



Economic Integration and Business Cycle Synchronization in Asia*

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Abstract

This paper examines the effects of internal (or regional) vs. external (inter-regional) integration and of trade vs. financial integration on regional business cycle synchronization in Asia. The empirical results show the following: (1) similar and strong common external linkages have significant positive effects on regional business cycle synchronization; (2) after controlling external linkages, internal trade integration has a positive effect on regional business cycle synchronization but internal financial integration has a negative effect; and (3) the measures of external linkages, particularly the measure of external financial linkages, are more important than those of internal linkages in explaining regional business cycle co-movements.

Keywords: Regional Business Cycle Synchronization, Asia, internal and external integration, trade and financial integration

JEL Classification Codes: F4

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I. INTRODUCTION

After the Asian financial crisis, international linkages in both finance and trade have increased rapidly in Asian countries. On the trade side, reductions in trade barriers and free trade agreements, combined with the rise of production sharing networks in emerging Asian countries have deepened regional integration. In 1990, the total exports and imports of ASEAN+3 countries was 56% of their GDP (3.5% of world GDP). This value increased to 104% of their GDP (15.8% of world GDP) in 2010.¹ Figure 1 shows the total trade of ASEAN+3 countries from 1987 to 2010 in comparison with that of countries in the North American Free Trade Agreement (NAFTA) and the Euro Area. Asia is currently a vital region for world trade, with the total trade of ASEAN+3 becoming even larger than that of the Euro and NAFTA areas in recent years.

On the finance side, capital account liberalization and various forms of regional financial cooperation, such as Chiang Mai Initiative Multilateralization (CMIM) and the Asian Bond Market Initiative (ABMI), have promoted the international integration of Asian economies. In 1990, the ratio of total assets and liabilities to GDP of ASEAN+3 countries was 122.6% (23.1% of world GDP). This value increased to 190.1% (40.9% of world GDP) in 2009. During the same period, the Euro and NAFTA areas recorded greater numbers at 347.05% (74.73% of world GDP) and 267.8% of their GDP (74.71% of world GDP), respectively. Nevertheless, the financial globalization trend in Asian countries remains very strong.

Coinciding with the trends of rising trade and financial integration has been an increase in business cycle co-movements across the Asian region. Past studies have documented the substantial changes in the business cycle co-movements of Asian countries after the Asian financial crisis. In particular, some studies (e.g., Kim and Lee, 2012; Imbs, 2011; Moneta and Ruffer, 2009) found that business cycles of Asian countries have become more synchronized after the Asian financial crisis and that these changes in business cycle properties are likely to be related to their economic integration process.

The business cycle co-movements of Asian countries have various important implications for the region. Some researchers and policymakers argue that the creation of

¹This paper considers nine economies in ASEAN+3; Japan, China, Republic of Korea, and six economies (Malaysia, the Philippines, Indonesia, Thailand, Hong Kong, and Singapore) in Association of South-East Asian Nations (ASEAN).



an Asian monetary union or a common Asian currency unit is crucial for future development of the region.²In this regard, business cycle synchronization or business cycle asymmetry of countries in the region is an important criterion to judge the costs and feasibility of Asian monetary integration. By investigating the effects of economic integration on regional business cycle co-movements, we may infer the possible effects of current trends of rapid economic integration on regional business cycle co-movements and the potential costs of Asian monetary integration.

Even without explicit monetary integration of Asian countries, the magnitude of business cycle synchronization in the region has important implications for macroeconomic policy coordination. In particular, a high degree of business cycle synchronization within the region, common policy responses and/or policy cooperation within the region are needed to stabilize economic fluctuations in the region.

This paper investigates how economic integration affects the business cycle synchronization of Asian countries. In particular, we distinguish two types of integration, namely, (1) trade integration vs. financial integration and (2) internal integration (regional integration or integration within Asia) vs. external integration (inter-regional integration or integration of Asian countries with the rest of the world). This paper examines how different types of integration (trade vs. financial and internal vs. external) affect the regional business cycle synchronization of Asian countries.

