Working Paper 02-08

Trade Integration and Business Cycle Co-movements: the Case of Korea with Other Asian Countries

Kwanho Shin and Yunjong Wang

KOREA INSTITUTE FOR INTERNATIONAL ECONOMIC POLICY

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Executive Summary

As Korea increases its trade within Asia, it is becoming more and more integrated with the other economies in the region. Theoretically, increased trade can lead business cycles across trading partners to be patterned in either direction, towards convergence or divergence. By using the data for twelve Asian economies, this paper finds 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.

JEL Classification: E32, F36, F41

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Yunjong Wang is a Senior Research Fellow at the Korea Institute for International Economic Policy (KIEP). He is currently a co-managing editor of *Asian Economic Papers* (the MIT Press). He has written extensively on international economic policy and international finance. His most recent publications include "What Kind of International Financial Architecture for an Integrated World Economy?"(*Asian Economic Papers*, 2002), "Fear of Floating: Korea's Exchange Rate Policy After the Crisis" (*Journal of the Japanese and International Economies*, 2001), "The Asian Financial Crisis and Its Aftermath: Do We Need a Regional Financial Arrangement?" (*ASEAN Economic Bulletin*, 2000).

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Trade Integration and Business Cycle Co-movements: the Case of Korea with Other Asian Countries*

Kwanho Shin** and Yunjong Wang***

I. Introduction

The recent pace of globalization in the world economy is so dramatic that, in many cases, examining the influence of foreign economies is becoming essential to understanding business fluctuations of domestic economies. For example, Japan's extended recession seems to be affecting the rest of Asia insofar as exports targeting the Japanese market have significantly shrunk. One might expect this interdependence of the economies to amplify as trade expands internationally. However, increased trade may not always intensify business cycle co-movements across different countries. For example, if trade occurs mainly across different industries, higher specialization

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would induce the industrial structures of the various countries to diverge, resulting in less synchronized movements of business cycles. From a theoretical point of view, increased trade can lead business cycles across trading partners to be patterned in either direction towards convergence or divergence.

One of the main objectives of this paper is to empirically analyze how the business cycle of the Korean economy is influenced by increased trade with other Asian economies. As Korea's trade within the region began accelerating in the 1990s, the influence of the trade linkages on business cycle co-movements seems to be growing increasingly important. As well, a possible free trade agreement in this region implies that this trend may persist even further.

Assessing business cycle co-movements of Korea with other Asian countries has another important implication for the economy in terms of evaluating the benefits and costs of adopting a common currency within the region. The recent Asian currency crisis has induced Asian countries to seriously consider forming a common currency area in the region as an alternative to the past soft-peg as well as the current floating exchange rate regimes. The successful launch of the euro in 1999 and its claimed benefits are also encouraging this movement. Many people believe that a currency union in East Asia is necessary to enhance exchange rate stability among East Asian currencies. For many developing countries in the region with common export markets, since the fluctuation of their bilateral exchange rates critically affects the competitiveness of their exports, they can expect to stabilize their overall export competitiveness by establishing a common currency.

As pointed out in the seminal paper written by Robert Mundell (1961), the major cost of adopting a common currency is losing monetary independence. A common currency means that all member

countries must yield their independent monetary policies to a supranational authority. When asymmetric macroeconomic shocks occur across the member countries, monetary policy cannot be tailored to one economy's individual disturbances. Hence it is less costly for the economies to form a common currency if the business cycles are synchronized across countries. From Korea's perspective, in order to find potential candidates in the region for a currency union with Korea, it is critical to perceive the changing patterns of business cycle co-movements of the Korean economy with other Asian countries.

This paper is organized as follows. Section 2 discusses the theoretical background on the relationship between trade and business cycle co-movements in more detail by reviewing the existing literature. Section 3 describes data and statistical findings. Section 4 presents empirical analyses. Section 5 discusses several extensions of the basic empirical analyses. The last section concludes.

II. Trade Patterns and Business Cycle Co-Movements

Many people insist that there is a strong correlation between trade linkage and business cycles (Canova and Dellas, 1993). The greater the trade linkage between two countries, the greater the probability that their business cycles are affected by each other. Eichengreen (1992) and Krugman (1993) presented an important argument in asserting that, as trade linkages increased, greater specialization of production would occur, resulting in less synchronization of business cycles. In particular, this is more so if business cycles are dominated by industry specific technological shocks. Krugman (1993) further argued that when the European countries adopted a single currency like the U.S., specialization within the countries would increase and thus result in a fall in the correlation of business cycles. He added that since countries that adopt a single currency tend to lose discretionary power with respect to monetary policy, each country would no longer be able to use monetary policy as a stabilization policy.

