Towards an East Asian Monetary Union: An Econometric Analysis of Shocks

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EXTENDED ABSTRACT

A regional monetary arrangement is actually not something new to the East Asian economies. History of monetary co-operation in the region can be traced back to the establishment of an ASEAN Swap Arrangement among ASEAN member countries in 1977. With the recent outbreak of the Asian financial crisis and the introduction of the euro in Europe, renewed attention has been given to potential monetary integration in East Asia. There have been few studies regarding the viability of an optimum currency area (OCA) in East Asia. This paper reexamines the viability of regional monetary integration in East Asia by focusing on the symmetry of structural shocks as one of the preconditions for forming an OCA. In particular, we attempt to extend the conventional structural VAR approach by employing a 3-variable and a 5-variable VAR model to identify the corresponding supply, demand, and exchange rate shocks, as well as the foreign shocks and country-specific shocks. Impulse response function analysis is applied to examining the size of these underlying shocks and the speed of adjustment to disturbances. For comparison purpose, we also conduct a similar study for the European countries. All data used in this study are quarterly, expressed in natural logarithms and seasonally adjusted, except for exchange rates. The sample period covers 1981Q1-1996Q4 for the East Asian economies and the USA, and 1980Q1-1997Q4 for the European countries. The results show that it is less suitable for the whole East Asian region to form an OCA than has been suggested in previous studies, as the identified underlying shocks (supply and demand shocks) are significantly correlated only among a few ASEAN economies and Asian NIEs. This conclusion is assured when we compare the correlation patterns of the underlying shocks with those of the European countries. The results also show that Japan has no significant correlations in supply, exchange rate and demand shocks with other East Asian economies, which is in contrast with the case of Germany in the European region. The impulse response function analysis concludes that, although the underlying structural shocks are less symmetric and the average size of the shocks is larger, the speed of adjustment to shocks in East Asia is much faster than in the EU region. On average, it takes less than one year to complete the adjustment to shocks. This is largely due to the fact that the labour market and wage rates in most East Asian economies are relatively more flexible, so that it is easier for the economies to make an internal adjustment in response to shocks. Although the results do not suggest an OCA in the entire East Asian region, they do imply that some sub-groups of the economies, such as some Asian NIEs and ASEAN economies, are more appropriate candidates as their underlying shocks are correlated and symmetric, and the speed of their adjustment to shocks is faster. Moreover, besides the symmetry of underlying shocks, theory also suggests the importance of other factors such as the intensity of intra-regional trade, flexibility of factor markets, and macroeconomic policy coordination, in determining the process of monetary integration. Further research on these issues will provide evidence regarding the viability of regional monetary integration in East Asia.

1. INTRODUCTION

It has been a long debate regarding a possible regional monetary arrangement in East Asia. With the recent outbreak of the Asian financial crisis and the introduction of the euro in Europe, renewed attention has been given to potential monetary integration in East Asia. There have been few studies regarding the viability of an optimum currency area (OCA) in East Asia. Among them, Bayoumi and Eichengreen (1994) first applied the structural vector autoregression (VAR) method developed by Blanchard and Quah (1989) to an analysis of OCA in East Asia. More recently, Bayoumi, Eichengreen and Mauro (2000) and Yuen (2001) extended Bayoumi and Eichengreen's (1994) approach using a longer sample period. However, these studies have typically adopted a 2-variable VAR model including output and prices, and their empirical results are also mixed.

This paper reexamines the viability of regional monetary integration in East Asia by focusing on the symmetry of structural shocks as one of the preconditions for forming an OCA. In particular, we attempt to extend the conventional structural VAR approach by employing a 3-variable and a 5-variable VAR model to identify the corresponding supply, demand, and exchange rate shocks, as well as the foreign and country-specific shocks. Impulse response function analysis is applied to examining the size of these underlying shocks and the speed of adjustment to disturbances. For comparison purpose, we also conduct a similar study for the European countries.

The remainder of this paper is organized as follows. In section 2, we discuss the theoretical framework and methodology employed in the paper. Section 3 describes data issue. Section 4 presents the regression model designed to test the underlying structural shocks and adjustments to shocks. Section 5 gives some concluding comments.

