Trade intensity and business cycle synchronization: East Asia versus Europe

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\textbf{ABSTRACT}

This paper provides a comparative analysis of the relationship between trade intensities and synchronization of business cycles in East Asia and Europe (EU-15). It extends the work of Shin and Wang (2004, 2005) by providing a comparative perspective between East Asia and Europe. The paper finds that intra-industry trade, rather than inter-industry trade, is the major factor in explaining business cycle co-movements in both regions. The paper also supports the hypothesis that the relationship between trade intensity and output co-movement is stronger in East Asia than in Europe. The major policy implication of this finding is that East Asia needs to further strengthen macroeconomic policy coordination within the region.

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1. Introduction

Unlike Europe where political will to integrate was strong and supra-national institutions led to integrated economies, economic integration in East Asia was essentially market-led. It is only after the Asian financial crisis that East Asia started to supplement market-led integration with various official schemes to promote regional integration. The factors that led to this change in policy stance are discussed in ADB (2008) and Rana (2009), among others. These studies find that trade integration within East Asia has deepened considerably and the share of total trade conducted within it is over one-half in recent years. East Asia is now broadly as interdependent in trade as Europe and North America are.

The objective of this paper is to examine whether rising trade intensities among the countries in East Asia and Europe has led to more synchronization of business cycles. If so, is such synchronization higher in East Asia or Europe? This topic is important because if trade integration among countries in the region has led to increased output co-movement, it would provide a strong case for macroeconomic policy coordination.

Industrial structures in East Asia are more diverse than in Europe. The development path followed the “flying geese pattern” (Akamatsu, 1962) which involved the transfer of export markets from the more advanced to less advanced countries. Japan began as a producer of low-priced final consumer goods and later moved on to capital-intensive intermediates and capital goods as labor costs increased. It also shed low-productivity production to the second-generation countries, generally the newly industrializing economies (NIEs) comprising Hong Kong, Korea, Taiwan, and Singapore, as...
producers invested and relocated to these countries. Thereby, the second generation countries moved into the vacated consumer goods assembly in the 1960s. Similarly, in the 1970s and the 1980s, the third generation countries, including Indonesia, Malaysia, Philippines, and Thailand, and the fourth generation countries, namely China and Vietnam, moved in to fill the gaps left by the NIEs.

The traditional production networks in East Asia were triangular where Japan and the NIEs exported component parts for electrical appliances, office and telecom equipment and textiles and garments industry to China and the third generation countries which in turn completed the processing and exported the final product to markets in the US and Europe. Since the mid-1990s, more sophisticated and complex production networks have emerged which involve transshipment of components, back and forth, across East Asia (Gill & Kharas, 2007).

On the contrary, Europe industrial structures are more homogeneous and less vertically integrated. Using data from Athukorala and Kohpaiboon (2008), Baldwin and Carpenter (2010) estimate that in East Asia 71% of all its exports of parts and components in the manufacturing sector go to East Asia itself whereas the share of parts and components in EU-15’s intra-regional trade is only 56%.

The impact of trade intensity on business cycle synchronization is theoretically ambiguous.

According to Frankel and Rose (1998), an output surge in one country can generate increased demand for imports, boosting economies abroad. Through these types of spillover effects, stronger trade flows result in more highly correlated business cycles across countries. Kenen (1969) and Krugman (1993), however, claims that trade flows could also induce increased specialization of production resulting in changes in the nature of business cycle correlations. If stronger trade flows are associated with increased inter-industry specialization across countries, and industry-specific shocks are important in driving business cycles, then international business cycle co-movement might be lower. Fig. 1 summarizes the economic prediction on the impact of trade integration on business cycle co-movement. Although the theoretical implications are not clear, empirical investigations help to test the validity of these theoretical predictions.

Although Frankel and Rose (1998) recognize the possible contrasting effects of inter- and intra-industry trade on business cycle synchronization, they continue to focus on the net effect of total trade on output co-movement. Many studies subsequently extend and complement the evidence presented by Frankel and Rose (1998) by analyzing the impact of intra-industry trade intensity on business cycle synchronization (Calderón, Chong, & Stein, 2007; Inklaar, Jong-A-Pin, & Haan, 2008; Shin & Wang, 2004). Shin and Wang (2004) find that intra-industry trade is the major channel by which Korea’s business cycle becomes synchronized with that of other Asian economies, although increased trade itself does not necessarily lead to close business cycle coherence. In their study, Shin and Wang (2004) examines four different possible channels of trade affecting business cycle co-movement: inter-industry trade, intra-industry trade, demand spillovers and policy coordination. Theoretically, only the first channel implies that increased trade leads to less synchronization of business cycles, while the other channels show that increased trade induces more synchronization. Empirically, Shin and Wang (2004) run both pooled and panel regressions using data from twelve Asian economies for the period of 1976–1997 and show that the signs of coefficients are consistent with theoretical prediction, however, only intra-industry trade has a significant coefficient which suggests that business cycle co-movements are strengthened only when increased trade is of intra-industry type. In this paper we extend Shin and Wang (2004) by providing a comparative analysis of East Asia and Europe so that the above hypothesis can be tested using a common framework.