Frankel and Rose (1998) countered Krugman's argument, insisting that when demand shocks were dominant and intra-industry trade was more significant than inter-industry trade between the countries adopting the single currency, business cycles would become more positively correlated as trade became more integrated. Furthermore, the creation of a currency union implies that important trade barriers are eliminated, leading to increased trade among member countries. Consequently, a country that failed to satisfy preconditions could become *ex post facto* qualified to enter the currency union by endogenously increasing trade after the establishment of the union. A recent finding by Frankel and Rose (2002) that a currency union leads to a

three-fold increase in trade makes this a very plausible story.

In the literature, there are at least two additional important linkages between business cycle co-movements and increased trade. First, if demand shocks drive a boom in one country, the effects can spill over to trading partners through an increased volume of imports. Second, increased trade may create a greater need for more coordinated fiscal as well as monetary policies, which synchronize policy shocks. Both of these linkages imply that increased trade leads to tighter business cycle co-movements.

In sum, the theoretical implications of more trade integration on business cycle co-movements are not clear and, to test the validity of the theories, an empirical investigation is in order. Recently, Frankel and Rose (1998) have investigated this issue. Based on 21 industrialized countries, they found that the more countries trade with each other, the more highly correlated their business cycles are. That is, there is a strong positive relationship between the degree of bilateral trade intensity and the cross-country bilateral correlation of outputs. Unfortunately, however, an important step is missing in Frankel and Rose's approach. Specifically, the authors fail to identify the channel through which increased trade affects business cycle co-movements. In this paper, by extending Frankel and Rose's important contribution, we try to investigate how increased trade affects business cycle co-movements.

We call the four different channels affecting business cycle co-movements: (1) inter-industry trade, (2) intra-industry trade, (3) demand spillovers, and (4) policy coordination channels. Only the first channel implies that increased trade leads to less synchronization of business cycles. The last three channels have in common that increased trade induces more synchronization of business cycles.

While it is apparent in Frankel and Rose's study that the first

channel is not the one that facilitates convergence of business cycles, it is not clearly specified exactly which channel out of the last three channels drives their findings. To find the answer, it is necessary to consider these three channels separately and analyze how each one influences business cycle co-movements. In the next section, we will explain the empirical methodology used to identify the most important channel leading to the positive links between trade and business cycle co-movements.

III. Data and Statistical Findings

To measure output co-movements, annual data on real GDP are collected for 12 Asian countries over the period 1976-97. The countries considered are five East Asian countries (China, Hong Kong, Japan, Korea and Taiwan), five ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore and Thailand) and two other Asian countries (Bangladesh and India).[1] The period after 1997 is excluded because we believe that the data is distorted by the Asian crisis and, by including it, the conventional measure of business cycle co-movements could be exaggerated.[2] All the data are drawn from the IMF International Financial Statistics CD-Rom.

The trade volume data are collected from KOTIS (Korea Trade Information Services). Industry-level trade data are available in Nicita and Olarreaga (2001), which reorganize the United Nations Statistics Department's Comtrade database through the World Bank's World Integrated Trade Solution (WITS) software. The industry disaggregation in the database follows the International Standard Industrial Classification (ISIC) and is provided at the 2 digit level (9 industries), the 3 digit level (28 industries) and at the 4 digit level (81 industries) manufacturing industries only. The trade data includes both imports and exports, and mirror exports (reported by other trading partners) are obtained using WITS.

In <Figure 3-1>, both exports (Figure 3-1-A) and imports (Figure 3-1-B) of Korea with 5 other major Asian countries are plotted from 1976 to 2000. In the figures, Japan stands out as the most important