2. ANALYTICAL FRAMEWORK

Most existing studies in the OCA literature have employed a 2-variable VAR model incorporating output and prices to identify the fundamental supply and demand shocks (e.g., Bayoumi and Eichengreen, 1994, and Bayoumi, Eichengreen and Mauro, 2000). However, as pointed out by Demertzis, Hallett and Rummel (2000), this type of model does not necessarily identify purely stochastic shocks because estimated demand shocks tend to include the effect of macroeconomic policies, whereas estimated supply shocks are less likely to include the impact of the implemented policies.[1] Furthermore, the estimated structural shocks in the existing studies tend to include the effect of foreign shocks in the open-economy framework, which may result in an inaccurate evaluation of the underlying shocks.[2]

Recently a few studies have attempted to identify monetary, supply and demand shocks (see Demertzis, Hallett and Rummel, 2000; Shioji, 2000; Fielding and Shields, 2001; and Zhang, Sato and McAleer, 2004). For example, Shioji (2000) attempted to make a rigorous comparison of the shock correlations between the US and EU regions by allowing for the effect of monetary shocks. In the present paper, we first construct a 3-variable VAR model that includes the money supply variable to identify the underlying shocks that are not the result of innovations in monetary policy. We include in the model the real effective exchange rate variable instead of domestic prices as the former is more appropriate in the open-economy framework to capture changes in the relative price of domestic and foreign countries.[3] We then extend the model to a 5-variable VAR by including foreign output and price variables. Although the conventional 2-variable VAR estimation detects a high degree of correlation in certain shocks, it is unclear whether the result simply reflects the correlation of local shocks or may be affected by foreign shocks. This is very likely in the East Asian economies given their close economic ties with the USA. Following Fielding and Shields (2001), we include the US output and price variables in the model to identify the country-specific supply and demand shocks.

2.1 Baseline Case: 3-Variable Model

Consider the following 3-variable model (Model 1):

$$\Delta x_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \cdots = A(L)\varepsilon_t \quad (1)$$

where

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[1] Supply shocks are typically considered more informative for evaluating the symmetry of shocks, and hence the feasibility of OCAs than other shocks (Bayoumi and Eichengreen, 1994 and Bayoumi, Eichengreen and Mauro, 2000).

[2] Kawai and Okumura (1996) focus on this issue and remove the effect of global shocks in calculating the correlation of underlying shocks.

[3] Demertzis, Hallett and Rummel (2000) and Zhang, Sato and McAleer (2004) incorporate the real exchange rate variable into the model for their structural VAR analysis of EU countries and East Asian economies, respectively.

$\Delta x_t = [\Delta y_t, \Delta q_t, \Delta m_t]'$, $\varepsilon_t = [\varepsilon_{st}, \varepsilon_{qt}, \varepsilon_{mt}]'$,

$$A(L) = \begin{pmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) \end{pmatrix}.$$

$A_{ij}(L) = a_{ij}^0 + a_{ij}^1 L + a_{ij}^2 L + \cdots$, is a polynomial function of the lag operator, *L*. The variables are the first-differences of the logarithm of real output (Δy), real effective exchange rate (Δq), and nominal money supply (Δm) that are subject to fundamental structural shocks, namely supply, exchange rate and monetary shocks ($\varepsilon_s, \varepsilon_q$ and ε_m). We assume that the structural shocks are serially uncorrelated and have a covariance matrix which is normalized to the identity matrix.

In order to identify the structural A_i matrices, we use the econometric technique of Blanchard and Quah (1989). We impose the following long-run restrictions based on the standard macroeconomic theory: (i) only supply shocks affect output in the long run, (ii) both supply and exchange rate shocks influence real effective exchange rates in the long run, and (iii) monetary shocks have no long run effects on either output or real effective exchange rates. Thus, the restrictions are $A_{12}(1) = A_{13}(1) = A_{23}(1) = 0$ which are sufficient to identify the structural A_i matrices and the time series of structural shocks.

