ECONSTOR Make Your Publications Visible.

A Service of

ZBW

Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Kawasaki, Kentaro; Wang, Zhi-Qian

Article

Is economic development promoting monetary integration in East Asia?

International Journal of Financial Studies

Provided in Cooperation with: MDPI – Multidisciplinary Digital Publishing Institute, Basel

Suggested Citation: Kawasaki, Kentaro; Wang, Zhi-Qian (2015) : Is economic development promoting monetary integration in East Asia?, International Journal of Financial Studies, ISSN 2227-7072, MDPI, Basel, Vol. 3, Iss. 4, pp. 451-481, https://doi.org/10.3390/ijfs3040451

This Version is available at: https://hdl.handle.net/10419/167794

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.



http://creativecommons.org/licenses/by/4.0/

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



WWW.ECONSTOR.EU

OPEN ACCESS International Journal of *Financial Studies* ISSN 2227-7072 www.mdpi.com/journal/ijfs

Article

Is Economic Development Promoting Monetary Integration in East Asia?

Kentaro Kawasaki ^{1,*,†} and Zhi-Qian Wang ^{2,†}

- ¹ Faculty of Business Administration, Toyo University, 5-28-20, Hakusan, Bunkyo-ku, Tokyo 112-8606, Japan
- ² Faculty of Commerce and Management, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8601, Japan; E-Mail: zhiqian_wang@126.com
- [†] These authors contributed equally to this work.
- * Author to whom correspondence should be addressed; E-Mail: kawasaki-k@toyonet.toyo.ac.jp; Tel.: +81-3-3945-4938; Fax: +81-3-3945-7477.

Academic Editors: Katsuhiko Takagaki and Nicholas Apergis

Received: 7 July 2015 / Accepted: 25 September 2015 / Published: 9 October 2015

Abstract: This paper tries to investigate whether there exist international integrated markets among East Asian economies, by employing the Generalized Purchasing Power Parity (G-PPP) model, then, it would help to suggest whether the East Asian region is the Optimum Currency Area (OCA) or not. The empirical results in this paper suggest that holding the G-PPP among nine Asian countries (China, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand and Vietnam) becomes more applicable in 2000–2013 than of that in 1984–1997. In the period of "globalization," which is characterized by expansion of world trade, increase of international capital flows, and development of information and communications technologies, Asian economic development has been promoting not only economic integrations but also constructing the stable linkages of real exchange rates. Therefore, it would help to adopt regional coordination for monetary policies to assure the feasibility of a possible monetary union.

Keywords: OCA; exchange rate; M-TAR; co-integration with thresholds adjustment

JEL Classification: F31; F33; F36

1. Introduction

It is well known that each of the East Asian countries considered here experienced rapid economic growth across two separate periods of development. The first period of rapid growth was called "The East Asian miracle." There were eight high-performing Asian economies (HPAEs): three ASEAN countries, four newly-industrializing countries (NIEs), and Japan, whose economy grew faster than almost all other economies from the mid-1960's until the early 1990's. Most of their economic achievements, in particular a rapid increase in GDP per capita, were based on maintaining macroeconomic stability with sound financial markets, providing government-backed supports for key industries, and maintaining sound fiscal and public policies. Although each country promoted to develop "internationalized" industries by expanding exports of manufacturing, the "localized" monetary environment played important roles in supporting the rapid growth of local infant industries.

The second period of growth has been experienced in the twenty-first century. It can be described as a century of "globalization," which is characterized by the expansion of world trade, the increase of international capital flows, and the development of information-communication technologies. These new growth factors led to spillover effects on developing countries in East Asia. Hence, this recent economic growth promoted an economic integration across the East Asian countries. Therefore, the question arises as to whether economic growth also promotes the monetary integration by moving away from monetary "localization" to monetary "regionalization".

This paper investigates this issue by employing the Generalized Purchasing Power Parity (G-PPP) model, which considers that countries that satisfy the criterion for an Optimum Currency Area (OCA) should share a common stochastic trend in their real exchange rates, which can be defined as the function of the national income process. Our empirical results suggest the existence of integrated markets among the region's economies. It allows us to consider whether the region represents an OCA. By adopting the non-linear co-integration method into Enders and Hurn's (1994) [1] original and well-known G-PPP model, our empirical analysis suggests that a consideration of G-PPP among nine Asian countries is more relevant in 2000–2013 than in the previous period of 1984–1997. This means that Asian economic development has been promoting not only economic integration but also monetary integration, where the stability of real exchange rates among regional currencies also enhances the efficiency of market transactions. Therefore, further economic integration potentially contributes to the coordination of regional monetary/financial policies, thus assuring the feasibility of a monetary union.

The rest of this paper is organized as follows. Section 2 provides the brief reviews of earlier studies on the necessity of monetary cooperation and on the OCA in East Asia. Section 3 gives the details of the G-PPP model. Section 4 provides explanations of the empirical strategy and its results. Section 5 is saved for the concluding remarks.

2. Monetary Cooperation in East Asia

The economic growth in East Asian area stood out as far back as 50 years ago. Since the 1960s, East Asia had been in a period of high growth; this led to Korea, Taiwan, Hong Kong, and Singapore being billed "The Four Tigers". In the 1980s, the Southeast Asian area—including Malaysia,

Indonesia, and Thailand—achieved a high growth rate. The excellent performance of the East Asian economy was considered "The East Asian Miracle" by the World Bank. The myth of economic growth there, however, was broken by the unexpected incident that has since come to be known as the Asian currency crisis.

In the aftermath of the 1997 Asian currency crises, some policymakers and academics proposed surveillance over the intra-regional exchange rates of East Asian currencies, to prevent future crises. In accordance with these proposals, the Chiang Mai Initiative (CMI) was established as a safety net for a liquidity crisis by the members of the Association of Southeast Asian Nations (ASEAN), Japan, China, and Korea (ASEAN+3) in 2000. Concurrently, the finance deputy ministers of the ASEAN+3 countries executed the Economic Review and Policy Dialogue (ERPD) to oversee the macroeconomic performance of each member country.

The objective of entering into a currency swap arrangement is to manage crises; therefore, the CMI exerts its effect only in cases of an actual currency crisis. On the other hand, the ERPD is simply a surveillance system that focuses on the performance of each country's macroeconomic variables (e.g., GDP and inflation rate), as well as the soundness of its financial sector. Therefore, it is necessary to incorporate intra-regional exchange rates into the surveillance process in order to enhance foreign exchange surveillance of the ASEAN+3 countries, which may result in lowering the probability of a future crisis. The monetary authorities are expected to establish a surveillance system to monitor fluctuations and misalignments of each ASEAN+3 currency. The exchange rates to monitor include intra-regional exchange rates, as well as the one $vis-\dot{a}-vis$ the US dollar.

In line with the need to establish a system for monitoring fluctuations in intra-regional exchange rates, Williamson (2000) [2], Ogawa and Ito (2002) [3], Kuroda and Kawai (2003) [4], and Ogawa (2004) [5] have suggested the introduction in the East Asian area of a common basket system. Given that a common currency basket system could inhibit foreign exchange volatility and contribute to stabilizing trade balance within the East Asian area, the monetary authority of East Asian countries are expected to adopt a common currency basket system. Furthermore, some positive results have been achieved in terms of CMI multi-lateralization (CMIM) and the ASEAN+3 Macroeconomic Research Office (AMRO), after the commencement of regional monetary cooperation in East Asia.

Within the context mentioned above, Kawasaki (2012) [6] employed the G-PPP model to conclude that a common currency basket would be a desirable step toward creating a common currency area in East Asia. With respect to the economic integration in East Asia, this paper investigates whether East Asian countries have been more or less integrated in the first decade of the twenty-first century than the period before Asian currency crisis. Furthermore, recognizing the importance of intra-regional foreign exchange stabilization, this paper also extends Kawasaki (2012) [6] to identify which ASEAN member countries are suitable to form a common currency area with Japan, China, and Korea.

3. The Generalized Purchasing Power Parity Model

The G-PPP model was developed by Enders and Hurn's (1994) [1], which extends from a simple Purchasing Power Parity (PPP) model. Enders and Hurn's (1994) [1] argue that changes in a bilateral exchange rate depend not only on changes in the relative prices between the related two countries but also on those in relative prices among other countries, such as trade partners. As Mundell (1961) [7]

pointed out, countries that have close economic relationships with each other can share factor mobility in their national income processes. The real exchange rates can be defined as a function of countries' income process; hence, the real exchange rates among countries which share factor mobility will be also highly correlated. Therefore, Enders and Hurn's (1994) [1] considered that countries that share factor mobility should exhibit a common stochastic trend in their real exchange rates, which can satisfy the criterion for the OCA. Kawasaki (2012) [6] shows the theoretical background of G-PPP model by extending the two-country and two-commodity model proposed in Obsteld and Rogoff (1996) [8]. As domestic labor mobility equalizes the productivity growth in tradables with that of non-tradables, international factor mobility between two countries would equalize the productivity growth in both two countries. Therefore, the nominal exchange rate between two countries would be equal to the relative PPP. The real exchange rates are constants over time; hence, the nominal exchange rate can be fixed between two countries. In consequence, the condition for the PPP to hold between the two countries is regarded as a sufficient condition for the OCA¹.

Here, following the theoretical background of the G-PPP model proposed by Kawasaki (2012) [6], we assume that *m* countries (1, 2, ..., j, ..., m) are expected to compose a common currency area. Country *j* has a trade relationship with *n* countries, and a strong trade relationship with m - 1 countries that are expected to compose the common currency area. The real effective exchange rate of country *j* can be expressed as follows:

$$ree_{j} = \zeta_{j} \cdot \left(\beta_{j,1}re_{j,1} + \beta_{j,2}re_{j,2} + \dots + \beta_{j,m}re_{j,m}\right) + \left(1 - \zeta_{j}\right) \cdot \left(\beta_{j,m+1}re_{j,m+1} + \beta_{j,m+2}re_{j,m+2} + \dots + \beta_{j,n}re_{j,n}\right)$$
(1)

where $re_{j,i}$ is real exchange rate between country *i* and country *j* in logarithm. Then, ζ_j is the trade weight of the group countries that are expected to compose a common currency area, and $\beta_{j,i}$ is the trade weight of country *j* with country $(\sum_{i=1,i\neq j}^{m} \beta_{j,i} = 1, \sum_{i=m+1}^{n} \beta_{j,i} = 1)$.

