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Regional Business Cycle Synchronization in Emerging and Developing Countries: Regional or Global Integration? Trade or Financial Integration?

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Regional Business Cycle Synchronization in Emerging and Developing Countries: Regional or Global Integration? Trade or Financial Integration?*

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Abstract

This paper examines the effects of regional versus global integration and trade versus financial integration on regional business cycle synchronization in three regions containing developing and emerging countries (East Asia, Latin America, and Central and Eastern Europe). The main empirical results are as follows: (1) strong and similar common global linkages, especially financial linkages, have significant positive effects on the synchronization of regional business cycles; (2) after controlling global linkages, regional trade integration has a positive effect on regional business cycle synchronization, whereas regional financial integration has a negative effect; and (3) although the direction for the effect of each type of integration is similar across regions, the relative importance of each in explaining regional business cycle synchronization is different. Specifically, while global financial linkages play the most important role in East Asia and Latin America, regional trade integration is most important in Central and Eastern Europe.

Key Words: regional business cycle synchronization, regional and global economic integration, trade and financial integration, emerging and developing countries

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1 Introduction

Economic linkages among countries around the world have rapidly increased in recent years through trade and financial integration. On the trade side, the accumulative increase in the volume of world trade is almost three times larger than that of world output from 1960 to 2010. Global trade as a percentage of global GDP has increased from 19% in 1980 to 24% in 2010. The rate of increase is even faster in emerging and developing economies, where it has grown from 6% in 1980 to 9% in 2010.[1] On the financial side, the world's total foreign assets jumped from 19% of global GDP in 1980 to 172.4% in 2011, and the world's total portfolio investments increased from 19% of global GDP in 1997 to 55.5% in 2011.[2] These figures show that there is a strong momentum behind the growth in trade and financial globalization.

This growth has also extended to regional economic linkages. Multiple trade agreements and trade unions, for example, ASEAN, NAFTA, MERCOSUR, and the EU, have been formed on a regional basis. In addition, regional financial and monetary integration and cooperation have also progressed. Monetary unions, for example, EMU, have frequently formed at the regional level. Further, repeated crises in emerging and developing countries, in addition to the recent global financial crisis, have facilitated regional financial and monetary integration and cooperation, especially in emerging and developing countries. CMIM (Chiang-Mai Initiative Multilateral) and ABMI (Asian Bond Market Initiative) are two regional financial cooperation in Asia created to reduce the possibility of future crises. Latin America has several types of regional monetary and financial cooperation, including the Latin American Integration Association's clearing system for intraregional payments and the Latin American Reserve Fund. The European Bank Coordination "Vienna" Initiative is a framework for safeguarding the financial stability of emerging Europe.

[1] Data source is the World Economic Outlook Database.

[2] Data source is the International Financial Statistics and Balance of Payment Statistics. The value of total foreign assets in 1980 is constructed by taking the sum of the values of foreign assets of all available countries from International Financial Statistics by the International Monetary Fund, while the value in 2011 is the world aggregate reported in the Balance of Payment Statistics by the International Monetary Fund.

Countries' underlying economic relationships significantly affect their business cycle co-movement through trade and financial integration. In particular, various types of regional and global integration influence business cycle co-movement among the countries in a region. This paper analyzes the effects of economic integration on the business cycle co-movements of countries in three regions of the emerging/ or developing world: East Asia (EA), Latin America (LA), and Central and Eastern Europe (CEE).[3] We distinguish among the effects of various types of economic integration, specifically (1) trade versus financial integration, and (2) regional versus global integration (or integration within the region versus integration with major industrial countries outside the region). Following Frankel and Rose (1998), many studies have analyzed the effects of trade integration on business cycle synchronization. More recent studies following Imbs (2004, 2006) have examined the effects of both trade and financial integration.[4] No prior studies, in this line of the literature following Imbs (2004, 2006), however, have analyzed the effects of regional integration and global linkages separately.[5]

Separating the effects of regional and global integration is important. An economic event in the major industrial countries substantially affects emerging and developing countries through the economic linkages between the two groups of countries. Therefore, economic integration with industrial countries is likely to be important in explaining the business cycles of emerging and developing countries, as well as business cycle co-movements of the countries within a region. For example, a US recession may worsen the trade balance of two developing countries in a region and generate business cycle co-movements between those two countries. This effect of global economic integration on business cycle co-movements may be as important as the effects of regional economic

[3] East Asia includes China, Japan, Korea, Malaysia, Thailand, Indonesia, the Philippines, Singapore, and Hong Kong; Central and Eastern Europe includes Albania, Bosnia, Bulgaria, Croatia, Czech, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, Slovenia, and Turkey; and Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay, and Venezuela. Throughout the paper, EA, CEE, and LA will include these countries unless specifically noted.

[4] Some studies on Asian countries include Shin and Wang (2003, 2004) and Shin and Sohn (2006).

[5] Hirata, Kose, and Otrok (2013) investigated the role of global, regional, and country-specific factors in explaining business cycle comovements, to discuss a similar issue. They used a dynamic factor model, which is different from the empirical methodology used in this paper. In addition, they did not model trade and finance linkages separately.

integration. Because the effects of these two types of economic integration can be different, separating them is crucial to measure the precise effect of each type of integration. In addition, discovering the relative importance of regional versus global economic integration in explaining the business cycle co-movements of countries in a region is an important issue itself.

The issue of business cycle synchronization of countries in a region has various important implications for that region. When a region's degree of business cycle synchronization is high, common policy responses and/or policy cooperation within the region can be emphasized to stabilize regional economic fluctuations. It is also an important criterion by which the costs of regional monetary integration are gauged; according to the theory of Optimum Currency Area (OCA) (Mundell, 1961), the cost of a monetary union is low when the business cycles of member countries are synchronized so that the common monetary policy can work more effectively for all member countries. As some researchers argue for the creation of regional monetary unions, the current analysis may provide important insights into the potential cost of the monetary integration under consideration.[6]

The remainder of the paper is organized as follows. Section 2 briefly reports on the trend of economic integration and business cycle co-movements in each region under study. Section 3 reviews existing theory and develops the empirical methodology. Section 4 discusses the empirical results, and Section 5 concludes.

2. Trends in Economic Integration and Business Cycle Synchronization

In this section, we briefly examine the trends in regional and global integration and trade and financial integration, as well as trends in regional business cycle co-movements for countries in EA, LA, and CEE.

[6] For example, Mundell (2003), Kuroda (2004), and Ogawa and Shimizu (2011) discussed an Asian monetary union or a common Asian currency unit, while Hochreitera (2002), Edwards (2006), Hofstetter (2011) discussed a monetary union in Latin America.

II. 1. Economic Integration

Globalization and regional economic integration has gained momentum in recent decades. Many EA countries adopted an export-oriented economic development strategy that has led to strong trade integration with the world economy, especially with the major industrial countries. More recently, EA countries have begun to pursue regional economic cooperation, especially after Asian financial crisis, which has led to stronger regional integration. In contrast, most CEE countries are former communist countries and are now members of EU. Relatively rapid trade integration has progressed since the early 1990s as these economies made the transition from planned economies to market economies. On the other hand, the process of economic integration occurred in three phases in LA. The first stage began in the 1960s with the creation of FTAs in the context of import substitution industrialization. In the second stage, beginning in the 1980s, Latin American countries initiated drastic policy reforms based on ‘‘neo-liberalism,’’ abandoning the interventionist strategy that had brought about the region’s financial and economic crisis. The third stage of integration began in the late 1990s and is characterized by a greater emphasis on inter-regional FTAs.

“INSERT Table 1 Here”

Table 1 presents exports and imports figures for countries in EA, CEE, LA, the EU (European Union), and the all three regions under study (ALL) between 1980 and 2012. The figures are in millions of US dollars, and each number in parentheses shows that country’s share in total world exports or imports.

