

East Asian Monetary Integration and the Composite Index of OCA Criteria*

Kwangsuk Han^{**} · Yeonho Lee^{***}

Since the 1997 Asian crisis and the commencement of the euro, renewed attention has been given to potential monetary integration in East Asia. After the 1997 crisis, many East Asian countries surrendered their pegs as they had no ability to sustain the peg exchange rate regimes. Therefore, the answers to the financial crisis could be an adoption of more flexible exchange rate regimes or a move to a hard fix such as a common currency. This study is differentiated from previous studies on OCA in East Asia in two respects. First, most previous studies focused on the evaluation with just a few criteria, which were too restrictive and potentially misleading. They also could not incorporate possible structural changes after the Asian crisis. As an alternative, this study covers more than ten OCA criteria, and extends the period that covers structural change after the Asian crisis. Second, this study proposes the Composite Index of OCA Criteria, which is the first trial in the study of OCA. Based on the Composite Index, we present a guideline for a step-by-step strategy to form a monetary union in East Asia. The results of our study suggest that relatively homogenous sub-groups — three Asian countries (Malaysia, Singapore and Hong Kong) or four countries (Malaysia, Singapore, Hong Kong and Taiwan) or six countries (Malaysia, Singapore, Hong Kong, Taiwan, Thailand, and Brunei) — could begin forming a monetary union, as a first step to form a common currency area.

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** First author, KDI, Tel: +82-2-958-4188, E-mail: kshan@kdi.re.kr

*** Author for correspondence, Chungbuk National University, Tel: +82-43-261-2215, E-mail: leeyh@chungbuk.ac.kr. The author was supported by the research grant of the Chungbuk National University in 2009.

1. INTRODUCTION

Since the 1997 financial crisis, researches have investigated the need for more monetary cooperation in East Asia, including the possibility of a new financial arrangement.¹⁾ Many East Asian countries were pushed to devalue their currencies and employed the flexible exchange rate regimes after the 1997 crisis. They surrendered the pegs to adopt the flexible exchange rates. Therefore, the answers to the financial crisis could be an adoption of more flexible exchange rates or a move to a hard fix such as a common currency.

The theory of optimum currency areas (hereafter OCA) was pioneered by Mundell (1961) and developed by McKinnon (1963) and Kenen (1969). The new theories of OCA have further provided microfoundations and more precise mathematical models than the traditional (criterion-based) and the alternative (cost-benefit) methods.²⁾ This study is differentiated from previous studies on OCA in East Asia in two respects. First, most previous studies focused on a few criteria, which were too restrictive and potentially misleading. They also could not incorporate the structural changes after the Asian crisis (Huh and Nam, 2010; Kang and Yoon, 2010). As an alternative, this study covers more than ten OCA criteria and extends the period that covers structural changes after the Asian crisis. Second, this study presents a guideline for a step-by-step strategy for forming a monetary union in East Asia by developing the Composite Index of OCA Criteria, which is the first trial in the OCA study. We identify a relatively homogenous group of East Asian countries by referring to the Composite Index of OCA Criteria.

The paper is organized as follows. In section 2, we briefly evaluate East Asia in the light of the various OCA criteria. In section 3, depending upon the evaluation of various OCA criteria, we present the Composite Index of OCA Criteria as a methodology to apply OCA criteria. Finally, section 4 concludes the study.

¹⁾ East Asia is defined as the following 15 economies, unless noted otherwise: 10 ASEAN countries, China, Hong Kong, Taiwan, Japan and Korea. ASEASN+3 include 10 ASEAN countries, China, Japan and Korea.

²⁾ We use monetary union/integration and currency union/area as interchangeable terms.

2. EVALUATION OF VARIOUS OCA CRITERIA FOR EAST ASIAN MONETARY INTEGRATION

As Willett (2001) points out, interest in the theory of OCA has waxed and waned over the years after the pioneering contribution of Mundell (1961). The surge of the Asian financial crisis and the commencement of the euro renewed attention to the theory of OCA. After the leading works by Mundell (1961), McKinnon (1963), and Kenen (1969), following works by Grubel (1970), Cordon (1972), Ishiyama (1975) and Tower and Willet (1976) pay attention to the costs and benefits of participating in a currency area.³⁾ To determine to what extent East Asian countries are ready to form a monetary union, we examine the OCA criteria as follows: trade openness, asymmetry of disturbances, real capital mobility, labor mobility, wage and price flexibility, financial market integration, diversification in production, similarities of inflation rates, credibility, fiscal federalism, and political factors.

2.1. Trade Openness

McKinnon (1963) argues that the trade openness of an economy is an important factor in determining the plausibility of a currency union. A high degree of economic openness lessens the effectiveness of a monetary policy and limits the usefulness of exchange rate changes. Trade integration is also considered to reduce the possibility of asymmetric shocks and enhance the transmission of any shocks (Wyplosz, 2001). Eichengreen and Park (2003) argue that countries that establish close economic ties through trade

³⁾ The traditional theory of OCA identified criteria such as factor mobility, trade openness, wage and price flexibility, product diversification, market integration, and inflation similarities, etc. A more recent traditional OCA theory uses further criteria such as financial integration and patterns of shocks. Endogenous OCA, controllability of money supply, time inconsistency and credibility, currency substitution, liability dollarization, and financial instability are called new OCA criteria (Willett *et al.*, 2007). For the recent literature review of the OCA theory, see Willett (2001) and Mongelli (2002). Refer to Mongelli (2008) and European Parliament (1998) for the discussion of limitations of the OCA theory.

Table 1 Trade Openness (Total Trade as a Percentage of GDP)¹⁾

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Brunei | 85.8 | 97.1 | 93.4 | 84.6 | 92.0 | 116.1 | 114.5 | 123.0 | 121.3 | 118.4 | n.a. |
| Cambodia | 77.7 | 69.2 | 50.7 | 65.9 | 64.8 | 69.4 | 72.5 | 77.4 | 80.4 | 140.5 | n.a. |
| Indonesia | 42.6 | 40.8 | 49.9 | 89.7 | 60.4 | 66.1 | 53.3 | 44.7 | 39.5 | 46.7 | 30.9 |
| Laos | 50.6 | 54.0 | 61.0 | 71.7 | 57.5 | 49.9 | 49.0 | 39.9 | 47.0 | 34.5 | 45.8 |
| Malaysia | 170.5 | 155.4 | 156.8 | 181.7 | 189.5 | 199.5 | 183.9 | 181.7 | 174.4 | 195.3 | 195.4 |
| Myanmar | 2.0 | 1.6 | 1.6 | 1.5 | 1.0 | 1.0 | 1.0 | 0.6 | 0.4 | 0.3 | n.a. |
| Philippines | 61.9 | 65.8 | 77.4 | 93.7 | 90.0 | 101.6 | 94.9 | 96.0 | 95.1 | 94.6 | 88.3 |
| Singapore | 289.0 | 278.2 | 269.9 | 261.1 | 273.4 | 294.0 | 277.5 | 272.8 | 293.4 | 346.1 | 368.2 |
| Thailand | 75.7 | 70.4 | 78.8 | 86.9 | 88.9 | 107.0 | 109.8 | 104.6 | 109.0 | 118.0 | 129.4 |
| Viet Nam | 74.7 | 74.6 | 77.4 | 76.7 | 81.2 | 96.5 | 95.1 | 101.3 | 113.9 | 139.5 | 128.9 |
| China | 40.1 | 35.3 | 36.0 | 33.9 | 36.1 | 43.9 | 42.8 | 47.6 | 57.9 | 59.6 | n.a. |
| Hong Kong | 254.1 | 238.6 | 225.0 | 214.8 | 216.4 | 245.7 | 234.8 | 249.1 | 287.5 | 319.8 | 331.4 |
| Taiwan | 78.5 | 80.1 | 83.1 | 87.7 | 80.1 | 90.9 | 78.7 | 84.3 | 92.2 | 109.1 | 110.1 |
| Japan | 14.8 | 16.5 | 17.9 | 17.4 | 16.7 | 18.5 | 18.4 | 19.3 | 20.2 | 22.2 | 24.4 |
| Korea | 50.3 | 50.2 | 54.4 | 65.3 | 59.1 | 65.0 | 60.5 | 57.5 | 61.3 | 70.3 | 69.3 |
| East Asia ²⁾ | 91.2 | 88.5 | 88.9 | 95.5 | 93.8 | 104.3 | 99.1 | 100.0 | 106.2 | 121.0 | 138.4 |
| EU ²⁾ | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | |
| | 58.2 | 55.6 | 53.3 | 51.7 | 55.3 | 58.3 | 60.8 | 60.6 | 63.8 | 65.8 | |

Notes: 1) Data are composed of export (f.o.b.) and import (c.i.f.) of goods except Cambodia (1995-1996, 2004) and Viet Nam (1995, 2004) for which the data include trade of goods & services. 2) Average of 15 countries and 11 countries (2005) in East Asia and 14 countries (1989-1992) in EU. 3) The term, "n.a." indicates that data are not available.

Sources: IMF, *International Financial Statistics* and Asian Development Bank, *Key Indicators*, various years.

liberalization are likely to be members of an OCA in the sense that the similar business cycles make it easier for them to accommodate a common monetary policy regime.

Table 1 presents the ratio of trade to GDP in East Asian countries and European Union (EU). In order to compare the current economic condition of East Asia with the precondition of forming EU, we measure the openness of EU up to 1998.

