Trade Intensity and Business Cycle Synchronization: East Asia versus Europe

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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) in two ways: by improving the specification of their business cycle correlation equation and 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 – it has to catch up with Europe.

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1. Introduction

Unlike Europe where supra-national institutions and more integrated economies were driven by strong political will and desire to promote peace and avoid wars, 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 Akamatsu's flying geese pattern 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 intermediate and capital goods. The second-generation countries, generally the newly industrializing economies (NIEs) comprising Hong Kong, Korea, Taiwan, and Singapore, followed and 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 nexus between trade and foreign direct investment among countries in the region was close.

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 and 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 (2009) estimate that in East Asia 71% of all its exports of parts and components in the manufacturing

sector go to East Asia itself. The share of parts and components in EU15's intra-regional trade is 56%.

The impact of trade intensity on business cycle synchronization is theoretically ambiguous. If the demand shocks dominate and intra-industry trade is more pervasive, business cycles converge (Frankel and Rose, 1998). On the other hand, if industry-specific shocks are the dominant force and inter-industry trade is deeper due to increasing specialization in production, business cycles diverge (Kenen, 1969 and Krugman, 1993). Although the theoretical implications are not clear, empirical investigations help to test the validity of these theoretical predictions. This paper extends Shin and Wang (2004) in two ways. First, as suggested by Frankel and Rose (1998) it introduces instrumental variables for the trade intensity term in order to remove the estimation bias.[1] Second, it provides a comparative analysis of Europe and East Asia so that the above hypothesis can be tested using a common framework.[2]

2. 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 1986-2006. The East Asian countries considered are China, Japan and their major trading partners in Asia, including the three NIEs and the five co-founding countries of ASEAN such as Indonesia, Malaysia, the Philippines, Singapore and Thailand. All the output data are drawn from IFS online. Data from Taiwan are collected from Directorate General of Budget, an official website of Taiwan.

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 equally sized periods, 1987-1996 as Period 1 and 1997-2006 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. 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.

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

[1] See also Rana (2008).
[2] Shin and Wang (2004) looks at the case of East Asia and Shin and Wang (2005) focuses only on Europe but not from a comparative perspective.

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:

$$wx(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{x_{ijt}}{X_{it}+X_{jt}}\right) \quad (1)$$

$$wm(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{m_{ijt}}{M_{it}+M_{jt}}\right) \quad (2)$$

$$wt(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{x_{ijt}+m_{ijt}}{\left(X_{it}+X_{jt}\right)+\left(M_{it}+M_{jt}\right)}\right) \quad (3)$$

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:

$$IIT(i,j,T) = \frac{1}{|T|}\sum_{t\in T}\frac{\sum_k\left(x^k_{ijt}+m^k_{ijt}\right)-\sum_k\left|x^k_{ijt}-m^k_{ijt}\right|}{\sum_k\left(x^k_{ijt}+m^k_{ijt}\right)} \quad (4)$$

where x^k_{ijt} denotes total nominal exports of industry *k* from country *i* to country *j* during year *t*, m^k_{ijt} 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 IIT_2 at two-digit level, IIT_3 at three-digit level and IIT_4 at four-digit level.

We run a panel regression and estimate the coefficients of the following equation to test the impact of trade integration on business cycle synchronization:

$$yr(i,j,T) = \alpha(i,j) + \beta \quad trade \quad \text{int}ensity(i,j,T) + \gamma \quad IIT(i,j,T) + \varepsilon(i,j,T) \quad (5)$$

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: IIT_2, IIT_3, and IIT_4. In addition, $\alpha(i, j)$ represents country pair-specific effects, which can either be fixed or random.

3. Results

The panel regression results, with fixed effects and with instrumental variable, for East Asia and EU are shown in Table 1 and Table 2, respectively.

[insert Table 1 around here]

[insert Table 2 around here]

When only trade intensity, either *wx*, *wm* or *wt* , is used as a regressor, the coefficient estimates are positive and significant for both East Asian and EU. Consistently, the coefficient estimates for East Asia are higher than those of EU indicating larger impact of trade intensity on real output correlation. For instance, when *wt* is the only regressor as in specification (3), the coefficient estimate for East Asia is 0.877 and the coefficient estimate for EU is 0.123. When only intra-industry trade intensity, either IIT_2, IIT_3 or IIT_4, is used as a regressor, again the coefficient estimates are positive. The level of significance improves. Again, the coefficient estimates for East Asia are higher. The results continue to hold even when both trade intensity and intra-industry trade intensity are used as regressors.

Gravity equation of trade predicts that the volume of trade between two countries is proportional to their real GDP and inversely related to trade barriers between them. Various versions of the gravity equation also account for other factors. The results from our gravity equations in Table 3 suggest that distance, border dummy, common language and gross domestic products are significant in affecting trade intensity in East Asia. However, for EU, only border dummy and partners' GDP are found significant.