Our main findings are the followings. First, intra-industry trade rather than inter-industry trade is found to be the major factor in affecting business cycle synchronization in both East Asia and Europe. Second, the effect of intra-industry trade on business cycle synchronization for East Asia is found to be higher than the one for Europe.

The structure of the paper is organized as follows. Section 2 provides some literature review regarding the relationship between trade integration and the synchronization of business cycles. Section 3 discusses the data and presents the econometric methodology used in estimating trade intensity and business cycle synchronizations in East Asia and Europe. Section 4 presents empirical results and findings. Finally, Section 5 concludes with policy implications.
2. Literature review

In the last several years, a number of researchers have focused on the degree of trade integration on business cycle synchronization. In their seminal papers, Frankel and Rose (1998) argue that countries with stronger trade ties have more similar business cycles. Since then, subsequent studies have confirmed this finding (Baxter & Kouparitsas, 2005; Calderón et al., 2007; Inklaar et al., 2008). Using a dataset that includes more than 100 developed and developing countries, Baxter and Kouparitsas (2005) find that bilateral trade intensity is robustly related to business cycle synchronization using the extreme bounds analysis (EBA). Calderón et al. (2007), using dataset of 147 for the period 1960–1999, find that the effect of trade intensity on business cycle correlation among developing countries is positive and significant, but substantially smaller than that among industrial countries. Inklaar et al. (2008) re-examine the relationship between trade intensity and business cycle synchronization for 21 OECD countries for the period 1970–2003 and confirm that trade intensity affects synchronization but the effect is smaller than those previously reported. Overall these studies provide evidence of a positive and significant link between trade integration and business cycle synchronization especially for industrial economies. Compared to developed countries, East Asia, as one of the most dynamic regions in terms of increasing trade integration, has only recently received attention in the synchronization literature (Choe, 2001; Rana, 2008). These studies generally find a positive and significant relationship between trade intensity and business cycle synchronization in the region. Nevertheless, none of these studies has look at the case of East Asia and Europe from a common and comparative perspective, even though Shin and Wang (2004) focus on the case of East Asia and Shin and Wang (2005) focus only on Europe.

3. Data and methodology

For both the cases of East Asian and EU-15, three sets of data are collected to measure output co-movements, trade intensity and intra-industry trade intensity.

First, output co-movement is measured using annual real GDP data at constant price for 10 East Asian countries and 15 EU-15 over the period of 1986–2007. The East Asian countries considered are China, Japan and their major trading partners in Asia, including the three NIEs such as Hong Kong, Korea and Taiwan, and the five co-founding countries of ASEAN such as Indonesia, Malaysia, the Philippines, Singapore and Thailand. Data from Taiwan are collected from Directorate General of Budget, an official website of Taiwan. The EU-15 comprises the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. All the output data are drawn from IFS online.

Following Rose and Engel (2000), a simple unconditional correlation is used as a proxy of bilateral output correlation. The output data are first-differenced in logarithm and divided into two periods, 1987–1996 as Period 1 and 1997–2007 as Period 2. The regression for the case of East Asian is based on 90 observations (10 × 9)/2 country pairs across two sub-sample periods while the regression for the case of EU-15 countries is based on 210 observations (15 × 14)/2 country pairs across two sub-sample periods. Given the lack of consensus about optimal detrending techniques, we decompose real GDP into trend and cycle using Hodrick-Prescott filter and quadratic trend model. No major difference is observed in terms of the resulting correlations. According to these measures, higher output correlation between two countries implies higher degree of business cycle synchronization.