Table 2 Intra-regional Trade (as a Percentage of Country's Total World Trade)¹⁾

| | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 |
|-------------|------|------|------|------|------|------|
| Brunei | 80.1 | 77.3 | 81.7 | 79.5 | 74.2 | 75.0 |
| Cambodia | n.a. | 67.4 | 68.6 | 81.5 | 35.8 | 46.8 |
| Indonesia | 58.3 | 53.3 | 51.7 | 49.5 | 50.6 | 54.6 |
| Laos | n.a. | 82.6 | 85.7 | 65.3 | 72.8 | 74.0 |
| Malaysia | 46.7 | 54.1 | 49.6 | 48.2 | 49.4 | 54.7 |
| Myanmar | 50.6 | 42.9 | 58.7 | 72.5 | 62.2 | 74.9 |
| Philippines | 33.8 | 36.0 | 32.8 | 37.5 | 39.7 | 52.7 |
| Singapore | 36.8 | 40.6 | 39.5 | 47.2 | 46.5 | 45.4 |
| Thailand | 38.1 | 42.7 | 42.6 | 43.7 | 44.9 | 49.5 |
| Viet Nam | n.a. | 10.5 | 27.8 | 57.6 | 56.4 | 52.7 |
| China | 29.4 | 36.2 | 21.3 | 33.7 | 33.1 | 30.0 |
| Japan | 20.7 | 20.3 | 21.2 | 29.9 | 30.9 | 36.8 |
| Korea | 29.2 | 26.7 | 29.1 | 35.4 | 36.6 | 43.6 |
| ASEAN+3 | 30.2 | 30.2 | 29.3 | 37.3 | 37.0 | 38.2 |
| ASEAN | 17.9 | 20.3 | 18.8 | 23.9 | 24.5 | 24.0 |
| EU 25 | 61.3 | 59.8 | 67.0 | 67.4 | 66.8 | 66.2 |
| NAFTA | 33.8 | 38.7 | 37.9 | 43.1 | 48.8 | 45.0 |

Notes: 1) Intra-regional trade share is defined as $X_{ii}/\{(X_{iw} + X_{wi})/2\}$, where X_{ii} represents exports of region i to region i . X_{iw} represents total exports of region i to the world, and X_{wi} represents total exports of the world to region i . 2) The term, "n.a." indicates that data are not available.

Sources: IMF, *Direction of Trade Statistics*, CEIC, and Rana (2006).

The data indicate that East Asian countries are highly open, particularly in the 2000s (Pomfret, 2009). The average of trade openness for East Asia is 102.4% during 1995-2005. This is greater than that for the European Union (58.3%) during 1989-1998.

Table 2 shows the degree of intra-regional trade from 1980 to 2005. Intra-regional trade among ASEAN+3 countries expanded from 30.2% to 38.2% although it is lower than that of NAFTA (45.0%) and EU (66.25%) in 2005.

2.2. Asymmetry of Disturbances

The issue of asymmetric responses to external shocks has been one of the main points of the OCA criteria. According to Mundell (1961), regions with symmetric shocks can take the same monetary policy against other regions receiving different shocks. Bayoumi and Eichengreen (1994), Bayoumi and Mauro (1999), and Eichengreen and Bayoumi (1999) employ a structural VAR model and find that there is little difference in the asymmetry of shocks between Europe and East Asia. Ng (2002) and Zhang *et al.* (2004) also use a structural VAR methodology and Lee *et al.* (2002) improve the methodology by assessing three different types of shocks. Baek and Song (2001) and Ahn *et al.* (2006) also use a structural VAR approach to find plausible candidates for a monetary union among East Asian countries.

We use the same methodology as Bayoumi (1992) and Bayoumi and Eichengreen (1994) to obtain underlying supply and demand shocks. However, we will use data for a longer sample period (1965-2005) than Bayoumi and Eichengreen (1994).

The estimation process can be summarized as follows: We consider a system where the true model can be represented by an infinite moving average representation of a vector of variables, X_t and an equal number of shocks, ε_t . Using the lag operator L , this can be written as

$$\begin{aligned} X_t &= A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + A_3\varepsilon_{t-3} + \dots \\ &= \sum_{i=0}^{\infty} L^i A_i \varepsilon_t, \end{aligned} \quad (1)$$

where the matrices A_i represent the impulse response functions of the shocks to the elements of X_t . Let $X_t \equiv [\Delta y_t, \Delta p_t]'$ and $\varepsilon_t \equiv [\varepsilon_{st}, \varepsilon_{dt}]'$ where y_t and p_t represent the logarithm of output and prices, and ε_{st} and ε_{dt} be supply and demand shocks which are independent. Then the model can be rewritten as

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{st} \\ \varepsilon_{dt} \end{bmatrix} \quad (2)$$

Since it is assumed that demand shocks have temporary effects on the level of output, their cumulative effect on the change in output (Δy_t) is zero. This implies the restriction

$$\sum_{i=0}^{\infty} a_{12i} = 0. \quad (3)$$

Equations (2) and (3) are estimated by a vector autoregression:

$$\begin{aligned} X_t &= B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_n X_{t-n} + e_t \\ &= (1 - B(L))^{-1} e_t \\ &= e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + \dots, \end{aligned} \quad (4)$$

where $e_t \equiv [e_{yt}, e_{pt}]'$ denotes the residuals of a regression of current value of Δy_t and Δp_t on their lagged values. Finally, the estimated residuals from the VAR, \hat{e}_t , are transformed into estimated demand and supply shocks, $\hat{\varepsilon}_t$.

For estimation, annual data on real and nominal GDP are collected for sixteen Asian countries and two Oceania countries over the period of 1965-2005.⁴⁾ The countries include ten ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam), five East Asian countries (China, Hong Kong, Taiwan, Japan and Korea), two Oceania countries (Australia and New Zealand), and one of the emerging countries in Asia, India. Equation (4) is estimated for each of the eighteen countries. Optimal lag length for each country is selected by the

⁴⁾ Time span varies among countries, depending on data availability; 1974-2005 for Brunei, 1986-2005 for Cambodia, 1980-2005 for Laos, 1969-2005 for Taiwan, 1980-2005 for Viet Nam and 1965-2005 for the rest of countries. Refer to Appendix 1 for data sources and sample periods.

Schwartz Information Criteria and set to one for all eighteen countries.

2.2.1. Correlations of disturbances

2.2.1.1. Supply disturbances

Table 3 shows the estimated correlation coefficients of supply disturbances for the eighteen countries over the period 1965-2005. Supply disturbances are more informative about regional patterns than demand disturbances. Supply disturbances are associated with the shocks to the real economy that permanently shift the long-run equilibrium. They are unaffected by changes in demand management policies and are less sensitive to the choice of exchange rate regime. On the other hand, demand disturbances that temporarily displace output and prices from steady state levels are closely related to fiscal, monetary, and exchange rate policies that would change as the result of currency union.

Table 3 indicates that supply disturbances of Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand are correlated positively and highly, compared with those of the other Asian countries.⁵⁾ For example, the correlation coefficient of supply disturbances of Korea is 0.608, 0.482, 0.452, 0.377, 0.329, and 0.259 with those of Thailand, Malaysia, Hong Kong, Singapore, Japan, and Taiwan, respectively. On the other hand, the correlation coefficient of supply disturbances of Korea is less than 0.171 with those of China, Philippines, and so forth. We observe the similar patterns of the correlation coefficients among the other seven countries. We will hereafter call these eight countries as the core group (EA 8). This finding is consistent with the results documented by Baek and Song (2001) and Ahn *et al.* (2006).

As for the other six ASEAN countries (Brunei, Cambodia, Laos, Myanmar, Philippines and Viet Nam), supply disturbances have significant correlations with only a few of the other countries. Supply disturbances to the Philippines

⁵⁾ Applying the usual *t*-test to the correlation coefficients, we also find that supply disturbances among these eight countries are correlated significantly at the conventional significance levels.

Table 3 Correlations of Supply Shocks, 1965-2005

| | AUS | BRU | CAM | CHN | HKG | IND | INO | JAP | KOR | LAO | MAL | MYA | NZL | PHL | SGP | TAW | THA | VTN |
|-----|----------|----------|----------|--------|----------|--------|----------|----------|----------|----------|----------|--------|-------|--------|----------|--------|--------|-------|
| AUS | 1.000 | | | | | | | | | | | | | | | | | |
| BRU | -0.070 | 1.000 | | | | | | | | | | | | | | | | |
| CAM | 0.118 | -0.187 | 1.000 | | | | | | | | | | | | | | | |
| CHN | -0.053 | -0.030 | 0.125 | 1.000 | | | | | | | | | | | | | | |
| HKG | 0.213 | -0.073 | -0.038 | 0.176 | 1.000 | | | | | | | | | | | | | |
| IND | -0.111 | -0.168 | -0.274 | 0.124 | 0.013 | 1.000 | | | | | | | | | | | | |
| INO | 0.220 | -0.141 | 0.168 | -0.373 | 0.265* | -0.251 | 1.000 | | | | | | | | | | | |
| JAP | 0.171 | 0.220 | 0.089 | -0.103 | 0.373** | 0.054 | 0.314** | 1.000 | | | | | | | | | | |
| KOR | 0.071 | 0.101 | -0.056 | 0.171 | 0.452*** | 0.047 | 0.054 | 0.329** | 1.000 | | | | | | | | | |
| LAO | 0.099 | 0.466*** | -0.062 | 0.208 | 0.357*** | -0.093 | 0.279 | 0.142 | 0.138 | 1.000 | | | | | | | | |
| MAL | 0.073 | -0.066 | -0.031 | -0.199 | 0.482*** | -0.121 | 0.460*** | 0.273* | 0.482*** | 0.155 | 1.000 | | | | | | | |
| MYA | -0.158 | -0.185 | -0.055 | -0.072 | 0.213 | -0.185 | 0.347** | 0.161 | 0.073 | 0.051 | 0.174 | 1.000 | | | | | | |
| NZL | 0.477*** | -0.223 | 0.070 | 0.240 | 0.374** | -0.007 | 0.089 | 0.047 | 0.138 | 0.063 | 0.066 | -0.117 | 1.000 | | | | | |
| PHL | 0.337** | 0.092 | -0.305 | 0.149 | 0.104 | -0.099 | 0.184 | -0.012 | 0.166 | 0.437*** | 0.191 | -0.108 | 0.259 | 1.000 | | | | |
| SGP | 0.147 | -0.049 | -0.366 | -0.086 | 0.558*** | -0.042 | 0.304* | 0.339** | 0.377** | 0.241 | 0.695*** | 0.071 | 0.225 | 0.132 | 1.000 | | | |
| TAW | 0.036 | -0.026 | -0.493 | -0.058 | 0.611*** | -0.141 | 0.347* | 0.184 | 0.259* | 0.109 | 0.297* | 0.151 | 0.207 | 0.155 | 0.551*** | 1.000 | | |
| THA | 0.164 | 0.138 | -0.244 | 0.071 | 0.525*** | 0.162 | 0.306* | 0.488*** | 0.608*** | -0.004 | 0.566*** | 0.026 | 0.195 | 0.161 | 0.504*** | 0.302* | 1.000 | |
| VTN | 0.001 | -0.095 | 0.701*** | -0.085 | -0.215 | -0.285 | 0.075 | -0.111 | -0.060 | -0.001 | -0.039 | -0.092 | 0.155 | -0.150 | -0.378 | -0.519 | -0.112 | 1.000 |

Notes: 1) ***, **, * : significant at the 1%, 5%, and 10% level, respectively. 2) AUS=Australia, BRU=Brunei, CAM=Cambodia, CHN=China, HKG=Hong Kong, IND=India, INO=Indonesia, JAP=Japan, KOR=Korea, LAO=Laos, MAL=Malaysia, MYA=Myanmar, NZL=New Zealand, PHL=Philippines, SGP=Singapore, TAW=Taiwan, THA=Thailand, VTN=Viet Nam.

are correlated significantly only with those to Laos. Supply disturbances to Brunei, Cambodia, and Myanmar are correlated significantly only with one of the other countries: Laos, Viet Nam, and Indonesia, respectively. Supply disturbances to the Philippines and Viet Nam have significant correlation with two of the other countries. In case of Laos, supply disturbances are significantly correlated with those of three countries.