For simplicity, we focus on the group of countries that is expected to adopt a common currency and the country m + 1 that is not expected to share a common currency with the other countries. Then the real effective exchange rate of country *j* can be rewritten as follows:

$$ree_{j} = \omega_{j,1}re_{j,1} + \omega_{j,2}re_{j,2} + \dots + \omega_{j,m}re_{j,m} + \omega_{j,m+1}re_{j,m+1}$$
(2)

where $\omega_{j,i}$ is the trade weight of country *j* with country $(\sum_{i=1,i\neq j}^{m+1} \omega_{j,i} = 1)$.

Since $\omega_{j,m+1} = 1 - \omega_{j,1} - \omega_{j,2} - \omega_{j,3} - \dots - \omega_{j,m}$, the real effective exchange rate of country *j* can be expressed as follows:

$$ree_{j} = \omega_{j,1} \left(re_{j,1} - re_{j,m+1} \right) + \omega_{j,2} \left(re_{j,2} - re_{j,m+1} \right) + \cdots + \omega_{j,m-1} \left(re_{j,m-1} - re_{j,m+1} \right) + \omega_{j,m} \left(re_{j,m} - re_{j,m+1} \right) + re_{j,m+1}$$
(3)

Given $re_{j,k} = re_{j,n} - re_{k,n}$,², then we can express the real effective exchange rate of country *j* as below:

Recently, there are several empirical studies to investigate the OCA issue to employ the G-PPP approach, such as Wilson and Choy (2007) [9], Sun and Sinons (2011) [10], and de Truchis and Keddad (2013) [11]. Especially, Keddad (2013) [12] has investigated this issue considering applying the Asian currency baskets.

² The real exchange rate between country *j* and country *k* can also be expressed as follows: $re_{j,k} = -re_{n,j} + re_{n,k}$.

$$ree_{j} = \omega_{j,l} re_{m+1,l,t} + \dots + \omega_{j,m} re_{m+1,m,t} - re_{m+1,j,t}$$
(4)

Therefore, the real effective exchange rate of other countries country one, country two, ..., and country m + 1 can be expressed as follows:

$$ree_{1,t} = -re_{m+1,1,t} + \omega_{1,2}re_{m+1,2,t} + \dots + \omega_{1,m}re_{m+1,m,t}S$$

$$ree_{2,t} = \omega_{2,1}re_{m+1,1,t} - re_{m+1,2,t} + \dots + \omega_{2,m}re_{m+1,m,t}$$

$$\vdots$$

$$ree_{m,t} = \omega_{m,1}re_{m+1,1,t} + \dots + \omega_{m,m-1}re_{m+1,m-1,t} - re_{m+1,m,t}$$

$$ree_{m+1,t} = \omega_{m+1,1}re_{m+1,1,t} + \dots + \omega_{m+1,m-1}re_{m+1,m-1,t} + \omega_{m+1,m}re_{m+1,m,t}$$

The real effective exchange rate of m + 1 countries can be expressed in a vector as follows:

$$\mathbf{ree}_t = \mathbf{\Omega} \cdot \mathbf{re}_t \tag{5}$$

where Ω is a matrix, which defines the trade weights, and **re** is the real exchange rate of country *j* vis-à-vis its trading partners (*m* countries).

$$\Omega_{(m+1)\times m} = \begin{bmatrix} -1 & \omega_{1,2} & \cdots & \omega_{1,m-1} & \omega_{1,m} \\ \omega_{2,1} & -1 & \cdots & \omega_{2,m-1} & \omega_{2,m} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ \omega_{m,1} & \omega_{m,2} & \cdots & \omega_{m,m-1} & -1 \\ \omega_{m+1,1} & \omega_{m+1,2} & \cdots & \omega_{m+1,m-1} & \omega_{m+1,m} \end{bmatrix}$$
 and
$$\mathbf{re} = \left(re_{m+1,1}, re_{m+1,2}, re_{m+1,3}, \cdots, re_{m+1,m-1}, re_{m+1,m} \right)'$$

As Enders and Hurn (1994) [1] discussed, within a common currency area the fundamental macroeconomic variables share common trends, and a G-PPP based on real macroeconomic variables suggests that certain groupings of real exchange rates share the same stochastic trends. Therefore, the real effective exchange rates within a currency area will share a common stochastic trend because the fundamental variables are sufficiently interrelated. Using the common trends representation developed in Stock and Watson (1988) [13], the real effective exchange rates can be expressed by the sum of a stationary component and a non-stationary component. That is:

$$\mathbf{ree}_t = \mathbf{ree}_t + \mathbf{ree}_t \tag{6}$$

where $r\bar{e}e$ represents a stationary component and $r\bar{e}e$ represents a non-stationary component.

Since the stationary component \mathbf{ree} , which represents the logarithm of the real effective exchange rate, can be expected to converge toward zero over the long run, the real effective exchange rate then can be described as the non-stationary component \mathbf{ree} only³. As described in Stock and Watson (1988) [13], in terms of the common trends representation, m + 1 non-stationary variables can be described as m + 1 stochastic trends. We can rewrite the real effective exchange rates as follows:

$$\mathbf{ree} = \mathbf{r\tilde{e}e} = \mathbf{\Phi} \cdot \mathbf{w} \tag{7}$$

³ The stationary component \mathbf{ree} can be given by $E(\mathbf{ree}) = \mathbf{0}$ over the long run.

where Φ is a $(m + 1) \times (m + 1)$ matrix, and **w** is a (m + 1) vector of which the vector is characterized by a random walk with non-stationary stochastic trends.

Based on Equations (5) and (7), we can obtain:

$$\Phi \cdot \mathbf{w}_t = \Omega \cdot \mathbf{r} \mathbf{e}_t \tag{8}$$

Here, we define a nonzero matrix Ψ which is given by $(m + 1) \times (m + 1)$ components, and then by substituting it into Equation (8), we can rewrite Equation (8) as follows:

$$\Psi \cdot \Phi \cdot \mathbf{w}_t = \Psi \cdot \Omega \cdot \mathbf{r} \mathbf{e}_t \tag{9}$$

If $\Psi \cdot \Phi \cdot w$ is expected to be equal to zero over the long run, then $\Psi \cdot \Phi$ should not be a full rank because w that was defined as a random walk with non-stationary stochastic trends is a nonzero vector. The rank condition of $\Psi \cdot \Phi$ will be expected as follows:

$$\operatorname{rank}(\Psi \cdot \Phi) = \operatorname{rank}(\Phi) < m$$

As long as the rank condition to be held, there exists a nonzero matrix Ψ with which we can obtain the following equation:

$$\Psi \cdot \Phi = 0 \tag{10}$$

Under the circumstance given by $\Psi \cdot \Phi \cdot \mathbf{w} = \mathbf{0}$, we can rewrite Equation (9) as follows:

$$\Psi \cdot \mathbf{\Omega} \cdot \mathbf{re} = \mathbf{Z} \cdot \mathbf{re} = 0 \tag{11}$$

where **Z** is defined as $\mathbf{Z} = \boldsymbol{\Psi} \cdot \boldsymbol{\Omega}$.

If we can find a matrix **Z** for which the rank condition satisfies $rank(\mathbf{Z}) < m$, then we can obtain $\mathbf{Z} \cdot \mathbf{re} = \mathbf{0}$ that there exists at least one linear combination of the real exchange rate co-integrating over the long run.

4. Empirical Analysis of a Common Currency Area

4.1. Empirical Methodology

As mentioned above, the G-PPP model assumes that there are common factors among the bilateral real exchange rates of these countries exhibiting strong economic relationships. Therefore, if we can detect an equilibrium relationship among the real exchange rates over the long run, these countries (with real exchange rates that share common trends), might be defined as representing a common currency area.

Ogawa and Kawasaki (2003) [14] employed the methodology of the Johansen test as elaborated by Johansen and Juselius (1990) [15] to identify whether there exist co-integration relationships among the real exchange rates of East Asian currencies over the long run. As is well known, the Johansen approach is designed to identify a co-integration relationship under the assumption of linear composition. In other words, the short-term instability converges to the long-term equilibrium level linearly. Therefore, when we identify whether combinations satisfy the condition of stationarity over the long run, some of them will be rejected due to the assumption of linear convergence. Here, we employ the momentum threshold autoregressive (M-TAR) model developed by Enders and Granger (1998) [16] to investigate the property of real exchange rates.

Int. J. Financial Stud. 2015, 3

It is well known that many macroeconomic variables display an asymmetric adjustment process. The TAR model suggested by Enders and Granger (1998) [16] allows for asymmetric adjustment processes and can capture the key aspects of any "sharp" or "deep" movements in a series. The TAR model with high order processes can be expressed as below:

$$\Delta X_{t} = I_{t} \rho_{1} \left(X_{t-1} - \tau \right) + \left(1 - I_{t} \right) \rho_{2} \left(X_{t-1} - \tau \right) + \sum_{i=1}^{p} \alpha_{i} \Delta X_{t-1} + \varepsilon_{t}$$

$$\rho_{1} < 0, \rho_{2} < 0, \ I_{t} = \begin{cases} 1 & if \quad X_{t-1} \ge \tau \\ 0 & if \quad X_{t-1} < \tau \end{cases}$$
(12)

where ρ_1 and ρ_2 indicate adjustment process respectively, $I_t\rho_1$ is regarded as the appreciation correcting coefficient, $(1 - I_t)\rho_2$ is regarded as the depreciation correcting coefficient, and the nonzero value τ is a threshold.

From Equation (12) we could detect whether there exists a long-term equilibrium relationship among the real exchange rate as far as the threshold value τ is given. It is also clear that autoregressive decay depends on the level value of X_{t-1} . As another alternative adjustment specification, Enders and Granger (1998) [16] indicated that it is useful to allow the autoregressive decay depending on the previous period's change in X_{t-1} instead of on the level value. Therefore, the M-TAR model can also be given as follows:

$$\Delta X_{t} = I_{t} \rho_{1} X_{t-1} + (1 - I_{t}) \rho_{2} X_{t-1} + \sum_{i=1}^{p} \alpha_{i} \Delta X_{t-1} + \varepsilon_{t}$$

$$\rho_{1} < 0, \rho_{2} < 0 \ I_{t} = \begin{cases} 1 & if \quad \Delta X_{t-1} \ge 0 \\ 0 & if \quad \Delta X_{t-1} < 0 \end{cases}$$
(13)

The M-TAR model suggests that there exists little autoregressive decay for positive ΔX_{t-1} , but a significant decay for negative ΔX_{t-1} as far as the prior condition $|\rho_1| < |\rho_2|$, and *vice versa*.

