	-1.57	-1.49	-0.90	-0.07	-0.56	-1.11	-1.60	-1.01	-2.71*

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Table 2 Johansen Multivariate Co-integration Test

ASEAN		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	290.74 *	68.45 *
At most 1	222.29 *	55.63 *
At most 2	166.65 *	47.98 *
At most 3	118.67 *	40.45
At most 4	78.21 *	29.16
At most 5	49.05	22.46
At most 6	26.58	12.58
At most 7	13.99	10.28
At most 8	3.71	3.71
-Advanced ASEAN		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	77.03 *	33.24
At most 1	43.79	19.22
At most 2	24.57	15.71
At most 3	8.85	4.95
At most 4	3.89	3.89
-Developing ASEAN		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	64.57 *	33.91 *
At most 1	30.65	16.19
At most 2	14.46	9.59
At most 3	4.86	4.86
South Asia		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	87.35 *	38.56 *
At most 1	48.78	22.25
At most 2	26.53	13.23
At most 3	13.30	9.46
At most 4	3.83	3.83
-South Asia + Advanced ASEAN		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	306.68 *	85.12 *
At most 1	221.56 *	56.67
At most 2	164.89	44.39
At most 3	120.50	32.07
At most 4	88.42	25.95
At most 5	65.46	20.45
At most 6	42.00	15.03
At most 7	26.97	12.98
At most 8	13.98	8.51
At most 9	5.46	5.46
-South Asia + developing ASEAN		
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statictic
None	288.56 *	66.74 *
At most 1	221.81 *	57.52 *
At most 2	164.28 *	51.80 *
At most 3	112.47 *	36.12
At most 4	76.35	30.45
At most 5	45.89	19.14
At most 6	26.74	13.19
At most 7	13.55	7.74
At most 8	5.81	5.81

Notes: * denotes rejection of the hypothesis at the 0.05 level.

Table 3 Outcomes of Vector Error-Correction Estimations

	Advanced ASEAN		Developing ASEAN		South Asia	
	Equation for EC	Adj. speed	Equation for EC	Adj. speed	Equation for EC	Adj. speed
Philippines	1.00	-0.04 **				
Malaysia	-0.76	-0.01				
Singapore	2.11 ***	-0.03 *				
Thailand	-2.98 ***	0.04 **				
Indonesia	0.76 ***	-0.07				
Cambodia			1.00	-0.02		
Lao PDR			0.02	0.05		
Myanmar			0.08 ***	0.03		
Vietnam			-1.09 ***	0.11 ***		
India					1.00	0.05
Pakistan					-0.01	0.12 **
Bangladesh					-0.20 **	0.10 **
Nepal					-0.62 ***	0.19 ***
Sri Lanka					-0.06	0.20 ***

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

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