Based on the size of the correlation coefficients of supply disturbances, we identify EA8 (Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand) as a feasible group for a currency union. These findings somewhat differ from previous studies. Bayoumi and Mauro (1999) analyze the data for eleven East Asian countries for the period of 1968-1989. They suggest that there are similarities between the aggregate supply disturbances of Hong Kong, Indonesia, Malaysia and Singapore. Bayoumi and Eichengreen (1994) analyze the data for nine East Asian countries (Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand) for the period of 1969-1989. They suggest two groups as feasible candidates for a currency union. The first group consists of Japan, Korea, and Taiwan; and Hong Kong, Indonesia, Malaysia, and Singapore are the member of the second group. The results of Eichengreen and Bayoumi (1999) are in line with those of Bayoumi and Eichengreen (1994) over the period of 1972-1989.

Baek and Song (2001), in view of pair-wise correlations of supply disturbances, suggest that six East Asian countries (Hong Kong, Indonesia, Japan, Korea, Malaysia, and Thailand) would be good candidates for a currency union. They consider fourteen East Asian countries over the period from 1970 to 1999. More recently, Ahn *et al.* (2006) cover eleven countries, including five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, Thailand), four East Asian countries (China, Hong Kong, Japan, Korea), and two Oceania countries (Australia and New Zealand) over the years from 1972 to 2002. They also find that six East Asian Countries, replacing Japan with Singapore in Baek and Song (2001), have a good reason to form a currency union. The main reason that our findings differ from

those of previous studies may be, first of all, that our data cover a longer sample period (1965-2005) along with a larger group of countries (eighteen countries). Specifically, the post-crisis period here may play an important role in explaining the differences in the estimation results.

2.2.1.2. Demand disturbances

The estimated correlations of demand disturbances are presented in table 4. Six countries (Indonesia, Japan, Malaysia, Singapore, Taiwan, and Thailand) among EA 8 exhibit demand shocks that are correlated highly with each other. For example, the correlation coefficient of demand disturbances of Japan is 0.677, 0.604, 0.537, and 0.516 with those of Thailand, Singapore, Taiwan, and Malaysia, respectively.⁶⁾ The patterns of the correlation coefficients are very similar among the other five countries. In sharp contrast to the case of supply shocks, however, Hong Kong and Korea seem to drop from EA 8 now. Demand shocks to Hong Kong have significant correlations with two other countries, Malaysia and the Philippines. One possible reason for weak correlations of Hong Kong may stem from the asymmetry of exchange rate systems. Hong Kong has adopted currency board, while many of East Asian countries shifted to floating exchange rate system after the 1997 financial crisis. A curious finding that warrants further investigation is for Korea. Demand shocks to Korea also have significant correlations with those of two countries only, Japan and Singapore.

What differs from the case of the supply shocks is that high and positive correlations of demand shocks are shared by the Philippines. The Philippines shows high and positive correlations of demand shocks with many of other countries. As in the case of supply disturbances, demand disturbances of China has no significant correlations with those of other countries. A possible reason is that in contrast to other countries, the Chinese yuan has been held fixed or fluctuated within a very limited band against the dollar for a long time period. As for the other members of ASEAN

⁶⁾ Note that all these correlation coefficients are significant at the 1% significance level.

Table 4 Correlations of Demand Shocks, 1965-2005

| | AUS | BRU | CAM | CHN | HKG | IND | INO | JAP | KOR | LAO | MAL | MYA | NZL | PHL | SGP | TAW | THA | VTN |
|-----|----------|--------|----------|--------|--------|----------|----------|----------|---------|----------|----------|---------|--------|--------|----------|----------|--------|-------|
| AUS | 1.000 | | | | | | | | | | | | | | | | | |
| BRU | -0.194 | 1.000 | | | | | | | | | | | | | | | | |
| CAM | 0.232 | -0.196 | 1.000 | | | | | | | | | | | | | | | |
| CHN | 0.003 | -0.067 | -0.072 | 1.000 | | | | | | | | | | | | | | |
| HKG | -0.241 | 0.183 | 0.048 | -0.109 | 1.000 | | | | | | | | | | | | | |
| IND | 0.168 | -0.118 | -0.246 | 0.203 | 0.256 | 1.000 | | | | | | | | | | | | |
| INO | 0.066 | 0.098 | -0.166 | -0.151 | -0.032 | 0.173 | 1.000 | | | | | | | | | | | |
| JAP | 0.193 | 0.003 | -0.085 | -0.034 | 0.107 | 0.433*** | 0.299* | 1.000 | | | | | | | | | | |
| KOR | 0.118 | -0.138 | 0.001 | 0.113 | 0.058 | 0.207 | 0.109 | 0.422*** | 1.000 | | | | | | | | | |
| LAO | 0.074 | -0.043 | -0.241 | -0.008 | -0.180 | -0.183 | 0.352* | 0.217 | -0.086 | 1.000 | | | | | | | | |
| MAL | 0.010 | 0.071 | -0.749 | -0.013 | 0.290* | 0.394** | 0.256 | 0.516*** | 0.146 | 0.276 | 1.000 | | | | | | | |
| MYA | 0.163 | 0.227 | 0.257 | -0.228 | 0.056 | 0.090 | 0.129 | 0.380** | 0.147 | -0.072 | 0.229 | 1.000 | | | | | | |
| NZL | -0.167 | -0.049 | 0.095 | 0.011 | 0.174 | -0.181 | -0.218 | -0.301 | -0.074 | -0.024 | -0.211 | -0.361 | 1.000 | | | | | |
| PHL | -0.208 | 0.051 | -0.449 | 0.057 | 0.271* | 0.299* | 0.120 | 0.453*** | 0.185 | -0.083 | 0.284* | 0.064 | -0.148 | 1.000 | | | | |
| SGP | 0.486*** | -0.064 | -0.114 | 0.181 | 0.069 | 0.493*** | 0.286* | 0.604*** | 0.346** | 0.535*** | 0.496*** | 0.188 | -0.136 | 0.112 | 1.000 | | | |
| TAW | 0.343** | 0.169 | 0.104 | -0.061 | -0.235 | 0.106 | 0.267* | 0.537*** | 0.202 | -0.058 | 0.187 | 0.379** | -0.280 | 0.096 | 0.478*** | 1.000 | | |
| THA | 0.322** | -0.051 | -0.017 | -0.021 | 0.073 | 0.428*** | 0.524*** | 0.677*** | 0.199 | 0.401** | 0.591*** | 0.257 | -0.223 | 0.158 | 0.689*** | 0.402*** | 1.000 | |
| VTN | 0.058 | -0.094 | 0.796*** | -0.080 | -0.005 | -0.180 | -0.009 | 0.056 | 0.085 | 0.023 | -0.394 | 0.235 | 0.025 | -0.141 | -0.145 | -0.070 | -0.056 | 1.000 |

Notes: 1) ***, **, *: significant at the 1%, 5%, and 10% level, respectively. 2) AUS=Australia, BRU=Brunei, CAM=Cambodia, CHN=China, HKG=Hong Kong, IND=India, INO=Indonesia, JAP=Japan, KOR=Korea, LAO=Laos, MAL=Malaysia, MYA=Myanmar, NZL=New Zealand, PHL=Philippines, SGP=Singapore, TAW=Taiwan, THA=Thailand, VTN=Viet Nam.

Table 5 Correlations of Growth Rates, 1965-2005

| | AUS | BRU | CAM | CHN | HKG | IND | INO | JAP | KOR | LAO | MAL | MYA | NZL | PHL | SGP | TAW | THA | VTN | |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|--------|-------|--|
| AUS | 1.000 | | | | | | | | | | | | | | | | | | |
| BRU | -0.375 | 1.000 | | | | | | | | | | | | | | | | | |
| CAM | 0.115 | 0.157 | 1.000 | | | | | | | | | | | | | | | | |
| CHN | 0.081 | -0.083 | 0.381 | 1.000 | | | | | | | | | | | | | | | |
| HKG | -0.047 | 0.321 | 0.583 | 0.528 | 1.000 | | | | | | | | | | | | | | |
| IND | 0.297 | -0.133 | 0.061 | 0.009 | -0.122 | 1.000 | | | | | | | | | | | | | |
| INO | -0.286 | 0.560 | -0.002 | 0.169 | 0.604 | -0.024 | 1.000 | | | | | | | | | | | | |
| JAP | -0.264 | 0.167 | 0.092 | -0.240 | 0.413 | -0.290 | 0.486 | 1.000 | | | | | | | | | | | |
| KOR | -0.155 | 0.591 | 0.256 | 0.089 | 0.665 | -0.298 | 0.796 | 0.500 | 1.000 | | | | | | | | | | |
| LAO | -0.014 | -0.004 | -0.464 | -0.296 | -0.316 | 0.579 | 0.174 | -0.348 | -0.148 | 1.000 | | | | | | | | | |
| MAL | -0.190 | 0.435 | -0.075 | 0.205 | 0.644 | -0.122 | 0.896 | 0.494 | 0.822 | 0.123 | 1.000 | | | | | | | | |
| MYA | -0.023 | 0.050 | -0.131 | -0.042 | -0.284 | 0.693 | -0.082 | -0.578 | -0.401 | 0.738 | -0.238 | 1.000 | | | | | | | |
| NZL | 0.563 | 0.219 | 0.521 | 0.427 | 0.379 | 0.255 | 0.067 | -0.381 | 0.208 | -0.181 | -0.010 | 0.117 | 1.000 | | | | | | |
| PHL | 0.488 | 0.296 | 0.147 | -0.112 | 0.280 | 0.218 | 0.458 | 0.404 | 0.376 | 0.043 | 0.361 | -0.046 | 0.300 | 1.000 | | | | | |
| SGP | 0.159 | 0.110 | -0.050 | 0.227 | 0.640 | -0.101 | 0.598 | 0.428 | 0.646 | 0.011 | 0.834 | -0.392 | 0.080 | 0.342 | 1.000 | | | | |
| TAW | 0.200 | -0.145 | 0.290 | 0.294 | 0.563 | -0.234 | 0.230 | 0.350 | 0.459 | -0.304 | 0.470 | -0.585 | 0.135 | 0.044 | 0.682 | 1.000 | | | |
| THA | -0.186 | 0.356 | 0.082 | 0.132 | 0.573 | -0.132 | 0.848 | 0.644 | 0.841 | -0.078 | 0.830 | -0.346 | 0.046 | 0.390 | 0.641 | 0.422 | 1.000 | | |
| VTN | 0.033 | -0.080 | -0.463 | 0.223 | -0.111 | 0.447 | 0.315 | -0.288 | -0.176 | 0.676 | 0.267 | 0.532 | -0.120 | 0.168 | 0.125 | -0.255 | -0.015 | 1.000 | |

Note: AUS=Australia, BRU=Brunei, CAM=Cambodia, CHN=China, HKG=Hong Kong, IND=India, INO=Indonesia, JAP=Japan, KOR=Korea, LAO=Laos, MAL=Malaysia, MYA=Myanmar, NZL=New Zealand, PHL=Philippines, SGP=Singapore, TAW=Taiwan, THA=Thailand, VTN=Viet Nam.

