

Research Institute of Economy, Trade and Industry (RIETI)

Japan-China-Korea (A3) Conference
Monetary and Financial
Cooperation in the Region
Reference

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May 24, 2012

<http://www.rieti.go.jp/en/>

**Regional Business Cycle Synchronization in Asia:
Internal or External Integration? Trade or Financial Integration? ***

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May 2012

Abstract

This paper examines the effects of internal (or regional) vs. external (inter-regional) and trade vs. financial integration on internal (or regional) business cycle synchronization in Asia during the 2000s. The empirical results show that (1) similar and positive external linkages have significant positive effects on regional business cycle synchronization in Asia (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 on regional business cycle synchronization. The negative effect of financial integration is especially interesting because past empirical studies often found a positive effect despite of the negative effect predicted by theories.

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

JEL Classification Codes: F4

* We thank Anwar Nasution, Bokyeong Park, and seminar participants at Seoul National University and Asian Economic Panel. Financial support from the Institute for Research in Finance and Economics of Seoul National University is gratefully acknowledged.

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I. Introduction

After Asian financial crisis, international economic linkages of Asian countries have increased rapidly for both financial and trade sides. Lowering trade barriers and forming free trade agreements have contributed to international trade integration of Asian countries. The total exports and imports of ASEAN+3 countries was 55.85% of their GDP (3.5% of world GDP) in 1990 but it increases up to 103.68% of their GDP (15.75% of world GDP).¹ Figure 1 shows total trade of emerging Asian countries during the period of 1987-2010 in comparison to other major regions such as NAFTA and the Euro Area. Obviously, Asia countries become a vital region for the world trade, as important as Euro Area now.

INSERT FIGURE 1

On the financial side, capital account liberalization and financial cooperation promote financial globalization of Asian countries. The ratio of total assets and liabilities to GDP of ASEAN+3 countries was 95.61% in 1990 (21.07% of world GDP), and it increases up to 246.44% (59.50% of world GDP) in 2009. These numbers are smaller than those for Euro Area and NAFTA in 2009. Euro Area's total assets and liabilities amount to 627.07% of its GDP (108.79% of world GDP). For NAFTA, they are 338.13% of its GDO (108.77% of world GDP). However, financial globalization trend in Asian countries is still very strong.

Economic integration process has also progressed at regional level. Regional trade agreements such as ASEAN and production sharing networks in emerging Asian countries have led to the deepening of regional trade integration. Regional financial cooperation such as CMIM and ABMI contributed to the developments of regional financial market integration.

On the other hand, many past studies documented that business cycle comovements of emerging Asian countries changed substantially after Asian financial crisis. In particular, some studies (i.e., Kim and Lee, 2012, Imbs, 2011, Moneta and Ruffer, 2009) documented that business cycles are more synchronized after Asian financial crisis. Business cycle comovements of emerging Asian countries have various important implications for the region. For example, business cycle synchronization in the region may suggest that common macroeconomic policy responses and policy cooperation are needed in the region. It is also an important criteria to judge the costs of regional monetary integration.

¹ In this paper, ASEAN+3 countries indicate nine economies (Japan, China, Korea, Malaysia, the Philippines, Indonesia, Thailand, Hong Kong, Singapore).

This paper investigates how economic integration affects business cycle synchronization in emerging Asian countries. In particular, we distinguish two types of integrations, (1) trade integration vs. financial integration and (2) external (or inter-regional) vs. internal (or regional) integration. That is, this paper examines how different types of integration (real vs. financial and internal vs. external) affect business cycle synchronization of countries within the region.

Many past studies (i.e., Imbs, 2004, 2006, Kalemli-Ozcan et al, 2009) investigated the effects of trade and financial integration on business cycle synchronization. Some past studies also investigated a similar issue for Asian countries, that is, how trade and/or financial integration affects business cycle synchronization within Asian countries. However, 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 business cycle synchronization. A few studies such as Shin and Sohn (2006) and Imbs (2011) examined the effects of both trade and financial integration but these studies either concentrate on internal integration or does not distinguish internal vs. external integration.

However, it is important to distinguish internal economic integration (within Asia) from external economic linkage (with the rest of the world), in explaining business cycle synchronization within Asia, because both internal and external economic linkages can affect business cycle synchronization within the region but in a different way. The size of the effects of internal trade (or financial) integration on regional business cycle may be different from the size of external trade (or financial) linkages. In such a case, the effects of internal and external integration are better to be estimated separately. In addition, internal and external integration may affect regional business cycle comovement in opposite directions. For example, a similar pattern of external financial linkage of countries in the region may increase business cycle synchronization within the region, but internal financial integration may decrease the business cycle synchronization within the region.

Further, by separately estimating the effects, we can infer which is more important, internal integration or external integration, in explaining business cycle synchronization of Asian countries. Also, effects of regional economic integration efforts on business cycle synchronization can be better understood. For example, we can have a more clear answer on how further trade integration within the region such as FTA among ASEAN+3 and further developments of Asian financial cooperation will affect Asian business cycle synchronization, separately.

The rest of the paper is organized as follows. Section 2 shows the trends in internal vs. external and financial vs. trade integration of Asian countries, and business cycle synchronization of East Asian countries. Section 3 explains the empirical methodology. Section 4 discusses the empirical results. Section 5 concludes with a summary of results.

II. Trends in Economic Integration and Business Cycle Synchronization

As trade and financial integration deepen, the business cycle comovements among countries can change. Empirical literature suggests that trade integration tends to increase the comovement of output (i.e., Canova and Dellas, 1993 and Frankel and Rose, 1998) although theoretical predictions are not always clear. Past empirical studies often found that financial integration also tends to increase the comovement of output (i.e., Imbs, 2004, 2006), but a recent study by Balemli-Ozcan et al. (2009) showed a negative effect, to be consistent with theoretical prediction.

Before we analyze the effects of economic integration on business cycle synchronization in Asia, we briefly show the trend in trade and financial integration and business cycle comovements of Asian countries. In particular, we show the trend in internal vs. external and trade vs. financial integration, and internal vs. external business cycle comovements of Asian countries.

II. 1. Economic Integration

Table 1 shows trade relation of Asian countries, comprising intra-regional and inter-regional trade relations. It shows that intraregional trade among nine Asian economies (“ASEAN+3”) increased steadily to 46.1% of total trade in 2005, from 37.8% in 1990 although declines to 44.6% in 2009 due to global financial crisis. The level is higher than the North American Free Trade Agreement (NAFTA) economies (40.5% in 2009) but lower than the EU economies (65.6% in 2009). If measured by % of GDP, the intra-East Asian trade reached 25.6% in 2006 and 21.7% in 2009, from 11.1% in 1990, higher than the EU economies after 1995 (17.7% in 2005 and 15.9% in 2009) and substantially higher than NAFTA (11.2% in 2005 and 9.3% in 2009). The share of intra-regional trade is also substantial among the 13 Asia-Pacific economies

(“ASEAN+7”), increasing to 49.4% in 2005, from 41.4% in 1990, but declining to 49.2% in 2009.² As % of GDP, the intraregional trade has also increased, to 25.4% in 2006 from 11.6% but declining to 22.7% in 2009. This increasing trend of intra-regional trade is found not only for the overall Asia, but also for individual Asian countries. In 2009, the average of intra-regional trade between the individual of ASEAN+3 with the whole ASEAN+3 is over 60% of GDP. This average rate is near 50% of GDP for ASEAN+7 economies in 2009. This reflects a tight trade linkage among Asian countries.