Based on the theoretical model of G-PPP, we can express the co-integration relationship of $\mathbf{Z} \cdot \mathbf{re} = \mathbf{0}$ with the m + 1 real exchange rates as follows:

$$re_{USD,EUR,t} = \beta_1 \cdot re_{USD,1,t} + \beta_2 \cdot re_{USD,2,t} + \dots + \beta_m \cdot re_{USD,m,t} + \nu_t$$
(14)

where $re_{USD,EUR,t}$ is the anchor exchange rate, $re_{USD,i,t}$ for which *i* is given by $i = 1, 2, 3, \dots, m$ is the individual I(1) components of real exchange rate, β_i for which *i* is given by $i = 1, 2, 3, \dots, m$ is estimated parameters, and v_i is the disturbance term which is considered serially correlated.

As the two-step methodology entails using the Ordinary least-squares (OLS) to estimate a long-term equilibrium relationship, we also focus on the disturbance term to conduct a co-integration test. However, the error correction model to identify the adjustment process is not symmetric, but asymmetric ⁴.

⁴ For more detail, see Enders and Siklos (2001) [17].

4.2. Data

The real exchange rate used in our empirical analysis is based on the nominal exchange rate and the consumer price index (CPI) from the *International Financial Statistics* of the IMF ⁵. The sample periods are from January 1984 to June 1997 and from January 2000 to June 2013. The possible candidates for a common currency area include six ASEAN countries (Singapore, Indonesia, Thailand, Malaysia, the Philippines, and Vietnam) and Japan, China, and Korea (ASEAN6+3). However, Vietnam is excluded from the first sample period (January 1984 to June 1997) and the inclusion of China begins in January 1987 due to data constraints. Since the United States and the euro area are important trading partners of ASEAN6+3, we employ the real exchange rate of the euro *vis-à-vis* the US dollar as an anchor exchange rate in our empirical analysis ⁶. The nominal exchange rates of the US dollar and the euro area also based on the *International Financial Statistics* of the IMF. The CPI of the euro area from January 1984 to June 1997 is calculated based the member of European Currency Unit (ECU), and that of the second sample period (January 2000 to June 2013) is from DataStream.

4.3. Analytical Results

For estimating the co-integration relationship over the long run, the estimation results of OLS coefficients for asymmetric co-integration and M-TAR unit root test were summarized in Tables $1-4^{7}$. Tables 1 and 3 which show the results of the OLS estimation only include the combinations which all independent variables indicate significant at 5% significance level. In Tables 2 and 4, which show the results of the M-TAR unit root test, the color filled columns suggests that two coefficients of adjustment process in the error correction model indicate significant at 2.5% significance level.

In the sample period from January 2000 to June 2013, there exist 502 possible candidates that contain nine, eight, seven, six, five, four, three, or two countries in the common currency area, and that selected from nine Asian currencies. Seventy-eight combinations were found that all coefficients for independent variables are statistically significant (Table 1). Out of the 78 combinations, 27 combinations were found that both coefficients for the M-TAR unit root test indicate statistically significant at 2.5% significance level (Table 2).

On the other hand, in the sample period from January 1984 to June 1997, of the 247 combinations of 8 currencies, 38 combinations were found that all OLS coefficient estimators indicate statistically significant (Table 3). For six of 38 combinations, adjustment coefficients the M-TAR unit root test are statistically significant (Table 4). The empirical results of this paper are summarized in Table 5.

⁵ The CPI data of China is based on the *International Financial Statistics* of IMF, as well as the AMU database in the Research Institute of Economy, Trade and Industry (RIETI).

⁶ In a strict sense, the anchor exchange rate in this empirical analysis should be a currency basket, which includes all the trading partners of ASEAN6+3. Here for simplicity, we use the exchange rate of euro to the US dollar instead of the currency basket. In our future research, we intend to calculate the currency basket along with data accumulation.

⁷ With respect to the property of real exchange rate of each currency, the M-TAR unit root test revealed that the PPP does not hold over the long run in both sample periods. The estimation results of OLS coefficients and M-TAR unit root test are not reported completely because of space limitations but are available upon request. Lag orders are based on the Akaike information criteria (AIC) and the Schwartz Bayes information criteria (SBIC).

N	Continution	Upper: D.F.									Explana	ntories								
No.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
07021	CNY KRW SGD IDR	155	-0.994	****	0.275	****	1.224	****	_		-1.231	****	0.644	****	_		0.708	***	0.404	****
9/031	THB VND PHP	0.470	(0.198)		(0.069)		(0.213)				(0.116)		(0.162)				(0.282)		(0.074)	
07000	JPY CNY KRW SGD	155	-0.873	****	—		1.821	****			-1.523	****	0.603	****	-0.092		0.729	**	0.411	****
97009	THB VND PHP	0.500	(0.248)		—		(0.170)				(0.088)		(0.168)		(0.060)		(0.343)		(0.096)	
0.000	CNY KRW SGD	156	-1.089	****	—		1.783	****			-1.578	****	0.598	****	_		1.028	****	0.509	****
96065	THB VND PHP	0.536	(0.206)		_		(0.169)				(0.081)		(0.169)		_		(0.284)		(0.072)	
0(0(1	CNY KRW SGD	156	-1.090	****	0.642	****	—		-0.668	****	-0.447	****	_		_		1.876	****	0.621	****
96061	IDR MYR PHP	0.443	(0.218)		(0.062)		_		(0.252)		(0.061)				_		(0.223)		(0.084)	
06050	CNY KRW SGD	156	-1.371	****	0.256	****	1.503	****	_		-1.224	****	_		_		1.572	****	0.437	****
96059	IDR THB PHP	0.504	(0.182)		(0.072)		(0.210)				(0.121)				_		(0.189)		(0.077)	
06050	CNY KRW SGD	156	-1.308	****	0.817	****	-0.675	****	_		_		0.618	****	_		0.906	***	0.544	****
96058	IDR THB VND	0.363	(0.256)		(0.060)		(0.151)				_		(0.212)		_		(0.369)		(0.095)	
06057	CNY KRW SGD	156	-1.427	****	0.843	****	-0.418	****	-0.734	***	_		_		_		1.933	****	0.607	****
96057	IDR THB MYR	0.445	(0.244)		(0.063)		(0.118)		(0.282)		—				_		(0.249)		(0.096)	
0(05(JPY IDR THB	156	_		0.307	****	1.616	****	-0.639	****	-1.210	****	0.444	****	-0.263	****			_	
96056	MYR VND PHP	0.398			(0.076)		(0.208)		(0.155)		(0.125)		(0.092)		(0.048)					
0.0050	JPY KRW THB	156			_		1.866	****	-0.330	**	-1.520	****	0.662	****	-0.235	****			0.246	****
96050	MYR VND PHP	0.401	_		_		(0.186)		(0.153)		(0.091)		(0.116)		(0.054)				(0.079)	
0(014	JPY KRW SGD	156	-0.408	****	_		1.847	****	_		-1.541	****	0.837	****	-0.165	****	_		0.282	****
96044	THB VND PHP	0.448	(0.119)		_		(0.171)		_		(0.089)		(0.128)		(0.050)		_		(0.075)	

Table 1. OLS Estimation for Asymmetric Integration (January 2000–June 2013).

No	Combination	Upper: D.F.									Explana	tories								
110.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
0(027	JPY KRW SGD	156	-0.693	****	0.790	****	-0.547	****			_		0.816	****	-0.158	***			0.337	****
96037	IDR THB VND	0.297	(0.152)		(0.067)		(0.184)				_		(0.160)		(0.066)				(0.094)	
0.6020	JPY CNY IDR	156	_		0.316	****	1.802	****	-0.953	****	-1.166	****			-0.311	****	0.481	****	_	
96032	THB MYR PHP	0.399			(0.078)		(0.208)		(0.215)		(0.128)				(0.048)		(0.130)		_	
0.0000	JPY CNY SGD	156	0.699	**	_		_		1.838	****	-1.039	****	2.527	****	-0.293	****	-2.884	****	_	
96030	MYR VND PHP	0.290	(0.340)						(0.414)		(0.123)		(0.250)		(0.088)		(0.396)		_	
0(000	JPY CNY SGD	156	-0.761	****	0.280	****	1.905	****			-1.256	****			-0.193	****	0.636	****	_	
96023	IDR THB PHP	0.402	(0.200)		(0.078)		(0.213)				(0.128)				(0.052)		(0.176)		_	
0(010	JPY CNY KRW	156	_		0.776	****	-0.599	****			_		0.910	****	-0.254	****	-0.693	****	0.219	**
96012	IDR THB VND	0.252			(0.070)		(0.189)						(0.200)		(0.066)		(0.218)		(0.105)	
0.000	JPY CNY KRW	156	-0.789	***	0.763	****			-1.083	****					-0.260	****	1.269	****	0.354	****
96002	SGD IDR MYR	0.369	(0.321)		(0.064)				(0.293)						(0.060)		(0.283)		(0.097)	
05105	SGD THB MYR	157	-0.928	****			2.383	****	0.653	****	-1.893	****	0.808	****					_	
95125	VND PHP	0.500	(0.183)				(0.137)		(0.220)		(0.071)		(0.107)		_				_	
05110	KRW IDR MYR	157			0.547	****			-0.388	***	-0.784	****	0.964	****	_				0.456	****
95119	VND PHP	0.295			(0.064)				(0.168)		(0.061)		(0.105)		_				(0.070)	
05116	KRW IDR THB	157	_		0.951	****	-1.030	****	-0.686	****	_		0.838	****	_				0.455	****
95116	MYR VND	0.302			(0.062)		(0.133)		(0.201)				(0.136)		_				(0.090)	
05115	KRW SGD MYR	157	-0.776	****					1.028	****	-1.020	****	1.627	****	_		_		0.839	****
95115	VND PHP	0.290	(0.208)						(0.244)		(0.060)		(0.111)		_				(0.059)	

 Table 1. Cont.