Table 6 Correlations of Inflation Rates, 1965-2005

| | AUS | BRU | CAM | CHN | HKG | IND | INO | JAP | KOR | LAO | MAL | MYA | NZL | PHL | SGP | TAW | THA | VTN | |
|-----|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|--|
| AUS | 1.000 | | | | | | | | | | | | | | | | | | |
| BRU | 0.269 | 1.000 | | | | | | | | | | | | | | | | | |
| CAM | -0.091 | -0.243 | 1.000 | | | | | | | | | | | | | | | | |
| CHN | 0.041 | 0.129 | 0.284 | 1.000 | | | | | | | | | | | | | | | |
| HKG | 0.283 | -0.095 | 0.458 | 0.397 | 1.000 | | | | | | | | | | | | | | |
| IND | 0.363 | -0.377 | 0.523 | 0.356 | 0.677 | 1.000 | | | | | | | | | | | | | |
| INO | -0.209 | -0.449 | -0.109 | -0.431 | -0.157 | -0.054 | 1.000 | | | | | | | | | | | | |
| JAP | 0.027 | -0.201 | 0.523 | 0.293 | 0.888 | 0.590 | -0.040 | 1.000 | | | | | | | | | | | |
| KOR | -0.061 | -0.349 | 0.664 | 0.511 | 0.768 | 0.628 | -0.070 | 0.817 | 1.000 | | | | | | | | | | |
| LAO | 0.082 | -0.063 | -0.074 | -0.362 | -0.061 | 0.166 | 0.496 | 0.042 | -0.196 | 1.000 | | | | | | | | | |
| MAL | 0.145 | 0.066 | -0.161 | 0.124 | 0.165 | 0.129 | 0.350 | 0.133 | 0.127 | 0.100 | 1.000 | | | | | | | | |
| MYA | 0.034 | -0.275 | 0.093 | -0.204 | 0.374 | 0.146 | 0.201 | 0.327 | 0.211 | 0.254 | -0.017 | 1.000 | | | | | | | |
| NZL | 0.801 | 0.085 | -0.011 | 0.340 | 0.242 | 0.410 | -0.198 | 0.024 | 0.009 | 0.095 | -0.031 | -0.055 | 1.000 | | | | | | |
| PHL | 0.012 | -0.170 | 0.537 | 0.157 | 0.534 | 0.570 | 0.209 | 0.741 | 0.576 | 0.267 | 0.233 | -0.071 | -0.017 | 1.000 | | | | | |
| SGP | 0.478 | 0.076 | 0.478 | 0.593 | 0.621 | 0.553 | -0.344 | 0.542 | 0.553 | -0.274 | 0.316 | -0.110 | 0.497 | 0.506 | 1.000 | | | | |
| TAW | -0.119 | -0.282 | 0.583 | 0.277 | 0.852 | 0.486 | 0.120 | 0.864 | 0.831 | -0.019 | 0.080 | 0.431 | -0.079 | 0.593 | 0.401 | 1.000 | | | |
| THA | 0.204 | -0.221 | 0.258 | 0.309 | 0.638 | 0.467 | 0.368 | 0.578 | 0.578 | -0.112 | 0.552 | 0.196 | 0.197 | 0.476 | 0.497 | 0.645 | 1.000 | | |
| VTN | 0.785 | 0.011 | 0.021 | 0.151 | 0.605 | 0.708 | -0.131 | 0.432 | 0.318 | 0.220 | 0.273 | 0.173 | 0.627 | 0.317 | 0.492 | 0.213 | 0.355 | 1.000 | |

Note: AUS=Australia, BRU=Brunei, CAM=Cambodia, CHN=China, HKG=Hong Kong, IND=India, INO=Indonesia, JAP=Japan, KOR=Korea, LAO=Laos, MAL=Malaysia, MYA=Myanmar, NZL=New Zealand, PHL=Philippines, SGP=Singapore, TAW=Taiwan, THA=Thailand, VTN=Viet Nam.

(Cambodia, Laos, Myanmar, and Viet Nam), demand shocks show only a few cases of significant correlations with those of the other countries. Bayoumi and Eichengreen (1994) suggest a group of five countries (Hong Kong, Indonesia, Malaysia, Singapore and Thailand) with highly correlated demand shocks.

To confirm whether the country grouping suggested above is supported by the raw data, we further investigate correlations of real GDP growth and inflation directly. Tables 5 and 6 present the correlation coefficients of real GDP growth rates and inflation rates, respectively. The estimation results are very similar to those of supply and demand disturbances. This is due to the fact that real GDP growth rates are associated closely with (permanent) supply shocks while inflation rates are tied to (temporary) demand shocks such as fiscal, monetary, and exchange rate policies. EA 8 countries show real GDP growth rates that are highly correlated with each other, as in the case of inflation rates. The other ASEAN countries (Brunei, Cambodia, Laos, Myanmar, and Viet Nam) have weak correlations with the core group of countries in both growth and inflation rates.

2.2.2. Size of disturbances and speed of adjustment

The size of disturbances and the speed at which the economy adjusts to shocks are also important considerations in evaluating the feasibility of country groupings as a currency union. The smaller the disturbances are, and the faster an economy responds, the smaller the costs of fixing the exchange rate and relinquishing policy independence.

2.2.2.1. Size of disturbances

The estimated sizes of supply and demand disturbances are shown in the second and fourth column of table 7, respectively. The variance of the estimated disturbances was set to unity so that their magnitude measures the effect of a unit shock on output and prices, which is obtained from the associated impulse response functions. For the supply disturbances, which are permanent, their size measures the long-run effect on real GDP. For the

Table 7 Size of Shocks and Speed of Adjustment to Shocks, 1965-2005

| Countries | Supply Shocks | | Demand Shocks | |
|----------------|---------------|--------------|---------------|--------------|
| | Size | Speed | Size | Speed |
| Australia | 0.024 | 0.479 | 0.023 | 0.199 |
| Brunei | 0.066 | 1.167 | 0.140 | 1.172 |
| Cambodia | 0.033 | 0.966 | 0.237 | 0.857 |
| China | 0.067 | 0.821 | 0.030 | 0.639 |
| Hong Kong | 0.048 | 1.024 | 0.034 | 0.543 |
| India | 0.052 | 1.067 | 0.019 | 0.979 |
| Indonesia | 0.052 | 0.913 | 0.113 | 0.867 |
| Japan | 0.080 | 0.457 | 0.018 | 0.526 |
| Korea | 0.054 | 0.637 | 0.014 | 0.259 |
| Laos | 0.028 | 0.988 | 0.236 | 0.894 |
| Malaysia | 0.042 | 0.994 | 0.049 | 1.019 |
| Myanmar | 0.072 | 0.864 | 0.077 | 0.808 |
| New Zealand | 0.027 | 0.991 | 0.038 | 0.519 |
| Philippines | 0.050 | 0.832 | 0.042 | 0.910 |
| Singapore | 0.052 | 0.890 | 0.040 | 0.876 |
| Taiwan | 0.051 | 0.845 | 0.043 | 0.850 |
| Thailand | 0.065 | 0.770 | 0.039 | 0.803 |
| Viet Nam | 0.043 | 0.441 | 0.208 | 0.523 |
| Average | 0.050 | 0.841 | 0.078 | 0.736 |
| Before Crisis | 0.069 | 0.894 | 0.175 | 0.839 |
| EMU | 0.032 | 0.683 | 0.023 | 0.413 |

Note: Estimates for the before-crisis period are from Baek and Song (2001), and estimates for EMU are from Bayoumi and Eichengreen (1994).

demand disturbances, which are temporary, we calculate their size as the sum of the first-year impact on output and prices that measures the short-run effect on nominal GDP. On average, the supply disturbances of eighteen countries are 0.050, about one and a half times as large as the average size of supply disturbances in the EMU, and range from 0.048 to 0.080 for the EA 8.

For demand disturbances, the average size of eighteen countries is 0.078, 3.4 times as large as that of the EMU. This is mainly due to the fact that Brunei, Cambodia, Laos, and Viet Nam experience large demand shocks. The size of demand disturbances for Cambodia and Laos is about 0.24. The core eight countries have demand disturbances in the range of 0.014 to 0.043 with an exception of Indonesia. Korea has the lowest value of 0.014 while Indonesia has the highest value of 0.113. The average size of the core group, excluding Indonesia, reduces to 0.0338, roughly one and half times as great as that of the EMU. Note that China experiences a relatively small size of demand disturbances (0.030).

2.2.2.2. Speed of adjustment

The speed of adjustment denotes the response for the first two years after the shock as a share of the long-run effect. The estimated results are shown in the third and fifth columns of table 7. The average speed of adjustment is around 0.841 and 0.736 for supply and demand disturbances, respectively, implying that about 84% to 74% of the changes in output and prices occur within two years. In contrast, it takes longer for the EMU where, in the first two years, 68% of real GDP changes occurs in the case of supply shocks, and 41% of price changes is brought about in case of demand shocks.