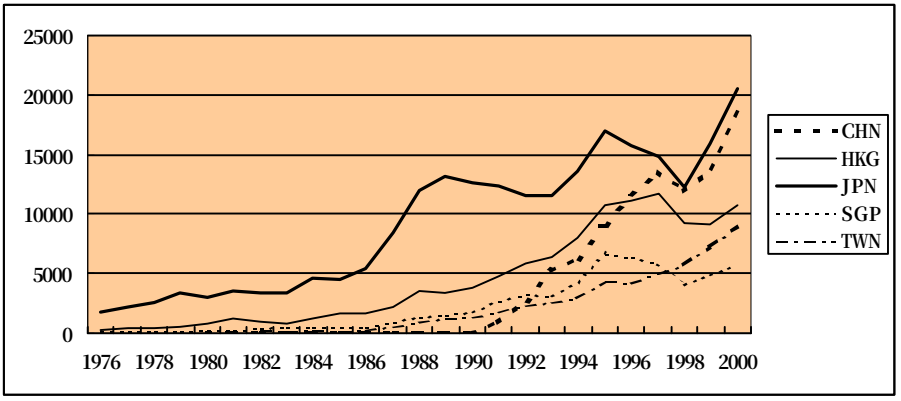
1) Five other ASEAN countries are excluded due to lack of data.

2) Recently Lee, Park and Shin (2002) have found that Asian regional shocks can be much larger when the Asian crisis period is included

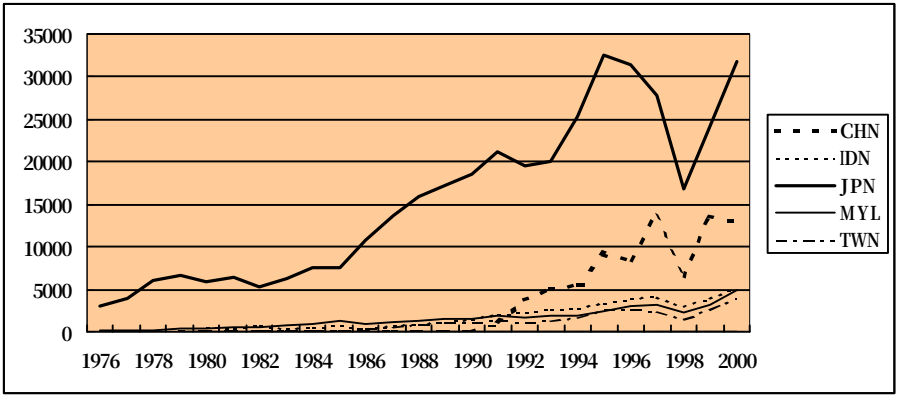
trading partner for the Korean economy. However, Korea experiences a very large trade deficit with Japan. In contrast, Korea has been experiencing a trade surplus with most other Asian countries.[3] The

<Figure 3-1> Trade with 5 Major Asian Countries

3-1-A. Exports of Korea to 5 Major Asian Trading Partners



3-1-B. Exports of Korea to 5 Major Asian Trading Partners



3) Indonesia and Malaysia are exceptions.

trade surplus with other Asian countries exceeds the trade deficit with Japan so that there is a total of about $10 billion in trade surplus from Asian countries. Regarding this figure, one recent notable phenomenon is that China has become a very important trading partner to Korea, especially as a destination for its exports.

To investigate how the bilateral trade intensity between Korea and other Asian countries influences business cycle co-movements, we use three different proxies for bilateral trade intensity, following Frankel and Rose (1998): wx_t, wm_t, and wt_t. The first uses export data only, the second, data for imports, and the third, both export and import data:

$$wx_t(k, j) = \frac{x_{kjt}}{X_{kt} + X_{jt}} \tag{1}$$

$$wm_t(k, j) = \frac{m_{kjt}}{M_{kt} + M_{jt}} \tag{2}$$

$$wt_t(k, j) = \frac{x_{kjt} + m_{kjt}}{X_{kt} + M_{kt} + X_{jt} + M_{jt}} \tag{3}$$

where x_{kjt} denotes total nominal exports from Korea to country j during period t, m_{kjt}, total nominal imports from country j to Korea during period t; and X and M denote total global exports and imports for the corresponding country. A higher value of any of these indices indicates greater trade intensity between Korea and country j.

A measure of intra-industry trade intensity is derived *á la* Grubel and Lloyd (1975). In constructing the measure, an important consideration is to decide how detailed a classification of industries we would like to use. If we want to measure trade in more homogeneous sectors, we need to further disaggregate industries. However, as we disaggregate industries further and further, the portion of in-

tra-industry trade will shrink and eventually go to nil. Rather than *a priori* determining a proper industry classification, we construct three measures based on two, three and four digit industry classifications following the International Standard Industrial Classification (ISIC). The constructed measure is

$$IIT = 1 - \frac{\sum_i | x^i_{kjt} - m^i_{kjt} |}{\sum_i (x^i_{kjt} + m^i_{kjt})} \tag{4}$$

where x^i_{kjt} is total nominal exports from Korea to country j and m^i_{kjt} is total nominal imports from country j to Korea. Depending on how industry is classified, we can have three measures: IIT_2 for two digit; IIT_3 for three digit; and IIT_3 for four digit classifications. Note that, since the second term on the right hand side in (4) decreases as more intra-industry trade occurs, we subtract it from 1 so that the index will monotonically increase as intra-industry trade increases.