N	Combination	Upper: D.F.									Explana	ntories								
NO.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
05111	KRW SGD IDR	157	-0.538	****	0.549	****					-0.708	****	1.112	****					0.448	****
95111	VND PHP	0.346	(0.124)		(0.056)						(0.062)		(0.109)						(0.066)	
05107	KRW SGD IDR	157	-0.791	****	0.890	****	-0.848	****					1.017	****					0.434	****
95107	THB VND	0.329	(0.149)		(0.053)		(0.135)						(0.137)						(0.085)	
0.500.0	CNY KRW IDR	157			0.924	****	-1.154	****					1.138	****			-0.639	****	0.400	****
95082	THB VND	0.285			(0.061)		(0.127)						(0.200)				(0.227)		(0.098)	
05001	CNY KRW IDR	157			0.992	****	-0.732	****	-1.362	****							1.073	****	0.492	****
95081	THB MYR	0.314			(0.063)		(0.115)		(0.288)								(0.221)		(0.103)	
0.5077	CNY KRW SGD	157	-1.435	****	_		2.006	****	_		-1.548	****	_				1.814	****	0.533	****
95077	THB PHP	0.573	(0.188)				(0.162)				(0.084)						(0.183)		(0.075)	
0.507.4	CNY KRW SGD	157	-1.293	****	0.599	****					-0.447	****					1.697	****	0.595	****
95074	IDR PHP	0.381	(0.208)		(0.061)						(0.062)						(0.216)		(0.085)	
0.5070	CNY KRW SGD	157	-1.823	****	0.839	****			-0.669	***			_				1.884	****	0.505	****
95072	IDR MYR	0.424	(0.225)		(0.065)				(0.292)								(0.258)		(0.095)	
05071	CNY KRW SGD	157	-1.668	****	0.795	****	-0.398	****									1.734	****	0.575	****
950/1	IDR THB	0.384	(0.230)		(0.061)		(0.120)										(0.241)		(0.097)	
05070	JPY THB MYR	157	_		_		2.289	****	-0.435	****	-1.578	****	0.449	****	-0.322	****			_	
95070	VND PHP	0.448					0.131		(0.154)		(0.091)		(0.096)		(0.047)					
050(0	JPY IDR MYR	157			0.778	****			-0.690	****	-0.415	****	0.605	****	-0.200	****	_		_	
95069	VND PHP	0.312			(0.053)				0.182		(0.085)		(0.105)		(0.055)				_	

 Table 1. Cont.

Ne	Combination	Upper: D.F.									Explana	ntories								
190.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
050(7	JPY IDR THB	157	_		0.312	****	1.842	****	-0.382	***	-1.147	****	_		-0.311	****	_			
93007	MYR PHP	0.308			(0.081)		(0.216)		(0.155)		(0.133)				(0.050)		_			
05064	JPY SGD THB	157	-0.410	****	_		2.294	****			-1.609	****	0.566	****	-0.254	****			_	
95064	VND PHP	0.478	(0.124)				(0.128)				(0.091)		(0.110)		(0.046)					
05045	JPY KRW IDR	157	_		0.711	****	-0.666	****			_		0.470	****	-0.240	****			0.353	****
95047	THB VND	0.213	_		(0.069)		(0.193)				_		(0.149)		(0.068)				(0.099)	
0.502.4	JPY CNY THB	157	_		_		2.139	****			-1.595	****	0.762	****	-0.282	****	-0.497	****	_	
95034	VND PHP	0.434	_		_		(0.120)				(0.091)		(0.160)		(0.045)		(0.160)		_	
	JPY CNY THB	157	_		_		2.497	****	-0.733	****	-1.543	****			-0.373	****	0.474	****	_	
95033	MYR PHP	0.444	_		_		(0.124)		(0.218)		(0.093)				(0.047)		(0.137)			
	JPY CNY IDR	157			0.706	****					-0.561	****	1.157	****	-0.148	****	-0.878	****	_	
95031	VND PHP	0.311	_		(0.046)		_		_		(0.077)		(0.168)		(0.053)		(0.176)		_	
	JPY CNY IDR	157	_		0.870	****	_		-0.973	****	-0.210	****	_		-0.258	****	0.540	****	_	
95030	MYR PHP	0.303	_		(0.054)		_		(0.261)		(0.079)				(0.057)		(0.158)		_	
	JPY CNY SGD	157	-0.635	****	_		2.526	****	_		-1.583	****	_		-0.271	****	0.623	****	_	
95022	THB PHP	0.458	(0.205)		_		(0.130)				(0.094)				(0.049)		(0.182)		_	
	JPY CNY SGD	157	-0.554	***	0.842	****					-0.264	****			-0.159	***	0.533	***		
95019	IDR PHP	0.261	(0.244)		(0.056)						(0.079)				(0.064)		(0.215)			
	JPY CNY KRW	157			0.611	****					-0.479	****			-0.144	***	0.481	****	0.346	****
95009	IDR PHP	0 193	_		(0.067)						(0.087)				(0.060)		(0.147)		(0.093)	

 Table 1. Cont.

No	Combination	Upper: D.F.									Explana	atories								
NO.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
05001	JPY CNY KRW	157	-1.373	****	0.721	****							_		-0.187	****	1.182	****	0.360	****
95001	SGD IDR	0.311	(0.291)		(0.066)										(0.059)		(0.293)		(0.100)	
0.4105	IDR MYR VND	158			0.834	****			-0.580	****	-0.631	****	0.674	****			_			
94125	PHP	0.292			(0.053)				(0.186)		(0.064)		(0.107)							
0.4100	IDR THB MYR	158	_		1.158	****	-0.700	****	-0.884	****			0.498	****			_		_	
94122	VND	0.301			(0.050)		(0.125)		(0.212)				(0.127)						_	
04117	SGD IDR VND	158	-0.642	****	0.813	****					-0.557	****	0.832	****					_	
9411/	PHP	0.330	(0.140)		(0.045)						(0.066)		(0.114)							
04112	SGD IDR THB	158	-0.926	****	1.067	****	-0.517	****					0.710	****			_			
94113	VND	0.323	(0.157)		(0.043)		(0.127)						(0.133)							
04107	KRW IDR VND	158	_		0.468	****					-0.839	****	0.898	****			_		0.484	****
94107	PHP	0.258			(0.056)						(0.057)		(0.103)				_		(0.069)	
0.4102	KRW IDR THB	158	_		0.857	****	-1.188	****					0.719	****					0.515	****
94103	VND	0.252			(0.057)		(0.129)						(0.136)				_		(0.091)	
0.4007	CNY IDR VND	158	_		0.762	****					-0.712	****	1.251	****			-0.910	****	_	
94087	PHP	0.314			(0.042)						(0.057)		(0.168)				(0.179)			
0.400.6	CNY IDR MYR	158	_		0.961	****			-0.766	****	-0.461	****	_				0.536	****	_	
94086	PHP	0.266			(0.053)				(0.272)		(0.060)						(0.167)			
0.4000	CNY IDR THB	158			1.099	****	-0.918	****	_		_		1.109	****			-1.024	****	_	
94083	VND	0.292			(0.045)		(0.118)						(0.209)				(0.216)			

 Table 1. Cont.

No	Combination	Upper: D.F.									Explana	atories								
INO.	Combination	Lower: D.W.	SGD		IDR		ТНВ		MYR		РНР		VND		JPY		CNY		KRW	
0.4000	CNY IDR THB	158	—		1.185	****	-0.484	****	-1.047	****	—		_				0.421	***	_	
94082	MYR	0.285			(0.051)		(0.109)		(0.298)								(0.185)			
0.4070	CNY SGD THB	158	-1.056	****			2.873	****			-1.969	****	_				1.093	****	_	
94078	PHP	0.519	(0.206)				(0.123)				(0.068)						(0.175)			
0.4075	CNY SGD IDR	158	-0.809	****	0.926	****	_		_		-0.364	****					0.770	****	_	
94075	PHP	0.284	(0.225)		(0.045)		_				(0.069)						(0.196)		_	
04057	CNY KRW SGD	158	-2.027	****	0.795	****	_		_								1.704	****	0.480	****
94057	IDR	0.372	(0.209)		(0.063)		_										(0.249)		(0.096)	
0.40.5.5	JPY THB VND	158					2.148	****			-1.583	****	0.349	****	-0.284	****			_	
94055	PHP	0.378	—				(0.123)				(0.093)		(0.091)		(0.046)		_		_	
0.40.50	JPY IDR VND	158	_		0.680	****	_		_		-0.534	****	0.468	****	-0.165	****			_	
94052	PHP	0.225	—		(0.049)		_				(0.083)		(0.103)		(0.056)		_		_	
	JPY SGD IDR	158	-0.735	****	0.801	****	_		_		_		0.428	****	-0.296	****			_	
94039	VND	0.277	(0.156)		(0.056)		_						(0.120)		(0.050)		_		_	
0.4020	JPY KRW IDR	158	_		0.780	****	_		_		-0.265	****			-0.213	****			0.143	**
94030	PHP	0.202	—		(0.044)		_				(0.060)				(0.058)		_		(0.072)	
0.400	JPY KRW SGD	158	1.238	****							-0.449	****			-0.534	****			0.606	****
94026	PHP	0.085	(0.129)				_				(0.111)				(0.071)		_		(0.091)	
0.404.5	JPY CNY IDR	158	_		0.877	****	_		-1.206	****	_				-0.365	****	0.469	****	_	
94013	MYR	0.314			(0.055)		_		(0.250)						(0.042)		(0.158)		_	

 Table 1. Cont.

NI.		Upper: D.F.									Explana	ntories								
NO.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		VND		JPY		CNY		KRW	
0.4007	JPY CNY SGD	158	-0.759	****	0.846	****							_		-0.267	****	0.459	**		
94007	IDR	0.266	(0.244)		(0.058)								_		(0.057)		(0.221)			
02076		159			1.067	****	-0.854	****					0.280	***						
93076	IDR THB VND	0.221			(0.047)		(0.125)						(0.122)		—		—			
02075		159			1.173	****	-0.423	****	-0.542	****			_		_		_		_	
93075	IDR THB MYR	0.246			(0.052)		(0.107)		(0.202)				_		_		_			
020(7		159	-1.213	****	1.037	****							0.526	****	_		_		_	
93067	SGD IDR VND	0.280	(0.147)		(0.044)								(0.131)		_		_			
02065		159	-0.461	****	1.128	****	-0.285	**					_							
93065	SGD IDR THB	0.236	(0.142)		(0.045)		(0.130)						—							
020(2		159							2.262	****	-0.821	****							0.801	****
93063	KRW MYR PHP	0.130							(0.154)		(0.075)		—						(0.091)	
02050		159					-0.599	****	1.908	****									1.065	****
93059	KRW THB MYR	0.089					(0.185)		(0.289)				_						(0.119)	
02046		159					2.670	****			-2.049	****	_				0.342	****		
93046	CNY THB PHP	0.347			_		(0.126)				(0.072)		_				(0.103)			
02025		159	-1.509	****	1.039	****	_						_				0.929	****	_	
93035	CNY SGD IDR	0.317	(0.196)		(0.043)								—				(0.209)			
02025		159					2.439	****			-1.528	****	_		-0.350	****			_	
93025	JAA JHR HHA	0.346			_		(0.101)				(0.096)		_		(0.045)		_			

 Table 1. Cont.