We estimate a reduced form VAR as:

$$\Delta x_t = B(L)\Delta x_{t-1} + u_t, \qquad (2)$$

where u_t is a vector reduced form disturbance and $B(L)$ is a 3×3 matrix of lag polynomials. An MA representation of equation (2) is:

$$\Delta x_t = C(L)u_t, \qquad (3)$$

where $C(L) = (1 - B(L)L)^{-1}$ and the lead matrix of $C(L)$ is, by construction, $C_0 = I$. By comparing equations (1) and (3), we obtain the relationship between the structural and reduced form disturbances, $u_t = A_0\varepsilon_t$. Since the shocks are mutually orthogonal and each shock has a unit variance, $C(1)\Sigma C(1)' = A(1)A(1)'$ where $\Sigma = Eu_t u_t' = EA_0\varepsilon_t\varepsilon_t' A_0' = A_0 A_0'$. Letting *H* denote the lower triangular Choleski decomposition of $C(1)\Sigma C(1)'$, we obtain $A(1) = H$ since the long run restrictions imply that $A(1)$ is also lower triangular. Consequently, we obtain $A_0 = C(1)^{-1}A(1) = C(1)^{-1}H$. Given an estimate of A_0, we can recover the time series of structural shocks.

It should be noted that when estimating a reduced form VAR for each country, the estimated reduced form disturbances (u_t) may be correlated across countries. In order to allow for possible cross-country residual correlations, we follow the approach of Fielding and Shields (2001) and use the seemingly unrelated regression (SUR) method, which is asymptotically more efficient than OLS. We first stack the Δy equations for each country and estimate them using SUR. The same procedure is conducted for the Δq and Δm equations. Then we construct a matrix of the reduced form residuals for each country using the estimates and impose the above long-run restrictions to recover the associated structural disturbances.

2.2 Extension: 5-Variable Model

We next consider the 5-variable model with two foreign variables (Model 2):

$\Delta x_t = A(L)\varepsilon_t$, where

$\Delta x_t = [\Delta y_t^*, \Delta p_t^*, \Delta y_t, \Delta p_t, \Delta m_t]'$,

$\varepsilon_t = [\varepsilon_{st}^*, \varepsilon_{dt}^*, \varepsilon_{st}, \varepsilon_{dt}, \varepsilon_{mt}]'$,

$$A(L) = \begin{pmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) & A_{14}(L) & A_{15}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) & A_{24}(L) & A_{25}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & A_{34}(L) & A_{35}(L) \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & A_{45}(L) \\ A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) \end{pmatrix}.$$

Δy^* and Δp^* denote the changes in the logarithms of foreign output and prices, respectively. For domestic variables, we use the first-difference of the logarithm of price (Δp) instead of real effective exchange rates (Δq). By including foreign variables in the model, we identify supply and demand shocks conditional on foreign output and price shocks, as well as the domestic monetary policy. We assume that domestic shocks have no impact on foreign variables in the long run, while foreign shocks have a long run effect on domestic variables. Hence, we impose the following long run restrictions:

$A_{13}(1) = A_{14}(1) = A_{15}(1) = A_{23}(1) = A_{24}(1) = A_{25}(1) = 0$.

Furthermore, we assume that shocks to foreign price will have no long run impact on foreign output ($A_{12}(1)=0$), such that, $A_{34}(1)=A_{35}(1)=A_{45}(1)=0$. Thus, the $A(1)$ matrix is lower triangular and these long run restrictions are sufficient to identify the time series of structural shocks.

Again, we apply the SUR method to estimate the Δy , Δp and Δm equations, respectively. For the real foreign output (Δy^*) and price (Δp^*) equations, we estimate a 2-variable VAR with a lag order of one, following Fielding and Shields (2001). We finally construct the matrix of reduced form residuals for each country using the estimates obtained above, and impose the long run restrictions to identify the structural shocks.