Considering that any time-series changes in trade patterns may influence the nature of business cycle co-movements, we divide the whole period into three sub-sample periods: 1976-83 (period 1), 1984-90 (period 2) and 1991-97 (period 3). For each period, total real outputs are first-differenced in logarithms and then a simple correlation across countries is used as a proxy for business cycle co-movements.[4] We do not adopt the Hodrick-Prescott filter, another standard method that decomposes each series into trend and cyclical components because the series are annual and rather short.

In <Table 3-1>, the average measure of output correlation, trade

4) In our analysis, a simple unconditional correlation is used as a proxy for bilateral output correlation. This measure was also used in other previous related literature. See, for example, Rose and Engel (2000).

intensity and intra-industry trade for Korea with other Asian countries in each period is calculated. Interestingly, the correlation measure increases from period 1 (-.0413) to period 2 (.2251), but decreases again in period 3 (.0876). This indicates that, while there is some weak evidence of increasing co-movements of business cycles of Korea with other Asian countries, this pattern does not seem sustained. On the other hand, trade intensity, whether based on exports, imports or total trade, has continuously increased. This shows that, as time passes, Asian countries are increasingly becoming important trading partners to Korea. Another interesting phenomenon, however, is that the intra-industry measure, whether based on 2 digit, 3 digit or 4 digit industries, increases from period 1 to period 2, but decreases again in period 3.[5] Compared to trade intensity, this pattern of intra-industry trade more closely resembles the patterns of business cycle co-movements.

<Table 3-1> Average across Countries in Each Period

	Period 1	Period 2	Period 3
Correlation of Output	-0.0413	0.2251	0.0876
Trade Intensity: Export	0.0882	0.1078	0.1746
Trade Intensity: Import	0.0943	0.1193	0.1452
Trade Intensity: Total Trade	0.0896	0.1112	0.1572
Intra-Industry Trade: 2 digit	0.3264	0.4955	0.4549
Intra-Industry Trade: 3 digit	0.2030	0.3646	0.3563
Intra-Industry Trade: 4 digit	0.1740	0.3218	0.3218

Notes: i) In period 1, China's data are not included.
ii) The trade intensity measures are all multiplied by 10.

5) The intra-industry measure based on 4 digit industries, however, is almost the same in period 2 and period 3.

Recently Imbs and Wacziarg (2002) find an interesting pattern of industry concentration in relation to the level of per capita income. According to them various measures of industry concentration follow a U-shaped pattern: countries first diversify, but relatively late in the development process, they start specializing again. It is interesting to note that the evolution of intra-industry trade for Korea with other Asian countries follows exactly the same pattern: at first intra-industry trade increases, but later it decreases. Since inter-industry trade generally causes more specialization of industries, Imbs and Wacziarg's finding can be closely related to the changing patterns of trade. We can hypothesize that, as intra-industry trade increases, the economy becomes more diversified and later as intra-industry trade decreases, it becomes more specialized. However we need further extensive studies to confirm that this pattern for Korea's intra-industry trade can be generalized to other countries.

In <Table 3-2>, the average of the correlation, the trade intensity and the intra-industry trade measures are reported for each country over the whole sample period. We can see that Korea's output is correlated highest with those of Thailand (.385) and Taiwan (.320) and correlated lowest with those of China (-.128), Bangladesh (-.036), and Singapore (-.008). In terms of trade intensity, the three countries, Japan (.040), China (.018), and Malaysia (.012) are in the highest group and three other countries, Bangladesh (.002), the Philippines (.006) and Thailand (.006) are in the lowest group. For intra-industry trade intensity, the highest group consists of China (.548) and Taiwan (.527) and the lowest group consists of Bangladesh (.014), India (.142) and Thailand (.172). While there is some apparent relationship between output correlation and intra-industry trade in the sense that Taiwan is high and Bangladesh is low in both measures, there does not seem to exist any strong relationship between output correlation

and trade intensity.