The exports and imports of these regions have increased rapidly from 1980 to 2012. EA’s exports and imports have increased more than 18 times, and in CEE and LA, they have increased more than eight times. Exports and imports growth has grown more rapidly in these three regions than in the EU. The figures for EA rose the fastest, with exports as a share of global exports increasing from 11.68% in 1980 to 22.63% in 2012, and with imports as a share of global imports increasing from 11.69% to 22.55% over the same period. The figures for CEE and LA are much lower, with imports and exports as a

share of the global total remaining steady at approximately 1.7-4.5% from 1980 to 2012.

Table 2 shows the regional and global trade relationship of the three regions, with the global trade relationship indicating trade relationships with major industrial countries outside each region. We used the G7 countries as the major industrial countries outside the region for LA and CEE and the G7 countries excluding Japan for EA[7]. Throughout the paper, we measure the global linkages in these ways.

In terms of dollar amounts, the regional trade relationships of EA, CEE and LA increased over 30, 15 and 13 times, respectively, from 1980 to 2012, and these regions' global trade relationships also increased rapidly over this time period. Even in terms of a percentage of GDP, the regional and global trade relationships of these regions increased in all but one case (LA). In EA, the amount of regional trade increased very rapidly, and in fact, makes up a larger percentage of global trade than EA's trade with the rest of the world (21.5% versus 19.4% in 2012). The opposite is true, however, for CEE and LA.

"INSERT Table 2 Here"

Table 3 reports the assets and liabilities of portfolio investments in each region from 1997 to 2012 in order to show financial linkages. From 1997 to 2012, the assets and liabilities of portfolio investments increased more than 10 times in CEE and more than five times in EA and LA, although the amount of assets and liabilities in these regions is still smaller than that in the EU. The amount of assets and liabilities in EA is still substantial, however, taking up approximately 10% of total world assets and liabilities.

"INSERT Table 3 Here"

Table 4 reports the regional (within each region) and global (with industrial countries outside the region) portfolio investments of countries in each region to show regional and global financial linkages. In terms of dollar amounts, regional and global portfolio investment increased substantially from 1997 to 2010. Even in terms of the percentage of GDP, the number increased in most cases.

"INSERT Table 4 Here"

In all three regions, the amount of portfolio investments with industrial countries

[7] Because Japan is a country in EA, we exclude it from the G-7 countries.

outside the region is larger than the size of portfolio investments within each region. The assets and liabilities of EA within the region remain substantial, reaching 579.0 and 541.8 billion US dollars, respectively, in 2010 (6.6% and 2.9% of GDP, respectively). They also count for 11.9% of total assets and 17.6% of total liabilities. The assets and liabilities of CEE and LA within their regions are relatively small.

2.2 Business Cycle Synchronization

This section studies the business cycle synchronization of countries in each region. We use the contemporaneous bilateral correlation coefficient of cyclical real GDP of two countries to describe the business cycle co-movements of two countries. To obtain cyclical real GDP, an HP filter is applied to the logarithm of real GDP. Annual data are used for 1990-2009.[8]

"INSERT Table 5 Here"

Table 5 presents the correlation coefficients of cyclical real GDP for all pairs of countries in each region, as well as the correlation coefficients of cyclical real GDP of all countries in each region and major industrial countries outside the region.

First, the regional business cycle synchronization of most countries is higher in the 2000s than in the 1990s, and the bilateral correlation of countries within each region increased in most cases. As seen in the average number ("Avg."), intra-regional business cycle co-movement increased in 7 out of the 10 countries in EA, in all 11 countries in CEE, and in 9 out of the 11 countries in LA. The bilateral correlations are quite high in the 2000s, over 0.5 for 32 (out of 45) pairs in EA, 40 (out of 55) pairs in CEE, and 45 (out of 55) pairs in LA.

Second, the business cycle synchronization of countries in each region with the U.S. and the G7 also increased. The correlation of EA with the U.S. increased from -0.15 to 0.45, and the correlation with the G6 (G7 minus Japan) increased from -0.13 to 0.66. The correlation of CEE with the U.S. increased from 0.41 to 0.66, and the correlation with the

[8] Real GDP in local unit is used for all cases except for the G7 aggregate, where real GDP in PPP is used.

G7 increased from 0.48 to 0.76. The correlation of LA with the U.S. increased from -0.42 to 0.14 and with the G7, from -0.32 to 0.47. Note that in the 1990s, all correlations are positive and high.

There are several possible explanations as to why the regional business cycle synchronization of countries in these three regions has increased. First, changes in the regional trade and financial integration, as reported in Tables 2 and 4, may have contributed to the increase in regional business cycle synchronization. Equally likely is that changes in global trade and financial integration, also as reported in Tables 2 and 4, are at least partially responsible. Strong trade and financial linkages between the countries in each region with major industrial countries outside the region can generate high business cycle synchronization between countries in each region and major industrial countries outside the region, as reported in Table 5. This may have eventually contributed to high levels of regional business cycle synchronization. In the next section, we will formally examine the effects of regional versus global and trade versus financial integration on the business cycle synchronization in these three regions.

3. Empirical Method

3.1 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), may be summarized as follows.

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

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.

This type of regression is adequate if the sample covers the majority of countries around the world. If we consider only the countries in a region, however (i.e., countries in East Asia), it will be problematic because business cycle co-movement of countries in a region can be affected not only by economic integration with countries within the region but also by economic linkages with countries outside the region. In particular, economic events in the major industrial countries like the U.S. often substantially affect the economic conditions of emerging/developing countries through the economic linkages between emerging/developing countries and major industrial countries. In our context, for example, recessionary shocks in the U.S. can affect both Korea and Thailand in a similar manner and generate business cycle co-movement between Korea and Thailand, if Korea and Thailand have similar and strong common economic linkages with the U.S.

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

$$\rho_{ij} = \alpha_0 + \alpha_1 \mathrm{T}_{ij} + \alpha_2 \mathrm{F}_{ij} + \alpha_3 \mathrm{EXT}_{ij} + \alpha_4 \mathrm{EXF}_{ij} + \varepsilon_{ij}, \quad (2)$$

where EXT and EXF are the variables that show the global trade and financial linkages (or the trade and financial linkages with major industrial countries outside the region), respectively, that generate business cycle synchronization between countries i and j. The measures show how strong and similar the global linkages of countries i and j are to that of industrial countries outside the region. In the next section, we explain how we construct EXT and EXF.

To consider interactions among various types of economic linkages, the following system of equations is used:

$$\rho_{ij} = \alpha_0 + \alpha_1 \mathrm{T}_{ij} + \alpha_2 \mathrm{F}_{ij} + \alpha_3 \mathrm{EXT}_{ij} + \alpha_4 \mathrm{EXF}_{ij} + \varepsilon_{ij}^1 \quad , \quad (3)$$

$$\mathrm{T}_{ij} = \beta_0 + \beta_1 \mathrm{F}_{ij} + \beta_2 \mathrm{I}_{ij}^{\mathrm{T}} + \beta_3 \mathrm{EXT}_{ij} + \beta_4 \mathrm{EXF}_{ij} + \varepsilon_{ij}^2,$$

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

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 between regional financial and trade integration are permitted. Regional trade integration can directly affect the business cycle synchronization (α_1). Regional trade integration can also have indirect effect ($\gamma_1\alpha_2$) through regional financial integration. That is, regional trade integration affect regional financial integration (γ_1), which in turn has the effect on business cycle synchronization (α_2). Therefore, the overall effect of regional trade integration is the sum of direct and indirect effects ($\alpha_1 + \gamma_1\alpha_2$). Similarly, regional financial integration can have not only direct effect (α_2) but also indirect effect ($\beta_1\alpha_1$) through regional trade integration, and the overall effect of regional financial integration on business cycle synchronization is ($\alpha_2 + \beta_1\alpha_1$). In addition, both measures of global or external linkages are permitted to affect each measure of regional integration.

Equations (1) and (2) are estimated by ordinary least squares (OLS). Equation system (3) is estimated by three-stage least squares.