3. DATA

We use real GDP, consumer price index (CPI) and narrow money (M1)[4] as proxies for real output, price and money supply, respectively. Real effective exchange rates are based on relative CPI. All data are quarterly, expressed in natural logarithms and seasonally adjusted, except for exchange rates. The sample period covers 1981Q1-1996Q4 for the East Asian economies and the USA, and 1980Q1-1997Q4 for the European countries.[5] The major data sources are IMF, *International Financial Statistics*, CD-ROM, the websites of the statistics authorities in the USA, Japan, Korea, Taiwan and Hong Kong, the NUS ESU databank and the ICSEAD database.

4. EMPIRICAL RESULTS

We investigated the stationarity of variables using the augmented Dickey-Fuller (ADF) test and the Kwiatkowski et al. (1992) (KPSS) test. Based on the results of both unit root tests, we obtained the first-differences of all variables to ensure stationarity (the results are available upon request).[6] In the empirical estimation, the equations have been estimated with one lag on the basis of SBIC. We present the results of cross-country correlations in supply, exchange rate and demand shocks in the following sub-sections. If the correlations of the structural shocks are positive, the shocks are considered to be symmetric, and if negative and/or insignificant, they are considered asymmetric.

4.1 Cross-Country Correlations in Shocks

The results of the cross-country correlations in supply and exchange rate shocks for East Asia are reported in Table 1 and for Europe in Table 2. It is found that supply shocks are correlated significantly only among a few ASEAN economies (Singapore, Malaysia and Indonesia) and Asian NIEs (Korea, Taiwan and Hong Kong). For the rest of the East Asian economies, asymmetric shocks seem to prevail (Panel A of Table 1). The East Asian economies have no significant correlations in supply shocks with Japan or the USA. This finding contrasts with previous studies which have found significant positive correlations in supply shocks between Japan and Asian NIEs. Moreover, the supply shocks are far less symmetric in East Asia than in Europe, where the supply shocks are significantly correlated among France, Italy, UK, Sweden and Finland (Panel A of Table 2). In a sharp contrast with Bayoumi and Eichengreen (1994) and Demertzis, Hallett and Rummel (2000), our results show that Germany, which is typically considered as the leading regional country, has significant correlations in supply shocks with only France and Italy (Panel A of Table 2).

Panel B of Table 1 shows a very different pattern of correlations in exchange rate shocks across the East Asian region as compared with supply shocks. There are significant positive correlations of exchange rate shocks between the USA and all the East Asian economies, with the exception of Japan, but the shocks are negatively correlated between Japan and the other East Asian economies. The result reflects the *de facto* pegging of the exchange rates of most East Asian economies, at least well before the financial crisis, to the US dollar, implying the effect of economic policies on the estimated shocks.

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[4] For some European countries, consistent series of M1 are not available and other money supply data are used instead: the sum of Currency in Circulation and Demand Deposits is used for Finland, Italy and the Netherlands, M2 is used for Norway and Sweden, and M0 (the wider monetary base) is used for the UK.

[5] The post-crisis period is not included in the sample for East Asia to avoid structural breaks in the series, whereas a longer sample period is preferable for the time series analysis. In a later section, we report the estimated results for a longer sample period. For the European countries, we chose the sample that ends in 1998Q4, namely before the start of the euro. Due to a lack of 1998 data for some countries, the sample period is from 1980Q1-1997Q4.

[6] The results of unit root tests indicate all series are I(1) processes, with the exceptions of CPI and money supply for a few economies. We take the first difference of the variables in our structural VAR estimation to ensure the stationarity and to reflect the dynamics of these variables.

Table 2 presents the correlations of structural shocks in the European countries. As seen in Panel B of Table 2, the exchange rate shocks are correlated significantly within the sub-group of countries: the first includes Germany, the Netherlands, Switzerland and France, and the other consists of Italy, UK, Sweden, Finland and Norway. These significant correlations appear to reflect the close coordination of their macroeconomic policy, as well as their exchange rate policy. In contrast to the finding that Japan has no significant correlations in both supply and exchange rate shocks with other East Asian countries, Germany is found to be significantly correlated with several European countries.