Distinguishing internal economic integration (within Asia) from external economic linkage (with the rest of the world) is important in explaining business cycle synchronization within Asia because both internal and external economic linkages can affect regional business cycle synchronization but in a different manner. The size of the effects of internal trade (or financial) integration on regional business cycle may differ from the size of external trade (or financial) linkages. In such a case, the effects of internal and external integration should be estimated separately. In addition, internal and external integration may affect regional business cycle co-movement in opposite directions. For example, a similar pattern of financial linkages of Asian countries and the rest of the world may increase business cycle synchronization of Asian countries. However, a strong financial integration among Asian countries may decrease the business cycle synchronization of Asian countries. Furthermore, by separately estimating the effects, we can infer which one is more important in explaining business cycle

²For example, see Mundell (2003), Kuroda (2004), and Ogawa and Shimizu (2011).

synchronization of Asian countries. In addition, the effects of recent regional integration efforts on business cycle synchronization can be better understood. For example, we can clearly picture how trade integration within the region, such as FTAs among some ASEAN+3 countries and Asian financial cooperation such as CMIM and ABMI, has contributed to Asian business cycle synchronization. Based on our empirical results, we also draw some implications on these issues. To estimate the effects of internal and external integration separately, we apply the method developed by Gong and Kim (2012).

While several studies have investigated the effects of economic integration on business cycle synchronization in Asia, these studies have not separated the effects of internal and external integration. Most studies (Shin and Wang, 2003, 2004; Cortinhas, 2007; Choe, 2001; Crosby, 2003; Kumakura, 2006; Rana, 2007, 2008) concentrated on the effects of internal trade integration on regional business cycle synchronization. A few studies, such as that of Shin and Sohn (2006) and Imbs (2011), did examine the effects of both trade and financial integration. However, these studies either concentrated only on internal integration or did not distinguish between internal vs. external integration.

The rest of the paper is organized as follows. Section 2 explains the empirical methodology. Section 3 discusses the empirical results. Section 4 concludes with a summary of results.

II. EMPIRICAL METHOD

II. 1. Empirical Model

Previous studies have used the following type of regression to analyze the effects of trade and financial integration on business cycle synchronization (i.e., Imbs, 2004, 2006, 2011).

$$(1) \quad \rho_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 F_{ij} + \varepsilon_{ij},$$

where ρ_{ij} is the correlation between the cyclical components of real GDP of countries i and j , T_{ij} is the intensity of bilateral goods trade between countries i and j , and F_{ij} is the intensity of bilateral asset trade between countries i and j . α_1 and α_2 show the impacts of trade and financial integration on business cycle synchronization.

In addition to economic integration among Asian countries, economic linkages between Asian countries and the rest of the world can contribute to business cycle co-movements of Asian countries. For example, structural shocks in the U.S. can affect both Korea and Thailand in a similar manner, as Korea and Thailand have similar and strong common economic linkages with

the U.S. To consider such effects based on economic relations with countries outside the region, two variables are added to Equation (1) as follows:

$$(2) \quad \rho_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 F_{ij} + \alpha_3 EXT_{ij} + \alpha_4 EXF_{ij} + \varepsilon_{ij},$$

where EXT and EXF are the variables that show the external trade and financial linkages, respectively, that generate business cycle synchronization between countries i and j . The measures show how strong and similar the external linkages of countries i and j are to that of countries outside the region.

We also consider the following system of equations in which interactions among various types of economic integration are allowed.

$$(3) \quad \rho_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 F_{ij} + \alpha_3 EXT_{ij} + \alpha_4 EXF_{ij} + \varepsilon_{ij}^1,$$

$$T_{ij} = \beta_0 + \beta_1 F_{ij} + \beta_2 I_{ij}^T + \beta_3 EXT_{ij} + \beta_4 EXF_{ij} + \varepsilon_{ij}^2,$$

$$F_{ij} = \gamma_0 + \gamma_1 T_{ij} + \gamma_2 I_{ij}^F + \gamma_3 EXT_{ij} + \gamma_4 EXF_{ij} + \varepsilon_{ij}^3,$$

where I_{ij}^T and I_{ij}^F are instruments that affect bilateral trade and finance intensities between country i and j , respectively. In this system, interactions among internal financial and trade integration are allowed. Internal trade integration can have both direct (α_1) and indirect effect ($\gamma_1 \alpha_2$) by affecting internal financial integration. Similarly, internal financial integration can have both direct (α_2) and indirect effect ($\beta_1 \alpha_1$) by affecting internal trade integration. In addition, two measures of external linkages are allowed to affect the measures of internal integration.