[insert Table 3 around here]

4. Policy Implications

The above findings have several important policy implications. As originally presented by Frankel and Rose (1998), optimum currency area criteria could be endogenous because a country's economic structure could change as a result of joining a currency union. Our findings suggest that caution should be exercised in searching appropriate partners for a currency union. When the level of intra-industry trade increases business cycles become more synchronized and the cost of a currency union falls.

East Asia is now broadly as interdependent in trade as Europe. 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 and East Asia should strengthen policy coordination to catch up with Europe. The Chiang Mai Initiative Multilateralism is a step forward, but more needs to be done to institutionalize policy coordination in East Asia.

Table 1: The effects of (intra-industry) trade on output co-movement among 10 East Asian countries for the period 1987-2006

	1	2	3	4	5	6	7	8	9
Panel regression with fixed effects									
wx	0.73 ***						0.136		
	(3.209)						(0.548)		
wm		0.444 **						-0.159	
		(2.422)						(-0.800)	
wt			0.877 ***						0.137
			(3.685)						(0.449)
IIT2				2.106 ***					
				(4.454)					
IIT3					2.744 ***				
					(5.089)				
IIT4						2.955 ***	2.978 ***	3.329 ***	2.957 ***
						(5.463)	(3.854)	(4.644)	(3.380)
Panel regression with instrumental variables									
wx	2.132 ***			0.513					
	(6.169)			(1.617)					
wm		1.262 ***			0.465 **				
		(7.921)			(2.139)				
wt			1.572 ***			0.497 *			
			(7.374)			(1.896)			
IIT4				2.483 ***	2.297 ***	2.371 ***			
				(4.099)	(3.805)	(3.895)			

Notes: (i) The dependent variable is output correlation between any two East Asian countries for the two sub-periods, 1987-1996 (Period 1) and 1997-2006 (Period 2). Three trade intensity measures, wx, wm and wt are defined as in Eqs. (1), (2) and (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.

(iii) *, ** and *** is the significance at 10%, 5% and 1% of the estimated coefficients, respectively.

Table 2: The effects of (intra-industry) trade on output co-movement among EU countries for the period 1987-2006

	1	2	3	4	5	6	7	8	9
Panel regression with fixed effects									
wx	0.104 ***						-0.003		
	(4.425)						(-0.079)		
wm		0.133 ***						0.046	
		(5.414)						(1.331)	
wt			0.123 ***						0.002
			(4.619)						(0.046)
IIT2				0.908 ***					
				(6.276)					
IIT3					0.956 ***				
					(6.414)				
IIT4						1.043 ***	1.057 ***	0.816 ***	1.034 ***
						(6.375)	(4.305)	(3.463)	(4.101)
Panel regression with instrumental variables									
wx	0.089 ***			-0.004					
	(4.095)			(-0.115)					
wm		0.111 ***			0.036				
		(4.624)			(0.954)				
wt			0.105 ***			-0.002			
			(4.217)			(-0.056)			
IIT4				1.064 ***	0.868 ***	1.054 ***			
				(4.266)	(3.521)	(4.096)			

Notes: See note to Table 1. The dependent variable is output correlation between any two EU-15 countries for Period 1 and Period 2.

Table 3: Gravity equations with trade intensities as the dependent variables

	10 East Asian Countries			EU-15 Countries		
	wx	wm	wt	wx	wm	wt
Constant	-11.249 ***	-21.161 ***	-16.68 ***	-14.693 ***	-17.324 ***	-15.536 ***
	(-3.609)	(-6.346)	(-6.302)	(-9.580)	(-8.607)	(-11.324)
Distance (in logs)	-0.446 ***	-0.321 **	-0.388 ***	-0.233 **	0.023	-0.079
	(-3.286)	(-2.099)	(-3.372)	(-2.520)	(0.224)	(-1.016)
Border dummy	0.403	0.222	0.242 ***	1.415 ***	1.206 ***	1.28 ***
	(1.247)	(0.657)	(0.881)	(5.856)	(4.447)	(6.302)
Common language	0.387 *	0.913 ***	0.7 ***	0.043	-0.006	0.023
	(1.945)	(4.170)	(4.137)	(0.140)	(-0.017)	(0.087)
Own GDP(in logs)	0.323 ***	0.182 **	0.285 ***	0.037	0.046	0.021
	(4.629)	(2.360)	(4.817)	(0.613)	(0.642)	(0.400)
Partners GDP (in logs)	0.03	0.486 ***	0.244 ***	0.363 ***	0.384 ***	0.374 ***
	(0.300)	(4.422)	(2.899)	(7.430)	(6.163)	(8.650)
Observations	84	84	84	171	171	171
R-squared	0.318	0.379	0.445	0.601	0.514	0.627

Notes (i) The dependent variables are bilateral trade intensity measures, wx, wm and wt, between any two East Asian/EU-15 countries for Period 1 and Period 2.

(ii) See note (ii) to Table 1.

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