Table 1. Correlation of Structural Shocks between the USA and East Asian Economies

	Model 1: 3-Variable Model									Model 2: 5-Variable Model							
	US	Jp	Kr	Tw	HK	Si	Ml	Id	Th	Jp	Kr	Tw	HK	Si	Ml	Id	Th
	Panel A: Supply Shocks (1981Q1-1996Q4)									*Panel C: Supply Shocks (1981Q1-1996Q4)*							
United States	1.00																
Japan	-0.05	1.00								1.00							
Korea	-0.05	0.04	1.00							0.09	1.00						
Taiwan	0.16	-0.07	0.32 *	1.00						-0.07	0.32 *	1.00					
Hong Kong	0.00	0.00	0.12	0.50 *	1.00					-0.01	0.13	0.50 *	1.00				
Singapore	0.03	-0.08	-0.02	0.10	0.17	1.00				-0.08	-0.01	0.08	0.22	1.00			
Malaysia	-0.03	0.04	-0.01	0.04	-0.03	0.33 *	1.00			0.11	0.07	0.03	-0.07	0.30 *	1.00		
Indonesia	0.15	-0.08	-0.03	-0.01	-0.07	0.06	0.36 *	1.00		-0.17	-0.01	-0.05	-0.16	0.04	0.29 *	1.00	
Thailand	0.18	-0.25	0.12	-0.02	-0.05	0.15	0.19	0.15	1.00	-0.18	0.10	-0.06	-0.06	0.14	0.22	0.18	1.00
	Panel B: Exchange Rate Shocks (1981Q1-1996Q4)									*Panel D: Demand Shocks (1981Q1-1996Q4)*							
United States	1.00																
Japan	-0.73	1.00								1.00							
Korea	0.68 **	-0.55	1.00							0.11	1.00						
Taiwan	0.61 *	-0.45	0.66 *	1.00						-0.06	0.37 *	1.00					
Hong Kong	0.42 *	-0.30	0.30 *	0.34 *	1.00					0.06	0.14	0.19	1.00				
Singapore	0.33 *	-0.27	0.32 *	0.14	0.46 *	1.00				0.04	0.28	-0.14	0.32 *	1.00			
Malaysia	0.55 *	-0.60	0.27	0.28	0.21	0.17	1.00			0.08	0.09	-0.08	0.23	0.45 *	1.00		
Indonesia	0.30 *	-0.30	0.29 *	0.10	0.19	-0.14	0.16	1.00		-0.06	-0.11	0.06	0.04	0.21	0.06	1.00	
Thailand	0.42 *	-0.46	0.29 *	0.33 *	0.35 *	0.08	0.31 *	0.08	1.00	-0.10	0.08	-0.10	0.27	0.29 *	0.10	0.02	1.00

Notes: Significance levels for correlation coefficients are assessed using Fisher's variance-stabilizing transformation (see Rodriguez, 1982). Painted figures denote significantly greater than zero at the 5 percent level (one-tailed test: critical value 0.209); * (**) denotes not significantly less (significantly greater) than 0.5 at the 5% level (two-tailed test: critical value 0.288 (0.665)).

Table 2. Correlation of Structural Shocks between European Countries (3-Variable Model)

	Ger	Net	Swi	Fra	Ita	UK	Swe	Fin	Nor	Spa	Por
	Panel A: Supply Shocks (1980Q1-1997Q4)										
Germany	1.00										
Netherlands	0.05	1.00									
Switzerland	-0.12	0.38 *	1.00								
France	0.22	0.14	0.27	1.00							
Italy	0.37 *	0.25	0.19	0.53 *	1.00						
United Kingdom	0.00	0.02	0.21	0.35 *	0.29	1.00					
Sweden	0.05	0.00	0.05	0.51 *	0.39 *	0.45 *	1.00				
Finland	-0.17	0.05	0.08	0.44 *	0.31 *	0.34 *	0.45 *	1.00			
Norway	0.07	0.25	0.19	0.24	0.21	0.01	0.20	0.14	1.00		
Spain	0.04	0.06	0.18	0.30	0.40 *	0.26	0.21	0.19	0.01	1.00	
Portugal	-0.01	0.04	0.23	0.36 *	0.22	0.19	0.07	0.03	-0.05	0.20	1.00
	Panel B: Exchange Rate Shocks (1980Q1-1997Q4)										
Germany	1.00										
Netherlands	0.87 **	1.00									
Switzerland	0.47 *	0.50 *	1.00								
France	0.54 *	0.48 *	0.30	1.00							
Italy	-0.14	-0.07	-0.10	-0.02	1.00						
United Kingdom	-0.29	-0.25	-0.18	-0.26	0.24	1.00					
Sweden	-0.33	-0.31	-0.13	-0.06	0.39 *	0.20	1.00				
Finland	-0.06	-0.02	0.10	-0.05	0.27	0.20	0.63 *	1.00			
Norway	0.19	0.14	0.11	0.34 *	0.12	0.26	0.20	0.34 *	1.00		
Spain	0.09	0.12	-0.06	-0.03	0.16	0.06	0.09	0.13	-0.01	1.00	
Portugal	0.10	-0.04	0.00	0.37 *	-0.06	-0.19	0.00	0.07	0.22	0.16	1.00