One interesting observation is that Japan and Korea are characterized by the slowest speed of adjustments in supply and demand disturbances among EA 8. In Japan, less than half of long-run change in real GDP occurs in two years and in Korea, only 26% of long-run change in nominal GDP occurs in two years.

2.3. Factor Mobility

Mundell (1961) asserts that perfect factor mobility would operate as an adjustment mechanism to mitigate the adverse consequences of asymmetric shocks in a currency area. He argues that countries with high labor and capital mobility are suitable candidates for a currency area. McKinnon

(1963) also states that factor mobility can serve as an adjustment mechanism to smooth out adverse effects of idiosyncratic demand shocks. Various studies investigate the labor mobility among the EMU countries compared with that of the U.S.⁷⁾

2.3.1. Real capital mobility

We examine the extent to which real capital can move into and out of East Asia. Table 8 shows inward and outward foreign direct investment (FDI) stocks as a percentage of GDP in East Asia during 1980-2008. The East Asia economies have maintained regional integration through not only international trade but also foreign direct investment. As a result, FDI inflows to East Asia recorded a very high rate from the mid-1980s to 2008, notably faster than trade. The amount of FDI inflows of East Asia increased from \$5.2 billion in 1985 to \$74.8 billion in 1995, and reached \$268.7 billion in 2008. FDI inflows to China are the largest among East Asian economies, followed by Hong Kong, Taiwan and Korea. Recently, some ASEAN countries including Asian NIEs have been active as foreign direct investors, especially in China. East Asia's overall share of inward FDI to GDP continues to grow and outward FDI stocks are also on the rise.

2.3.2. Labor mobility

Tower and Willett (1976) say that "both the greater relative wage-price flexibility and the higher mobility of labor in the long run would tend to reduce the sum of unemployment over time necessary to accomplish a given amount of adjustment when capital is highly mobile". If shocks cause productivity differences among countries with high labor mobility, they tend to be eliminated by the movement of workers from countries with higher productivity to others.

Goto and Hamada (1994) examine shares of foreign workers and outflows of domestic labor to foreign countries in several East Asian countries, and document that the labor mobility in Southeast Asia might be as high as that

⁷⁾ Refer to Eichengreen (1990, 1993), Decressin and Fatás (1995), and Krueger (2000).

Table 8 Inward and Outward FDI Stock as a Percentage of GDP, 1980-2008

| | | 1980 | 1985 | 1990 | 1995 | 2000 | 2003 | 2006 | 2007 | 2008 |
|-------------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Brunei | Inward | 0.4 | 0.8 | 1.0 | 12.9 | 64.5 | 134.3 | 85.3 | 81.7 | 71.2 |
| | Outward | n.a. | n.a. | n.a. | 6.5 | 7.4 | 8.5 | 5.7 | 5.6 | 5.0 |
| Cambodia | Inward | 5.3 | 3.6 | 2.2 | 10.7 | 43.1 | 42 | 40.6 | 44.2 | 41.5 |
| | Outward | n.a. | n.a. | n.a. | 4.2 | 5.3 | 5.2 | 3.8 | 3.3 | 2.8 |
| Indonesia | Inward | 5.7 | 6.0 | 6.9 | 9.3 | 15.2 | 4.4 | 15 | 13.7 | 13.1 |
| | Outward | - | 0.1 | 0.1 | 2.7 | 4.2 | 3.2 | 4.6 | 4.9 | 5.3 |
| Laos | Inward | 0.7 | 0.1 | 1.4 | 11.9 | 32.1 | 29.3 | 24.6 | 28.3 | 26.8 |
| | Outward | - | - | - | 0.4 | 1.2 | 1.0 | 0.6 | 0.5 | 0.4 |
| Malaysia | Inward | 21.1 | 23.7 | 23.4 | 32.3 | 56.2 | 37.4 | 34.4 | 41.0 | 33.0 |
| | Outward | 1.2 | 1.3 | 1.7 | 5.8 | 16.9 | 10.9 | 23.1 | 31.2 | 30.4 |
| Myanmar | Inward | - | - | 5.4 | 15.6. | 53.1 | 45.4. | 36.4 | 28.4 | 20.4 |
| | Outward | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Philippines | Inward | 2.8 | 6 | 10.2 | 13.7 | 24.2 | 14.3 | 14.4 | 13.8 | 12.7 |
| | Outward | 0.3 | 1.0 | 0.9 | 1.8 | 2.7 | 1.6 | 1.8 | 3.9 | 3.4 |
| Singapore | Inward | 45.7 | 60.0 | 82.6 | 78.2 | 119.3 | 155.4 | 175.7 | 181.7 | 179.3 |
| | Outward | 6.6 | 6.1 | 21.2 | 41.8 | 61.2 | 96.9 | 108.5 | 107.9 | 103.9 |
| Thailand | Inward | 3.0 | 5.1 | 9.7 | 10.5 | 24.4 | 34.3 | 37.3 | 38.6 | 38.4 |
| | Outward | - | - | 0.5 | 1.4 | 1.8 | 2.4 | 3.1 | 3.3 | 4.0 |
| Viet Nam | Inward | 59.1 | 30.2 | 25.5 | 34.5 | 66.1 | 69.5 | 55.1 | 56.6 | 53.8 |
| | Outward | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| China | Inward | 0.4 | 2.0 | 5.1 | 13.4 | 16.2 | 13.9 | 11.0 | 9.7 | 8.7 |
| | Outward | n.a. | 0.3 | 1.1 | 2.3 | 2.3 | 2.0 | 2.8 | 2.8 | 3.4 |
| Hong Kong | Inward | 616.8 | 515.6 | 252.3 | 157.8 | 269.3 | 240.5 | 390.9 | 568.6 | 388.1 |
| | Outward | 0.5 | 6.6 | 15.5 | 54.7 | 229.6 | 214.2 | 356.5 | 488.3 | 360.3 |
| Taiwan | Inward | 5.7 | 4.6 | 5.9 | 5.7 | 6.1 | 12.2 | 13.7 | 12.6 | 11.6 |
| | Outward | 30.8 | 20.9 | 18.4 | 15.6 | 20.7 | 27.5 | 34.7 | 41.2 | 44.6 |
| Korea | Inward | 1.8 | 1.9 | 2.0 | 1.8 | 7.1 | 10.3 | 12.5 | 11.4 | 9.8 |
| | Outward | 0.2 | 0.5 | 0.9 | 2.0 | 5.0 | 3.9 | 5.2 | 7.1 | 10.3 |
| Japan | Inward | 0.3 | 0.4 | 0.3 | 0.6 | 1.1 | 2.1 | 2.5 | 3.0 | 4.1 |
| | Outward | 1.9 | 3.3 | 6.7 | 4.5 | 6.0 | 7.9 | 10.3 | 12.4 | 13.9 |

Notes: The term, "n.a." indicates that data are not available. "-" indicates that the magnitude is negligible.

Source: UNCTAD, *World Investment Report 2009* (Statistical Annex FDI Tables).

Table 9 Estimated Stocks and Ratio of Migrant Workers in East Asia

| Source Country | Number (Ratio ¹⁾) | Main Destination | Year |
|------------------------|-------------------------------|---|------|
| Cambodia | 200,000 (3.3) | Malaysia, Thailand | 1999 |
| Indonesia | 2,000,000 (2.0) | Malaysia, Taiwan, Singapore, Korea, Middle East | 2001 |
| Laos | 173,000 (7.5) | Thailand | 2004 |
| Malaysia ²⁾ | 250,000 (2.8) | Japan, Taiwan | 1995 |
| Myanmar | 1,100,000 (4.3) | Thailand | 2001 |
| Philippines | 4,750,000 (12.8) | Middle East, Malaysia, Thailand, Korea, Hong Kong, Taiwan | 2005 |
| Singapore | 150,000 (7.5) | | 2002 |
| Thailand | 340,000 (0.9) | Taiwan, Myanmar, Singapore, Brunei, Malaysia, Saudi Arabia | 2002 |
| Viet Nam | 340,000 (0.8) | Korea, Japan, Malaysia, Taiwan | 2004 |
| China | 530,000 (0.1) | Middle East, Asia Pacific, Africa | 2004 |
| Korea | 632,000 (2.6) | Japan | 2002 |
| Japan | 61,000 (0.1) | Hong Kong | 2000 |
| Total | 10,526,000 | | |

Notes: 1) Migrant workers ratio (%)=estimates number of migrant workers/labor forces. 2) Available year for labor force is 1998.

Sources: Hugo (2005) and *World Development Indicators*.

in Europe. Eichengreen and Bayoumi (1999) show that labor markets are more flexible in East Asia than in Europe and the speed of adjustment to a shock are much faster in East Asia.

Tables 9 shows there are over 10 million East Asian workers in other countries and nearly 6 million foreign workers in East Asia. The largest labor migrants originate from the Southeast Asian countries, particularly from the Philippines (4.8 million, mainly to the Middle East, Malaysia, Thailand, Korea, Hong Kong, and Taiwan), followed by Indonesia (2 million, mainly to the Middle East, Malaysia, Taiwan, Singapore, and Korea), Myanmar (1.1 million, mainly to Thailand), Korea (0.6 million, mainly to

Table 10 Estimated Stocks and Ratio of Foreign Labor in East Asia

| Country | Stocks (Ratio ¹⁾) | Sources | Year |
|----------------------|--------------------------------|---------------------------------------|------|
| Brunei ²⁾ | 91,800 (57.2) | <i>Migration News</i> , February 2000 | 1999 |
| Indonesia | 91,736 (0.09) | Soeprobo, 2005 | 2004 |
| Malaysia | 1,359,500 (12.7) | Kanapathy, 2005 | 2004 |
| Philippines | 9,168 (0.03) | Go, 2005 | 2003 |
| Singapore | 580,000 (26.4) | Yap, 2005 | 2004 |
| Thailand | 1,623,776 (4.6) | Chalamwong, 2005 | 2004 |
| Viet Nam | 30,000 (0.07) | Nguyen, 2003 | 2001 |
| China | 90,000 (0.01) | Ma, 2005 | 2003 |
| Hong Kong | 216,863 (5.9) | Chiu, 2005 | 2003 |
| Taiwan | 600,177 (5.9) | Lee, 2005 | 2003 |
| Korea | 423,597 (1.8) | Park, 2005 | 2004 |
| Japan | 870,000 (1.4) | Iguchi, 2005 | 2004 |
| Total | 5,986,617 | | |

Notes: 1) Foreign labor ratio (%)=estimates number of foreign labor/labor forces. 2) Available year for labor force is 2004 in http://www.brunei.gov.bn/about_brunei/land.htm.