3.2 Measurement and Data

To measure the degree of trade integration, we use the measure of the trade intensity between countries i and j ($T_{i,j}$), 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 country *i*'s export to country *j* at time *t*; $M_{i,j,t}$ is country *i*'s import from country *j* at time *t*; Y_t^W is global GDP at time t; and $Y_{i,t}$ is country *i*'s GDP at time *t*. This measure originates from Deardorff's (1998) theoretical work based on the gravity model,

and has been used in past studies such as Imbs (2006). The measure does not depend on country size. This property is particularly useful in our case because the sizes of the countries in each region are often different. Deardorff (1998) shows that the measure equals one if preferences are homothetic and trade barriers do not exist.

To measure the degree of financial integration, independent of the country size, a similar measure between countries *i* and *j* is constructed.[9] The measure of the degree of financial integration between i and j (Fi,j) is as follows:

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

where $\mathrm{I}_{i,j,t}$ is country *i*'s portfolio investment in country *j* at time t. As in many past studies, we used bilateral portfolio investment data (CPIS) to measure the degree of financial integration.[10]

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

$$(6) \qquad \mathrm{EXT}_{ij} \equiv \sum_{k=1}^{\mathrm{K}} \mathrm{w}_k \{\mathrm{MAXT} - |\mathrm{T}_{i,k} - \mathrm{T}_{j,k}|\} \min\{\mathrm{T}_{i,k}, \mathrm{T}_{j,k}\},$$

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

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

[10]China's asset data is calculated using the counter party's (liability) data throughout the sample period. The same method is used for the asset data of Hong Kong in 1997.

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 the following. The business cycle co-movement between two countries in a region, for example, Korea and Thailand in EA, is likely to be high, if (1) two countries have similar global trade integration with major countries outside the region, for example, G7 countries (excluding Japan) and (2) two countries have strong common global trade integration with major countries outside the region. The first term naturally shows the similarity of Korea and Thailand's global trade linkages with the G7, and the second term shows the strength of the common global trade linkages of Korea and Thailand with the G7. The trade intensities of Korea and Thailand with the G7 (T_{ik} and T_{jk}) show the strength of the global trade linkages of Korea and Thailand. The business cycle correlation of Korea and Thailand is likely to be generated only to the extent that they have a common part. Therefore, the minimum of global trade intensities of two countries is used. [11]

The measure of global financial linkages that affect business cycle synchronization between countries *i* and *j* (EXT_{ij}) is constructed in a similar manner:

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

[11] Suppose that both $T_{i,k}$ and $T_{j,k}$ are very small but the magnitudes are the same. Then, the first term, the similarity of trade integration of i and j with k, is large. However, the trade integration between i and k and the trade integration between j and k are very small, so the trade linkages with k cannot play any role in explaining business cycles of i and j. Therefore, the trade linkages with k have only minor effects on business cycle comovments of i and j. In this case, the second term is very small, so EXT is small and EXT properly measures the strength of global trade linkage to generate business cycle synchronization. If the second term is not multiplied, EXT will be large, which is problematic. We can compare this example with the following example. Suppose that both $T_{i,k}$ and $T_{j,k}$ are large and the magnitude are the same. Now the trade integration between i and k and the trade integration between j and k are similar and they are also large. Therefore, the trade linkages with k can play an important role in explaining business cycle comovements of i and j. The first and the second terms are large, and EXT is large.

where MAXF is the largest value between $F_{i,j}$ 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 global linkages are different by nature from the measures for regional integration. The measures for regional integration simply show the intensity of trade and financial integration between countries *i* and *j* in a region, whereas the measures for global linkages show how strong and similar the integration of country *i* and industrial countries outside the region is to that of country *j* and industrial countries outside the region.

"INSERT Table 6 Here"

Table 6 reports the averages and the standard deviations of EXT and EXF for each region for the period of 2001-2009. The averages of EXT's are 0.34, 1.21., and 0.02 for EA, CEE, and LA, respectively while the averages of EXF's are 1.05, 0.49, and 0.19, respectively. These numbers suggest that global linkages (to generate regional business cycle comovements) are stronger in EA and CEE than LA. In particular, global trade linkage is the strongest in CEE while global finance linkage is the strongest in EA.

As the instruments for the trade equation, we include the geographic distance of two countries' capital cities, whether there is a border between two countries, and whether the common official language is used in both countries, following past empirical studies on the determinants of bilateral trade. These instruments are usually argued as being 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 and the difference in income may affect the degree of financial integration.

First, we estimate the model for each region separately for EA, CEE, and LA; all possible pairs of countries in each region are considered as observations in the estimation

for each region. Next, we estimate the model by combining observations in all three regions. We indicate this case as "ALL" throughout the paper.[12]

For the measure of business cycle correlation, we use the correlation of cyclical real GDP for 2001-2009, as reported in Table 5.[13] For all other measures, the average values for 2001-2009 are used. Correlations among various measures are reported in Table 6. The table shows that the correlation between business cycle measures (ρ) and global linkage measures (EXT, EXF) is as high as the correlation between business cycle synchronization measures (ρ) and regional integration measures (T, F). This may imply that global linkages are as important as regional integration when we explain regional business cycle synchronization. A formal analysis is performed in the next section.

"INSERT Table 7 Here"

4. Empirical results

4.1. Basic results

In Table 7, we report the results from various regressions based on the single equation method. The coefficient of the measure for regional trade integration is mostly positive, with the exception of LA; however, the coefficient for the measure of regional financial integration shows a different pattern. In EA and CEE, the coefficient is positive when only the measures for regional integration are included, but negative when the measures for global linkage are added in. This change in the sign of the estimated coefficient is interesting as it may imply that the coefficient of regional financial integration is properly estimated when global linkages (that are likely to affect the regional

[12] Because we are interested in business cycle synchronization within a region, we only consider the pairs of countries in the same region as observations.

[13] We start the sample from 2001 since only limited data on bilateral cross-border assets are available before 2001. More recent data (from 2010) was not available when we initially collected data for this paper. In addition, under unusual economic condition in recent years (for example, some regional crisis such as crisis in Eurozone, prolonged world-wide recessions with dramatic policy measures, huge build up and transmission of global liquidity, and so on), it may not be easy to recover true trade and finance linkages. At any rate, in Section 4.2., we report the results when we extend the sample up to 2015. The main conclusion does not change.

business cycle synchronization) are properly controlled. It is also interesting that the coefficients of the measures of regional trade and financial integration have opposing signs. Finally, the coefficients of the measures of global linkages are mostly positive. The positive coefficient of the measures of global financial linkages is significant at the 1% level for all regions but CEE. In addition, the adjusted R^2 increases substantially when the measures of global linkages are added to the regression. All of these suggest that it is crucial to consider global linkages in the explanation of regional business cycle synchronization within each region.

"INSERT Table 8 Here"

Table 8 reports the estimation results for the system of equations (3). The sign of the coefficient of each variable in the main equation (the first equation in (3)) is very similar to that of the single equation estimation that includes all four variables; the regional trade integration and global trade and financial linkages have positive effects on business cycle co-movements, but regional financial integration has a negative effect. The estimated coefficients are significant in many cases.

"INSERT Table 9 Here"

The results show that the measures of global trade and financial linkages positively affect regional business cycle co-movements. The positive coefficient of the measure of global trade linkage is significant at the 5% level in EA and at the 1% level in CEE, while the positive coefficient of the measure of global financial linkage is significant at the 1% level in all regions but CEE. In each case, at least one of the positive coefficients of the measures of global linkage is significant at the 1% level. This finding implies that similar and strong common global linkages between 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 those between Thailand and the U.S. are strong and similar. Suppose further that the U.S. economy is hit by a recession. Then, both Korea and Thailand will experience difficulties exporting their goods 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 the 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 a 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 and expenditure of the latter two countries and may therefore have a positive effect on their business cycle co-movement.

The results show that regional trade integration has a positive effect on business cycle co-movements. The positive coefficient of the measure of regional trade integration is significant at the 1% level in EA and CEE and at the 5% level in ALL. Many studies, following Frankel and Rose (1998), have also observed the positive effect of trade integration on business cycle co-movements. Frankel and Rose (1998) argued 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. Some studies, such as that of Calderon, Chong, and Stein (2007), found that the effect of trade integration on business cycle co-movements among developing countries is also positive, although smaller than those among industrial countries.