Second, bilateral trade intensity is measured using data from the United Nations Commodity Trade Statistics Database. Following the method of Frankel and Rose (1998), three different proxies for bilateral trade intensity are used: wx, wm, and wt. The first proxy uses export data only, the second uses import data only, and the third uses both:

\[ wx(i, j, T) = \ln \left( \frac{1}{T} \sum_{t \in T} \frac{x_{ijt}}{X_{it} + X_{jt}} \right) \]  
\[ wm(i, j, T) = \ln \left( \frac{1}{T} \sum_{t \in T} \frac{m_{ijt}}{M_{it} + M_{jt}} \right) \]  
\[ wt(i, j, T) = \ln \left( \frac{1}{T} \sum_{t \in T} \frac{x_{ijt} + m_{ijt}}{(X_{it} + X_{jt}) + (M_{it} + M_{jt})} \right) \]

where \( x_{ijt} \) denotes total nominal exports from country \( i \) to country \( j \) during year \( t \), \( m_{ijt} \) denotes the total nominal imports from country \( j \) to country \( i \) during year \( t \); \( X \) and \( M \) denote total global exports and imports for the corresponding country, and \( T \) is period, which is a set of ten years, thus \( T = \) Period 1 or Period 2.

Third, intra-industry trade intensity is measured using industry-level trade data from the United Nations Commodity Trade Statistics Database and other national sources. The database provides bilateral trade flows by partner at the industry level. The sector disaggregation in the database, provided at the two, three, four-digit level, follows the International Standard Industrial Classification (ISIC). A measure of intra-industry trade intensity is derived from Grubel and Lloyd (1975)
as:

\[ IIT(i, j, T) = \frac{1}{T} \sum_{t=1}^{T} \left( \frac{\sum_{k} x_{ijt}^{k} + m_{ijt}^{k}}{\sum_{k} x_{ijt}^{k}} \right) - \frac{\sum_{k} \left| x_{ijt}^{k} - m_{ijt}^{k} \right|}{\sum_{k} x_{ijt}^{k}} \]  

(4)

where \( x_{ijt}^{k} \) denotes total nominal exports of industry \( k \) from country \( i \) to country \( j \) during year \( t \), \( m_{ijt}^{k} \) the total nominal imports of industry \( k \) from country \( j \) to country \( i \) during year \( t \). Depending on how an industry is classified, we construct \( IIT2 \) at two-digit level, \( IIT3 \) at three-digit level and \( IIT4 \) at four-digit level.

We run a panel regression and estimate the coefficients of the following equation to test the impact of trade integration (approximated by coefficients of bilateral trade intensity) on business cycle synchronisation (measured by the correlation between cyclical outputs):

\[ yr(i, j, T) = \alpha_0(i, j) + \alpha_1 \text{trade}(i, j, T) + \alpha_2 IIT(i, j, T) + \epsilon(i, j, T) \]  

(5)

where \( yr(i, j, T) \) refers to correlation of output between country \( i \) and country \( j \) during period \( T \). For trade intensity, three measures are used: \( wx \), \( wm \), and \( wt \); and for intra- industry trade intensity, another three measures are used: \( IIT2 \), \( IIT3 \), and \( IIT4 \). In addition, \( \alpha_0(i, j) \) represents country pair-specific effects, which can either be fixed or random.

4. Results

The panel regression results, with fixed effects and random effects, for East Asia and EU-15 are shown in Tables 1 and 2, respectively.

Table 1 reports the regression results for both the panel regression with fixed effects (upper panel) and random effects (lower panel) for 10 East Asian countries. In the panel regression with fixed effects, when only trade intensity, either \( wx \) (Specification 1), \( wm \) (Specification 2) or \( wt \) (Specification 3), is used as a regressor, the coefficient estimates are positive and significant. Similarly, when only intra-industry trade intensity, either \( IIT3 \) (Specification 4) or \( IIT4 \) (Specification 5), is used as regressor, the reported coefficients are again positive and significant. However, in the panel regression with random effects, the coefficient estimates for trade intensity, either \( wx \) (Specification 1), \( wm \) (Specification 2) or \( wt \) (Specification 3), are positive but not significant whereas the coefficient estimate for intra-industry trade intensity, either \( IIT3 \) (Specification 4) or \( IIT4 \) (Specification 5), are positive and significant. Interestingly, when both trade-intensity and intra-industry trade intensity (Specifications 6–8) are used as regressors, for both panel regressions with fixed effects and random effects, the coefficient estimates for trade intensity become not significant whereas the coefficient estimates for intra-industry trade remain

Table 1
The effects of (intra-industry) trade on output co-movement among 10 East Asian countries for the period 1987–2007.