“INSERT Table 1 Here”

For external trade relation, the share of the G6 economies (G7 countries excluding Japan) in trade for ASEAN+3 has been declining, but remains substantial at 24.3% in 2005 and 21.0% in 2009, from 35.8% in 1990. The share of the G6 economy in trade for ASEAN+7 has also been declining from 35.6% in 1990 to 20.8% in 2009. However, this does not necessarily imply that the trade linkage of Asian countries with G6 is weaker in the 2000s than in the 1990s. As % of GDP, the trade of ASEAN+3 with G6 was 10.5% in 1990 and it is still 10.2% in 2009. Similarly, the trade of ASEAN+7 with G6 was 10.0 % in 1990 and it is till 9.6% in 2009. Considering the rapid economic growth of Asian countries, this implies that the actual trade amount with G6 economies increased. In addition, as documented by some past studies (see ADB, 2007, Kim, Lee, and Park, 2011), a substantial part of intraregional trade is driven by trade of intermediate goods among Asian economies, with final production destined for export outside the region. In this context, intraregional trade dynamics remain sensitive to changes in external demand in industrialized economies.

Table 2 shows a quantitative measure of financial integration, cross-border holdings of portfolio assets and liabilities including equity and long-, and short-term debt securities. For ASEAN+3, total portfolio assets increased from 0.95 trillion \$ in 1997 to 4.86 trillion \$ and total portfolio liabilities increased from 0.57 in 1997 to 3.07 trillion \$ in 2010.

“INSERT Table 2 Here”

² In this paper, ASEAN+7 includes nine ASEAN+3 economies, India, Pakistan, New Zealand, and Australia.

We can also see that intraregional portfolio investments increased substantially. The total recorded level of cross-border portfolio asset and liability holdings among ASEAN+3 economies was just about 85.52 and 44.98 billion \$, respectively, in 1997. They increased to 579.03 and 541.75 billion \$, respectively, in 2010. ASEAN+3's assets constituted 9.0 % of total holdings for ASEAN+3 in 1997, but decreased to 5.7% in 2001, which was partly affected by the Asia financial Crisis, but increased to 11.9% in 2010. In comparison, the proportion of their assets in G6 declined to 60.0% in 2001 and 46.6% in 2010, from 62.0% in 1997. For liabilities, we can see even a sharper increase in the proportion of intra-regional portfolio investments. The proportion of intra-regional portfolio investment in liabilities increased from 7.9% in 1997 to 17.6% in 2010. However, as in the case of trade relation, this does not imply that the financial linkage with the G6 has decreased in recent years. As shown in Table 2, the actual size of cross-border assets between Asia and the U.S. increased substantially, along with financial globalization around the world.

II.2. Business Cycle Comovements

This section gives a brief description on business cycle comovements of Asian countries. As in many past studies, we use the contemporaneous bilateral correlation coefficient of cyclical real GDP of two countries to describe business cycle comovements of two countries. To obtain (log of) the trend real GDP, HP filter is applied to (log of) the real GDP. To obtain (log of) the cyclical real GDP, (log of) the trend real GDP is subtracted from (log of) the real GDP. Annual data is used for 1990-2009.³

Table 3 present the correlation coefficients of cyclical real GDP for the pair of 14 Asia-Pacific countries, and also the correlation coefficients of cyclical real GDP of 14 Asia-Pacific countries and G-6 countries. First, business cycle comovements of Asian countries are higher in the 2000s than in the 1990s. Bilateral correlation among Asian countries increased in most cases. As can be seen in the average number ("Avg."), the business cycle comovements increased in 7 out of 10 countries in ASEAN+3 and increased in 11 out of 14 countries in ASEAN+7. In addition, the business cycle synchronization of Asian countries with U.S. and G6 also increased. On average, the correlation ASEAN+3 with the U.S. increased from -0.15 to 0.45 and the correlation with G6 increased from -0.13 to 0.66, while the correlation of ASEAN+7 with the U.S. increased from 0.03 to 0.45 and the correlation with G6 increased from 0.04 to 0.63.

³ Real GDP in local unit is used for all cases except for G6 aggregate, where real GDP in PPP is used.

“Insert Table 3 Here”

The increase in the business cycle comovements of Asian countries can be related to a higher degree of trade and financial integration within Asian economies documented in the previous section. However, this can also be related to a higher business cycle comovement of Asian countries with advanced countries (as can be seen in Table 3), which in turn can be related to a more similar and stronger economic linkages between Asian countries and advanced countries, possibly with a stronger shocks in advanced countries. In the next section, we formally examine the effects of internal vs. external and trade vs. financial integration on business cycle comovments of Asian countries.

III. Empirical Method

III. 1. Empirical Model

A simplified version of the regression that analyzes the effects of trade and financial integration on business cycle synchronization, used in past studies (i.e., Imbs, 2004, 2006, 2011), may be summarized as follows.

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

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 effects of trade and financial integration on business cycle synchronization.

Such a regression may not have much problem if the sample covers most countries around the world. However, if we consider only countries in a region (i.e., countries in Asia), it can be problematic because business cycle synchronization of countries in a region can be affected not only by economic integration of countries within the region but also by economic linkages with countries outside the region. For example, structural shocks in the U.S. can affect both Korea and Thailand in a similar way, when Korea and Thailand have a similar and strong economic linkages

with the U.S. As a more concrete example, U.S. recession is likely to decrease the exports of Korea and Thailand to the U.S., which may generate recession in Korea and Thailand and generate a positive business cycle comovement between Korean and Thailand. In particular, if Korea and Thailand's trade relation with the U.S. are strong and similar, business cycle comovements due to this external trade linkage is likely to be stronger.

To consider such effects from the economic relation with the countries outside the region, a variable is added in equation (1) as follows.

$$(2) \quad \rho_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 F_{ij} + \alpha_3 EX_{ij} + \varepsilon_{ij}$$

where EX shows the external linkage that generates business cycle synchronization between country i and j, or more precisely how strong and similar the external linkage of country i and j with the countries outside the region.

The external linkage may be divided into two types, trade and financial linkages as follows.

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

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

We also consider the following equation system in which interactions among RHS variables are allowed.

$$(4) \quad \rho_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 F_{ij} + \alpha_3 EXT_{ij} + \alpha_4 EXF_{ij} + \varepsilon_{ij}^1$$

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

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

where I_{ij}^T and I_{ij}^F are the 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 effect (α_1) and indirect effect ($\gamma_1 \alpha_2$) by affecting internal financial integration. Similarly, internal financial integration can have both direct effect (α_2) and indirect effect ($\beta_1 \alpha_1$) by affecting internal trade integration. In addition, indirect effects of two external linkages through internal integration are also allowed; two external linkages are allowed to affect business cycle synchronization by affecting internal trade or financial integration.