Interestingly, regional financial integration is found to have a negative effect on the regional business cycle correlation. The negative coefficient of the measure for regional financial integration is significant at the 5% level in all cases. Past empirical studies (e.g., Imbs, 2004, 2006) have generally found that the effect is either positive or insignificant. The results of the current study are particularly interesting because the effect is often positive (in Table 7) when the measures for global linkages are not included in the estimation as in the earlier studies. Global linkages are found to have a significant effect on regional business cycle synchronization. By omitting the measures for global linkages, the effect of regional integration on regional business cycle synchronization can be improperly estimated.

Using panel regressions with individual and time-fixed effect, Kalemli-Ozcan et al. (2013) found that financial integration has a negative effect. After controlling aggregate

(common shock) and pair-specific effects, they also found that financial integration has a negative effect. Our results are in line with the results of Kalemli-Ozcan et al. (2013), as we found a negative effect after controlling the global relationships. Our analysis further suggests that among the various aggregate effects, it is important to control the global linkages with industrial countries outside the region. In addition, compared to Kalemli-Ozcan et al.'s (2013) use of a panel regression, we obtain results using a cross-sectional regression, which tends to show a long run effect. This is a useful evidence because we are often interested in the long run relationship between financial integration and business cycle co-movement. Finally, while Kalemli-Ozcan et al. (2013) focused on banking integration, we consider general financial integration based on general cross-border portfolio investment data.

Theoretically, the effects of financial integration on business cycle correlation are ambiguous. As summarized by Kalemli-Ozcan et al. (2013), the theory predicts a positive effect if shocks to the financial sector dominate and/or there is a contagion, but a negative relationship if shocks to the real sector dominate in the form of firms' productivity change. For example, as suggested by Backus, Kehoe, and Kydland (1992) and Baxter and Crucini (1995), a country-specific positive productivity shock in the home country induces capital flows from the foreign country in a two-country model by increasing the marginal productivity of the capital gap between the home and foreign country, thereby generating a negative correlation between the two countries' outputs. Obstfeld (1994) suggested that financial integration can promote investments in risky projects, leading countries to specialize on where there are comparative advantages. These effects may have led to a negative output correlation.

The results also show that regional trade and financial integration affect each other positively. The estimated coefficients of the measure of regional trade integration in the finance equation and the measure of regional financial integration in the trade equation are positive, which is significant at the 5% level in all cases but LA. 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 further suggests that regional financial integration has a negative direct effect on business cycle co-movement, but simultaneously has a positive indirect effect by affecting regional trade integration positively. Similarly, regional trade integration has a positive direct effect on business cycle co-movement, but has a simultaneous a negative indirect effect by affecting regional financial integration positively.

Table 10 shows the direct, indirect, and overall effects of regional trade and financial integration.[14] After considering the indirect positive effect, the overall negative effect of regional financial integration on regional business cycle co-movements is not especially large. The size of the overall effect is less than one-tenth of the direct effect in EA, while it is less than half in CEE. This is because the financial indirect effects through the channel of regional trade integration will largely weaken the financial direct effects on regional business cycle co-movements. In another word as we mentioned before, regional financial integration will increase the regional trade integration, if financed-induced effects of trade integration are large enough we will get a positive overall effect. Thus, some past studies may have found more positive effects by improperly controlling the indirect effect. On the other hand, the total effect of trade integration is smaller than the direct effect of trade integration because the indirect effect is negative. The overall effect is still positive in EA, but it is even negative in CEE.

Finally, global linkages tend to have a negative effect on regional trade integration and positive effects on regional financial integration. Similarity among global linkages may have increased the competition among countries within the region and may have contributed to weakening regional trade linkages.

"INSERT Table 10 Here"

4.2. Extended Analysis

In the regression, the majority of the coefficients are often estimated significantly, so it is not so easy to infer which variable is the most important in explaining business cycle synchronization. To infer the relative importance of the variables, we apply the method

[14] We assume that the coefficient is zero when it is not significantly estimated because using the pointe estimate is meaningless in such cases. At any rate, the main conclusion is the same even when we use the point estimate of the insignificant coefficient.

developed by Kruskal (1987) to calculate the proportion of variance of the business cycle correlation explained by each variable.[15]

"INSERT Table 11 Here"

Table 11 reports the results. First, the role of global linkages is substantial. The sum of the proportion explained by the two global linkage measures is far larger than the sum of the proportion explained by the two regional integration measures in LA and ALL. The former is only slightly smaller than the latter in EA and CEE. This suggests that regional business cycle synchronization is strongly affected by global linkages with the major industrial countries outside the region.

The most important variable is the measure of global financial linkages in EA and LA. In these two regions, the (regional and global) financial linkages are more important than the (regional and global) trade linkages in EA and LA. It is interesting that newly-growing economic linkages, i.e., financial linkages, are more important than the traditional economic linkages, i.e., trade linkages, in explaining regional business cycle synchronization in EA and LA.

In contrast to these two regions, regional trade integration is the most important variable in CEE. In addition, the trade linkage is more important than the financial linkage. Although countries in CEE have, in recent years, recorded a period of strong economic growth, often accompanied by robust capital inflows, the extent of financial linkages remains weak (refer to Tables 3 and 4).

We also perform various exercises to check the robustness of the results. First, we use the correlation of real GDP in the log-difference form rather than the correlation of cyclical real GDP as the measure of business cycle correlation. Second, the business cycle co-movement structure may 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 based only on 2001 data. Third, we consider an

[15]This method can be described as averaging the 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. Finally, we calculate the average proportion of all possible orderings. For the details, see Kruskal (1987).

alternative structure of the system of equations in which the global financial (or trade) integration does not affect the regional trade (or financial) integration. Fourth, as suggested by Imbs (2006), we include S_{ij}, which is a measure of dissimilarities in sectorial patterns of production across countries or of differences in industrial specialization across countries, in the system because specialization, such as trade-induced specialization, may affect business cycle synchronization and thus the empirical results.[16] Fifth, we used alternative sample periods. The sample period up to 2007 is considered to exclude the global financial crisis that may have affected business cycle synchronization strongly. The sample period up to 2005 is also considered since the buildup to the financial crisis might distort the financial integration measure, as discussed in Cesa-Bianchi, Imbs, and Saheen (2016).

Sixth, when we construct EXT and EXF, we consider the weight (w_k) based on the volume of trade (for EXT) and the volume of cross-border assets (for EXF), instead of GDP. Seventh, we consider alternative measures of EXT, and EXF. The following measures of EXT and EXF are considered.

$$\mathrm{EXT2}_{ij} \equiv \sum_{k=1}^{K} w_k \{\mathrm{CORRELATION}(T_{i,k}\ ,\ T_{j,k})\}$$

$$\mathrm{EXF2}_{ij} \equiv \sum_{k=1}^{K} w_k \{\mathrm{CORRELATION}(F_{i,k}\ ,\ F_{j,k})\}$$

These measures show the correlation between trade (or finance) integration between i and k and that between j and k. Eighth, we also consider alternative measures of T and F,

[16] Following Clark and vanWincoop (2001) and Imbs (2004, 2006), sectorial real value added data are used to compute S_{ij}.

$$S_{ij} = \frac{1}{T}\sum_{t}\sum_{n}^{N}\left|S_{n,i} - S_{n,j}\right|$$

where $S_{n,i}$ denotes the GDP share of industry *n* in country *i*, S_{ij} is the time average of the discrepancies in economic structures between countries *i* and *j*. The larger the value for S_{ij}, the greater the degree of difference of specialization between the two countries. Three-digit manufacturing value added data from UNDIO INDSTAT4 is used. In this estimation, we use the structure and instruments that are similar to those used by Imbs (2006).

following Imbs (2004,2006) and Frankel and Rose (1998). The following measures are considered.

$$T2_{i,j} \equiv \frac{1}{2T}\sum_t \frac{X_{i,j,t}+M_{i,j,t}}{Y_{i,t}+Y_{j,t}} \qquad F2_{i,j} \equiv \frac{1}{2T}\sum_t \frac{I_{i,j,t}+I_{j,i,t}}{(Y_{i,t}+Y_{j,t})}$$

$$T3_{i,j} \equiv \frac{1}{2T}\sum_t \frac{X_{i,j,t}+M_{i,j,t}}{(X_{i,t}+M_{i,t})+(X_{j,t}+M_{j,t})} \qquad F3_{i,j} \equiv \frac{1}{2T}\sum_t \frac{I_{i,j,t}+I_{j,i,t}}{I_{i,t}+I_{j,t}}$$

where $X_{i,t}$ and $M_{i,t}$ are country *i*'s total exports and imports at time *t*, respectively, and $I_{i,t}$ is the sum of country *i*'s portfolio investment in foreign countries and foreign countries' portfolio investment in country *i*. Finally, we extend the sample period up to 2015.