Equations (1), (2), and (3) are estimated by ordinary least squares (OLS). Equation system (4) is estimated by three-stage least squares. More detailed explanations on the empirical model are found in Gong and Kim (2012).

II.2. Measurement and Data

To measure the degree of trade integration, the following measure of trade intensity between countries i and j ($T_{i,j}$) is constructed.

$$(4) \quad T_{i,j} = \frac{1}{2T} \sum_t \frac{(X_{i,j,t} + M_{i,j,t}) Y_t^W}{Y_{i,t} * Y_{j,t}},$$

where $X_{i,j,t}$ is the amount of country i 's export to country j at time t ; $M_{i,j,t}$ is the amount of country j 's import from country i at time t ; Y_t^w is the world GDP at time t ; and $Y_{i,t}$ is country i 's GDP at time t . This measure is traces to Deardorff's (1998) theoretical work based on the gravity model, and has been used in several studies including Imbs (2006). The measure depends on trade barriers and not on country size. This property is particularly useful in our case because Asian countries in our sample are quite diversified in terms of their sizes but we would like to use the measure that properly captures the extent of trade integration, independent of the country size.³ Deardorff (1998) shows that the measure equals one if preferences are homothetic and if trade barriers are non-existent.

To properly capture the size of financial integration, independent of the country size, a similar measure between countries i and j is constructed for financial integration.⁴ The measure for financial integration between countries i and j ($F_{i,j}$) is given by:

$$(5) \quad F_{i,j} = \frac{1}{2T} \sum_t \frac{(I_{i,j,t} + I_{j,i,t}) Y_t^w}{Y_{i,t} * Y_{j,t}},$$

where $I_{i,j,t}$ is the amount of portfolio investment from country i to country j at time t . To measure the degree of financial integration, past studies often used portfolio investment data. In our case, we also used the bilateral portfolio investment data (CIPS).⁵

The measure of external trade linkages that affects business cycle synchronization between countries i and j (EXT_{ij}) is constructed as follows:

$$(6) \quad EXT_{ij} \equiv \sum_{k=1}^6 w_k \{ MAXT - |T_{i,k} - T_{j,k}| \} \min\{T_{i,k}, T_{j,k}\},$$

where w_k is the relative weight of G6 countries based on real GDP, and MAXT is the largest value among $T_{i,j}$ and $T_{i,k}$ for all i, j , and k . The first term $\{ MAXT - |T_{i,k} - T_{j,k}| \}$ in Equation (6) shows the similarity in trade integration of countries i and k with that of

³Other things being equal, a larger country is likely to trade more.

⁴Previous studies suggested that the gravity model can also explain international transactions in financial assets (i.e., Portes and Rey, 2001).

⁵The asset data of China are calculated by the counter party's (liability) data throughout the sample period. The same method is used for the asset data of the following countries: Hong Kong (1997), India (1997, 2001, 2002, 2003), and Pakistan (1997, 2001).

countries j and k . $|T_{i,k} - T_{j,k}|$ measures the difference between the trade integration of countries i and k and that of j and k . By subtracting from the largest possible value of T in the sample, the first term $\{MAXT - |T_{i,k} - T_{j,k}|\}$ shows the similarity. The second term $(\min\{T_{i,k}, T_{j,k}\})$ in Equation (6) shows the common part of the trade integration of countries i and k and that of countries j and k . The second term shows the strength of the common part of the trade integration of countries i and k and that of countries j and k .

The rationale behind this measure is that if two countries in a region, for example, Korea and Thailand in Asia, have similar and strong common external trade integration with countries outside the region, for example, G6, the business cycle co-movement between Korea and Thailand is likely to be high. The first term naturally shows the similarity of Korea and Thailand's external trade linkages. The second term shows the strength of the common external trade linkages of Korea and Thailand. Trade intensities of Korea and Thailand with the G6 (T_{ik} and T_{jk}) show the strength of the external trade linkages of Korea and Thailand. However, the business cycle correlation of Korea and Thailand is likely to be generated only to the extent that they have the common part. Therefore, the minimum of external trade intensities of two countries is used.