<Table 3-2> Average over Periods

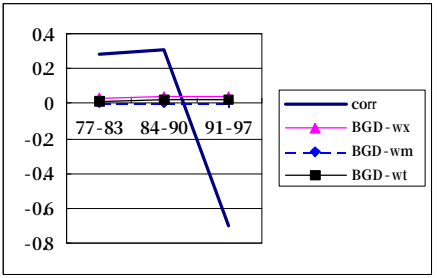
	BGD	CHN	HKG	IDN	IND	JPN	MYS	PHL	SGP	THA	TWN
Corr_y	-0.0366	-0.1283	0.0316	0.107	0.0408	0.1164	0.1232	0.0148	-0.0081	0.3853	0.32
wx	0.0356	0.1731	0.2557	0.1017	0.0881	0.2685	0.0811	0.0722	0.1401	0.0834	0.0875
wm	0.0011	0.172	0.0396	0.1592	0.039	0.5611	0.1647	0.0392	0.0598	0.0402	0.0656
wt	0.0178	0.1724	0.1445	0.129	0.0617	0.4	0.1223	0.055	0.0983	0.0605	0.0791
2-digit	0.5165	0.7346	0.2735	0.283	0.3218	0.4429	0.4314	0.3404	0.4902	0.2623	0.684
3-digit	0.0148	0.6392	0.2699	0.1576	0.2466	0.3929	0.3213	0.2288	0.4159	0.2323	0.6137
4-digit	0.0138	0.5476	0.2626	0.142	0.2188	0.3713	0.2848	0.204	0.3781	0.1725	0.5269

Notes: i) In period 1, the data for China is omitted.
ii) The measures of the trade intensity are all multiplied by 10.

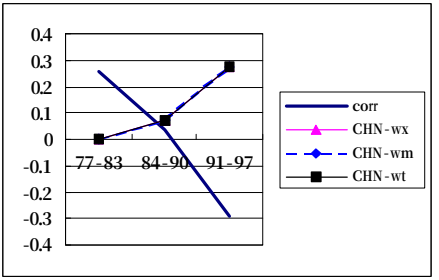
In <Figure 3-2>, in order to see the time series pattern for an individual country, the output correlation and the trade intensity measures in each sub-sample period are illustrated for each country. Generally we do not find any strong relationship between output correlation and trade intensity except that we find a positive relationship for India and Singapore. These results are contrasted with those of Frankel and Rose (1998) that find a close relationship between output correlation and trade intensity for twenty-one industrial countries. In <Figure 3-3>, we illustrate the time series pattern for the intra-industry trade measure. Unlike the case for trade intensity, we can see a strong relationship between output correlation and intra-industry trade. Especially China, Hong Kong, Indonesia, Malaysia and Singapore show a strong positive relationship between the output correlation and the intra-industry trade measure. For other countries, this positive relationship holds at least for either between