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<td>(a) Panel regression with fixed effects</td>
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<tr>
<td>( wx )</td>
<td>0.58***</td>
<td>0.03</td>
<td>0.12</td>
<td>0.03</td>
<td>0.11</td>
<td>0.28</td>
<td>0.95</td>
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<tr>
<td>( wm )</td>
<td>0.53***</td>
<td>3.51</td>
<td>2.31***</td>
<td>4.22</td>
<td>2.59***</td>
<td>4.79</td>
<td>2.13***</td>
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<tr>
<td>( wt )</td>
<td>2.82</td>
<td>2.55***</td>
<td>2.53***</td>
<td>3.45</td>
<td>2.96</td>
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<td>( IIT3 )</td>
<td>0.86***</td>
<td>0.95</td>
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<tr>
<td>( IIT4 )</td>
<td>1.16***</td>
<td>1.21***</td>
<td>1.19***</td>
<td>3.26</td>
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(b) Panel regression with random effects

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<tr>
<td>( wx )</td>
<td>0.06</td>
<td>0.06</td>
<td>0.08</td>
<td>0.08</td>
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<tr>
<td>( wm )</td>
<td>1.02</td>
<td>1.39</td>
<td>1.43</td>
<td>3.20</td>
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<td>( wt )</td>
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<tr>
<td>( IIT3 )</td>
<td>0.99***</td>
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<tr>
<td>( IIT4 )</td>
<td>1.16***</td>
<td>3.62</td>
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<tr>
<td>(c) Hausman test (( H_0: ) difference in coefficients not systematic)</td>
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<tr>
<td>Chi²</td>
<td>3.74</td>
<td>6.54***</td>
<td>10.66***</td>
<td>8.55***</td>
<td>10.78***</td>
<td>10.28***</td>
<td>10.40***</td>
<td>11.76***</td>
</tr>
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</table>

Notes: (i) The dependent variable is output correlation between any two East Asian countries for the two sub-periods, 1987–1996 (Period 1) and 1997–2007 (Period 2). Three trade intensity measures, \( wx \), \( wm \) and \( wt \) are defined as in Eqs. (1)–(3) based on exports, imports, total trade respectively. The intra-trade intensity measures, \( IIT2 \), \( IIT3 \), and \( IIT4 \) are defined as in Eq. (4) based on ISIC two-, three- and four-digit classifications; (ii) The values in parentheses are t-ratios.

* Significance at 10% of the estimated coefficients.

** Significance at 5% of the estimated coefficients.

*** Significance at 1% of the estimated coefficients.
positive and significant suggesting that it is the intra-industry trade that drives business cycle synchronization. As there are substantial differences between the regressions with fixed effects and random effects, casting doubt on the results of the panel regression. To choose between the two models, we perform Hausman test. Since the estimated chi-square value is highly statistically significant, we reject the hypothesis that there is no significant difference in the estimated coefficients of the two models. It seems there is correlation between the error term and one or more regressors. Hence, we can reject the random effects model in favor of the fixed effects model.

The results of the panel regressions with fixed effects and random effects for 15 EU countries are shown in Table 2. The sign and significance of the coefficient estimates for both models are rather mixed. As a result, to choose between the two models, we perform Hausman test. The chi-square value of the Hausman test is statistically insignificant. Therefore, we cannot reject the random effects model in favor of the fixed effects model. The test also suggests that there is more homogeneity in trade and business cycle structure among EU countries.

Consistently, the coefficient estimates for East Asia are higher than those of EU indicating impact of trade intensity on real output correlation is larger in East Asia. The results continue to hold even when both trade intensity and intra-industry trade intensity are used as regressors.

5. Policy implications

The above findings have several important policy implications. First, our findings suggest that caution should be exercised in searching appropriate partners for a currency union. Rather than total trade intensity, it is the level of intra-industry trade that matters and increases business cycle synchronization and reduces the cost of forming a currency union. If increased trade were of inter-industry trade type, then business cycle co-movements could be weakened.

Second, the finding that the relationship between intra-industry trade and output co-movement is stronger in East Asia than in Europe means that benefits from macroeconomic policy coordination are becoming larger in East Asia and East Asia should strengthen policy coordination to catch up with Europe. In the aftermath of the Asian financial crisis of 1997–98, as part of their regional self-help measures, East Asian countries had established a network of bilateral swaps among each other. The swaps were subsequently multilateralized, and more recently, the ASEAN+3 Macroeconomic Research Office (AMRO) was established to conduct due diligence to trigger the fund. Going forward, the AMRO should issue a composite basket currency to promote exchange rate coordination and facilitate further economic integration in the region.
References