Equations (1), (2), and (3) are estimated by OLS. Equation system (4) is estimated by three stage least square.

III.2. Measurement and Data

To measure the degree of trade integration, we use the measure of the trade intensity between country i and j (T_{ij}) is constructed by the following formula.

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

where $X_{i,j,t}$ is the amount of export from country i to j at time t ; $M_{i,j,t}$ is the amount of import from country i to j at time t ; Y_t^W is the world GDP at time t ; $Y_{i,t}$ is the country i 's GDP at time t . This measure is used in many past studies including Imbs (2006). The measure has a theoretical background, as shown in the gravity model of Deardorff (1998). The measure depends only on trade barriers, but not on the country size. This property is particularly useful in our case, since Asian countries in our sample are quite diversified in terms of their sizes. Deardorff (1998) showed that it equals one if preferences are homothetic and there are no trade barriers.

A similar measure for financial integration between country i and j is constructed for financial integration.⁴ The measure of the financial integration between i and j ($F_{i,j}$) is as follows.

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

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

where $I_{i,j,t}$ is the amount of portfolio investment from country i to j at time t . To measure the degree of financial integration, many past studies inclined to use the portfolio investment data when studying the effects of financial integration on business cycle synchronization. Following past studies, we also used bilateral portfolio investment data (CIPS).⁵

The measure of external trade linkages that affect 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 the trade integration of countries i and k and that of countries j and k . $|T_{i,k} - T_{j,k}|$ shows the difference between the trade integration of countries i and j with 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 how strong the common part of trade integration of countries i and j with country k .

The intuition behind this measure is the following. If two countries in a region, for example, Korea and Thailand in Asia, have a similar and strong external trade integration with the countries outside the region, for example, G6, business cycle comovement between Korea and Thailand is likely to be high. The first term naturally shows the similarity of Korea's external trade linkages and Thailand's external trade linkages. The second term shows how strong common external trade linkages of Korea and Thailand are. Trade intensities of Korea and Thailand with G6 themselves (T_{ik} and T_{jk}) show how strong external trade linkages of Korea and Thailand are, but business cycle correlation of Korea and Thailand is likely to be generated only to the extent that

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

they have the common part. Therefore, the minimum of external trade intensities of two countries is used.

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

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

where $MAXT$ is the largest value among T_{ij} and $T_{i,k}$ 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 j with k . The second term ($\min\{F_{i,k}, F_{j,k}\}$) how strong the common part of financial integration of countries i and j with country k .

Also note that these measures for external linkages are different from the measures for internal integration in their nature. The measures for internal integration simply show how intensive trade and financial integration between countries i and j but the measures for external linkages show how strong and similar the external integration of countries i and j with countries outside the region by using the basic measure of external trade intensities.

As instruments for the system estimation, we include the geographic distance of two countries' capital cities, whether the border exists between two countries, and whether the common official language is used in both countries, following past empirical studies on the determinants of bilateral trade, in 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 capital real GDP and the difference of two countries' per capital real GDP. The level of income may affect the degree of financial integration since financial markets and technologies are better developed in high income countries and financial integration between high income countries may be easier. A large difference in the level of income may make financial integration difficult.

We consider the following group of countries. First, we consider large countries in ASEAN+3 (China, Japan, Korea, Malaysia, Thailand, Indonesia, the Philippines, Singapore, Hong Kong) since various policy cooperation such as CMIM and ABMI is lively discussed among these group of countries. Second, we add four countries (India, Pakistan, New Zealand, Australia,

“ASEAN+7”) to ASEAN+3 since policy debates often include these four countries as potential candidates for extended policy cooperation in Asia.

For the measure of business cycle correlation, we calculate the correlation of cyclical real GDP for 2001-2009 (annual data) as reported in Table 3. For all other measure, the average values of 2001-2009 are used. Correlations among various measures are reported in Table 4.⁶ The table shows that the business cycle synchronization measure (ρ) is more correlated with external linkage measures than with internal integration measures. This might imply that business cycle synchronization of Asian countries is more related with external linkages than with internal integration, but the formal analysis will be performed in the next section.

IV. Results

Table 5 shows the results for the single equation method; each equation is estimated by OLS. When the measure for internal trade integration is included as the only regressor, the coefficient on the measure for internal trade integration is positive for both ASEAN+3 and ASEAN+7, although it is significant at 10% level only for ASEAN+7. Similarly, when the measure for internal financial integration included as the only regressor, the coefficient on the measure for international financial integration is positive and significant at 5% level for ASEAN+7 and at 10% level for ASEAN+3. However, when both measures are included as regressors, both coefficients are not significantly estimated. This is probably because of the high correlation between these two measures as reported in Table 4.

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 but 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 5% level, while the estimated coefficients on the measure for external financial integration are significant at 1% level. From Table 5, we can also see that adjusted R^2 increased substantially when two measures of external linkages are added in the regression.

Table 6 reports the estimation results for the equation system (4). The estimation result for the main equation (the first equation in (4)) is similar to the result of the single equation estimation.

⁶ ρ_1 , EXT1, and EXF1 are alternative measures to check the robustness of the results. Section 4 explains those measures.

The sign of the effects of each variable in the GDP correlation equation is the same; internal trade integration and external trade and financial integration have positive effects on business cycle comovements but internal financial integration has a negative effect. The estimated coefficients are significant in most cases. The positive effect of internal trade integration is significant at 1% level for ASEAN+3. The negative effect of internal financial integration is significant at 1% level for ASEAN+3 and at 5% level for ASEAN+7. The positive effect of external trade integration is significant at 5% level for ASEAN+3 and at 10% level for ASEAN+7. The positive effect of external financial integration is significant at 1% level for both samples.

These results suggest that external linkages affect regional business cycle comovements. Similar and strong external linkages of two countries increase the business cycle comovements of the two countries. Foreign shocks are likely to affect two countries in a similar way and generate positive business cycle comovements of the two countries, if external linkages of two countries are similar and strong. Internal trade integration also has a positive effect on business cycle correlation, which is consistent with many past studies that document a positive effect of trade integration on business cycle comovements.

A very interesting result is the negative effect of internal financial integration on internal business cycle correlation. Theoretically, financial integration is likely to have a negative effect on business cycle correlation. As suggested by Backus, Kehoe, and Kydland (1992) and Baxter and Crucini (1995), in a two country complete market model, a country-specific positive productivity shock induces capital from the other country by increasing marginal productivity of capital, and generate a negative correlation between output of two countries. Obstfeld (1994) suggested that financial integration can promote investments on risky projects, leading countries to specialize based on comparative advantages. This may lead to a negative correlation of output. Despite of these theoretical predictions, past empirical studies (i.e., Imbs, 2004, 2006, Otto, Voss, and Wilard, 2001, Terrones, 2004, Davis, 2008) often found insignificant or positive effects of financial integration on business cycle comovements.