Notes: Painted figures denote significantly greater than zero at the 5% level (one-tailed test: critical value 0.197); * (**) denotes not significantly less (significantly greater) than 0.5 at the 5% level (two-tailed test: critical value 0.288 (0.665)).

4.2 Correlations after Removing the Effects of Foreign Shocks

In order to reflect the impacts of foreign output and price shocks and to identify country-specific demand shocks, we incorporate two foreign variables, namely US output and prices, in estimating the 5-variable model. The estimates are also reported in Table 1 (Panel C and D).

According to Panel C of Table 1, the number of significant correlation in supply shocks improves slightly among the East Asian economies, whereas Japan still exhibits no significant correlations with the rest of East Asia. In contrast, Panel D of Table 1 shows a different pattern of cross-country correlations in demand shocks from the exchange rate shocks. By accommodating the effects of the US output and price shocks, the degree of symmetry in demand shocks declines considerably among the East Asian economies in comparison with the correlation pattern of exchange rate shocks (see Panel B of Table 1).[7] In particular, the number of significant correlations in demand shocks with other economies has decreased for Korea and Taiwan, but improved for Singapore. Again, Japan still shows no significant correlations in demand shocks with other East Asian economies, even after including the US variables in the model.

Finally, we have also estimated the 5-variable model for the European region and for East Asia by including the post-crisis period (the results are available upon request). Similar results to Table 2 are found, indicating the symmetric supply shocks prevail in Europe. By including the post-crisis period, the degree of correlation in supply shocks improves substantially across the East Asian economies, and the demand shocks became significantly correlated among the most heavily affected economies. In addition, Japan has substantially improved the degree of correlation in supply shocks, indicating a significant correlation with Korea and Malaysia. However, the inclusion of post-crisis period observations in estimation may cause structural breaks in the series, and hence may significantly affect the estimates.

4.3 The Shock Size and Speed of Adjustment

Now we examine the other conditions associated with the OCA, namely (1) the size of shocks and (2) the speed of adjustment to shocks. Asymmetric shocks would not have significant impacts on an economy if the size of shocks were much smaller and if an economy responded more quickly to shocks. As the estimated shocks are assumed to have unit variances in the structural VAR method, their size and adjustment speed can be inferred by examining the associated impulse response functions (see Bayoumi and Eichengreen, 1994; Bayoumi, Eichengreen and Mauro, 2000). We conduct an impulse response function analysis to determine the size of the underlying shocks and the speed of adjustment to shocks, both for the East Asian and European regions. We use the long run impacts of a unit shock on changes in real GDP, real effective exchange rate and CPI, respectively, as measures of the size of supply, exchange rate and demand shocks. The speed of adjustment in each case is measured by the response after 4 quarters as a share of the long run effect.[8]

Table 3 reports the estimated results of the impulse response function analysis. It is interesting to note that the size of shocks and the adjustment speed to shocks are very different between East Asia and Europe. On average, the sizes of supply shocks and exchange rate shocks in Europe are smaller than in East Asia, but the size of demand shocks in Europe is larger than in East Asia. Nevertheless, the speed of adjustment to shocks is much faster in East Asia than in Europe, with the exception of adjustment to exchange rate shocks.[9] A possible explanation for this result is that the labour market and wage rates in most East Asian economies are relatively more flexible, so that it is easier for these economies to make internal adjustments to shocks.