Seventh, we exclude an advanced country, Japan, in our sample. Eighth, we use z-transformed correlations for the measure of business cycle synchronization. Ninth, we use HP filter to construct cyclical output and the measure for business cycle synchronization. We use three alternative methods. We consider the first differenced output as cyclical output. We use the band pass filter. Then, we consider the method suggested by Hamilton (2017). Tenth, we use value added trade data to construct the measures of regional and global trade linkages. Global value chain or vertical trade integration and transit trade may complicate to identify the clear role of each trade linkage. By using value added trade data, we try to clearly identify the contribution of each trade linkage.

Table 12 reports the results when we use all samples from the three regions.[17] The results are similar to those of the baseline case. The positive effects of regional trade integration and external financial linkage and the negative effect of regional financial integration are estimated significantly in most cases. However, the positive effect of external trade linkage is estimated significantly in some cases but not in other cases.[18]

[17] The results for each region are also similar; results are available from the authors upon request.

[18] A trade linkage with one country can be related to a trade linkage with another country. In such a case, the role of each trade linkage may not be clearly separated. For example, consider a case of vertical trade integration as follows. Country *i* in a region exports the intermediate goods to country *j* in the same region,

"INSERT Table 12 Here"

5. Conclusion

This paper examines the effects of economic integration on regional business cycle synchronization in three emerging/developing regions: East Asia (EA), Central and Eastern Europe (CEE), and Latin America (LA). In particular, this paper analyzes the effect of regional versus global integration and trade versus financial integration.

The empirical results suggest that similar and strong common linkages with major industrial countries outside the region, in particular, financial linkages, have a significant positive effect on regional business cycle synchronization. This finding is consistent with the popular notion that shocks in major industrial countries like the U.S. can affect the countries in a certain region in a similar way through similar economic linkages.

The empirical results also show that regional trade integration has a positive effect on regional business cycle synchronization and that regional financial integration has a negative effect. The positive effect of trade integration is consistent with some theories and past empirical studies. Many past empirical studies, however, have found financial integration to have a positive effect. After controlling the important variable that affect regional business cycle synchronization, namely, global linkages, the empirical effects are shown to be negative in the current study.

The empirical results also show that the relative importance of these economic linkages is different across regions. In EA and LA, financial linkages, especially financial linkages with major industrial countries outside the region, are the most important determinant of regional business cycle synchronization. In CEE, however, trade linkages,

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and then country *j* uses the intermediate goods to export final goods to country *k* outside the region. In this case, the global trade linkage of country *j* with country *k* may affect the regional trade linkage of country *j* with country *i*. In this sense, the regional trade linkage may not be clearly separated from the global trade linkage in our analysis, and some regional trade linkage may be attribute to global trade linkage. This may be related to a less significant role of global trade linkage found in our analysis.

especially regional trade integration, are the most important determinant.

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Table 1. Exports and Imports

Units: Billion USD, %

		1980	1997	2001	2005	2010	2012
Exports	EA	213.6	886.3	996.6	1906.6	3308.9	4040.5
		(11.7%)	(16.1%)	(16.3%)	(18.4%)	(22.2%)	(22.6%)
	CEE	64.7	97.1	129. 2	299.1	492.3	594.5
		(3.5%)	(1.8%)	(2.1%)	(2.9%)	(3.3%)	(3.3%)
	LA	65.2	153.4	161.3	314.5	520.7	649.6
		(3.6%)	(2.8%)	(2.6%)	(3.0%)	(3.5%)	(3.6%)
	EU	789.4	2208.2	2457.0	4090.5	5015.0	5583.3
		(43.2%)	(40.0%)	(40.1%)	(39.4%)	(33.6%)	(31.3%)
	ALL	343.5	1136.8	1287.1	2520.2	4321.9	5284.6
		(18.8%)	(20.6%)	(21.0%)	(24.3%)	(29.0%)	(29.6%)
Imports	EA	223.7	787.4	889.5	1738.2	3159.3	4154.8
		(11.7%)	(14.1%)	(14.0%)	(16.2%)	(20.6%)	(22.6%)
	CEE	84.6	154.4	178.8	410.1	634.3	754.9
		(4.4%)	(2.8%)	(2.8%)	(3.8%)	(4.1%)	(4.1%)
	LA	68.6	173.5	154.6	219.3	467.3	620. 7
		(3.6%)	(3.1%)	(2.4%)	(2.0%)	(3.1%)	(3.4%)
	EU	890.9	2133.0	2455.9	4162.2	5219.6	5734.4
		(46.6%)	(38.2%)	(38.6%)	(38.7%)	(34.1%)	(31.1%)
	ALL	376.9	1115.3	1222.9	2367.6	4260.9	5530.4
		(19.7%)	(20.0%)	(19.2%)	(22.0%)	(27.8%)	(30.0%)

Notes: Each number shows the exports (or imports) of countries in each region. Each number in parentheses shows the share of exports (or imports) in world exports (imports). EA, LA, CEE, EU, and ALL indicate East Asia, Latin America, Central and Eastern Europe, and all three regions, respectively.

Source: IMF, Direction of Trade Statistics.

Table 2. Regional and Global Trade Relationships

Units: Billions USD

	Regional						Global					
	1980	1997	2001	2005	2010	2012	1980	1997	2001	2005	2010	2012
EA	57.1	263.2	320.5	690.1	1375.1	1762.1	128.0	526.4	566.1	901.0	1327.9	1587.0
% of total	13.1%	15.7%	17.0%	18.9%	21.3%	21.5%	29.3%	31.5%	30.0%	24.7%	20.5%	19.4%
% of GDP	7.8%	12.9%	13.4%	17.3%	14.5%	14.3%	7.0%	8.3%	8.6%	10.5%	8.8%	8.7%
CEE	15.5	27.3	36.8	110.5	205.1	245.8	34.6	120.0	148.2	299.4	422.9	473.8
% of total	11.6%	8.3%	11.7%	20.7%	20.8%	19.4%	25.9%	36.7%	46.9%	56.1%	42.8%	37.3%
% of GDP	6.2%	5.0%	6.5%	9.5%	11.7%	13.4%	14.0%	21.9%	26.2%	25.6%	24.2%	25.8%
LA	18.4	78.8	72.2	116.5	208.1	255.0	66.4	142.7	133.7	201.8	308.7	396.4
% of total	12.3%	31.3%	23.5%	16.4%	18.5%	18.9%	44.5%	56.7%	43.4%	28.5%	27.4%	29.4%
% of GDP	2.2%	3.6%	3.4%	4.3%	4.2%	4.5%	7.9%	6.6%	6.4%	7.5%	6.3%	7.0%
World	3742.0	11103.4	12485.1	21150.2	30226.7	36275.9	3742.0	11103.4	12485.1	21150.2	30226.7	36275.9

Notes: Each number shows regional or global trade amounts of the countries in each region. “Regional” trade indicates the trade with countries within each region, while “Global” trade indicates trade with the major industrial countries outside the region (G7 countries for CEE and LA, G7 excluding Japan for EA). “% of total” shows the percentage of the regional or global trade from total trade of countries in each region. EA, LA, and CEE indicate East Asia, Latin America, and Central and Eastern Europe, respectively.