The result of current study is particularly interesting because the effect is positive when the measures for external linkages are not included in the estimation. We find that external linkages 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. In our case, the effect of internal financial integration is negative when external linkages are included in the regression, but it is positive when

external linkages are not included. This result is in line with Kalemli-Ozcan, Papaioannou, and Peydró (2009). Kalemli-Ozcan, Papaioannou, and Peydró (2009) suggested that past studies suffer from omitted variable bias, for example, not controlling aggregate effect, and that the effect of financial integration on business cycle comovements is negative, after controlling such a bias.

In the regression, most coefficients are estimated significantly, so it is not so easy to infer which variable is the most important variable in explaining business cycle comovements. To infer the relative importance of the variables, the method suggested by Kruskal (1987) is applied in calculating the proportion of variance of business cycle correlation explained by each variable.⁷ Table 7 reports the results. The most important variable is external finance linkage. The next one is internal financial integration. This is interesting in that newly growing economic linkage, that is, financial linkage is more important than the traditional economic integration, that is, trade integration, in explaining business cycle synchronization of Asian countries. In addition, the sum of the proportion for two external linkages is larger than the sum of the proportion for two internal linkages. This result suggests that external linkage is as important as internal linkage, which is consistent with the popular notion that Asian economies are significantly affected by economic condition of advanced countries.

We also perform various exercises to check the robustness of the results. First, we use the correlation of real GDP growth rate (“ ρ_1 ”), instead of the correlation of cyclical real GDP, as the measure of business cycle correlation. Second, alternative measures for external linkages are used as follows.

$$EX1_{ij} \equiv \sum_{k=1}^6 w_k \rho_{ij,k}$$

$$EXT1_{ij} \equiv \sum_{k=1}^6 w_k \min\{T_{i,k}, T_{j,k}\}$$

$$EXF1_{ij} \equiv \sum_{k=1}^6 w_k \min\{F_{i,k}, F_{j,k}\}$$

⁷ The method can be called as 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 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).

In these measures, the size of the common external linkage is only considered by dropping the term showing the similarity of external linkage. Third, alternative measures for trade and financial integration are considered.

$$T1_{i,j} = \frac{1}{T} \sum_t \frac{(X_{i,j,t} + M_{j,i,t})}{Y_{i,t} + Y_{j,t}}$$

$$F1_{i,j} = \frac{1}{T} \sum_t \frac{(I_{i,j,t} + I_{j,i,t})}{Y_{i,t} + Y_{j,t}}$$

Differently from the original measures, these measures also depend on the country size. Fourth, business cycle comovement structure might have caused economic integration. In this regard, business cycle correlation measures are constructed for the sample period of 2002-2009 but integration measures are constructed only based on 2001 data. The results are reported in Table 7. The results are similar in general.

V. Conclusion

This paper examines the effects of economic integration on business cycle synchronization of Asian countries. In particular, this paper analyzes the effect of internal (or regional) vs. external integration and trade vs. financial integration on business cycle synchronization of Asian countries.

The paper found that a similar and strong external linkage has a significant positive effect on business cycle synchronization. This finding is not surprising because shocks from outside the region can affect countries in a region and generate business cycle comovements among countries in the region, through similar and strong economic linkages of the countries in the region with the countries outside the region.

The paper also found that the internal trade linkage has a positive effect on business cycle synchronization but the internal financial linkage has a negative effect. The positive effect of trade integration is consistent with some theories and past empirical studies. On the other hand, past empirical studies often found a positive effect of the internal financial linkage although theory suggests a negative effect. After controlling the important variable that affects internal business cycle synchronization, namely, external linkages, the empirical effects turn out to be consistent with the theory.

The results suggest that the regional policy efforts on trade integration within Asia, such as FTA among ASEAN+3, is likely to increase business cycle synchronization within the region. On the other hand, the regional efforts on financial integration within Asia, such as ABMI and ACMI, are likely to decrease business cycle synchronization within the region. However, whatever the effects of internal economic integration within Asia, external economic linkages play an important role in determining business cycle synchronization within the region.

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Table 1. Trade Relation of Selected Economies in Asia**A. as % of Total Trade**

	ASEAN+3					ASEAN+7					G6				
	1990	1995	2000	2005	2009	1990	1995	2000	2005	2009	1990	1995	2000	2005	2009
Hong Kong	53.3	54.7	56.1	64.2	67.0	55.5	57.1	58.6	66.8	70.4	26.5	23.9	23.4	17.2	13.8
China	55.9	54.2	47.7	40.2	35.0	58.1	56.5	50.2	43.7	40.0	25.4	26.8	28.9	28.1	26.3
Indonesia	53.8	49.9	51.0	58.1	57.3	58.3	55.0	56.6	64.6	65.6	24.3	26.2	22.0	15.6	14.2
Japan	24.3	34.3	33.9	39.5	42.5	29.4	38.6	37.6	44.0	47.8	43.7	37.8	36.5	27.7	21.7
Korea	34.5	40.9	39.9	44.7	44.0	38.3	44.6	43.4	48.7	48.9	39.3	32.1	29.9	22.2	16.9
Malaysia	54.3	54.2	53.7	54.6	57.4	58.8	57.9	57.6	59.4	63.6	28.0	28.2	26.4	23.6	17.4
Philippines	37.6	44.2	45.1	55.3	57.9	40.7	47.0	47.0	57.3	60.5	38.6	35.6	32.3	22.4	19.0
Singapore	44.4	51.4	50.3	52.0	51.7	48.6	54.8	54.1	57.8	58.4	30.0	26.5	24.7	19.7	16.9
Thailand	45.8	47.0	46.4	49.8	48.5	48.8	49.6	49.8	54.5	55.2	29.6	25.2	26.2	19.3	15.8
Australia	40.7	44.8	44.5	49.0	54.7	46.6	51.7	50.4	56.4	62.4	34.1	29.1	28.0	23.1	18.7
India	18.3	22.5	22.4	25.7	26.7	20.7	24.8	24.4	28.8	30.2	35.4	33.9	30.2	25.3	19.4
NewZealand	26.7	30.7	29.8	31.1	33.6	47.5	54.3	53.0	54.7	57.9	31.6	27.9	28.6	25.7	20.7
Pakistan	27.2	29.6	23.2	23.7	24.9	29.7	31.7	26.5	27.2	29.3	35.6	33.0	30.3	26.9	22.4
ASEAN+3	37.8	45.0	44.2	46.1	44.6	41.8	48.5	47.5	50.2	49.9	35.8	30.9	29.9	24.3	21.0
ASEAN+7	37.1	44.1	43.3	45.1	43.8	41.4	48.0	46.9	49.4	49.2	35.6	30.8	29.8	24.4	20.8