The measure of external financial linkages that affects business cycle synchronization between countries i and j (EXT_{ij}) is constructed in a similar manner.

$$(7) \quad EXF_{ij} \equiv \sum_{k=1}^6 w_k \{MAXF - |F_{i,k} - F_{j,k}|\} \min\{F_{i,k}, F_{j,k}\},$$

where $MAXF$ is the largest value between F_{ij} and $F_{i,k}$ for all i, j , and k . The first term $\{MAXF - |F_{i,k} - F_{j,k}|\}$ shows the difference between the financial integration of countries i and k and that of j and k . The second term $(\min\{F_{i,k}, F_{j,k}\})$ shows the strength of the common part of the financial integration of countries i and k and that of j and k .

Note that these measures for external linkages are different by nature from the measures for internal integration. The measures for internal integration simply show how intensive trade and financial integration are between countries i and j , whereas the measures for external linkages show how strong and similar the external integration of country i and countries outside the region is to that of country j and countries outside the region (see Gong and Kim (2012) for details).

Following previous empirical studies, we include the geographic distance of the capital cities of two countries, whether a border exists between two countries, and whether a common official language is used in both countries as instruments for the trade equation. These three instruments are usually argued as clearly exogenous with high



predictive power when analyzing the determinants of bilateral trade. For the finance equation, two instruments are used: the sum of two countries' per capita real GDP and the difference between the per capita real GDP of the two countries. The combined income level may affect the degree of financial integration because financial markets and technologies are better developed in high-income countries, and financial integration between high-income countries may be easier. On the contrary, a large difference in the level of income may make financial integration more difficult.

We consider the following group of countries. First, we consider nine countries in ASEAN+3, as policy cooperation such as CMIM and ABMI has been discussed among this group of countries. Second, we consider "ASEAN+7" by adding four countries (India, Pakistan, New Zealand, and Australia) to ASEAN+3 because policy debates often include these four countries as potential candidates for extended policy cooperation in the Asia-Pacific area.

For the measure of business cycle correlation, we calculate the correlation of cyclical real GDP from 2001 to 2009 (annual data). For all other measures, the annual average values from 2001 to 2009 are used.

III. RESULTS

III. 1. Basic Results

Table 1 shows the estimation results based on the single equation method. When only the measure for internal trade integration (and a constant term) is included as the regressor, the coefficient is positive for the ASEAN+3 and ASEAN+7 samples, although it is insignificant at only the 10% level for ASEAN+7. Similarly, when only the measure for internal financial integration is included as the regressor, the coefficient is positive and significant at the 5% and 10% level for ASEAN+7 and ASEAN+3, respectively. However, when both internal trade and financial integration measures are included, no coefficients are significantly estimated, probably because of the high correlation between two measures.

When the measures for external financial and trade linkages (EXF and EXT) are added, the coefficients on the measures for internal trade integration and two external linkages are positively estimated, whereas the coefficient on the measure for internal financial integration is negatively estimated. The estimated coefficients on the measures for internal trade and financial integration are significant at the 5% level, whereas the estimated coefficients on the measure for external financial integration are significant at

the 1% level. Table 1 shows the substantial increase in the adjusted R^2 when both measures of external linkages are added to the regression.

Table 2 reports the estimation results for the equation system (3). The estimation results for the main equation (the first equation in [3]) are similar to those of the single equation estimation. The sign of the effects of each variable in the GDP correlation equation is the same; the internal trade integration and external trade and financial integration have positive effects on business cycle co-movements, but internal financial integration has a negative effect. The estimated coefficients are significant in most cases.