Source: IMF, Direction of Trade Statistics, World Economic Outlook Databases

Table 3. Assets and Liabilities of Portfolio Investments

(billions USD)

		1997	2001	2005	2010	2012
Assets	EA	946.14	1621.63	2892.22	5060.58	5549.70
	CEE	…	9.23	35.97	110.88	108.26
	LA	33.19	28.27	58.96	200.79	199.46
	EU	2279.6	6019	13302.36	19217.45	19823.44
	World	5885.14	12719.41	26045.39	40636.10	43568.30
Liabilities	EA	566.15	838.98	2031.76	3076.94	3586.17
	CEE	43.86	63.23	215.68	384.56	521.08
	LA	179.24	128.65	264.27	690.48	753.36
	EU	2567.42	6360.39	13293.49	19363.02	20052.02
	World	5885.87	12719.07	26038.11	40596.13	43519.17

Notes: Each number shows the assets or liabilities of portfolio investments in the countries of each region. "…" indicates that data are not available, EA, LA, CEE, and EU indicate East Asia, Latin America, Central and Eastern Europe, and the European Union, respectively.

Source: IMF, Coordinated Portfolio Investment Survey

Table 4. Regional versus Global Portfolio Investments

(USD billion)

			Asset in				Liability from			
			1997	2001	2005	2010	1997	2001	2005	2010
EA	Regional	amount	85.5	92.5	188.6	579.0	45.0	85.6	188.6	541.8
		% of total	9.0%	5.7%	8.5%	11.9%	7.9%	10.2%	10.0%	17.6%
		% of GDP	1.8%	1.6%	2.6%	6.6%	0.2%	1.0%	1.5%	2.9%
	Global	amount	586.5	969.1	1519.1	2265.3	446.2	523.8	1288.1	1625.9
		% of total	62.0%	60.0%	68.4%	46.6%	78.8%	62.4%	68.1%	53.0%
		% of GDP	12.2%	17.0%	21.2%	25.7%	0.4%	5.8%	10.3%	8.6%
CEE	Regional	amount	…	0.6	2.9	11.4	…	0.6	2.9	11.4
		% of total	…	6.6%	8.2%	10.3%	…	1.0%	1.4%	3.0%
		% of GDP	…	0.1%	0.2%	0.0%	…	0.1%	0.2%	0.6%
	Global	amount	…	4.0	14.0	35.3	39.9	45.0	104.9	202.0
		% of total	…	43.7%	38.9%	31.8%	89.3%	71.2%	48.7%	53.0%
		% of GDP	…	0.6%	1.0%	1.7%	2.6%	6.9%	7.8%	9.9%
LA	Regional	amount	0.6	1.6	3.4	13.9	0.6	1.6	3.4	13.9
		% of total	1.8%	5.6%	5.8%	6.8%	0.3%	1.2%	1.3%	2.0%
		% of GDP	..	0.1%	0.2%	0.4%	..	0.1%	0.2%	0.4%
	Global	amount	8.2	19.7	31.6	115.3	162.5	101.9	186.5	463.8
		% of total	24.7%	69.7%	53.5%	56.4%	90.7%	73.5%	70.6%	67.1%
		% of GDP	..	1.6%	1.9%	3.2%	0.0%	8.3%	11.4%	12.9%
World		amount	1102.8	1507.6	2788.6	2966.5	5652.7	12228.3	25244.3	38785.5

…= no data available

..= too small

Notes: Each number shows the regional or global portfolio investments of countries in each region. “Amount” shows the amount in billions of USD. “% of total” shows the shares in the total assets or liabilities of each region. “% of GDP” shows the percentage of own GDP. EA, LA, and CEE indicate East Asia, Latin America, and Central and Eastern Europe, respectively.

Data Source: IMF, Coordinated Portfolio Investment Survey (CPIS). China’s asset data are calculated by the counter data (the liabilities data) from the IMF; Hong Kong’s data for 1997 are also calculated using the counter data from the IMF

Table 5. Correlations of Cyclical Real GDP

A. East Asia

	HK	CHN	INO	JPN	KOR	MAL	PHI	SIN	THA	ALL	US	G6
						1990s						
HK	1										-0.70	-0.73
CHN	-0.27	1									0.78	0.66
INO	0.92	-0.09	1								-0.61	-0.60
JPN	0.67	-0.31	0.81	1							-0.59	-0.44
KOR	0.72	0.02	0.83	0.67	1						-0.35	-0.24
MAL	0.87	0.05	0.98	0.78	0.89	1					-0.46	-0.44
PHI	-0.08	0.78	0.21	0.25	0.37	0.36	1				0.56	0.61
SIN	0.71	0.44	0.81	0.47	0.77	0.87	0.57	1			-0.10	-0.15
THA	0.91	-0.20	0.93	0.63	0.8	0.89	-0.03	0.70	1		-0.71	-0.71
AVG	0.49	0.05	0.60	0.44	0.56	0.63	0.27	0.59	0.51	0.46	-0.15	-0.13
						2000s						
HK	1										0.68	0.91
CHN	0.51	1									-0.24	0.18
INO	0.49	0.98	1								-0.28	0.14
JPN	0.75	-0.12	-0.15	1							0.98	0.94
KOR	0.52	-0.11	-0.14	0.79	1						0.74	0.74
MAL	0.91	0.47	0.47	0.73	0.56	1					0.66	0.83
PHI	0.93	0.70	0.69	0.57	0.37	0.93	1				0.46	0.75
SIN	0.97	0.61	0.57	0.66	0.50	0.92	0.95	1			0.59	0.83
THA	0.71	-0.11	-0.13	0.94	0.69	0.80	0.59	0.67	1		0.94	0.85
AVG	0.64	0.33	0.31	0.46	0.35	0.64	0.64	0.65	0.46	0.50	0.45	0.66

B. Central and Middle Europe

	ALB	BUL	CRO	HUN	LAT	MAC	POL	ROM	SLO	TUR	ALL	US	G7
							1990s						
ALB	1											-0.26	-0.42
BUL	0.15	1										0.79	0.65
CRO	-0.38	0.20	1									0.13	0.65
HUN	-0.19	0.93	0.28	1								0.91	0.77
LAT	-0.50	0.68	0.63	0.83	1							0.84	0.92
MAC	-0.24	0.85	0.44	0.9	0.93	1						0.91	0.88
POL	-0.63	0.42	0.79	0.58	0.88	0.77	1					0.55	0.82
ROM	0.43	-0.62	0.07	-0.80	-0.71	-0.73	-0.45	1				-0.9	-0.52
SLO	-0.24	0.78	0.39	0.86	0.83	0.82	0.57	-0.57	1			0.82	0.92
TUR	-0.58	-0.32	0.29	-0.19	0.16	0.05	0.52	-0.10	-0.34	1		-0.12	-0.02
AVG	-0.25	0.38	0.28	0.40	0.45	0.47	0.41	-0.43	0.37	-0.03	0.22	0.41	0.48
							2000s						
ALB	1											-0.43	-0.19
BUL	0.14	1										0.83	0.93
CRO	-0.13	0.95	1									0.93	0.96
HUN	-0.38	0.85	0.93	1								0.98	0.92
LAT	-0.26	0.90	0.97	0.94	1							0.97	0.99
MAC	0.57	0.83	0.67	0.42	0.61	1						0.43	0.67
POL	0.71	0.52	0.35	0.04	0.29	0.89	1					0.06	0.35
ROM	0.19	0.98	0.92	0.82	0.85	0.83	0.58	1				0.78	0.88
SLO	0.17	0.98	0.94	0.79	0.90	0.88	0.63	0.97	1			0.79	0.92
TUR	-0.42	0.82	0.91	0.96	0.96	0.45	0.07	0.77	0.78	1		0.99	0.95
AVG	0.03	0.79	0.75	0.63	0.71	0.67	0.43	0.78	0.79	0.62	0.63	0.66	0.76