B. as % of GDP

	ASEAN+3					ASEAN+7					G6				
	1990	1995	2000	2005	2009	1990	1995	2000	2005	2009	1990	1995	2000	2005	2009
Hong Kong	102.6	112.2	109.7	177.0	177.4	106.9	117.2	114.7	184.0	186.5	51.0	49.1	45.7	47.4	36.6
China	18.2	24.6	21.6	26.8	16.0	18.9	25.6	22.7	29.2	18.3	8.3	12.1	13.1	18.8	12.1
Indonesia	19.8	19.0	30.1	33.5	24.3	21.4	20.9	33.4	37.3	27.8	9.0	10.0	13.0	9.0	6.0
Japan	4.1	5.1	6.2	9.7	9.6	5.0	5.7	6.9	10.8	10.8	7.4	5.6	6.7	6.8	4.9
Korea	16.7	19.4	24.5	28.9	36.3	18.6	21.2	26.6	31.5	40.3	19.0	15.2	18.3	14.4	14.0
Malaysia	72.9	94.4	109.6	107.1	91.4	78.9	100.7	117.5	116.5	101.4	37.6	49.1	53.9	46.3	27.7
Philippines	121.4	131.6	134.3	158.4	130.3	133.2	140.4	144.6	175.9	147.0	82.2	67.8	66.0	59.8	42.6
Singapore	29.5	36.6	49.9	64.3	52.6	31.4	38.6	53.5	70.4	59.9	19.1	19.6	28.2	25.0	17.2
Thailand	4.6	6.0	5.6	5.7	5.3	5.0	6.4	6.0	6.2	5.8	5.6	6.2	6.8	6.5	5.3
Australia	10.1	13.3	15.1	15.4	17.8	11.5	15.3	17.1	17.7	20.3	8.4	8.6	9.5	7.2	6.1
India	2.4	4.2	4.4	7.1	8.9	2.7	4.6	4.8	8.0	10.1	4.7	6.3	5.9	7.0	6.5
NewZealand	7.4	7.6	6.1	8.8	7.8	8.1	8.2	6.9	10.2	9.1	9.7	8.5	8.0	10.0	7.0
Pakistan	16.9	25.0	46.4	55.0	34.0	18.3	26.6	48.4	57.1	35.5	17.4	20.1	33.3	22.2	11.2
ASEAN+3	11.1	14.1	17.4	25.6	21.7	12.3	15.2	18.8	27.9	24.3	10.5	9.7	11.8	13.5	10.2
ASEAN+7	10.4	13.6	16.4	23.1	20.2	11.6	14.8	17.8	25.4	22.7	10.0	9.5	11.3	12.5	9.6

Note: Total trade is the average of export and import.GDP use the current price data.

Source: *Direction of Trade Statistics*, International Monetary Fund.

Table 2. Total Portfolio Investment in Asia

A. (\$ billion)

Year	Economy	Assets in				Liabilities from			
		ASEAN +3	ASEAN +7	G6	TOTAL	ASEAN +3	ASEAN +7	G6	TOTAL
1997	China	3.01	3.01	...	...	5.29	5.34	8.66	14.82
	HongKong	37.54	46.94	...	...	10.16	11.11	56.41	74.12
	Indonesia	0.22	0.22	0.07	1.12	2.34	2.42	6.49	9.76
	Japan	29.07	63.18	573.56	906.66	1.23	5.71	305.03	364.96
	Korea	4.36	4.63	2.82	13.50	8.52	8.70	22.13	32.69
	Malaysia	0.92	1.08	0.53	1.79	10.38	10.52	13.29	25.08
	Philippines	0.00	0.00	0.00	...	1.52	1.57	9.47	11.66
	Singapore	10.35	11.40	9.36	22.79	2.67	2.88	16.83	21.54
	Thailand	0.07	0.08	0.11	0.27	2.85	2.89	7.94	11.52
	Austrilia	5.53	6.07	29.45	41.54	30.60	31.64	73.32	116.29
	New Zealand	0.65	1.70	4.06	6.45	2.92	3.41	12.79	17.69
	Pakistan	0.00	0.00	...	...	0.02	0.03	1.80	1.89
	India	1.63	1.63	...	...	2.08	2.14	11.53	14.82
	ASEAN+3	85.52	130.53	586.45	946.14	44.98	51.15	446.24	566.15
	as %of total	9.0%	13.8%	62.0%	100.0%	7.9%	9.0%	78.8%	100.0%
ASEAN+7	93.33	139.93	619.96	994.13	80.59	88.37	545.68	716.83	
as %of total	9.4%	14.1%	62.4%	100.0%	11.2%	12.3%	76.1%	100.0%	
2001	China	6.89	6.89	...	...	11.70	11.70	6.03	20.26
	HongKong	30.26	48.83	82.86	205.60	11.60	13.85	59.47	96.68
	Indonesia	0.15	0.21	0.35	0.72	1.17	1.18	3.00	5.55
	Japan	21.05	42.91	832.18	1289.75	20.01	25.33	346.59	542.29
	Korea	1.71	1.83	4.53	8.03	14.17	14.64	52.08	76.79
	Malaysia	0.78	0.81	0.71	2.28	12.31	12.36	7.52	22.59
	Philippines	0.11	0.12	1.94	2.13	4.19	4.20	5.63	12.75
	Singapore	31.26	42.35	46.15	105.24	5.65	6.46	38.11	50.69
	Thailand	0.25	0.26	0.38	0.83	4.76	4.78	5.39	12.01
	Austrilia	8.11	9.00	59.60	79.35	45.65	47.25	88.70	169.97
	New Zealand	0.84	2.45	8.10	12.42	5.34	6.15	7.83	18.34
	Pakistan	0.00	0.00	...	...	0.01	0.01	0.22	0.47
	India	0.06	0.06	...	...	0.75	0.83	10.51	15.38
	ASEAN+3	92.45	144.20	969.09	1614.58	85.56	94.51	523.81	839.61
	as %of total	5.7%	8.9%	60.0%	100.0%	10.2%	11.3%	62.4%	100.0%
ASEAN+7	101.47	155.72	1036.79	1706.36	137.31	148.76	631.08	1043.77	
as %of total	5.9%	9.1%	60.8%	100.0%	13.2%	14.3%	60.5%	100.0%	
2010	China	37.28	37.37	...	...	253.67	256.27	154.12	498.18
	HongKong	258.81	305.22	216.01	928.94	43.03	50.37	192.06	320.76
	Indonesia	1.19	1.30	1.41	6.50	25.37	26.33	46.07	101.92
	Japan	79.77	230.09	1839.76	3345.83	55.26	77.53	812.43	1348.18
	Korea	25.76	31.42	51.34	116.69	78.34	82.66	230.85	407.80
	Malaysia	17.46	18.51	10.07	35.89	28.73	29.71	46.94	105.75
	Philippines	1.14	1.14	2.57	5.86	9.18	12.33	21.46	46.53
	Singapore	144.37	194.15	140.45	398.76	37.06	40.51	88.99	172.17
	Thailand	13.25	15.03	3.63	22.98	11.12	12.36	32.99	68.82

Australia	44.46	54.03	298.21	468.04	198.73	216.35	483.53	931.48
New Zealand	1.63	19.23	15.70	47.80	7.06	13.33	24.39	44.74
Pakistan	0.01	0.01	0.02	0.18	0.06	0.06	1.53	4.60
India	0.24	0.26	0.70	1.58	49.27	52.56	130.79	376.48
ASEAN+3	579.03	834.23	2265.25	4861.44	541.75	588.09	1625.90	3070.11
as %of total	11.9%	17.2%	46.6%	100.0%	17.6%	19.2%	53.0%	100.0%
ASEAN+7	625.37	907.75	2579.89	5379.04	796.86	870.39	2266.13	4427.40
as %of total	11.6%	16.9%	48.0%	100.0%	18.0%	19.7%	51.2%	100.0%

Note: (...) no data available

Source: *Coordinated Portfolio Investment Survey (CPIS)*, International Monetary Fund.