Sources: Hugo (2005), *World Development Indicator*, and National Statistical Office (2005).

Japan), and China (0.5 million, mainly to the Middle East, Asia-Pacific, and Africa).

Table 10 indicates that the main labor recipient countries are Thailand with 1.6 million, followed by 1.4 million in Malaysia, 0.9 million in Japan, 0.6 million in Taiwan, 0.6 million in Singapore, 0.4 million in Korea, and 0.2 million in Hong Kong. Although the stock of foreign workers was a relatively small part of the total labor supply in most importing countries, the growth rate of labor supply increased gradually since the early 1990s.

2.4. Wage and Price Flexibility

Corden (1972) considers the flexibility of prices and wages as the most important criterion in forming a currency area.⁸⁾ Flexibility of prices and

⁸⁾ However, Tower and Willett (1976) argue that exchange rate adjustments are only a partial

wages diminishes the need for employing the exchange rate for adjustment within a currency area. Price and wage flexibility are particularly important in the very short-run to facilitate the adjustment process following a shock.

Labor markets are more flexible in East Asia than in most industrial countries. Ngiam and Yuen (2001) examine the minimum wage policy in East Asian countries and compare it with that in EU. They find that most of the countries in Euroland maintain some kind of minimum wage policies, but a few East Asian countries have minimum wage policies. As we can see in table 11, many of countries in EU keep minimum wage policies. These countries may not easily adjust wages to clear the labor market compared with East Asian countries as Ngiam and Yuen (2001) suggest.

2.5. Financial Market Integration

Financial integration has been considered as a prerequisite for a potential OCA. Various measures of financial integration are divided into three categories: regulatory measures, quantity-based measures, and price-based measures. This section focuses on the first two categories of measures since the applicability of price-based measures is limited not only by difficulties in controlling for cross-country differences in risk premium, but also by the possibility that co-movements of interest rates, stock prices and exchange rates could reflect common factors or similarities in fundamentals rather than the degree of financial integration.

A large number of studies have attempted to measure the degree of financial integration. Among others, Miniane (2004) constructs the degree of capital controls for 34 countries during 1983-2000. Table 12 reports capital controls index constructed by Miniane (2004). According to the Miniane's index, only Japan, Hong Kong, Australia, and Singapore had relatively low degrees of capital controls in 2000, whereas four other Asian countries kept strict restrictions on capital account transactions. Since Miniane's index covers only 8 Asian countries, and many of these countries

substitute for wage and price adjustment.

Table 11 Comparing Labor Market Conditions in East Asia and European Union

| | Minimum Wage Policy | Unemployment Rate | |
|-------------|---------------------|-------------------|-------------|
| | (1995-1999) | (1990-1992) | (2000-2004) |
| Brunei | n.a. | n.a. | n.a. |
| Cambodia | n.a. | n.a. | 1.8 |
| Indonesia | Yes ²⁾ | 3.9 | 9.9 |
| Laos | n.a. | n.a. | n.a. |
| Malaysia | No ¹⁾ | 3.7 | 3.5 |
| Myanmar | n.a. | n.a. | n.a. |
| Philippines | Yes | 8.6 | 9.8 |
| Singapore | n.a. | 2.7 | 5.4 |
| Thailand | Yes ²⁾ | 1.4 | 1.5 |
| Viet Nam | Yes | n.a. | 2.1 |
| China | n.a. | 2.3 | 4.0 |
| Hong Kong | n.a. | 2.0 | 7.9 |
| Taiwan | n.a. | n.a. | n.a. |
| Korea | Yes | 2.5 | 3.5 |
| Japan | Yes | 2.2 | 4.7 |
| East Asia | | 2.5 | 4.4 |
| Austria | No ¹⁾ | 3.6 | 4.9 |
| Belgium | Yes | 6.7 | 7.4 |
| Denmark | Yes | 9.0 | 5.2 |
| Finland | No ¹⁾ | 11.7 | 8.9 |
| France | Yes ²⁾ | 10.0 | 9.9 |
| Germany | No ¹⁾ | 6.6 | 9.8 |
| Greece | Yes | 7.8 | 10.2 |
| Ireland | Yes | 15.2 | 4.4 |
| Italy | No ³⁾ | 11.6 | 8.0 |
| Luxembourg | n.a. | n.a. | n.a. |
| Netherlands | Yes | 5.5 | 4.3 |
| Portugal | Yes | 4.1 | 6.7 |
| Spain | Yes | 18.1 | 11.0 |
| Sweden | n.a. | 5.7 | 6.5 |
| EU | | 9.5 | 9.2 |

Notes: 1) Country has sectoral minimum wage but no minimum wage policy. 2) Refer to 1990-1994. 3) The term, "n.a." indicates that data are not available.

Source: *World Development Indicators*, various years.

Table 12 Indexes of Financial Integration

| | Miniane | | Chinn and Ito | | Lane and Milesi-Ferretti (%) | |
|----------------|--------------|--------------|---------------|--------------|------------------------------|--------------|
| | 1990 | 2000 | 1990 | 2005 | 1986-1990 | 2000-2004 |
| Asia | | | | | | |
| Australia | 0.500 | 0.462 | 1.226 | 2.327 | 94.1 | 207.3 |
| Brunei | - | - | - | - | 431.1 | 861.8 |
| Cambodia | - | - | -0.062* | 0.653 | 96.3* | 182.8 |
| China | - | - | -1.767 | -1.105 | 27.5 | 94.2 |
| Hong Kong | 0.077 | 0.231 | 2.603 | 2.603 | 1,290.3 | 1,228.1 |
| India | 0.917 | 0.923 | -1.105 | -1.105 | 27.3 | 50.7 |
| Indonesia | - | - | 2.603 | 1.226 | 76.9 | 115.2 |
| Japan | 0.462 | 0.154 | 2.603 | 2.603 | 92.9 | 118.5 |
| Korea | 0.846 | 0.769 | -0.062 | -0.062 | 42.6 | 95.7 |
| Lao | - | - | -1.767 | -1.105 | 136.1 | 189.8 |
| Malaysia | 0.846 | 0.846 | 2.603 | -0.062 | 134.8 | 204.9 |
| Myanmar | - | - | -1.105 | -1.767 | 43.8 | 129.4 |
| New Zealand | - | - | 2.603 | 2.603 | 124.8 | 223.8 |
| Philippines | 0.923 | 0.846 | -1.105 | -1.767 | 103.3 | 141.6 |
| Singapore | 0.231 | 0.462 | 2.603 | 2.603 | 359.3 | 930.2 |
| Taiwan | - | - | - | - | 108.5 | 200.1 |
| Thailand | - | - | -0.062 | -0.062 | 65.0 | 132.3 |
| Viet Nam | - | - | -1.767 | -1.105 | 96.2* | 111.3 |
| Average | 0.601 | 0.587 | 0.540 | 0.405 | 99.0 | 149.6 |
| EU | | | | | | |
| Average | 0.401 | 0.187 | 1.091 | 2.445 | 151.0 | 469.3 |
| NAFTA | | | | | | |
| Average | 0.462 | 0.410 | 1.494 | 2.144 | 80.4 | 166.7 |

Notes: (-) denotes that data are not available and (*) is data for the year 1995. While a high value of Miniane's index indicates a higher (lower) degree of capital controls (openness), a higher value of the Chinn-Ito's index implies a higher degree of financial openness.

Sources: Miniane (2004), Chinn and Ito (2008), Lane and Milesi-Ferretti (2006), and author's calculation.

were not free from unexpected shocks of the 1997-1998 financial crisis, comparison between Asia and the EU conveys limited information about capital controls in the two regions.

We therefore turn to the Chinn and Ito (2008) index that incorporates as many countries and years as those available in the *AREAER*. Chinn and Ito (2008) construct an index of financial openness for 181 countries during the period 1970-2005. Their index covers 16 Asian countries (Brunei and Taiwan excluded) and 14 countries in EU (Luxemburg excluded). Besides restrictions on capital account transactions, their index incorporates 3 more categories of restrictions on external accounts: presence of multiple exchange rates, restrictions on current account transactions, and surrender requirement for export proceeds. In order to focus on financial openness rather than controls, they reverse the dummies such that the variables are equal to one when capital controls are non-existent. According to the Chinn and Ito (2008) index presented in table 12, Asian countries overall have lower degrees of financial integration than those of the EU.

While the two regulatory measures described above are concerned with *de jure* controls on capital transactions, quantity-based measures reflect *de facto* financial integration that has taken place actually. The volume of cross-border capital flows is one indicator of the degree of international financial integration. The most widely accepted index of quantity-based measures is the sum of gross external assets and liabilities relative to GDP (Lane and Milesi-Ferretti, 2006). This is a capital account counterpart to the conventional trade openness measure. Table 12 exhibits the average ratios of Lane and Milesi-Ferretti's indicators during 1986-1990 and 2000-2004 for Asian countries, the EU, and the NAFTA. The average ratio of the East Asian countries during 2000-2004 is comparable to that of the NAFTA but much lower than that of the EU in the same period. It is worthwhile to note, however, that the average ratio of the Asian countries during 2000-2004 is similar to that of the EU during 1986-1990.

2.6. Production Diversification

If an economy is more diversified in its products, it can reduce the need to frequently change its nominal exchange rate as an adjustment instrument.