The results show that the measures of external trade and financial linkages positively affect regional business cycle co-movements. This finding implies that similar and strong common external linkages of two countries increase the business cycle co-movements between them. This is not surprising. For example, suppose the trade linkages between Korea and the U.S. and that between Thailand and the U.S. are strong and similar. Suppose further that the U.S. economy is hit by recession. Then, both Korea and Thailand will have difficulties exporting to the U.S. Hence, both countries are likely to experience a fall in income and a worsening trade balance against the U.S., which leads to business cycle synchronization of the two countries. Similarly, suppose the financial linkage between Korea and the U.S. and that between Thailand and the U.S. are strong and similar. Suppose further that the U.S. economy goes into recession, which decreases the price of U.S. financial assets. Then, the net investment income and capital gain on financial assets in the U.S. owned by Korea and Thailand are likely to fall. Such a case may lead to a fall in income of the latter two countries and therefore have a positive effect on the business cycle co-movement of the two.

The results also indicate that internal trade integration has a positive effect on business cycle co-movements. Many studies, following Frankel and Rose (1988), likewise observed the positive effect of trade integration on business cycle co-movements. Frankel and Ross (1988) interpreted that a possible negative effect of trade-induced specialization can be weaker than the direct positive effect of trade integration on business cycle co-movements; Imbs (2004) confirmed such a conjecture. We may attach a similar interpretation to our empirical results.

Interestingly, internal financial integration is found to have a negative effect on the regional business cycle correlation. Past empirical studies (e.g., Imbs, 2004, 2006 for the countries around the world; Shin and Sohn, 2006, for Asian countries) mostly found that the effect is either positive or insignificant. The result of the current study is particularly interesting because the effect is positive when the measures for external



linkages are not included in the estimation as in the past studies. External linkages are found to have a significant effect on internal business cycle synchronization. By omitting the measures for external linkages, the effect of internal integration on internal business cycle synchronization can be improperly estimated.⁶

Theoretically, the effects of financial integration on business cycle correlation are ambiguous. On the one hand, some theories imply a negative effect. As suggested by Backus, Kehoe, and Kydland (1992) and by Baxter and Crucini (1995), a country-specific positive productivity shock in the home country induces capitalflows from the foreign country in a two-country model, by increasing the marginal productivity of capital gap between the home and the foreign countries, thereby generating a negative correlation between the two countries' outputs. Obstfeld (1994) suggested that financial integration can promote investments on risky projects, leading countries to specialize based on comparative advantages. This effect may lead to a negative output correlation. On the other hand, other theories, such as that by Calvo and Mendoza (2000) suggest a positive effect: financial globalization may promote contagion and increase business cycle co-movement by weakening incentives for gathering costly information in the presence of short-selling constraints and by strengthening incentives for imitating arbitrary market portfolio if below-market performance is costly for portfolio managers. The former theory, which suggests a negative effect, is consistent with our results.

Our results also show that internal trade and financial integration affect each other positively; the estimated coefficients on the measure of internal trade integration in the finance equation and the measure of internal financial integration in the trade equation are both positive and significant. This result may imply that policy efforts to promote regional trade (or financial) integration lead not only to regional trade (or financial) integration but also to regional financial (or trade) integration. This result also suggests that regional financial integration has a negative direct effect on business cycle co-movement, but it also has a positive indirect effect by affecting regional trade integration positively. After considering this indirect positive effect, the overall negative

⁶Gong and Kim (2012) applied a similar method to various regions of developing countries and found that the effect is negative after controlling external linkages. On the other hand, the result is broadly aligned with that of Kalemli-Ozcan, Papaioannou, and Peydró (2009). The latter suggested that past studies suffer from omitted variable bias, for example, not controlling the aggregate effect, and that the effect of financial integration on business cycle co-movements is negative after controlling such a bias.



effect of internal financial integration on regional business cycle co-movements may not be all that great.

Most coefficients are estimated significantly in the above regressions. Thus, inferring which of the variables is the most important in explaining business cycle co-movements is difficult. To infer the relative importance of the variables, the method suggested by Kruskal (1987) is applied in calculating the proportion of variance of the business cycle correlation explained by each variable.⁷

Table 3 shows that the most important variable is external finance linkages, followed by internal financial integration, suggesting that financial linkages may be more relevant than trade integration in explaining the business cycle synchronization of Asian countries. In addition, the sum of the proportion for the two external linkages is larger than the sum of the proportion for two internal linkages, which is consistent with the popular notion that Asian economies are significantly affected by the economic conditions of advanced countries.