China's asset data is calculated by the counter data (the liabilities data) from IMF; HongKong's 1997, India's 1997 and 2001, and Pakistan's 1997 and 2001 are also calculated by the counter data from IMF

Table 2. Total Portfolio Investment in Asia (Continued)

B. (as % GDP)

Year	Economy	Assets in				Liabilities from			
		ASEAN +3	ASEAN +7	G6	TOTAL	ASEAN +3	ASEAN +7	G6	TOTAL
1997	China	0.13	0.13	...	...	0.23	0.23	0.38	0.65
	HongKong	23.24	29.06	...	...	6.29	6.88	34.92	45.88
	Indonesia	0.04	0.04	0.01	0.22	0.45	0.47	1.25	1.88
	Japan	0.95	2.07	18.82	29.75	0.04	0.19	10.01	11.98
	Korea	0.67	0.71	0.43	2.07	1.31	1.34	3.40	5.02
	Malaysia	0.48	0.56	0.28	0.94	5.45	5.52	6.97	13.16
	Philippines	0.00	0.00	...	...	0.91	0.94	5.67	6.97
	Singapore	9.21	10.16	8.34	20.29	2.38	2.57	14.98	19.18
	Thailand	0.02	0.03	0.04	0.09	0.95	0.96	2.63	3.82
	Australia	1.24	1.37	6.63	9.34	6.88	7.12	16.50	26.16
	New Zealand	0.97	2.56	6.10	9.69	4.38	5.12	19.21	26.57
	Pakistan	0.00	0.00	...	...	0.01	0.01	0.86	0.91
	India	0.13	0.13	...	...	0.17	0.17	0.93	1.19
		ASEAN+3	1.77	2.71	12.16	19.62	0.60	0.69	6.00	7.61
	ASEAN+7	1.75	2.62	11.63	18.64	0.86	0.94	5.80	7.62
2001	China	0.21	0.21	...	...	0.35	0.35	0.18	0.61
	HongKong	16.71	26.97	45.76	113.54	6.41	7.65	32.84	53.39
	Indonesia	0.03	0.04	0.07	0.14	0.22	0.22	0.56	1.04
	Japan	0.64	1.30	25.27	39.16	0.61	0.77	10.52	16.47
	Korea	0.21	0.22	0.55	0.97	1.72	1.77	6.31	9.31
	Malaysia	0.35	0.37	0.32	1.04	5.61	5.63	3.43	10.29
	Philippines	0.06	0.06	0.98	1.08	2.13	2.13	2.85	6.46
	Singapore	23.17	31.40	34.22	78.03	4.19	4.79	28.26	37.59
	Thailand	0.08	0.08	0.12	0.25	1.47	1.48	1.66	3.71
	Australia	1.46	1.63	10.76	14.33	8.24	8.53	16.01	30.69
	New Zealand	1.06	3.07	10.15	15.57	6.69	7.71	9.82	22.99
	Pakistan	0.00	0.00	...	...	0.01	0.01	0.09	0.18
	India	0.00	0.00	...	...	0.05	0.05	0.63	0.92
		ASEAN+3	1.62	2.53	16.99	28.30	0.95	1.04	5.79	9.28
	ASEAN+7	1.60	2.46	16.36	26.92	1.18	1.28	5.44	9.00
2010	China	0.37	0.37	...	...	2.51	2.53	1.52	4.92
	HongKong	79.09	93.27	66.01	283.88	13.15	15.39	58.69	98.02
	Indonesia	0.12	0.13	0.14	0.63	2.46	2.55	4.46	9.87
	Japan	1.84	5.32	42.55	77.39	1.28	1.79	18.79	31.18
	Korea	1.76	2.14	3.50	7.96	5.34	5.64	15.75	27.81
	Malaysia	4.19	4.44	2.42	8.62	6.90	7.13	11.27	25.39
	Philippines	0.31	0.31	0.70	1.59	2.49	3.35	5.82	12.63
	Singapore	49.30	66.30	47.96	136.17	12.65	13.84	30.39	58.79
	Thailand	2.25	2.55	0.62	3.90	1.89	2.10	5.60	11.68
	Australia	5.03	6.11	33.74	52.96	22.49	24.48	54.71	105.39
	New Zealand	1.38	16.23	13.25	40.33	5.95	11.25	20.58	37.75
Pakistan	0.00	0.00	0.01	0.04	0.01	0.01	0.33	0.98	

	India	0.01	0.01	0.02	0.04	1.21	1.30	3.22	9.28
	ASEAN+3	6.57	9.46	25.69	55.14	2.86	3.11	8.59	16.21
	ASEAN+7	4.36	6.33	17.99	37.50	3.26	3.56	9.26	18.10

... = no data available

Source: *Coordinated Portfolio Investment Survey (CPIS)*, International Monetary Fund.

China's asset data is calculated by the counter data (the liabilities data) from IMF; HongKong's 1997, India's 1997 and 2001, and Pakistan's 1997 and 2001 are also calculated by the counter data from IMF