N		Upper: D.F.								Explanat	ories						
No.	Combination	Lower: D.W.	SGD	IDR		ТНВ		MYR		РНР		VND		JPY		CNY	KRW
02022		159	_	0.814	****					-0.260	****			-0.231	****	_	_
93022	JPY IDR PHP	0.208		(0.04))					(0.060)				(0.058)			_
02020		159	_	0.884	****			-0.585	****	_				-0.343	****		_
93020	JPY IDR MYR	0.251		(0.050)			(0.140)						(0.042)			_
0000		160	_							-1.212	****	1.918	****	_			_
92036	VND PHP	0.160	_					_		(0.086)		(0.096)					_
00000		160	_	_		2.984	****	_		-2.098	****			_		_	_
92033	THR PHP	0.351	_			(0.085)		—		(0.072)							_
02020		160	_	0.93	****			_		-0.444	****			_		_	_
92030	IDR PHP	0.206		(0.028)			—		(0.041)							_
		160	_	1.152	****			-1.101	****	_				_			_
92028	IDR MYR	0.233	_	(0.054)	—		(0.149)		_						_	_
00007		160	_	1.10	****	-0.626	****	_		_				_		_	_
92027	IDR THB	0.211	_	(0.04)	(0.078)		—		_				_			_
		160	-0.715	**** 1.099	****	_		_		_				_		_	_
92022	SGD IDR	0.228	(0.084)	(0.04))									_		_	

 Table 1. Cont.

Note: SGD denotes the Singapore dollar, IDR denotes the Indonesian rupiah, THB denotes the Thai baht, MYR denotes the Malaysian ringgit, VND denotes the Vietnamese dong, PHP denotes the Philippine peso, JPY denotes the Japanese yen, CNY denotes the Chinese yuan, and KRW denotes the Korean won. Explained variable for all estimations is the euro real exchange rates against the US dollar. D.F. denotes the degree of freedom and D.W. denotes the Durbin Watson statistics. ****, ***, ***, and * indicate significance at the 1%, 2.5%, 5%, and 10% levels in two-tailed test, respectively. Standard error is in parentheses.

No	Combination	Upper: D.F.	Lag(s)	Coef	fficient (with S.	E.)	No	Combination	Upper: D.F.	Lag(s)	Coeff	icient (with S	.E.)
110.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-	Plus) (Lower:	Z-Minus)	110.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-I	Plus) (Lower:	Z-Minus)
07021	CNY KRW SGD IDR	159	0	-0.288	(0.068)	****	0(027	JPY KRW SGD	159	0	-0.139	(0.061)	***
97031	THB VND PHP	2.0499	0	-0.163	(0.077)	**	96037	IDR THB VND	1.9364	0	-0.153	(0.057)	****
07000	JPY CNY KRW SGD	149	5	-0.265	(0.088)	****	0(022	JPY CNY IDR	159	0	-0.247	(0.069)	****
97009	THB VND PHP	2.0194	5	-0.210	(0.092)	***	96032	THB MYR PHP	2.0749	0	-0.137	(0.068)	**
0(0(5	CNY KRW SGD	149	~	-0.285	(0.087)	****	0(020	JPY CNY SGD	159	0	-0.167	(0.055)	****
96065	THB VND PHP	2.0209	5	-0.201	(0.098)	**	96030	MYR VND PHP	1.9598	0	-0.114	(0.062)	*
0(0(1	CNY KRW SGD	159	0	-0.237	(0.075)	****	0.0000	JPY CNY SGD	159	0	-0.254	(0.063)	****
96061	IDR MYR PHP	2.0587	0	-0.203	(0.067)	****	96023	IDR THB PHP	2.1121	0	-0.123	(0.073)	*
0(050	CNY KRW SGD	151	4	-0.236	(0.081)	****	0(012	JPY CNY KRW	159	0	-0.108	(0.057)	*
96039	IDR THB PHP	1.9952	4	-0.200	(0.088)	***	96012	IDR THB VND	1.8988	0	-0.136	(0.053)	***
0(059	CNY KRW SGD	159	0	-0.150	(0.069)	**	0(002	JPY CNY KRW	159	0	-0.150	(0.068)	**
96038	IDR THB VND	1.9631	0	-0.204	(0.061)	****	96002	SGD IDR MYR	1.9875	0	-0.204	(0.064)	****
0(057	CNY KRW SGD	159	0	-0.239	(0.080)	****	05125	SGD THB MYR	159	0	-0.367	(0.072)	****
96057	IDR THB MYR	2.0237	0	-0.209	(0.064)	****	95125	VND PHP	1.9960	0	-0.123	(0.074)	*
0(05)	JPY IDR THB	159	0	-0.263	(0.069)	****	05110	KRW IDR MYR	159	0	-0.202	(0.063)	****
96056	MYR VND PHP	2.0355	0	-0.128	(0.066)	*	95119	VND PHP	1.9990	0	-0.101	(0.055)	*
06050	JPY KRW THB	159	0	-0.280	(0.070)	****	05116	KRW IDR THB	159	0	-0.158	(0.059)	****
96050	MYR VND PHP	1.9604	0	-0.119	(0.066)	*	95116	MYR VND	1.9165	0	-0.140	(0.060)	***
0(044	JPY KRW SGD	159	0	-0.318	(0.072)	****	05115	KRW SGD MYR	159	0	-0.128	(0.056)	***
96044	THB VND PHP	1.9479	0	-0.133	(0.069)	*	95115	VND PHP	1.9194	0	-0.162	(0.061)	****

Table 2. M-TAR Unit Root Test for Residuals from Co-integration Estimation (January 2000–June 2013).

Na	Combination	Upper: D.F.	Lag(a)	Coeff	icient (with S	.E.)	Na	Combination	Upper: D.F.	Lag(a)	Coeff	icient (with S	.E.)
INU.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-F	Plus) (Lower:	Z-Minus)	INO.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-P	lus) (Lower:	Z-Minus)
05111	KRW SGD IDR	159	0	-0.221	(0.067)	****	05067	JPY IDR THB	159	0	-0.194	(0.063)	****
95111	VND PHP	1.9888	0	-0.131	(0.060)	**	95067	MYR PHP	2.0663	0	-0.112	(0.058)	*
05107	KRW SGD IDR	159	0	-0.174	(0.063)	****	05064	JPY SGD THB	159	0	-0.292	(0.074)	****
95107	THB VND	1.9469	0	-0.155	(0.060)	***	95064	VND PHP	1.9595	0	-0.181	(0.073)	***
0.5000	CNY KRW IDR	159	0	-0.147	(0.058)	***	05045	JPY KRW IDR	159	0	-0.108	(0.051)	**
95082	THB VND	1.9160	0	-0.136	(0.057)	***	95047	THB VND	1.9371	0	-0.097	(0.051)	*
	CNY KRW IDR	159		-0.135	(0.061)	**		JPY CNY THB	159		-0.307	(0.073)	****
95081	THB MYR	1.9319	0	-0.173	(0.060)	****	95034	VND PHP	1.9329	0	-0.133	(0.067)	**
	CNY KRW SGD	151		-0.249	(0.089)	****		JPY CNY THB	159		-0.258	(0.077)	****
95077	THB PHP	1.9746	4	-0.249	(0.094)	****	95033	MYR PHP	1.9975	0	-0.181	(0.067)	****
	CNY KRW SGD	159		-0.184	(0.071)	***		JPY CNY IDR	159		-0.182	(0.063)	****
95074	IDR PHP	2.0784	0	-0.193	(0.062)	****	95031	VND PHP	1.9755	0	-0.129	(0.058)	**
	CNY KRW SGD	159		-0.237	(0.079)	****		JPY CNY IDR	159		-0.131	(0.062)	**
95072	IDR MYR	2.0864	0	-0.195	(0.062)	****	95030	MYR PHP	1.9863	0	-0.159	(0.058)	****
	CNY KRW SGD	159		-0.172	(0.074)	***		JPY CNY SGD	159		-0.242	(0.074)	****
95071	IDR THB	2.0385	0	-0.205	(0.060)	****	95022	THB PHP	1.9936	0	-0.211	(0.070)	****
	JPY THB MYR	159		-0.290	(0.074)	****		JPY CNY SGD	159		-0.129	(0.056)	***
95070	VND PHP	1.9712	0	-0.154	(0.069)	**	95019	IDR PHP	2.0536	0	-0.128	(0.055)	***
	JPY IDR MYR	159		-0.173	(0.066)	****		JPY CNY KRW	159		-0.081	(0.048)	*
95069	VND PHP	1.9840	0	-0.134	(0.057)	***	95009	IDR PHP	2.0529	0	-0.106	(0.049)	**

 Table 2. Cont.

No	Combination	Upper: D.F.	Lag(s)	Coef	ficient (with S.	.E.)	No	Combination	Upper: D.F.	Lag(s)	Coeff	icient (with S	.E.)
110.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-	Plus) (Lower:	Z-Minus)	190.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-P	'lus) (Lower:	Z-Minus)
05001	JPY CNY KRW	159	0	-0.121	(0.066)	*	0.4000	CNY IDR THB	159	0	-0.140	(0.060)	***
95001	SGD IDR	2.0386	0	-0.176	(0.055)	****	94082	MYR	1.9609	0	-0.143	(0.056)	***
0.4105	IDR MYR VND	159	0	-0.185	(0.060)	****	0.4070	CNY SGD THB	159	0	-0.370	(0.079)	****
94125	PHP	2.0103	0	-0.105	(0.057)	*	94078	PHP	2.0317	0	-0.170	(0.071)	***
0.44.00	IDR THB MYR	159	0	-0.191	(0.062)	****		CNY SGD IDR	159	<u>^</u>	-0.163	(0.056)	****
94122	VND	1.9694	0	-0.114	(0.057)	**	94075	PHP	2.0921	0	-0.117	(0.059)	**
0.44.4.7	SGD IDR VND	159	0	-0.186	(0.062)	****		CNY KRW SGD	159	0	-0.198	(0.074)	****
94117	PHP	2.0371	0	-0.142	(0.061)	***	94057	IDR	2.0991	0	-0.178	(0.059)	****
0.44.4.0	SGD IDR THB	159	0	-0.156	(0.063)	***		JPY THB VND	159	<u>^</u>	-0.221	(0.068)	****
94113	VND	1.9969	0	-0.166	(0.059)	****	94055	PHP	1.9667	0	-0.149	(0.065)	***
	KRW IDR VND	159		-0.147	(0.055)	****		JPY IDR VND	159		-0.120	(0.052)	***
94107	PHP	2.0132	0	-0.105	(0.056)	*	94052	PHP	2.0247	0	-0.096	(0.052)	*
0.44.0.0	KRW IDR THB	159		-0.117	(0.054)	**		JPY SGD IDR	159		-0.106	(0.061)	*
94103	VND	1.9321	0	-0.132	(0.055)	***	94039	VND	1.9752	0	-0.159	(0.054)	****
	CNY IDR VND	159		-0.209	(0.060)	****		JPY KRW IDR	159		-0.086	(0.051)	*
94087	PHP	2.0056	0	-0.104	(0.060)	*	94030	PHP	1.9903	0	-0.111	(0.048)	***
	CNY IDR MYR	159	_	-0.127	(0.055)	***		JPY KRW SGD	135		-0.087	(0.035)	***
94086	PHP	2.0313	0	-0.137	(0.058)	***	94026	PHP	2.0056	12	-0.056	(0.032)	*
	CNY IDR THB	159	_	-0.134	(0.062)	**		JPY CNY IDR	159		-0.136	(0.067)	**
94083	VND	1.9273	0	-0.156	(0.055)	****	94013	MYR	1.9560	0	-0.161	(0.056)	****

 Table 2. Cont.