Table 13 Production Diversification in Manufacturing Sector in East Asia¹⁾

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|-------------------------|--------------------|-------|-------------|-------|-------------|-------|-------------|
| Brunei | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Cambodia | n.a. | n.a. | n.a. | 32.91 | n.a. | n.a. | n.a. |
| Indonesia | n.a. | 4.28 | 4.22 | 3.83 | 3.93 | 3.72 | 4.05 |
| Laos | n.a. | n.a. | 18.69 | n.a. | n.a. | n.a. | n.a. |
| Malaysia | n.a. | n.a. | n.a. | 5.88 | 5.62 | 4.89 | 5.37 |
| Myanmar | 22.63 | 21.62 | 18.18 | 11.04 | 15.67 | 39.24 | n.a. |
| Philippines | 5.77 | 6.48 | 5.66 | n.a. | 6.33 | n.a. | 6.36 |
| Singapore | 10.42 | 10.07 | 9.11 | 11.86 | 9.35 | 10.05 | 11.08 |
| Thailand | 4.07 ²⁾ | 6.38 | n.a. | 4.52 | n.a. | n.a. | n.a. |
| Viet Nam | n.a. | 5.04 | n.a. | n.a. | n.a. | 4.73 | n.a. |
| China | 6.49 | 6.79 | 7.89 | 7.31 | 8.30 | 7.36 | 7.51 |
| Hong Kong | 9.34 | 9.28 | 10.01 | 10.99 | 11.74 | 11.02 | 11.87 |
| Taiwan | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Japan | n.a. | 3.25 | 3.30 | 3.32 | 3.42 | 3.66 | n.a. |
| Korea | n.a. | 3.72 | 3.85 | 4.04 | 3.66 | 3.87 | n.a. |
| East Asia ³⁾ | 9.79 | 7.69 | 8.99 | 9.57 | 7.56 | 9.84 | 7.71 |
| EU ⁴⁾ | 6.29 (1985) | | 6.53 (1990) | | 6.56 (1995) | | 6.87 (1998) |

Notes: 1) The term, "n.a." indicates that data are not available and figures in parentheses indicate years. 2) Data of 1996. 3) Average of countries that have data. 4) Calculated from UNIDO, *International Yearbook of Industrial Statistics*.

Source: UNIDO, *International Yearbook of Industrial Statistics*, various years.

Thus, a more diversified economy is more suitable for a currency union than a less diversified one (Kenen, 1969). Table 13 compares the degree of product diversification in East Asia during 1997-2003 and in EU during 1985-1998 before the starting of EU. The values in table 13 are constructed by a Herfindahl Index:

$$\text{Product Diversification}_i (PD_i) = 100 * \sum_{j=1}^n S_j^2,$$

where PD_i is the product diversification index for the country i , where S_j is the fraction occupied by sector j in total value added of manufacturing industries in country i . A higher value indicates a lower degree of product diversification. The value of the index can vary from 0 to 100. The data we used is from UNIDO's *International Yearbook of Industrial Statistics* and is on manufacturing industries classified at 3-digit level of ISIC (International Standard Industrial Classification). Table 13 shows that the industrial structure in East Asia is diversified over the period 1997-2003. On average, East Asian countries had a value of about 8.7 during 1997-2003. This is higher than 6.6 for EU during 1985-1998.

2.7. Similarities of Inflation Rates

The similarity of inflation rates is one of the criteria used for examining the suitability of a currency union. Haberler (1970) and Fleming (1971) argue that similarity of inflation rates is an OCA criterion because divergent inflation rates will eventually make the purchasing power of two countries divergent. Jonung and Sjöholm (1998) argue that if countries are to be good candidates for a currency union, the patterns and levels of inflation should be similar across countries over time.⁹⁾ Recently, Mongelli (2002) shows that persistent differences in national inflation rates can cause external imbalance.

As shown in table 14, the average rates of inflation in East Asia differ considerably during 1990-2006. Cambodia has the highest average rate of inflation, followed by Myanmar and Laos, though the rate has fallen recently. The dissimilarity in the average rates of inflation in the East Asian countries reflects some dissimilarity in the way they have been conducting their economic policies, and hence making it more difficult for them to form a currency union.

⁹⁾ On the other hand, difference in inflation rate may not be a problem. Gandolfo (1992) argues that similarities of inflation rates could be a feasible outcome from participating in a monetary union. Fukuda (2002) also criticizes the validity of inflation rate as an OCA criterion.

Table 14 Inflation Rates of East Asia¹⁾

(unit: %)

| | 1990-2006 | 1990-1997 | 1998-2006 |
|-------------------------|---------------|--------------------|--------------------|
| Brunei | 0.30 (4.62) | 2.83 (1.86) | -1.66 (5.53) |
| Cambodia | 33.37 (56.54) | 66.38 (70.21) | 4.02 (4.64) |
| Indonesia | 12.29 (12.44) | 8.32 (1.18) | 15.82 (16.69) |
| Laos | 25.59 (33.39) | 16.51 (10.43) | 33.65 (44.48) |
| Malaysia | 2.97 (1.23) | 3.58 (0.74) | 2.43 (1.37) |
| Myanmar | 24.55 (14.79) | 24.86 (6.12) | 24.27 (20.12) |
| Philippines | 7.47 (3.65) | 9.35 (4.26) | 5.81 (2.04) |
| Singapore | 1.47 (1.20) | 2.46 (0.79) | 0.59 (0.72) |
| Thailand | 3.96 (2.20) | 5.18 (0.96) | 2.88 (2.47) |
| Viet Nam | 4.44 (3.43) | 4.45 (2.16) | 4.44 (3.68) |
| China | 5.05 (7.15) | 9.97 (7.83) | 0.67 (1.64) |
| Hong Kong | 3.55 (5.49) | 8.74 (1.83) | -1.06 (2.54) |
| Taiwan | 2.00 (1.66) | 3.36 (1.12) | 0.79 (0.95) |
| Japan | 0.56 (1.27) | 1.47 (1.25) | -0.26 (0.51) |
| Korea | 4.62 (2.33) | 6.13 (1.89) | 3.28 (1.85) |
| East Asia ⁴⁾ | 8.81 | 11.57 | 6.38 |
| EU ⁵⁾ | 3.03 | 3.70 ²⁾ | 2.28 ³⁾ |

Notes: 1) Average inflation rates during the period and standard deviation in parenthesis.
 2) During the period of 1990-1998. 3) During the period of 1999-2006. 4) Inflation rates for 12 East Asian countries, excluding Cambodia, Myanmar and Laos, are 4.06, 5.85 and 2.81 for each period, respectively. 5) EU includes 15 countries.

Sources: IMF, *International Financial Statistics* and ADB, *Key Indicators 2007*.

2.8. Credibility Issues

Cukierman (1997) argues that limited credibility relates to the likelihood of financial crises, and increases the employment costs of stabilization policy to government. Kydland and Prescott (1977) examine the interaction between fiscal policymakers and the general public in terms of credibility issues. Tavlas (1993) also discusses government policies with credibility problems. Alesina and Barro (2000) incorporate credibility issues into the model of OCA. Arroyo (2002) shows the possible credibility gains from

monetary union and the advantages of stabilizing the exchange rate.

The decision on whether or not to form a monetary union can be viewed as an attempt to pick a point most suitable for East Asian countries along the credibility-flexibility tradeoff. It is noteworthy that a low level of credibility was largely responsible for the 1997 Asian financial crisis. A high degree of price stability represents both a necessary condition to monetary union and a necessary feature of the monetary environment in East Asia. Non-transparent policy procedures increase the public's uncertainty about the commitment of policy makers to price stability. In most East Asian countries, monetary authority is not fully committed to price stability, nor is it totally discretionary.

The important point is that a positive but low inflation should be the goal of monetary policy in East Asia. Because we know the costs of limited credibility and the relative merits of alternative credibility building institutions, countries should try to maintain the objectives of achieving and maintaining price stability and a high level of credibility. In particular, it should be emphasized that the legal independence of central bank should be upgraded.¹⁰⁾ Such a course of action is advisable independently of whether East Asian countries decide to form a monetary union or not.

2.9. Fiscal Federalism

Another criterion of the OCA theory is the system of fiscal transfers among member countries. Kenen (1969) argues that sharing a fiscal transfer system would allow countries to redistribute funds to a member country influenced by an asymmetric shock. Masson and Pattillo (2001)

¹⁰⁾ In industrialized countries, a higher degree of central bank independence occurs concurrently with lower inflation. The degree of correlation is strong for the 1970s-1980s. This suggests that an independent central bank may provide the appropriate response to the inflationary shocks that hit the western economies in the 1970s, and thereby promoting a culture of monetary stability, as in the 1980s (Cukierman, 1992). However, strong independent status does not automatically translate into higher anti-inflationary credibility. The experience of certain central banks having acquired a high degree of independence to fight inflation shows that disinflation may still be costly in terms of foregone output.

and Fatás (2002) discuss the insurance benefits of a European fiscal federation.¹¹⁾ Most economists agree that the loss of the exchange rate channel for adjustment to asymmetric shocks should be compensated for by an appropriate fiscal policy tool. However, Seidel and Schrooten (2000) point out that there are a lot of arguments on pros and cons of fiscal competition among member states. Diva (1992) argues that there is a limitation of fiscal policy to counter permanent shocks. Tower and Willett (1976) point out the limitation of the role of government policy. Arroyo (2002) and Fatás (1998) also discuss the limitation of budget to buffer for asymmetric shocks.¹²⁾

Currently, East Asia does not have a system of coordination of fiscal policies or a transfer mechanism of fiscal resources to alleviate the effects of regional shocks. But the Chiang Mai Initiative (CMI) is in the right direction to help countries in times of crisis under rapidly globalized and virtualized speculative attacks. There has been increasing support in East Asia for developing a regional mechanism of defense in the form of financial cooperative arrangements. The CMI is perceived as a major step toward strengthening financial cooperation among East Asian countries although details of the swap arrangements among the ASEAN+3 countries will need further elaboration.

2.10. Political Considerations

Cohen (1993) argues that political factors are important in adopting a currency area. Tower and Willett (1976) stress that a successful currency area needs a reasonable degree of agreement in policy objectives. Torres (2007) argues that the creation of European institutions should consider possibilities of disagreement. Walter (2000) finds that historically, political union has been the precursor of a monetary union. A number of empirical

¹¹⁾ Eichengreen (1990) also points out that fiscal federalism will be beneficial to a monetary union.

¹²⁾ Kletzer and Hagen (2000) argue that the welfare effects of inter-regional taxes and transfers are ambiguous.

studies have assessed the importance of political factors in joining a currency area. These include, among others, Wyplosz (2006), Mundell (2003), Jonung and Sjöholm (1998), Vaubel (1995), Haberler (1970) and Ingram (1969).¹³⁾

Even if the economic criteria are satisfied to form a monetary union, another important question would be whether East Asian countries have the political will to form a monetary union. To be sure, the Asian financial crisis has changed the minds of Asian policy-makers, even leading some to propose a common currency to make the region more resilient against currency attacks. However, a common currency for East Asia is unlikely to be a reality in near future because it would require an enormous degree of political commitment. East Asia is far from being united as there is still a great deal of contentions and doubts among the major power, China and Japan. Furthermore there is no pan-East Asian institution, except for ASEAN, which could expedite the process of East Asian monetary integration.