Table 3. Correlation of Output in Asia**A. 1990–1999**

	HK	CHN	INO	JPN	KOR	MAL	PHI	SIN	THA	VIE	AU	NZ	PAK	INA	US	G6
HK	1.00	-0.27	0.92	0.67	0.72	0.87	-0.08	0.71	0.91	-0.30	-0.61	0.20	0.14	-0.60	-0.70	-0.73
CHN	-0.27	1.00	-0.09	-0.31	0.02	0.05	0.78	0.44	-0.20	0.88	0.90	0.81	-0.24	0.82	0.78	0.66
INO	0.92	-0.09	1.00	0.81	0.83	0.98	0.21	0.81	0.93	-0.02	-0.47	0.39	0.28	-0.35	-0.61	-0.60
JPN	0.67	-0.31	0.81	1.00	0.67	0.78	0.25	0.47	0.63	0.03	-0.52	0.04	0.46	-0.30	-0.59	-0.44
KOR	0.72	0.02	0.83	0.67	1.00	0.89	0.37	0.77	0.80	0.07	-0.26	0.52	0.30	-0.04	-0.35	-0.24
MAL	0.87	0.05	0.98	0.78	0.89	1.00	0.36	0.87	0.89	0.12	-0.32	0.52	0.27	-0.18	-0.46	-0.44
PHI	-0.08	0.78	0.21	0.25	0.37	0.36	1.00	0.57	-0.03	0.94	0.68	0.75	0.01	0.78	0.56	0.61
SIN	0.71	0.44	0.81	0.47	0.77	0.87	0.57	1.00	0.70	0.37	0.08	0.80	-0.10	0.08	-0.10	-0.15
THA	0.91	-0.20	0.93	0.63	0.80	0.89	-0.03	0.70	1.00	-0.24	-0.57	0.35	0.30	-0.45	-0.71	-0.71
VIE	-0.30	0.88	-0.02	0.03	0.07	0.12	0.94	0.37	-0.24	1.00	0.82	0.67	-0.02	0.86	0.71	0.71
Avg1	0.46	0.14	0.60	0.44	0.57	0.65	0.37	0.63	0.49	0.20	-0.03	0.51	0.14	0.06	-0.15	-0.13
AU	-0.61	0.90	-0.47	-0.52	-0.26	-0.32	0.68	0.08	-0.57	0.82	1.00	0.56	-0.29	0.91	0.96	0.88
NZ	0.20	0.81	0.39	0.04	0.52	0.52	0.75	0.80	0.35	0.67	0.56	1.00	-0.13	0.59	0.36	0.29
PAK	0.14	-0.24	0.28	0.46	0.30	0.27	0.01	-0.10	0.30	-0.02	-0.29	-0.13	1.00	0.00	-0.25	-0.16
INA	-0.60	0.82	-0.35	-0.30	-0.04	-0.18	0.78	0.08	-0.45	0.86	0.91	0.59	0.00	1.00	0.86	0.88
Avg2	0.25	0.27	0.40	0.28	0.44	0.47	0.43	0.50	0.31	0.32	0.07	0.47	0.08	0.16	0.03	0.04

B. 2000–2009

	HK	CHN	INO	JPN	KOR	MAL	PHI	SIN	THA	VIE	AU	NZ	PAK	INA	US	G6
HK	1.00	0.51	0.49	0.75	0.52	0.91	0.93	0.97	0.71	0.70	0.65	0.20	0.95	0.64	0.68	0.91
CHN	0.51	1.00	0.98	-0.12	-0.11	0.47	0.70	0.61	-0.11	0.97	0.22	-0.68	0.70	0.98	-0.24	0.18
INO	0.49	0.98	1.00	-0.15	-0.14	0.47	0.69	0.57	-0.13	0.95	0.23	-0.70	0.68	0.96	-0.28	0.14
JPN	0.75	-0.12	-0.15	1.00	0.79	0.73	0.57	0.66	0.94	0.10	0.71	0.75	0.52	0.01	0.98	0.94
KOR	0.52	-0.11	-0.14	0.79	1.00	0.56	0.37	0.50	0.69	0.05	0.71	0.59	0.28	-0.04	0.74	0.74
MAL	0.91	0.47	0.47	0.73	0.56	1.00	0.93	0.92	0.80	0.63	0.81	0.27	0.84	0.57	0.66	0.83
PHI	0.93	0.70	0.69	0.57	0.37	0.93	1.00	0.95	0.59	0.83	0.72	-0.01	0.93	0.78	0.46	0.75
SIN	0.97	0.61	0.57	0.66	0.50	0.92	0.95	1.00	0.67	0.77	0.68	0.12	0.95	0.72	0.59	0.83
THA	0.71	-0.11	-0.13	0.94	0.69	0.80	0.59	0.67	1.00	0.09	0.74	0.77	0.51	0.02	0.94	0.85
VIE	0.70	0.97	0.95	0.10	0.05	0.63	0.83	0.77	0.09	1.00	0.35	-0.52	0.85	0.99	-0.02	0.40
Avg1	0.72	0.43	0.42	0.47	0.36	0.72	0.73	0.74	0.47	0.57	0.58	0.08	0.72	0.56	0.45	0.66
AU	0.65	0.22	0.23	0.71	0.71	0.81	0.72	0.68	0.74	0.35	1.00	0.45	0.53	0.27	0.61	0.69
NZ	0.20	-0.68	-0.70	0.75	0.59	0.27	-0.01	0.12	0.77	-0.52	0.45	1.00	-0.04	-0.58	0.83	0.50
PAK	0.95	0.70	0.68	0.52	0.28	0.84	0.93	0.95	0.51	0.85	0.53	-0.04	1.00	0.81	0.45	0.74
INA	0.64	0.98	0.96	0.01	-0.04	0.57	0.78	0.72	0.02	0.99	0.27	-0.58	0.81	1.00	-0.10	0.32
Avg2	0.69	0.40	0.38	0.48	0.37	0.69	0.69	0.70	0.48	0.52	0.54	0.05	0.65	0.47	0.45	0.63

Notes: The figures indicate present the bilateral BCS as the description in the paper. Average is the simple average of correlations with nine East Asian economies (excluding own economy).AU(Australia), People's Republic of China (CHN); Hong Kong, China (HK); India(INA) Indonesia (INO); Japan (JPN); the Republic of Korea (KOR); Malaysia (MAL);New Zealand(NZ); Pakistan (PAK); Philippines (PHI); Singapore (SIN); Thailand (THA); and Vietnam(VIE).

Sources: Bloomberg, CEIC, *International Financial Statistics* (International Monetary Fund), and national sources.

Table 4. Correlation among Various Measures

A. ASEAN+3

	ρ	ρ_1	T	F	EXT	EXT1	EXF	EXF1
ρ	1							
ρ_1	0.948	1						
T	0.261	0.231	1					
F	0.297	0.276	0.904	1				
EXT	0.382	0.374	0.675	0.811	1			
EXT1	0.382	0.374	0.676	0.812	1	1		
EXF	0.439	0.424	0.284	0.600	0.591	0.5902	1	
EXF1	0.444	0.430	0.290	0.605	0.594	0.594	1	1

B. ASEAN+7

	ρ	ρ_1	T	F	EXT	EXT1	EXF	EXF1
ρ	1							
ρ_1	0.903	1						
T	0.208	0.164	1					
F	0.232	0.202	0.864	1				
EXT	0.281	0.243	0.712	0.757	1			
EXT1	0.282	0.244	0.712	0.758	1	1		
EXF	0.333	0.279	0.249	0.606	0.437	0.437	1	
EXF1	1							1

note: "1" stands alternative measure.