IV. CONCLUSION

This paper examines the effects of economic integration on the regional business cycle synchronization of Asian countries. In particular, we analyze the effects of internal vs. external integration and trade vs. financial integration on the business cycle synchronization of Asian countries. A similar and strong common external linkage was found to have a significant positive effect on the business cycle synchronization of Asian countries. This finding implies that shocks from major industrial countries outside Asia affect Asian countries and generate business cycle co-movement among countries in the region. Furthermore, external linkages, especially external financial linkages, were found to be the most important determinant of business cycle co-movements of Asian countries. The positive effect of internal trade linkages found in past empirical studies was also confirmed. Interestingly, we found that, after controlling for external linkages, internal financial linkages have a negative effect on Asian business cycle

⁷This method can be referred to as the averaging relative importance over all orderings of the independent variables. First, we calculate the proportion of variance of the dependent variable linearly accounted by the first independent variable. Then, we calculate the proportion of the remaining variance of the dependent variable linearly accounted by the second independent variable, and so on. Then, we calculate the average proportion of all possible orderings. For the details, see Kruskal (1987).



synchronization. This is in contrast with previous studies that found a positive effect of internal financial linkages but did not take external linkages into account.

The empirical results suggest that the regional policy efforts on trade integration within Asia, such as FTAs among some ASEAN+3 countries, have contributed to the business cycle synchronization of member countries by increasing the extent of internal trade integration. If such efforts are pursued further in the future, business cycles of Asian countries are likely to be synchronized further. More synchronized regional business cycles in turn will increase the need for regional macroeconomic policy coordination and decrease the cost of regional monetary integration.

On the other hand, the empirical results indicate that regional efforts to improve financial integration within Asia, such as CMIM and ABMI, have affected regional business cycle co-movements negatively. However, the empirical results also show that regional financial integration has a positive effect on regional trade integration, which in turn has a positive effect on business cycle co-movements. For example, regional efforts like CMIM and ABMI may have a negative direct effect on business cycle comovements, but they can have a positive indirect effect on business cycle by increasing the trade integration. After taking account of the indirect effect, the overall negative effect is likely to be small.

More importantly, regional financial integration/cooperation provides various other benefits, for example, reducing the possibility of future crisis, enhancing risk sharing, and efficiently allocating savings into investments.⁸ When such benefits are considered, further efforts on regional financial cooperation are highly likely to improve welfare of countries in the region. In addition, even regional monetary integration can be more feasible with further efforts on regional financial cooperation. For example, regional financial integration can reduce the cost of monetary union by increasing consumption risk sharing within the region, which can be regarded as a built-in stabilization mechanism in the presence of asymmetric income shocks.⁹ Therefore, further regional financial integration/cooperation, especially comprehensive efforts like ACMI (Asian Capital Market Initiative) that can provide various general benefits to Asian countries, is a crucial task for Asia.

⁸Refer to Kim and Yang (2012) for various benefits of regional financial cooperation/integration in the context of Asia.

⁹Refer to Kim, Kim, and Wang (2004, 2006) for the measurement of the degree of consumption risk sharing in Asia.



REFERENCES

- Backus, David, Patrick Kehoe, and Finn E. Kydland. 1992. International real business cycles. *Journal of Political Economy* 100 (4): 745-775.
- Brooks, Douglas H. and Changchun Hua. 2008. Asian Trade and Global Linkages. ADB Institute Working Paper no. 122
- Canova, Fabio and Harris Dellas. 1993. Trade Interdependence and the International Business Cycle. *Journal of International Economics* 34: 23–47.
- Gong, Chi, and Soyoung Kim. 2012. Regional Business Cycle Synchronization in Developing Countries: Regional or Global Integration? Trade or Financial Integration?. Working Paper. Seoul National University.
- Dées, Stéphane and Nico Zorell. 2011. Business cycle synchronisation: disentangling trade and financial linkages. European Central Bank working paper NO 1322
- Imbs, Jean. 2004. Trade, finance, specialization, and synchronization. *Review of Economics and Statistics* 86(3): 723-734.
- Imbs, Jean. 2006. The real effects of financial integration. *Journal of International Economics* 68: 296-324.
- Frankel, Jeffrey Alexander and Andrew Kenan Rose. 1998. The endogeneity of the optimum currency area criteria. *The Economic Journal* 108: 1009–1025.
- Frankel, Jeffrey Alexander and Andrew Kenan Rose. 2002. An Estimate of the Effect of Common Currencies on Trade and Income. *The Quarterly Journal of Economics* 117(2): 437-466
- Heathcote, Jonathan and Fabrizio Perri. 2002. Financial Globalization and Real Regionalization. NBER Working Papers 9292.
- Hodrick, R.J. and E. Prescott. 1980. Post-war U.S. Business-Cycles: An Empirical Investigation. Working Paper. Carnegie-Mellon University.
- Kalemli-Ozcan, Sebnem, Elias Papaioannou, and José Luis Peydró. 2009. Financial integration and business cycle synchronization. NBER Working Paper 14887.
- Kim, Soyoung, Sunghyun Henry Kim, and Yunjong Wang. 2004. Regional vs. Global Risk Sharing in East Asia. *Asian Economic Papers* 3(3): 182-201.