C. Latin America

	ARG	BOL	BRA	CHI	COL	ECU	GUY	PAR	PER	URU	VEN	ALL	US	G7
	1990s													
ARG	1.00												-0.58	-0.63
BOL	-0.21	1.00											0.35	0.54
BRA	0.46	-0.07	1.00										-0.83	-0.50
CHI	0.28	0.19	0.13	1.00									-0.45	-0.32
COL	0.34	0.14	0.24	0.81	1.00								-0.54	-0.53
ECU	0.71	0.20	0.52	0.72	0.82	1.00							-0.66	-0.55
GUY	0.24	-0.03	0.18	0.70	0.82	0.61	1.00						-0.42	-0.34
PAR	0.24	0.07	0.30	0.77	0.97	0.74	0.76	1.00					-0.59	-0.54
PER	-0.38	0.53	-0.08	0.38	0.58	0.27	0.59	0.60	1.00				0.12	0.27
URU	0.82	0.08	0.11	0.44	0.51	0.79	0.39	0.34	-0.02	1.00			-0.27	-0.36
VEN	0.74	-0.02	0.62	0.56	0.36	0.69	0.17	0.36	-0.30	0.49	1.00		-0.70	-0.51
AVG	0.32	0.09	0.24	0.50	0.56	0.61	0.44	0.51	0.22	0.40	0.37	0.39	-0.42	-0.32
	2000s													
ARG	1.00												0.17	0.49
BOL	0.83	1.00											-0.27	0.14
BRA	0.79	0.83	1.00										0.19	0.56
CHI	0.68	0.34	0.70	1.00									0.79	0.95
COL	0.90	0.82	0.91	0.73	1.00								0.26	0.63
ECU	0.62	0.42	0.61	0.78	0.51	1.00							0.49	0.60
GUY	0.36	0.68	0.58	-0.06	0.54	-0.17	1.00						-0.48	-0.10
PAR	0.76	0.67	0.91	0.79	0.86	0.56	0.46	1.00					0.35	0.68
PER	0.81	0.95	0.91	0.47	0.89	0.41	0.67	0.81	1.00				-0.08	0.33
URU	0.94	0.96	0.82	0.48	0.87	0.52	0.56	0.72	0.90	1.00			-0.12	0.27
VEN	0.85	0.74	0.84	0.75	0.86	0.74	0.39	0.74	0.72	0.83	1.00		0.26	0.61
AVG	0.75	0.72	0.79	0.57	0.79	0.50	0.40	0.73	0.75	0.76	0.75	0.68	0.14	0.47

Notes: “AVG” indicates the average for each country. “AVG’ under ‘ALL’ indicates the average of all pairs of correlations in each region. Due to data availability, 1990s figures for CEE are based on observations during the period from 1992 to 1999, and the 2000s figures on observations during the period from 2002-2009. For the same reason, Bosnia, Czech, Lithuania, and Slovakia are excluded in this table.
Data Source: IMF, World Economic Outlook Databases

Table 6. Descriptive Statistics for EXT and EXF

	EXT		EXF	
	Mean	St. Dev	Mean	St. Dev
EA	0.34	0.26	1.05	1.54
CEE	1.21	1.43	0.49	0.44
LA	0.02	0.01	0.19	0.21
ALL	0.75	1.21	0.51	0.77

Table 7. Correlation among Various Measures

A. EA

	ρ	T	F	EXT	EXF
ρ	1				
T	0.261	1			
F	0.297	0.904	1		
EXT	0.382	0.675	0.811	1	
EXF	0.439	0.284	0.600	0.591	1

B. CEE

	ρ	T	F	EXT	EXF
ρ	1				
T	0.176	1			
F	0.129	0.563	1		
EXT	0.182	0.195	0.625	1	
EXF	0.136	0.049	0.402	0.614	1

C. LA

	ρ	T	F	EXT	EXF
ρ	1				
T	-0.049	1			
F	-0.202	-0.027	1		
EXT	-0.117	-0.090	0.572	1	
EXF	0.171	-0.160	0.437	0.667	1

D. ALL

	ρ	T	F	EXT	EXF
ρ	1				
T	0.127	1			
F	0.085	0.637	1		
EXT	0.050	-0.021	-0.003	1	
EXF	0.191	0.213	0.581	0.080	1

Table 8. Single Equation Estimation

A. EA

	regression 1	regression 2	regression 3	regression 4
T	0.005 (1.584)	---	-0.001 (-0.110)	0.027 (2.557)**
F	---	0.019 (1.823)*	0.021 (0.865)	-0.109 (-2.612)**
EXT	---	---	---	0.015 (1.450)
EXF	---	---	---	0.090 (3.201)***
R^2	0.068	0.089	0.089	0.360

B. CEE

	regression 1	regression 2	regression 3	regression 4
T	0.010 (1.690)*		0.009 (1.198)	0.012 (1.605)
F	---	0.256 (1.225)	0.086 (0.340)	-0.258 (-0.791)
EXT	---	---	---	0.548 (1.156)
EXF	---	---	---	2.085 (0.500)
R^2	0.020	0.006	0.010	0.063

C. LA

	regression 1	regression 2	regression 3	regression 4
T	-0.002 (-0.320)	---	-0.002 (-0.359)	-0.003 (-0.042)
F	---	-0.130 (-1.354)*	-0.131 (-1.349)	-0.154 (-1.353)
EXT	---	---	---	-2.077 (-1.377)
EXF	---	---	---	14.349 (2.392)**
R^2	-0.021	0.041	-0.002	0.164

D. ALL

	regression 1	regression 2	regression 3	regression 4
T	0.003 (1.805)*	---	0.003 (1.341)	0.005 (2.056)**
F	---	0.008 (1.201)	0.001 (0.074)	-0.018 (-1.657)*
EXT	---	---	---	0.010 (0.476)
EXF	---	---	---	0.116 (2.890)***
R^2	0.011	0.002	0.006	0.040

The dependent variable in all regressions is the correlation of cyclical real GDP (ρ)
*P<0.1; ** P<0.05; ***P<0.01
The numbers in brackets are the T-value.

Table 9. System of Equations Estimation

	EA	CEE	LA	ALL
	GDP correlations (ρ) equation			
T	0.070 (2.841)***	0.051 (2.963)***	0.006 (0.448)	0.114 (2.242)**
F	-0.303 (-2.818)***	-3.913 (-5.045)***	-0.719 (-1.992)**	-0.094 (-3.024)***
EXT	0.038 (2.202)**	3.512 (6.392)***	1.024 (0.421)	0.001 (0.033)
EXF	0.186 (3.284)***	6.182 (0.976)	17.840 (2.598)***	0.299 (3.461)***
	Trade (T) equation			
F	3.941 (7.021)***	42.435 (2.339)**	37.808 (1.101)	5.756 (5.359)***
EXT	-0.285 (-1.160)	-31.520 (-2.021)**	-209.003 (-1.027)	0.297 (0.448)
EXF	-1.950 (-5.318)***	-79.881 (-1.391)	-224.501 (-0.906)	-11.312 (-3.711)***
	Finance (F) equation			
T	0.217 (7.177)***	0.013 (4.181)***	0.012 (0.704)	0.053 (1.450)
EXT	0.122 (2.091)**	0.830 (5.516)***	5.221 (2.733)***	-0.157 (-1.009)
EXF	0.473 (4.340)***	2.147 (1.402)	2.961 (0.261)	2.117 (7.140)***

*P<0.1; ** P<0.05; ***P<0.01
The numbers in brackets are the Z-value.