Table 3. The Size of Shocks and Speed of Adjustment to Shocks (3-Variable Model)

	Supply Shocks		*Exchange Rate Shocks*	
	Size	Speed	Size	Speed
Panel A: US and the EA Economies (1981Q1-1996Q4)				
United States	0.010	0.987	0.043	0.995
Japan	0.008	0.995	0.066	0.989
Korea	0.011	0.995	0.037	0.994
Taiwan	0.010	1.003	0.036	1.005
Hong Kong	0.018	1.000	0.039	1.000
Singapore	0.017	0.998	0.027	0.987
Malaysia	0.015	0.990	0.032	0.976
Indonesia	0.009	1.001	0.073	0.995
Thailand	0.013	1.002	0.035	0.993
Average	0.013	0.998	0.043	0.992
Panel B: European Countries (1980Q1-1997Q4)				
Germany	0.014	0.995	0.021	0.988
Netherlands	0.007	1.000	0.018	1.000
Switzerland	0.008	1.006	0.027	1.008
France	0.006	0.999	0.018	0.994
Italy	0.006	1.000	0.034	0.988
United Kingdom	0.009	1.007	0.042	1.007
Sweden	0.011	0.984	0.046	0.986
Finland	0.015	0.984	0.031	0.978
Norway	0.010	0.999	0.020	0.986
Spain	0.010	0.655	0.024	1.001
Portugal	0.017	0.997	0.026	0.999
Average	0.010	0.966	0.028	0.994

Note: In Panel A, the average of 8 East Asian economies (including Japan) is reported.

5. CONCLUDING REMARKS

In this paper we have applied two structural VAR models with three and five variables, respectively,

[7] The results of the 3-variable model estimation show that the correlation pattern of the estimated demand shocks differs markedly from the 5-variable model which includes US output and price variables. Thus, demand shocks are correlated significantly among the USA, Japan and other East Asian economies, with the exception of Taiwan and Indonesia.

[8] Whereas our choice of time horizon for calculating the size and the adjustment speed is somewhat arbitrary, choosing other horizons will not change the conclusion appreciably.

[9] In Table 3, the speed of adjustment to supply shocks in Spain is exceptionally low in Europe. Even if Spain were excluded, the average adjustment speed to supply shocks is still slower in Europe than in East Asia.

to examine the symmetric nature of fundamental shocks in East Asian economies according to the criteria of the optimum currency area literature. The results show that it is less suitable for the whole East Asian region to form an OCA than has been suggested in previous studies, as the identified underlying shocks (supply and demand shocks) are significantly correlated only among a few ASEAN economies and Asian NIEs. This conclusion is assured when we compare the correlation patterns of the underlying shocks with those of the European countries. The results also show that Japan has no significant correlations in supply, exchange rate and demand shocks with other East Asian economies, which is in contrast with the case of Germany in the European region.

The impulse response function analysis concludes that, although the underlying structural shocks are less symmetric and the average size of the shocks is larger, the speed of adjustment to shocks in East Asia is much faster than in the EU region. On average, it takes less than one year to complete the adjustment to shocks. This is largely due to the fact that the labour market and wage rates in most East Asian economies are relatively more flexible, so that it is easier for the economies to make an internal adjustment in response to shocks.

Although the results do not suggest an OCA in the entire East Asian region, they do imply that some sub-groups of the economies, such as some Asian NIEs and ASEAN economies, are more appropriate candidates as their underlying shocks are correlated and symmetric, and the speed of their adjustment to shocks is faster. Moreover, besides the symmetry of underlying shocks, theory also suggests the importance of other factors such as the intensity of intra-regional trade, flexibility of factor markets, and macroeconomic policy coordination, in determining the process of monetary integration. Further research on these issues will provide evidence regarding the viability of regional monetary integration in East Asia.

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