As mentioned above, political will and powerful leadership are essential in promoting monetary integration in the East Asian region. These two problems in political independence is a brainteaser due to the characteristic of political history in the region. We can observe that the institutional inefficiencies and governance problems are more significant in East Asia than in Europe, because of the lack of institutional experience as well as political leadership. Therefore, it can be much harder to build an efficient mechanism that can help minimize inefficiencies from the political decision-making process in economic integration of the East Asian countries.

3. COMPOSITE INDEX OF OCA CRITERIA

In the previous section, we have evaluated various OCA criteria for East Asian countries. We do not cover all the OCA criteria but touch on many of

¹³⁾ Willett (2001) says that political considerations certainly impose important constraints on the relevance of application of OCA analysis. Williamson (1999) claims that political factors hamper the possibility of a currency union in East Asia.

them.¹⁴⁾ It is not easy to determine which criteria are more important in evaluating the suitability of forming a currency area. This is because we need to score a criterion of great importance with a numeric form to compare each criterion¹⁵⁾ and because the effect of each criterion depends on various economic and political conditions of each country. We thus proceed to give a grading number to each country for each of twelve OCA criteria based on the analysis of the previous section. Then, we make a synthesized ranking (RK) for each country by averaging its grades in twelve OCA criteria with equal weight of each criterion. We exclude such factors as credibility issues, fiscal federalism, and political factors that could not be given a ranking number.

Asymmetry of shocks (AS) among the East Asian countries is analyzed by tables 3 and 4. The results indicate that eight (EA 8) and six countries (EA 6) are reliable candidates for forming a currency area, respectively. We give a grade of 1 to six countries that are correlated highly with each other in both of supply shocks and demand shocks and give a grade of 2 to two countries that are not correlated highly with each other in demand shocks but satisfy supply shocks symmetry. Others are given a grade of 3. The grade of inflation rates (IR) based on the result of correlations of inflation rates in Table 6 follows the same method as asymmetry of shocks (AS).

According to the trade openness in table 1, Singapore is the most open country and Myanmar is the least open country in the region. We give a grade to each country according to its level of trade openness (TO) and then categorize all countries into three groups by its level of degree. For example, we give a grade of 1 to the high degree group (Brunei, Malaysia, Singapore, Thailand and Hong Kong) and give grades of 2 and 3 to the middle (Cambodia, Philippines, Viet Nam, Taiwan and Korea) and the low (Indonesia, Laos, Myanmar, China and Japan) degree group respectively.

¹⁴⁾ Ishiyama (1975) points out the limitations of defining optimum currency area based on any single OCA property. Willett *et al.* (2007) also argues that OCA analysis is currently quite in vogue but it is unfortunately often misapplied. One of the common misapplications in technical papers is that they focus on a small number of OCA criteria and then draw strong conclusion about the economic suitability of countries to adopt a common currency.

¹⁵⁾ Mongelli (2008) points out it is still complex to measure and compare the various OCA properties, and there is still no simple OCA test with a clear-cut scoring card.

The grading of the other criteria — size of supply shocks (SI), speed of adjustment to supply shocks (SP), size of demand shocks (DS), speed of adjustment to demand shocks (DP), level of intra-regional trade (IT), real capital mobility (level of FDI stock, CM), labor mobility (tables 9 and 10, LM), financial integration (index of Lane and Milesi-Frerretti, FI) and product diversification (PD) — follows the same method as trade openness (TO).¹⁶⁾ For wage and price flexibility (WP), we are not able to utilize numeric form because of limited availability of data.

Table 15 presents the numeric form that can make several combinations of groups with plausible candidates for forming a monetary union. The results of the synthesized ranking suggest that relatively homogenous sub-groups — three East Asian countries (Malaysia, Singapore and Hong Kong), or four countries (Malaysia, Singapore, Hong Kong and Taiwan) or six countries (Malaysia, Singapore, Hong Kong, Taiwan, Thailand, and Brunei) — could begin taking steps towards a monetary union, as a first step to form a single currency union in East Asia. These findings are somewhat different from the results of section 2, but five countries (Malaysia, Singapore, Hong Kong, Taiwan and Thailand) are included in EA 8.

We believe that the Composite Index of OCA Criteria is more suitable for deciding reliable candidates for forming a monetary union because it considers a number of OCA criteria. Our methodology and results are not conclusive but suggestive. Furthermore, our methodology is not an elaborate one because both the grade and the synthesized ranking index do not express precisely the specific characteristic of each criterion; nevertheless, our methodology gives an intuitive way for thinking about further study. It is a useful methodology to adopt a common currency if we can add more criteria that could be quantified precisely and put the weight to each OCA criteria. It remains to be further developed in the OCA analysis.

¹⁶⁾ We give grades 1 to Hong Kong and Taiwan whose data are not available in intra-regional trade (IT) using other source (Aminian *et al*, 2007). For the degree of product diversification (PD), we give grades 3 and 1 to Brunei and Taiwan, respectively because the product of Brunei is mainly dependent on the oil and gas industry. For Taiwan, see Ricardo and Berrettoni (2006).

Table 15 Composite Index of OCA Criteria⁵⁾

| | AS | IR | SI | SP | DS | DP | TO | IT | CM | LM | FI | PD | WP ⁴⁾ | RK |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|------------------|-----------|
| BRU | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | n.a. | 5 |
| CAM | 3 | 3 | 1 | 1 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | n.a. | 8 |
| INO | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 0 | 6 |
| LAO | 3 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 3 | n.a. | 8 |
| MAL | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | X | 1 |
| MYA | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | n.a. | 9 |
| PHL | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 2 | 2 | 0 | 7 |
| SGP | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | n.a. | 2 |
| THA | 1 | 1 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 0 | 5 |
| VTN | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 0 | 11 |
| CHN | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | n.a. | 12 |
| HKG | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | n.a. | 3 |
| TAW | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | n.a. | 4 |
| JAP | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 0 | 10 |
| KOR | 2 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 1 | 0 | 7 |

Notes: 1) AS (asymmetry of shocks), IR (correlation of inflation rates), SI (size of supply shocks), SP (speed of adjustment to supply shocks), DS (size of demand shocks), DP (speed of adjustment to demand shocks), TO (trade openness), IT (intra-regional trade), CM (real capital mobility), LM (labor mobility), FI (financial integration), PD (production diversification in manufacturing sector), WP (wage and price flexibility), and RK (ranking). 2) RK (Ranking) numbers are given by averaging each country's grades in twelve criteria (AS, IR, SI, SP, DS, DP, TO, IT, CM, LM, FI and PD). 3) In WP, 0 and X indicate whether or not minimum wage policy exists, respectively. 4) The term, "n.a." indicates that data are not available. 5) Author calculates the figures based on the results of section 2.

4. CONCLUSIONS

Our study explores the extent to which East Asian countries can form a monetary union compared with the case of the EU countries. In recognition of the different economic conditions and development of the region, an approach towards East Asian monetary integration would be to begin with relatively a homogenous small sub-group. On the basis of the Composite Index of OCA Criteria, our results suggest three groups of East Asian

countries — EA 3 (Malaysia, Singapore and Hong Kong) or EA 4 (Malaysia, Singapore, Hong Kong and Taiwan) or EA 6 (Malaysia, Singapore, Hong Kong, Taiwan, Thailand, and Brunei) — are better poised for deeper monetary integration. The implication is that on purely economic grounds monetary union in East Asia could begin with these smaller groups, and include other countries at a later stage when a sufficient degree of convergence has been achieved. In the long run, countries participating in the currency area could even consider adopting a single currency, given full economic integration.

In the process of forming a currency area, political factors are an important consideration; a strong political will and a strong public support are necessary to reach the goal. Even if the economic conditions are satisfied to form a monetary integration, another important question is whether East Asian countries have the political will to form a monetary integration in the region. Not only political will but also the powerful leadership is necessary to make progress for the monetary integration in the East Asia. Political will and powerful leadership are difficult problems to solve due to the political history in the region. Political situation in East Asia seems to be far from achieving integration because there is still a great deal of contentions and doubts among the major power, e.g., China and Japan. Mundell (2003) expresses the relationship between China and Japan as “Asian currency area with both powers would have to evolve as an arrangement like the two foci of an ellipse”.

The East Asian economies have to make their own plan as there is no history of monetary integration in the region. The experience of the European Monetary System (EMS) is instructive and widely admired in East Asia. But the East Asian countries might not be able to copy much of the European experience as there are great differences in political systems, exchange rate regimes and economic disparities. Given the different levels of economic development in East Asian countries, it would take several decades for them to fulfill the convergence criteria as in the case of the EMS. It should be noted that it takes Europe more than fifty years to meet the

conditions for fixing their exchange rates immutably in the EU. As Willett *et al.* (2007) recommend, it may not be too late for East Asia to adopt its own modified version of Europe's economic integration.

APPENDIX

Table A1 Data Sources and Sample Periods of Asymmetry of Disturbances

| Countries | Sample | Sources |
|-------------|-------------------|--|
| Australia | 1965-2005 | IFS |
| Brunei | 1974 -2005 | IFS 1974-2004, WEO 2005 |
| Cambodia | 1986 -2005 | WEO 1986-1992, 2005, IFS 1993-2004 |
| China | 1965-2005 | WDI 1965-1978, IFS 1979-2004, WEO 2005 |
| Hong Kong | 1965-2005 | IFS |
| India | 1965-2005 | IFS |
| Indonesia | 1965-2005 | IFS |
| Japan | 1965-2005 | IFS |
| Korea | 1965-2005 | IFS |
| Laos | 1980 -2005 | WEO 1980-1981, IFS 1982-2005 |
| Malaysia | 1965-2005 | WDI 1965-1969, IMF 1970-2005 |
| Myanmar | 1965-2005 | WB 1965-1975, IMF 1976-2005 |
| New Zealand | 1965-2005 | IFS |
| Philippines | 1965-2005 | IFS |
| Singapore | 1965-2005 | IFS |
| Taiwan | 1969 -2005 | ADH & TSDB 1969-1979, WEO 1980-2005 |
| Thailand | 1965-2005 | IFS |
| Viet Nam | 1980 -2005 | WEO 1980-1989, IFS 1990-2005 |

Sources: ADH=Asian Data Handbook, ICSEAD; IFS=International Financial Statistics, IMF; TSDB=Taiwan Statistical Data Book, Council for Economic Planning and development (www.cepd.gov.tw); WDI=World Development Indicator, World Bank; WEO=World Economic Outlook (<http://www.imf.org/external/pubs/ft/weo/2007/01/data>), IMF.

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