Table 10. Direct, Indirect, and Overall Effects

	EA	CEE	LA	ALL
F direct effects	-0.303	-3.913	-0.719	-0.094
T direct effects	0.070	0.051	0	0.114
F Indirect effects	0.276	2.164	0	0.656
T Indirect effects	-0.066	-0.052	0	0
F overall effects	-0.028	-1.749	-0.719	0.562
T overall effects	0.004	-0.001	0	0.114

Table 11. Contribution of Each Variable

Variable	EA	CEE	LA	ALL
T	0.060	0.055	0.002	0.020
F	0.063	0.015	0.057	0.008
EXT	0.021	0.042	0.029	0.051
EXF	0.091	0.019	0.099	0.047

Table 12. Results from Various Exercises

	R1	R2	R3	R4	R5	R6
GDP correlations (ρ) equation						
T	0.050 (7.262)***	0.014 (2.210)**	0.010 (1.882)**	0.027 (1.901)*	0.044 (5.563)***	0.049 (3.876)***
F	-0.256 (-6.073)***	-0.102 (-2.927)***	-0.969 (-3.118)***	-0.113 (-2.040)**	-0.253 (-4.635)***	-0.487 (-7.919)***
EXT	0.053 （1.397）	0.429 (2.147)**	0.008 （0.416）	0.005 （0.234）	0.065 （1.554）	0.826 (1.856)*
EXF	0.731 (6.263)***	0.194 (3.624)***	0.316 (3.653)***	0.280 (2.467)**	0.718 (4.693)***	0.541 (6.119)***
S				-0.334 （-1.518）		
Trade (T) equation						
F	6.488 (6.715)**	4.910 (3.913)***	2.029 (6.297)***	3.649 (6.388)***	5.417 (5.036)***	6.355 (4.629)***
EXT	-0.719 (-1.103)	1.143 (0.909)	-0.198 (-0.331)	0.083 （0.151）	-0.477 (-0.759)	1.377 （0.172）
EXF	-15.274 (-5.533)***	-5.78 (-4.277)***		-5.721 (-3.183)***	-12.182 (-3.977)***	-5.606 (-4.334)***
Finance (F) equation						
T	0.118 (3.456)***	0.036 （1.598）	0.044 （1.218）	0.124 (3.159)***	0.081 (1.857)*	0.063 (2.571)**
EXT	0.071 （0.463）	2.760 (3.972)***		-0.036 (-0.241)	0.031 （0.181）	2.408 (2.304)**
EXF	2.458 (8.484)***	0.182 （0.701）	2.447 (8.101)***	2.099 (7.398)***	2.490 (6.859)***	0.892 (6.245)***
Specialization (S) equation						
F				-0.024 (-2.050)**		

Notes: The results using all samples (EA, LA, and CEE) are reported. “S” indicates the difference in industrial specializations between two countries. The numbers in brackets are the Z-value.

R1 shows the results when real GDP in log-difference is used rather than of cyclical real GDP.

R2 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.

R3 shows the results when we assume that global financial linkages cannot affect regional trade linkages and that global trade linkages cannot affect regional financial linkages.
R4 shows the results when the differences in industrial specializations is introduced in the model.
R5 shows the results when the sample period of 2001~2007 is considered.

Table 12 (continued). Results from Various Exercises

	R7	R8	R9	R10	R11
GDP correlations (ρ) equation					
T	0.031 （3.901）***	47.017 (7.808)***	31.405 (6.660)***	0.045 (6.387)***	0.058 (2.383)**
F	-0.123 (-2.590)***	-265.134 (-10.341)***	-52.629 (-5.203)***	-0.277 (-5.991)***	-1.178 (-6.396)***
EXT	1.782 （6.304）***	0.0421 (1.160)	0.142 (4.029)***	0.071 (1.938)*	1.333 (6.192)***
EXF	0.649 （1.899）*	0.896 (9.189)***	0.263 (4.101)***	0.723 (6.172)***	1.869 (7.303)***
Trade (T) equation					
F	4.863 （8.355）***	5.450 (9.133)*	1.657 (10.671)***	6.025 (6.290)***	8.372 (2.941)***
EXT	-32.836 （-3.468）**	-0.0004 (-0.582)	-0.003 (-3.127)***	-0.597 (-0.974)	-6.187 (-1.793)**
EXF	-15.007 （-2.599）	-0.016 (-5.839)***	-0.004 (-2.245)**	-12.885 (-5.029)***	-7.793 (-2.430)**
Finance (F) equation					
T	0.064 （2.776）***	0.189 (7.848)***	0.504 (9.757)***	0.119 (3.890)***	0.038 (1.795)*
EXT	0.436 (0.203)	0.0001 (-0.580)	0.001 (2.270)**	0.077 (0.586)	1.309 (5.401)***
EXF	3.377 （3.196）***	0.003 (10.098)***	0.001 (1.351)	2.171 (7.187)***	1.114 (13.769)***

Notes: The results using all samples (EA, LA, and CEE) are reported. “S” indicates the difference in industrial specializations between two countries. The numbers in brackets are the Z-value.

R6 shows the results when the volume of trade and the volume of cross-border assets are used as weight (w_k) to construct EXT and EXF, respectively.

R7 shows the results when $EXT2_{ij} \equiv \sum_{k=1}^{K} w_k\{CORRELATION(T_{i,k}, T_{j,k})\}$ and $EXF2_{ij} \equiv \sum_{k=1}^{K} w_k\{CORRELATION(F_{i,k}, F_{j,k})\}$.

R8 shows the results when alternative definitions of T and F are used ($T2_{i,j} \equiv \frac{1}{2T}\sum_t \frac{X_{i,j,t}+M_{i,j,t}}{Y_{i,t}+Y_{j,t}}$, $F2_{i,j} \equiv \frac{1}{2T}\sum_t \frac{(I_{i,j,t}+I_{j,i,t})}{Y_{i,t}+Y_{j,t}}$)

R9 shows the results when alternative definitions of T and F are used ($T3_{i,j} \equiv \frac{1}{2T}\sum_t \frac{X_{i,j,t}+M_{i,j,t}}{(X_{i,t}+M_{i,t})+(X_{j,t}+M_{j,t})}$, $F3_{i,j} \equiv \frac{1}{2T}\sum_t \frac{(I_{i,j,t}+I_{j,i,t})}{I_{i,t}+I_{j,t}}$)

R10 shows the results when the sample period of 2001~2005 is considered.

R11 shows the results when the sample period of 2001~2015 is considered.

Table 12 (continued). Results from Various Exercises

	R12	R13	R14	R15	R16	R17
GDP correlations (ρ) equation						
T	0.045 （5.293)***	0.081 (5.352)***	0.037 (3.847)***	0.048 (4.649)***	0.042 (2.715)***	0.050 (5.743)***
F	-0.164 (-4.562)***	-0.559 (-6.201)***	-0.157 (-5.910)***	-0.202 (-7.250)***	-0.159 (-3.802)***	-0.177 (-4.729)***
EXT	0.057 （1.232)	0.025 (0.311)	1.373 (4.210)***	1.610 (4.541)***	1.116 (2.100)**	0.054 (1.114)
EXF	0.510 （4.829)***	1.486 (6.359)***	0.274 (4.019)***	0.331 (4.538)***	0.282 (2.576)**	0.524 (4.857)***
Trade (T) equation						
F	4.083 （5.148)***	6.774 (5.473)***	1.987 (2.578)**	2.203 (2.859)***	2.312 (3.106)***	4.070 (5.726)***
EXT	-1.039 （-1.457)	0.114 (0.138)	12.082 (0.830)	7.613 (0.524)	4.362 (0.311)	-0.948 (-1.383)
EXF	-9.729 （-3.942)***	-15.312 (-4.161)***	-3.612 (-2.665)***	-3.892 (-2.873)***	-3.992 (-3.002)***	-9.607 (-4.312)***
Finance (F) equation						
T	0.136 (2.682)***	0.157 (5.884)***	0.235 (8.273)***	0.232 (8.346)***	0.232 (8.325)***	0.141 (2.990)***
EXT	0.146 (0.593)	-0.012 (-0.092)	7.575 (3.339)***	7.857 (3.555)***	8.321 (3.757)***	0.110 (0.474)
EXF	2.555 (6.030)***	2.290 (9.986)***	1.392 (5.379)***	1.454 (5.721)***	1.365 (5.365)***	2.489 (6.341)***

Notes: The results using all samples (EA, LA, and CEE) are reported. “S” indicates the difference in industrial specializations between two countries. The numbers in brackets are the Z-value.

R12 shows the results when Japan is excluded.

R13 shows the results when z-transformed correlation is used to construct the measure of business cycle correlation.

R14 shows the results when the log-differenced output is used as cyclical output.

R15 shows the results when the band pass filter is used to extract cyclical output.

R16 shows the results when the method by Hamilton (2017) is used to extract cyclical output.

R17 shows the results when value added trade data is used.