<Figure 3-2> Output Correlations and Trade Intensity

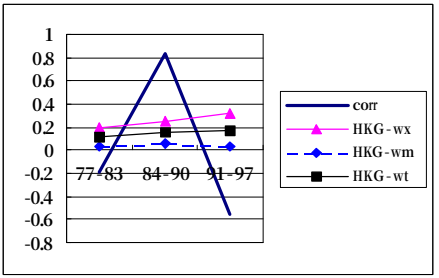
A. Bangladesh



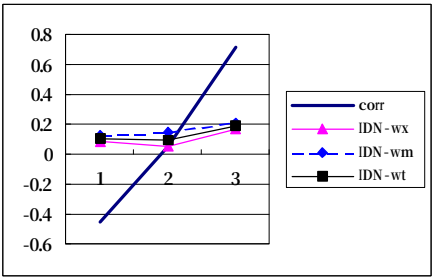
B. China



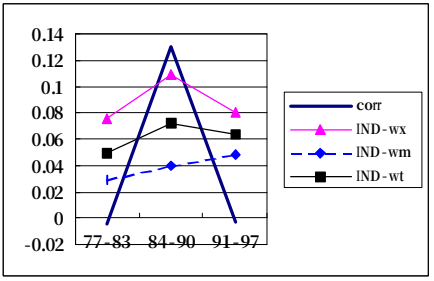
C. Hong Kong



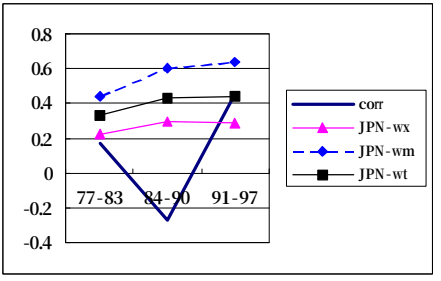
D. Indonesia



E. India

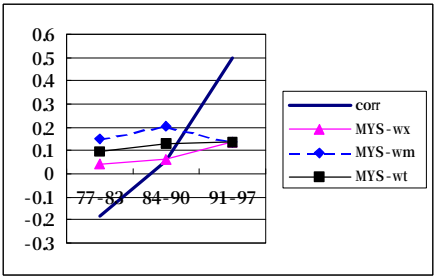


F. Japan

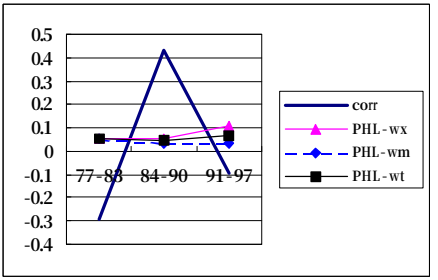


<Figure 3-2> (Continued)