- Kim, Soyoung, Sunghyun Henry Kim, and Yunjong Wang. 2006. Financial Integration and Consumption Risksharing in East Asia. *Japan and the World Economy* 18: 143-157.
- Kim, Soyoung and Jong-Wha Lee. 2008. Real and Financial Integration in East Asia. Working Papers on Regional Economic Integration 17. Asian Development Bank.
- Kim, Soyoung, Jong-Wha Lee, and Cynyoung Park. 2011. Emerging Asia: Decoupling or Recoupling. *The World Economy* 34(1): 23-53.
- Kim, Soyoung and Doo Yong Yang. 2012. Tied or Not Tied? Regional Financial Architecture in Asia. Working Paper. Seoul National University.
- Kose, Ayhan, Kei-Mu Yi. 2001. International trade and business cycles: Is vertical specialization the missing link? *American Economic Review* 91(2): 371-375.
- Kose, Ayhan, Christopher Otrok, and Eswar Prasad. 2008. Global Business Cycles: Convergence or Decoupling?. International Monetary Fund Working Paper No. 08/143.
- Kose, Ayhan, Eswar S. Prasad, and Marco E. Terrones. 2003. How Does Globalization Affect the Synchronization of Business Cycles? *The American Economic Review* 93(2): 57-62.
- Kruskal, William. 1987. Relative Importance by Averaging Over Orderings. *The American Statistician* 41(1): 6-10.
- Kuroda, Haruhiko. 2004. Transition Steps in the Road to a Single Currency in East Asia. Paper presented at the ADB Seminar, A Single Currency for East Asia—Lessons from Europe, 14 May, Jeju
- Moneta, Fabio and Rasmus Ruffer. 2009. Business cycle synchronisation in East Asia. *Journal of Asian Economics* 20: 1-12.
- Mundell, Robert. 1961. A theory of optimum currency area. *American Economic Review* 60 : 657–665.
- Mundell, Robert. 2003. Prospects for an Asian currency area. *Journal of Asian Economics* 14(1) : 1-10.
- Ogawa, Eiji, and Junko Shimizu, 2011, Asian Monetary Unit and Monetary Cooperation in Asia. ADBI Working Paper No. 275
- Shin, Kwanho, and Chan-Hyun Sohn. 2006. Trade and financial integration in East Asia: Effects on Co-movements. *World Economy* 29(12) : 1649–1669.



Rana, Pradumna B. 2007. Trade Intensity and Business Cycle Synchronization: The Case of East Asia. ADB Working Paper Series on Regional Economic Integration No. 10.