No	Combination	Upper: D.F.	Lag(g)	Coef	fficient (with S	.E.)	Ne	Combination	Upper: D.F.		Coeff	icient (with S	.E.)
INO.	Combination	Lower: D.W.		(Upper: Z-	Plus) (Lower:	Z-Minus)	190.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-F	Plus) (Lower:	Z-Minus)
04007	JPY CNY SGD	159	0	-0.097	(0.057)	*	02025		159	0	-0.197	(0.065)	****
94007	IDR	2.0087	0	-0.161	(0.055)	****	93025	JAA IHR HHA	1.9810	0	-0.143	(0.062)	***
02076		159	0	-0.120	(0.051)	***	02022		159	0	-0.090	(0.053)	*
93076	IDR THB VND	1.9707	0	-0.100	(0.051)	*	93022	JPY IDR PHP	2.0066	0	-0.112	(0.048)	***
02075		159	0	-0.126	(0.056)	**	0000		159	0	-0.132	(0.058)	***
93075	IDR THB MYR	1.9707	0	-0.119	(0.052)	***	93020	JPY IDR MYR	1.9727	0	-0.114	(0.052)	**
		159	0	-0.117	(0.062)	*			159	0	-0.074	(0.043)	*
93067	SGD IDR VND	2.0408	0	-0.158	(0.054)	****	92036	VND PHP	1.9578	0	-0.081	(0.045)	*
		159	0	-0.138	(0.055)	***			159	0	-0.264	(0.068)	****
93065	SGD IDR THB	2.0275	0	-0.101	(0.051)	**	92033	THB PHP	2.0242	0	-0.108	(0.059)	*
00060		141	2	-0.078	(0.043)	*			159	0	-0.119	(0.050)	***
93063	KRW MYR PHP	1.9068	9	-0.091	(0.041)	**	92030	IDR PHP	2.0481	0	-0.087	(0.049)	*
		135	10	-0.065	(0.038)	*			159	0	-0.172	(0.063)	****
93059	KRW THB MYR	1.9757	12	-0.067	(0.039)	*	92028	IDR MYR	2.0614	0	-0.087	(0.046)	*
		159		-0.256	(0.065)	****			159	_	-0.120	(0.052)	***
93046	CNY THB PHP	2.0123	0	-0.102	(0.060)	*	92027	IDR THB	1.9935	0	-0.093	(0.049)	*
		159		-0.183	(0.068)	****			159		-0.116	(0.058)	**
93035	CNY SGD IDR	2.1130	0	-0.143	(0.055)	***	92022	SGD IDR	2.0476	0	-0.112	(0.048)	***

Table 2. Cont.

Note: ****, ***, ***, and * indicate significance at the 1%, 2.5%, 5%, and 10% levels in single-tailed test, respectively. Standard error is in parentheses. D.F. denotes the degree of freedom and D.W. denotes the Durbin Watson statistics.

Na	Combination	Upper: D.F.								Explan	natories							
190.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		JPY		CNY		KRW	
8705	JPY CNY KRW IDR	119			0.946	****	-1.556	****	-1.092	****	0.664	****	0.188	****	0.192	****	-0.879	****
(97012)	THB MYR PHP	0.407			(0.305)		(0.323)		(0.264)		(0.121)		(0.071)		(0.057)		(0.160)	
8626	CNY KRW IDR	120			1.346	****	-1.651	****	-0.723	****	0.508	****			0.104	**	-0.603	****
(96068)	THB MYR PHP	0.314			(0.271)		(0.329)		(0.230)		(0.108)				(0.048)		(0.124)	
8610	JPY CNY KRW	120					-1.165	****	-1.137	****	0.747	****	0.299	****	0.290	****	-1.032	****
(96018)	THB MYR PHP	0.441					(0.308)		(0.273)		(0.122)		(0.064)		(0.049)		(0.157)	
8606	JPY CNY KRW	120	-0.710	****					-1.194	****	0.802	****	0.302	****	0.166	***	-0.935	****
(96009)	SGD MYR PHP	0.467	(0.164)						(0.263)		(0.124)		(0.063)		(0.064)		(0.161)	
8551	KRW SGD IDR	157	-0.483	****	0.973	****	-0.791	****	0.751	****			_				0.250	**
(95106)	THB MYR	0.352	(0.088)		(0.077)		(0.196)		(0.192)								(0.123)	
8547	CNY SGD IDR	121	-0.809	****	1.306	****	-1.173	**			0.472	****	_		-0.133	****		
(95093)	THB PHP	0.224	(0.216)		(0.292)		(0.563)				(0.111)				(0.047)			
8544	CNY KRW IDR	121			0.818	****			-1.055	****	0.240	***			0.245	****	-0.902	****
(95085)	MYR PHP	0.334			(0.273)				(0.241)		(0.103)				(0.042)		(0.119)	
8531	JPY SGD IDR	157	-0.200	***	0.679	****	-0.595	****	0.503	****			-0.269	****				
(95056)	THB MYR	0.285	(0.085)		(0.083)		(0.131)		(0.132)				(0.043)					
8525	JPY KRW SGD	157	-0.490	***			0.687	****			0.316	****	-0.578	****			-0.619	****
(95042)	THB PHP	0.124	(0.191)				(0.136)				(0.120)		(0.044)				(0.094)	
8510	JPY CNY KRW	121							-1.452	****	0.511	****	0.273	****	0.368	****	-1.245	****
(95014)	MYR PHP	0.491							(0.274)		(0.111)		(0.067)		(0.047)		(0.155)	

Table 3. OLS Estimation for Asymmetric Integration (January 1984–June 1997).

Na	Combination	Upper: D.F.								Explan	atories							
INO.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		JPY		CNY		KRW	
8509	JPY CNY KRW	121					-1.556	****			0.456	****	0.144	***	0.167	****	-0.391	****
(95012)	THB PHP	0.262					(0.312)				(0.107)		(0.056)		(0.042)		(0.035)	
8470	IDR THB MYR	158			0.981	****	-0.928	****	0.694	****	-0.202	****			—			
(94123)	PHP	0.356			(0.082)		(0.109)		(0.149)		(0.060)							
8460	KRW SGD THB	158	-1.476	****			2.054	****			0.486	****					-1.156	****
(94098)	PHP	0.138	(0.254)				(0.126)				(0.173)						(0.122)	
8445	CNY KRW MYR	122							-0.730	****	0.301	****			0.269	****	-0.806	****
(94070)	PHP	0.296							(0.222)		(0.104)				(0.043)		(0.118)	
8444	CNY KRW THB	122					-1.263	****			0.406	****			0.154	****	-0.369	****
(94068)	PHP	0.227					(0.298)				(0.108)				(0.043)		(0.035)	
8441	CNY KRW IDR	122			0.943	****			-0.679	****					0.198	****	-0.673	****
(94063)	MYR	0.306			(0.273)				(0.182)						(0.038)		(0.068)	
8432	JPY IDR THB	158			0.668	****	-0.810	****	0.568	****			-0.314	****				
(94047)	MYR	0.289			(0.084)		(0.094)		(0.131)				(0.040)					
8431	JPY SGD MYR	158	-0.651	****					0.919	****	0.241	***	-0.459	****				
(94045)	PHP	0.137	(0.112)						(0.086)		(0.100)		(0.045)					
8428	JPY SGD IDR	158	-0.729	****	0.805	****					0.323	****	-0.259	****				
(94040)	PHP	0.274	(0.094)		(0.052)						(0.083)		(0.044)					
8420	JPY KRW IDR	158			0.808	****	-0.414	****					-0.324	****			-0.198	***
(94027)	THB	0.267			(0.079)		(0.112)						(0.041)				(0.084)	

 Table 3. Cont.

No	Combination	Upper: D.F.								Explan	atories							
110.	Combination	Lower: D.W.	SGD		IDR		THB		MYR		PHP		JPY		CNY		KRW	
8418	JPY KRW SGD	158	-0.268	***					0.787	****			-0.461	****			-0.246	***
(94024)	MYR	0.140	(0.104)						(0.104)				(0.045)				(0.101)	
8353	IDD THD MVD	159			1.060	****	-1.070	****	0.668	****							_	
(93075)	IDK THB MYK	0.344			(0.081)		(0.104)		(0.154)									
8346		159							1.472	****	-0.417	****					-0.551	****
(93063)	KKW MYK PHP	0.171							(0.070)		(0.089)						(0.107)	
8345	VDW THD DHD	159			_		1.558	****			-0.331	****					-1.669	****
(93061)	KKW IND PNP	0.134					(0.102)				(0.111)						(0.093)	
8343		159			0.969	****					-0.226	****					-0.445	****
(93058)	KKW IDK PHP	0.277			(0.032)						(0.066)						(0.080)	
8341		159			1.236	****	-0.602	****									-0.242	***
(93055)	KKW IDR THB	0.329			(0.068)		(0.129)										(0.098)	
8338		159	-0.896	****			1.896	****									-1.279	****
(93051)	KRW SGD THB	0.133	(0.151)				(0.116)										(0.116)	
8332	CNV IDD MVD	123			-1.173	****			1.031	****					0.306	****		
(93041)	CNY IDR MYR	0.237			(0.228)				(0.078)						(0.049)			
8319	IDV THD MVD	159			_		-0.797	****	1.287	****			-0.497	****			_	
(93023)	JPY THB MYK	0.184					(0.111)		(0.111)				(0.038)					
8316		159			0.921	****	-0.594	****			_		-0.331	****				
(93019)	JET IDK IHB	0.287			(0.064)		(0.084)						(0.042)					

 Table 3. Cont.