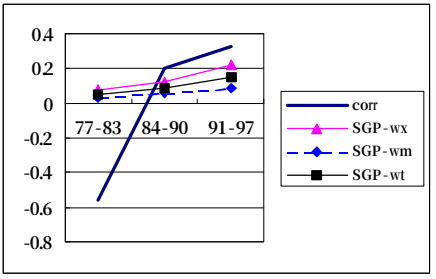
G. Malaysia



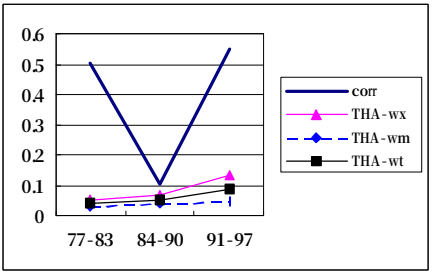
H. Philippines



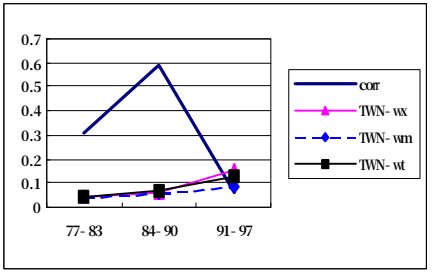
I. Singapore



J. Thailand

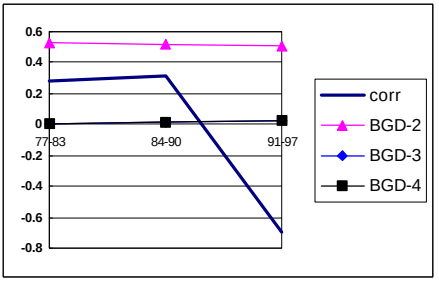


K. Taiwan

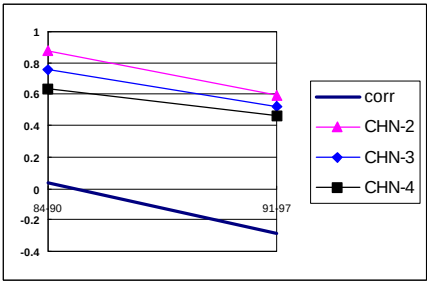


<Figure 3-3> Output Correlation and Intra-Industry Trade

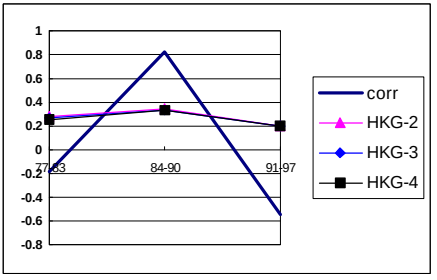
A. Bangladesh



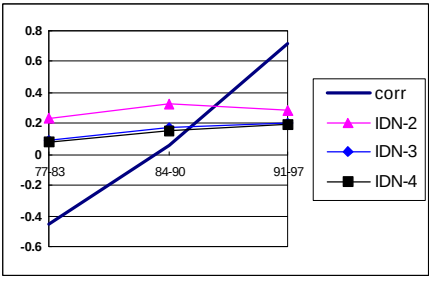
B. China



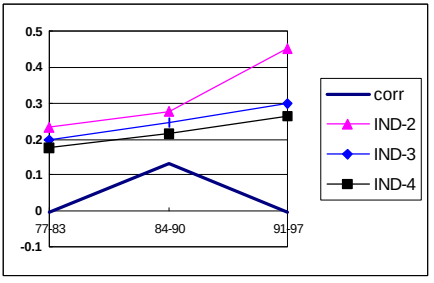
C. Hong Kong



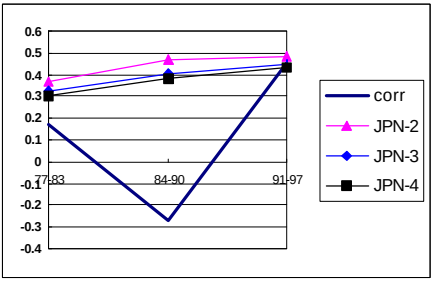
D. Indonesia



E. India

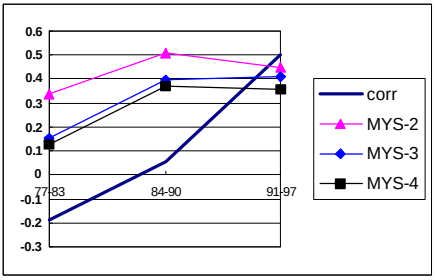


F. Japan

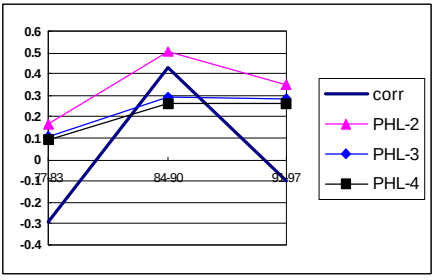


<Figure 3-3> (continued)

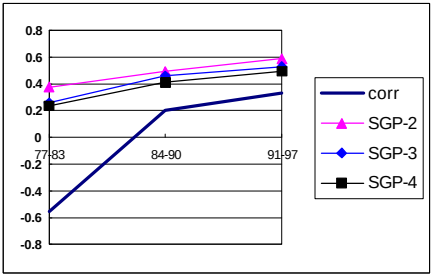
G. Malaysia



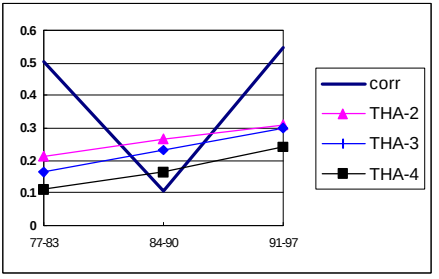
H. Philippines



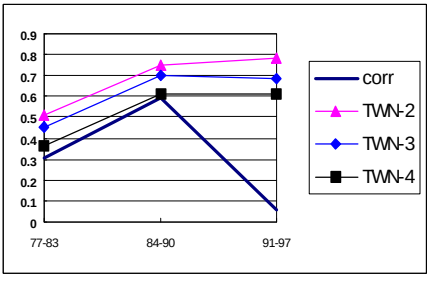
I. Singapore



J. Thailand



K. Taiwan



period 1 and 2 or between period 2 and 3. This strong positive relationship indicates that a higher correlation of output is accompanied by more intra-industry trade with the partner country.

IV. Methodology and Results

To more formally analyze this relationship, we set up the following equation and estimate the coefficients in the regression:

$$corr(k, j)_\tau = \alpha + \alpha_1 \text{ trade intensity } (k, j)_\tau + \alpha_2 \text{ intra-industry trade } (k, j)_\tau + \varepsilon_{k\tau}$$

where $corr(k, j)_\tau$ refers to correlation of output between Korea (k) and country j during period τ. For trade intensity, we used three measures, wx_t, wm_t and wt_t, and for intra-industry trade, another three measures IIT_2, IIT_3 and IIT_4.

In <Table 4-A>, the regression results from pooling the three periods are reported. In columns 1 through 6, either trade intensity or intra-industry trade is used as a regressor. In columns 7 through 9, both trade intensity and intra-industry trade are included as regressors. Since the results for intra-industry trade in columns 4 through 6 are very similar for the different measures of intra-industry trade, only IIT_4 is used for the measure of intra-industry trade in the estimation in columns 7 through 9. Indeed regression results using IIT_2 or IIT_3 instead of IIT_4 are very similar and hence not reported.