Table 1. Single Equation Estimation

A. ASEAN+3

ρ	OLS	OLS	OLS	OLS
T	0.005 (1.58)		-0.001 (-0.11)	0.027 (2.56)**
F		0.019 (1.82)*	0.021 (0.87)	-0.109 (-2.61)**
EXT				0.015 (1.45)
EXF				0.090 (3.20)***
$\bar{R}^2$	0.041	0.062	0.034	0.277

*P<0.1; ** P<0.05; ***P<0.01

B. ASEAN+7

P	OLS	OLS	OLS	OLS
T	0.006 (1.86)*		0.001 (0.14)	0.018 (2.09)**
F		0.020 (2.08)**	0.0177 (0.92)	-0.069 (-2.24)**
EXT				0.011 (1.18)
EXF				0.067 (3.16)***
$\bar{R}^2$	0.031	0.041	0.029	0.146

*P<0.1; ** P<0.05; ***P<0.01



Table 2. Equation System Estimation

	ASEAN+3	ASEAN+7
GDP correlations (ρ) equation		
T	0.070 (2.84)***	0.033 (1.60)
F	-0.303 (-2.82)***	-0.155 (-2.07)**
EXT	0.038 (2.20)**	0.023 (1.71)*
EXF	0.186 (3.28)***	0.112 (2.63)***
$\bar{R}^2$	-0.202	0.045
Trade (T) equation		
F	3.941 (7.02)***	3.794 (5.47)***
EXT	-0.285 (-1.16)	-0.059 (-0.22)
EXF	-1.950 (-5.32)***	-2.026 (-5.42)***
$\bar{R}^2$	0.915	0.848
Finance (F) equation		
T	0.217 (7.18)***	0.243 (5.95)***
EXT	0.122 (2.09)**	0.044 (0.49)
EXF	0.473 (4.34)***	0.517 (6.24)***
$\bar{R}^2$	0.948	0.908



Table 3. Partial and Relative Importance Index

A. ASEAN+3

Variable	Partial Corr.	Semipartial Corr.	Relative Importance Index
T	0.42	0.37	0.06
F	-0.42	-0.38	0.06
EXT	0.25	0.21	0.02
EXF	0.50	0.46	0.09

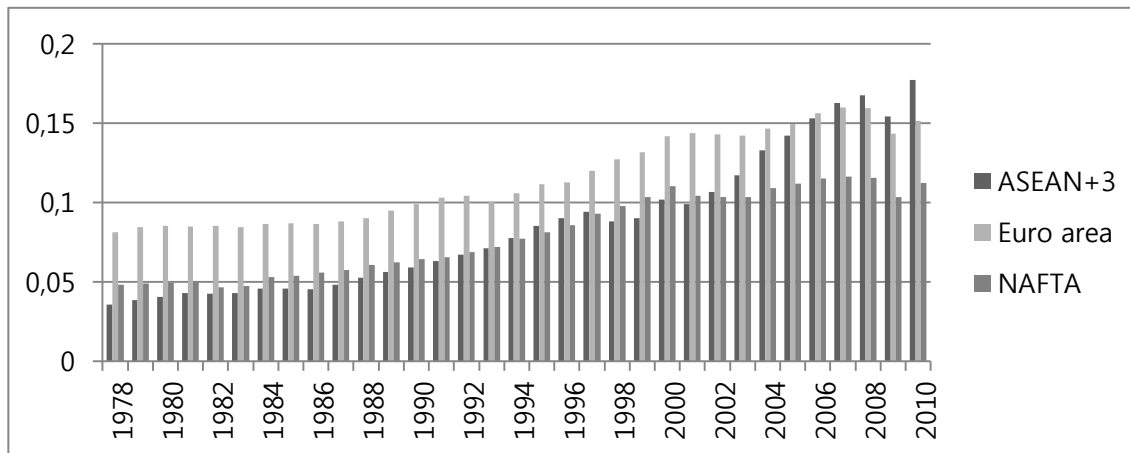
B. ASEAN+7

Variable	Partial Corr.	Semipartial Corr.	Relative Importance Index
T	0.24	0.22	0.02
F	-0.25	-0.24	0.03
EXT	0.14	0.12	0.01
EXF	0.35	0.33	0.05

Note: Partial correlation measures the degree of association between two random variables, with the effect of a set of controlling random variables removed. The semipartial correlation statistic is similar to the partial correlation statistic. Both measure variance correlations after certain factors are controlled, but to calculate the semipartial correlation, the third variable is held constant for either X or Y, whereas for partial correlations, the third variable is held constant for both.



Figure 1. Total Trade of Various Regions (% of World GDP)



Source: The World Bank, World Development Indicators & Global Development Finance.

Note: Constant 2000US\$