N.	Court in at	Upper: D.F.							Expla	natories							
N0.	Combination	Lower: D.W.	SGD	IDR		THB		MYR		PHP		JPY		CNY		KRW	
8311		159								0.213	****	-0.760	****			-0.596	****
(93013)	JPY KKW PHP	0.099								(0.073)		(0.029)				(0.086)	
8309		159				0.482	****					-0.609	****			-0.713	****
(93010)	JPY KKW IHB	0.115				(0.090)						(0.038)				(0.086)	
8308		159		0.579	****							-0.356	****			-0.407	****
(93009)	JPY KRW IDR	0.208		(0.051)								(0.042)				(0.064)	
8305	IDV CNV MVD	123		_				0.749	****			-0.301	****	0.217	****		
(93005)	JPY CNY MYK	0.162						(0.079)				(0.053)		(0.053)			
8223	IDD THD	160		1.386	****	-0.828	****										
(92027)	IDR THB	0.361		(0.032)		(0.092)											
8217		160		_				1.386	****							-0.812	****
(92019)	KKW MIIK	0.130						(0.072)								(0.097)	
8212		124		_				0.915	****					0.350	****		
(92013)	CNY MYR	0.200						(0.083)						(0.053)			
8208		124												0.223	****	-0.431	****
(92009)	UNY KKW	0.275		_										(0.039)		(0.023)	

 Table 3. Cont.

Note: SGD denotes the Singapore dollar, IDR denotes the Indonesian rupiah, THB denotes the Thai baht, MYR denotes the Malaysian ringgit, PHP denotes the Philippine peso, JPY denotes the Japanese yen, CNY denotes the Chinese yuan, and KRW denotes the Korean won. Explained Variable for all estimations is the euro real exchange rates against the US dollar. D.F. denotes the degree of freedom and D.W. denotes the Durbin Watson statistics. ****, ***, and * indicate significance at the 1%, 2.5%, 5%, and 10% levels in two-tailed test, respectively. Standard error is in parentheses.

Na	Combination	Upper: D.F.	Lag(a)	Coef	ficient (with S.	E.)	No	Combination	Upper: D.F.	Lag(a)	Coeff	icient (with S	.E.)
INO.	Complitation	Lower: D.W.		(Upper: Z-	Plus) (Lower: 2	Z-Minus)	190.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-I	Plus) (Lower:	Z-Minus)
8705	JPY CNY KRW IDR	121	1	-0.227	(0.077)	****	8509	JPY CNY KRW	121	1	-0.103	(0.058)	*
(97012)	THB MYR PHP	1.9850	1	-0.262	(0.081)	****	(95012)	THB PHP	1.9638	1	-0.228	(0.072)	****
8610	JPY CNY KRW	123	0	-0.189	(0.076)	***	8470	IDR THB MYR	159	0	-0.209	(0.059)	****
(96018)	THB MYR PHP	1.7700	0	-0.257	(0.084)	****	(94123)	PHP	1.8554	0	-0.122	(0.072)	*
8606	JPY CNY KRW	123	0	-0.165	(0.078)	**	8460	KRW SGD THB	157		-0.080	(0.037)	**
(96009)	SGD MYR PHP	1.7918	0	-0.314	(0.085)	****	(94098)	PHP	1.9861	1	-0.079	(0.047)	*
8551	KRW SGD IDR	159	0	-0.206	(0.059)	****	8445	CNY KRW MYR	121		-0.130	(0.063)	**
(95106)	THB MYR	1.8744	0	-0.121	(0.070)	*	(94070)	PHP	1.9668	1	-0.236	(0.072)	****
8547	CNY SGD IDR	121		-0.115	(0.057)	**	8444	CNY KRW THB	121		-0.093	(0.052)	*
(95093)	THB PHP	1.9851	1	-0.132	(0.065)	**	(94068)	PHP	1.9690	1	-0.211	(0.071)	****
8544	CNY KRW IDR	121		-0.155	(0.070)	**	8441	CNY KRW IDR	121		-0.122	(0.066)	*
(95085)	MYR PHP	1.9651	1	-0.255	(0.072)	****	(94063)	MYR	1.9581	1	-0.260	(0.069)	****
8531	JPY SGD IDR	159	<u>^</u>	-0.144	(0.054)	****	8432	JPY IDR THB	159	0	-0.133	(0.054)	***
(95056)	THB MYR	1.8646	0	-0.134	(0.063)	**	(94047)	MYR	1.8741	0	-0.155	(0.064)	***
8526	JPY KRW SGD	145	_	-0.076	(0.044)	*	8431	JPY SGD MYR	145	_	-0.080	(0.041)	*
(95044)	MYR PHP	1.9545	7	-0.190	(0.044)	****	(94045)	PHP	1.9681	7	-0.193	(0.045)	****
8525	JPY KRW SGD	145	_	-0.093	(0.039)	***	8428	JPY SGD IDR	159		-0.149	(0.053)	****
(95042)	THB PHP	1.9795	7	-0.120	(0.044)	****	(94040)	PHP	1.8383	0	-0.118	(0.062)	*
8510	JPY CNY KRW	121		-0.205	(0.080)	***	8420	JPY KRW IDR	159	0	-0.149	(0.051)	****
(95014)	MYR PHP	1.9962	1	-0.401	(0.090)	****	(94027)	THB	1.8387	0	-0.108	(0.062)	*

Table 4. M-TAR Unit Root Test for Residuals from Co-integration Estimation (January 1984–June 1997).

		Upper: D.F.		Co	efficient (with S	.E.)			Upper: D.F.		Coefficient (with S.F.)				
No.	Combination	Lower: D.W.	Lag(s)	(Upper: Z	Z-Plus) (Lower:	Z-Minus)	No.	Combination	Lower: D.W.	Lag(s)	(Upper: Z-l	Plus) (Lower:	Z-Minus)		
8418	JPY KRW SGD	145	_	-0.086	(0.044)	*	8316		159		-0.156	(0.053)	****		
(94024)	MYR	1.9382	7	-0.176	(0.046)	****	(93019)	JPY IDR THB	1.8746	0	-0.119	(0.065)	*		
8353		159	<u>^</u>	-0.191	(0.057)	****	8311		145	_	-0.087	(0.035)	***		
(93075)	IDR THB MYR	1.8563	0	-0.138	(0.071)	*	(93013)	JPY KRW PHP	2.0032	7	-0.082	(0.041)	**		
8346		155		-0.088	(0.043)	**	8309		131	14	-0.083	(0.041)	**		
(93063)	KRW MYR PHP	2.0047	2	-0.127	(0.049)	***	(93010)	JPY KRW THB	1.9759	14	-0.125	(0.049)	***		
8345		131		-0.145	(0.043)	****	8308		157		-0.124	(0.047)	****		
(93061)	KRW THB PHP	2.0071	14	-0.120	(0.053)	**	(93009)	JPY KRW IDR	1.9779	I	-0.106	(0.053)	**		
8343		157		-0.192	(0.053)	****	8305		121		-0.074	(0.044)	*		
(93058)	KRW IDR PHP	2.0106	1	-0.106	(0.063)	*	(93005)	JPY CNY MYR	1.9948	I	-0.142	(0.061)	***		
8341		157		-0.211	(0.054)	****	8223		157		-0.226	(0.056)	****		
(93055)	KRW IDR THB	2.0148	1	-0.125	(0.075)	*	(92027)	IDR THB	2.0177	I	-0.135	(0.081)	*		
8338		131		-0.129	(0.041)	****	8217		155		-0.073	(0.038)	*		
(93051)	KRW SGD THB	1.9866	14	-0.145	(0.053)	****	(92019)	KRW MYR	2.0166	2	-0.093	(0.042)	**		
8332		121	_	-0.096	(0.052)	*	8212		121	_	-0.090	(0.051)	*		
(93041)	CNY IDR MYR	2.0009	1	-0.235	(0.072)	****	(92013)	CNY MYR	1.9974	1	-0.156	(0.063)	***		
8319		145		-0.108	(0.049)	**	8208		121		-0.118	(0.059)	**		
(93023)	JPY THB MYR	1.9852	7	-0.254	(0.055)	****	(92009)	CNY KRW	1.9663	1	-0.237	(0.072)	****		

 Table 4. Cont.

Note: SGD denotes the Singapore dollar, IDR denotes the Indonesian rupiah, THB denotes the Thai baht, MYR denotes the Malaysian ringgit, PHP denotes the Philippine peso, JPY denotes the Japanese yen, CNY denotes the Chinese yuan, and KRW denotes the Korean won. D.F. denotes the degree of freedom and D.W. denotes the Durbin Watson statistics. ****, ***, and * indicate significance at the 1%, 2.5%, 5%, and 10% levels in two-tailed test, respectively. Standard error is in parentheses.

Table 5. Summary of Empirical Results (Candidates for member states of the Con	nmon
Currency Union).	

The Num	ber of Countries	No.	SGD	IDR	THB	MYR	PHP	VND	JPY	CNY	KRW
			(Janua	ry 200	0–June	2013)					
	7	97009	Х	—	Х	—	Х	Х	Х	Х	Х
		96061	Х	Х	—	Х	Х	—	_	Х	Х
	6	96059	Х	Х	Х	_	Х	—	_	Х	Х
	0	96057	Х	Х	Х	Х	_	_	_	Х	Х
		96037	Х	Х	Х	_	-	Х	Х	—	Х
		95116	-	Х	Х	Х	-	Х	-	-	Х
		95115	Х	-	_	Х	Х	Х	-	_	Х
		95107	Х	Х	Х	_	-	Х	-	-	Х
		95082	_	Х	Х	_	-	Х	-	Х	Х
		95077	Х	_	Х	_	Х	_	-	Х	Х
		95074	Х	Х	-	_	Х	_	-	Х	Х
	5	95072	Х	Х	-	Х	-	_	-	Х	Х
		95071	Х	Х	Х	_	-	_	-	Х	Х
		95069	-	Х	-	Х	Х	Х	Х	-	_
			Х	-	Х	_	Х	Х	Х	_	_
		95033	_	-	Х	Х	Х	_	Х	Х	_
		95022	Х	-	Х	_	Х	_	Х	Х	_
		95019	Х	Х	_	_	Х	—	Х	Х	_
		94117	Х	Х	_	_	Х	Х	-	_	_
		94113	Х	Х	Х	_	-	Х	-	_	_
		94086	_	Х	_	Х	Х	_	-	Х	_
	4	94082	_	Х	Х	Х	-	_	-	Х	_
		94078	Х	-	Х	_	Х	_	-	Х	_
		94057	Х	Х	_	_	-	_	-	Х	Х
		94055	_	_	Х	_	Х	Х	Х	_	_
	2	93035	Х	Х	_	_	-	_	-	_	Х
	3	93025	_	_	Х	_	Х	_	Х	_	_
			(Janua	ry 198	4–June	1997)					
7	8705	(97012)	_	Х	Х	Х	Х	_	Х	Х	Х
6	8610	(96018)	_	_	Х	X	Х	_	Х	Х	X
5	8525	(95042)	Х	_	Х	_	Х	_	Х	_	Х
3	8510	(95014)	_	_	_	X	Х	_	Х	Х	Х
4	8432	(94047)	_	Х	Х	Х	_	_	Х	_	_
3	8338	(93051)	Х	_	Х	_	_	_	_	_	Х

Note: "X" denotes the candidate for the member states of a possible common currency union.