Table 5. Single Equation Estimation

A. ASEAN+3

ρ	OLS	OLS	OLS	OLS
T	0.00537(1.58)		-0.00091(-0.110)	0.0272(2.56)**
F		0.0188(1.82)*	0.0213(0.87)	-0.109(-2.61)**
EXT				0.0154(1.45)
EXF				0.0902(3.2)***
\bar{R}^2	0.068	0.0885	0.0888	0.360

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

B. ASEAN+7

P	OLS	OLS	OLS	OLS
T	0.0060(1.86)*		0.0009(0.14)	0.0177(2.09)**
F		0.0200(2.08)**	0.0177(0.92)	-0.0687(-2.24)**
EXT				0.0107(1.18)
EXF				0.0673(3.16)***
\bar{R}^2	0.0434	0.0538	0.0541	0.191

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

Table 6. Equation System Estimation

	ASEAN+3	ASEAN+7
GDP correlations (ρ) equation		
T	0.0699(2.84)***	0.0326(1.60)
F	-0.303 (-2.82)***	-0.155(-2.07)**
EXT	0.0383(2.20)**	0.0234(1.71)*
EXF	0.186(3.28)***	0.112(2.63)***
Trade (T) equation		
F	3.941(7.02)***	3.794(5.47)***
EXT	-0.285(-1.16)	-0.0587(-0.22)
EXF	-1.950(-5.32)***	-2.0263(-5.42)***
Finance (F) equation		
T	0.217(7.18)***	0.243(5.95)***
EXT	0.122(2.09)**	0.0443(0.494)
EXF	0.473(4.34)***	0.517(6.24)***

Table 7. Partial and Relative Important Index

A. ASEAN+3

Variable	Partial Corr.	Semipartial Corr.	relative important index
T	0.417	0.368	0.0599
F	-0.424	-0.375	0.0627
EXT	0.253	0.209	0.0212
EXF	0.499	0.460	0.0911

B. ASEAN+7

Variable	Partial Corr.	Semipartial Corr.	relative important index
T	0.238	0.221	0.0235
F	-0.254	-0.236	0.0267
EXT	0.137	0.124	0.00765
EXF	0.347	0.332	0.0514

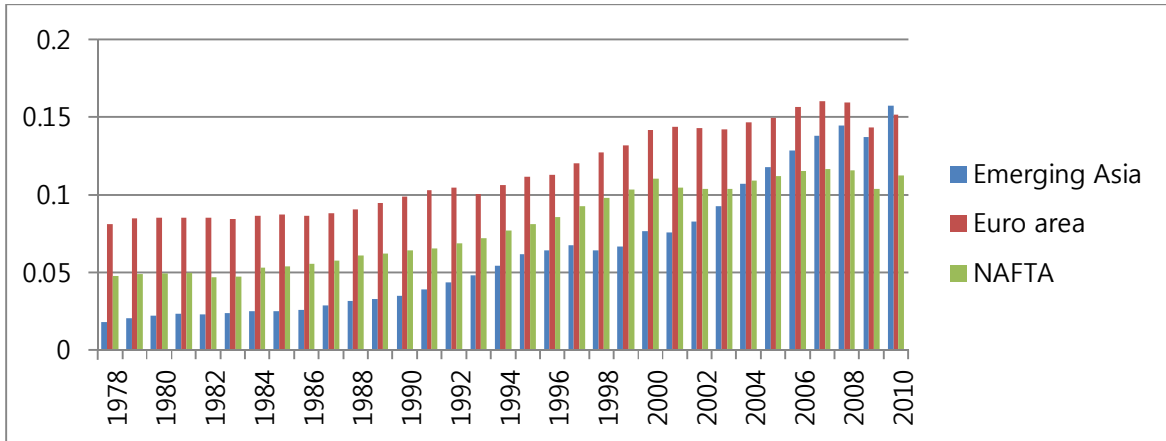
Note: Partial correlation measures the degree of association between two random variables, with the effect of a set of controlling random variables removed. The semipartial correlation statistic is similar to the partial correlation statistic. Both measure variance correlations after certain factors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

Table 8. Extended Results

	1		2	
	ASEAN+3	ASEAN+7	ASEAN+3	ASEAN+7
GDP correlations (ρ) equation				
T	0.0642(3.18)***	0.0316(1.83)*	0.0742(3.54)***	0.344(1.69)*
F	-0.290(-3.29)***	-0.165(-2.6)***	-0.328(-3.46)***	-0.165(-2.17)**
EXT	0.0394(2.71)***	0.0258(2.17)**	5.250(2.46)**	3.040(1.77)*
EXF	0.168(3.61)***	0.106(2.91)***	6.264(3.96)***	3.690(2.71)***
Trade (T) equation				
F	4.034(7.26)***	3.713(5.4)***	4.154(7.48)***	3.869(5.35)***
EXT	-0.318(-1.31)	-0.0289(-0.11)	-45.454(-1.47)	-9.926(-0.28)
EXF	-2.000(-5.51)***	-1.988(-5.37)***	-2.057(-5.63)***	-65.298(-5.32)***
Finance (F) equation				
T	0.223(7.44)***	0.241(5.99)***	0.221(7.96)***	0.244(6.09)***
EXT	0.113(1.95)*	0.0476(0.75)	14.150(2.05)**	5.010(0.66)
EXF	0.496(4.66)***	0.511(6.29)***	15.808(4.70)***	16.562(6.57)***
	3		4	
	ASEAN+3	ASEAN+7	ASEAN+3	ASEAN+7
GDP correlations (ρ) equation				
T	16.720(1.42)	14.708(1.75)*	0.00532(0.41)	0.0227(1.13)
F	-0.130(-1.41)	-0.140(-2.36)**	-9.324(-0.30)	-64.459(-1.57)
EXT	0.0298(1.46)	0.0315(2.26)**	0.00591(0.48)	0.0114(0.80)
EXF	0.0955(2.01)**	0.102(3.00)***	0.0443(1.24)	0.109(2.05)**
Trade (T) equation				
F	0.00688(5.82)***	0.00672(4.51)***	1803.06(5.04)***	2035.663(3.99)***
EXT	-0.00099(-1.91)*	-0.000456(-0.78)	0.197(0.81)	0.322(1.11)
EXF	-0.0033(-4.22)***	-0.00348(-4.34)***	-1.651(-3.65)***	-2.553(-4.0)***
Finance (F) equation				
T	122.3181(6.40)***	120.105(5.09)***	0.000295(4.34)***	0.000406(3.84)***
EXT	0.186(3.19)***	0.129(2.12)**	0.000240(1.85)*	-0.0000404(-0.24)
EXF	0.433(3.41)***	0.472(4.98)***	0.000563(2.33)**	0.00116(5.34)***
	5			
	ASEAN+3	ASEAN+7		
GDP correlations (ρ) equation				
T	0.0699(2.84)***	0.0326(1.60)		
F	-0.303(-2.82)***	-0.155(-2.07)**		
EXT	0.0383(2.20)**	0.0234(1.71)*		
EXF	0.186(3.28)***	0.112(2.63)***		
Trade (T) equation				
F	3.941(7.02)***	3.794(5.47)***		
EXT	-0.285(-1.16)	-0.0587(-0.22)		
EXF	-1.950(-5.32)***	-2.0263(-5.42)***		
Finance (F) equation				
T	0.217(7.18)***	0.243(5.95)***		
EXT	0.122(2.09)**	0.0443(0.494)		
EXF	0.473(4.34)***	0.517(6.24)***		

- 1 shows the results when real GDP in log-difference is used, instead of cyclical real GDP.
- 2 shows the results when alternative measures for external trade and financial linkages are used.
- 3 shows the results when the alternative measure for internal trade linkages is used.
- 4 shows the results when the alternative measure for internal financial linkages is used.
- 5 shows the results when the integration measures are calculated based on 2001 data but the business cycle measures are calculated based on 2002-2009 data.

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



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

Note: constant 2000 US\$