Our empirical study suggests three features. First, in recent years, the ASEAN6+3 countries might come closer to OCA than before. Because that there exist 28 co-integration relationships among currencies of ASEAN6+3 countries in the period from January 2000 to June 2013, while only six combinations were found as a possible currency union in the period from January 1984 to June 1997. Even if we ignore the VND as a candidate for the member states of currency union, we could find

478

16 combinations contain co-integration relationship among the currencies of the original ASEAN5+3 countries in the period from January 2000 to June 2013⁸.

Second, in the case that the common currency union contains more than four countries, the possible currency union should include the Japanese yen as a key currency when the samples from January 1984 to June 1997 were applied. On the other hand, the ASEAN6 countries could form a common currency union with Japan, China, and/or Korea, in the sample period from January 2000 to June 2013. Therefore, not only Japan but also "the plus three" countries might affect significant impacts on the possible common currency union.

Third, our empirical results suggest the combination of Singapore, Indonesia, Philippines, and Vietnam (94117), and the combination of Singapore, Indonesia, Thailand, and Vietnam (94113) could form a currency union without "the plus three" countries. This might reflect the recent economic integration which is deepening with the intra-industrial trade or the horizontal trade; the regional integration might not be only dominated by the large economies such as Japan or China or by the developed economies such as Japan or Korea. This might suggest that the possible currency union might be deepening not as "vertical integration" but as "horizontal integration".

4.4. Discussion

The results can be explained by the recent developments of economic integration in ASEAN6+3. Since the beginning of 2000, on the basis of high economic growth in the East Asian area, intra-regional trade and investment has become more vigorous than ever before, and real economic integration within the area is in progress. Foreign direct investment via intra-regional multinational firms has also given rise to a manufacturing network within the East Asian area. The intra-regional trade volumes of ASEAN6+3 have been increasing steadily since the early 2000s and reached approximately one-half of its total trade volume in recent years. Through this manufacturing network, advanced economies, such as Japan and Korea, have tended to export their low-added-value products to developing countries, and process these products while incurring low labor costs. In contrast, most of the developing countries in East Asia—such as China and Thailand—act as the "workshops" of developed economies by taking on low-added-value work and re-exporting the end products to advanced and other developing economies in the East Asian area. The added-profit trade-which includes processing and assembly-has been a typical economic growth model among most developing East Asian countries, and it is obvious that each country's economic growth is deeply involved in the manufacturing network. Through the integration of real economies, multinational firms have been optimizing their supply chains, information technologies, and capital flows.

Another aspect of the difference between the growth periods of 1984–1997 and 2000–2013 is related to exchange rate regimes or policies. Most of the monetary authorities in East Asian countries had adopted the *de facto* dollar peg system before the Asian Crisis in 1997, and switched to the floating system after the crisis. In some cases, countries adopted a basket beg system to fix their currencies. Although the East Asian countries could promote exports and investments to/from the US

⁸ Since the sample period in the recent years includes nine currencies and covers larger sample currencies than in the sample period from 1984 to 1997, we cannot compare the two sample periods without careful consideration and further conclude that the currencies of the recent sample period are more cointegrated.

under the fixed exchange rates regimes, they had faced with significant fluctuations in exchange rates against the other trade partner's currencies, such as the Japanese yen, the German mark and the sterling pound. Since the dependencies of East Asian economies are not only on the US economy, but also on other developed economies, a more flexible exchange rate regime, such as the floating or the basket peg, would help the East Asian countries develop their economies in "the globalization era", as the countries expand their trade partners across the world.

Based on our empirical analysis and our conclusions on economic integration, East Asia is now closer than ever to exhibiting the conditions for a common currency. However, the integration of the financial markets in this region is still under development. As the Chinese economy has been growing rapidly, the RMB has become more popular as a currency of settlement for export and import in this area. However, the capital investments across the region are still mostly the dollar-denominated investments because the local financial markets are fragile against liquidity risks, systemic risks, and sovereign risks. This means that the agents in this area still have to manage exchange rate risks of the dollar fluctuations when they invest their local money in the regional economy. In order to utilize the available local/regional savings as a growth engine, the fragile local markets need to be interlinked with the regional financial center. Further regional monetary cooperation or political collective actions should play important roles in developing and integrating the regional financial market. This would contribute to forming a common currency union in this region.

5. Conclusions

Since the 1960s, economic integration within the East Asia area has been implemented through the use of corporate initiatives, in what has been referred to as "functioning integration". East Asian multi-national production networks have been established through the expansion of Japanese enterprises—as well as those of newly industrialized economies—into ASEAN and China. The trade volumes within the East Asian area are one-half its total trade volume worldwide. FTAs among the East Asian countries have been enacted since the 2000s, and internal trade among them will increase as more FTAs are formulated. However, the exchange rate—one of the key factors affecting trade volume—might be a destabilizing factor in intra-regional trade transactions. In line with the need to stabilize the foreign exchange rate within the East Asian area, the monetary authorities of East Asian countries need to cooperate with each other on their foreign exchange policy. As a measurement to stabilize the foreign exchange rate, the monetary authorities of East Asian countries need to create a common currency basket. Some of the previous studies argued that a common currency basket can rectify currency overvaluation or undervaluation, and is more suitable for East Asian countries to create a common currency area.

In this paper, we investigate whether East Asian countries are suitable candidates for forming a common currency area by employing the G-PPP model and by testing for co-integration with asymmetric error correction. Comparing the pre- and post-period of the Asian currency crisis, some East Asian countries tend to converge. In particular, after the crisis the member countries of ASEAN are converging either around themselves or around the three largest economies of Japan, China, and Korea. The results of our empirical analysis suggest that East Asian countries are more suitable today for creating a common currency area based on the G-PPP model in the first decade of the twenty-first century than before the Asian currency crisis. It implies that East Asian economic development has been promoting trade transactions and monetary regionalization. In the next decade, a stable real exchange rate among East Asian countries is expected to promote the efficiency of market transactions and economic integration.

Furthermore, to evaluate which East Asian countries are more applicable for creating a common currency area appropriately, in future research, we need to improve the anchor exchange rate by reference to a currency basket calculated by including all the trading partners of ASEAN6+3.

Acknowledgments

This study is conducted as a part of the Project "Research on Currency Baskets" undertaken at Research Institute of Economy, Trade and Industry (RIETI).dx. The authors are grateful for helpful comments and suggestions by Ganeshan Wignaraja (Asian Development Bank Institute) as a discussant of the 14th conference of East Asian Economic Association, 1–2 November 2014, and Discussion Paper seminar participants at RIETI.

Author Contributions

Kentaro Kawasaki and Zhi-Qian Wang conceived and designed the experiments; Zhi-Qian Wang performed the experiments; Kentaro Kawasaki and Zhi-Qian Wang analyzed the data; Kentaro Kawasaki contributed analysis tools; Kentaro Kawasaki and Zhi-Qian Wang wrote the paper.

Conflicts of Interest

The authors declare no conflict of interest.

References

- 1. Enders, W.; Hurn, S. Theory and tests of generalized purchasing power parity: Common trends and real exchange rates in the Pacific Rim. *Rev. Int. Econ.* **1994**, *2*, 179–190.
- 2. Williamson, J. *Exchange Rate Regimes for Emerging Markets: Reviving the Intermediate Option*; Institute for International Economics: Washington, DC, USA, 2000.
- 3. Ogawa, E.; Ito, T. On the desirability of a regional basket currency arrangement. *J. Jpn. Int. Econ.* **2002**, *16*, 317–334.
- Kuroda, H.; Kawai, M. Strengthening regional financial cooperation in East Asia. PRI Discussion Paper Series. Available online: https://www.mof.go.jp/pri/research/discussion_paper/ron061.pdf (accessed on 30 September 2006).
- 5. Ogawa, E. Regional monetary cooperation in East Asia against asymmetric responses to the US dollar depreciation. *J. Korean Econ.* **2004**, *5*, 43–72.
- 6. Kawasaki, K. Are the ASEAN plus three countries coming closer to an optimum currency area? *China Econ. Policy Rev.* **2012**, doi:10.1142/S1793969012500112.
- 7. Mundell, R.A. A theory of optimum currency areas. Am. Econ. Rev. 1961, 51, 657–665.

- 8. Obstfeld, M.; Rogoff, K. *Fundations of International Macroeconomics*; The MIT press: Cambridge, MA, USA, 1996.
- 9. Wilson, P.; Choy, K.M. Prospects for enhanced exchange rate cooperation in East Asia: Some preliminary findings from Generalized PPP theory. *Appl. Econ.* **2007**, *39*, 981–995.
- 10. Sun, W.; Simons, G. Monetary integration in East Asia: Evidence from real effective exchange rates. *Rev. Int. Econ.* **2011**, *19*, 865–876.
- 11. De Truchis, G.; Keddad, B. Southeast Asian monetary integration: New evidences from fractional cointegration of real exchange rates. *J. Int. Financ. Mark. Inst. Money* **2013**, *26*, 394–412.
- Keddad, B. Exchange rate coordination in Asia under regional currency basket systems. *Econ. Bull.* 2013, *4*, 2913–2929.
- 13. Stock, J.H.; Watson, M.W. Testing for common trends. J. Am. Stat. Assoc. 1988, 83, 1097–1107.
- Ogawa, E.; Kawasaki, K. *Possibility of Creating a Common Currency Basket for East Asia*; JBICI Discussion Paper Series; Japan Bank for International Cooperation: Tokyo, Japan, 2003.
- 15. Johansen, S.; Juselius, K. Maximum likelihood estimation and inference on cointegration (with applications to the demand for money). *Oxf. Bull. Econ. Stat.* **1990**, *52*, 169–210.
- 16. Enders, W.; Granger, C.W.J. Unit root tests and asymmetric adjustment with an example using the term structure of interest rates. *J. Bus. Econ. Stat.* **1998**, *16*, 304–311.
- 17. Enders, W.; Siklos, P.L. Cointegration and threshold adjustment. J. Bus. Econ. Stat. 2001, 19, 166–176.

© 2015 by the authors; licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).