The regression results in <Table 4-A> indicate that, as expected, the estimated coefficient for trade intensity is highly insignificant. Furthermore, in every specification, the coefficient for intra-industry trade is positive and the t-ratios are generally larger indicating a positive relationship between output correlation and intra-industry trade, but the estimates are not significant at 5%. However, compared to trade intensity, intra-industry trade seems to matter more in explain-

ing the co-movements of outputs.

In <Table 4-B>, the results for a panel regression with fixed effects are reported. Compared to the OLS estimation with pooling, the estimation with fixed effects eliminates unobservable country specific components and is more appropriate than the effects of time series patterns of trade. In this case, the coefficient estimates for intra-industry trade are much more significant and quite robust across different specifications. In this case, every specification yields the estimates significant at 5%. Furthermore, even after including the trade intensity measure, the estimates change very little, with the same level of significance maintained. On the other hand, the coefficient estimates for trade intensity are very unstable and not significant at the 5% level. When only trade intensity is used as a regressor, the coefficient estimates are in the right sign with improved significance. However, when both trade intensity and intra-industry trade variables are used as regressors, the coefficient estimates for trade intensity become insignificant with the opposite sign. These results suggest that intra-industry trade might be a major source of business cycle co-movements. In contrast to the pooling regression results, the effect of intra-industry trade seems to be more prominent in the time series dimension for the same country. However, unlike Frankel and Rose (1998), our results indicate that increasing trade itself does not induce synchronization of business cycles. Especially, if increasing trade occurs mainly across different industries, it would not foster co-movements of outputs with trading partners.

<Table 4-C> reports the results for an instrumental variable (IV) panel regression with fixed effects. Frankel and Rose (1998) argued that a simple OLS regression might be inappropriate for estimating the effect of trade on business cycle correlation. This is so because countries are likely to link their currencies deliberately to those of

their most important trading partners, in order to capture gains associated with greater exchange rate stability. That is, trading partners lose the ability to set monetary policy independently of their neighbors and this tied monetary policy could result in a spurious association between trade intensity and business cycles co-movements. They suggested using 1) log of distance; 2) a dummy variable for common border; and 3) a dummy variable for common language for instrumental variables. Since these three dummy variables are not varying in the time series dimension, we add real output as another instrumental variable in order to estimate fixed effects.[6] Further we use these instrument variables in estimating the coefficient of trade intensity only because these are not believed to be appropriate instruments for measuring intra-industry trade. To check whether policy coordination blemishes our empirical results, we explicitly consider the policy variables in Section 5.

The results in <Table 4-C> do not change our main conclusions. When only trade intensity is used as a regressor, the significance improves in the sense that z-ratios are larger, but they are still not significant at the 5% level. More importantly, when intra-industry trade is added, the sign changes and its significance drops. In contrast, the coefficient estimates for intra-industry trade are significant even at the 1% level. Further, the estimated values are very robust across different specifications and even compared to those in <Table 4-B>, they change very little. In conclusion, the effect of intra-industry trade on output correlation seems to be clearly evident in the regression

6) To allow for a comparison of the real GDP across countries, we have used a data set from the Penn World Table developed by Summers and Heston (1991) for the available years, and extended it using the last year's value for the unavailable years.

analyses.

The results so far indicate that intra-industry trade is most important in explaining the co-movements of outputs over the business cycle. Especially we also find that just increasing the volume of trade does not necessarily increase business cycle synchronization.

<Table 4> The Effects of Trade Intensity and Intra-industry Trade on Co-movement

4-A Pooled Regression

	1	2	3	4	5	6	7	8	9
wx	-2.070						-51.883		
	(-0.03)						(-0.61)		
wm		6.830						-11.993	
		(0.16)						(-0.27)	
wt			9.482						-27.557
			(0.15)						(-0.40)
IIT_2				0.330					
				(0.82)					
IIT_3					0.515				
					(1.46)				
IIT_4						0.564	0.667	0.597	0.629
						(1.42)	(1.53)	(1.41)	(1.45)

Notes: i) The dependent variable is output correlation between Korea and other 11 Asian countries for the three sub-sample periods, 1976-83 (period 1), 1984-90 (period 2) and 1991-97 (period 3). The trade intensity measures, wx, wm and wt are defined as in equation (1), (2) and (3) based on exports, imports and total trade respectively. The intra-industry trade measure, IIT_2, IIT_3 and IIT_4 are defined as in equation (4) based on ISIC 2, 3 and 4 digit classifications.

ii) The values in parentheses are t-ratios.

4-B Panel Regression: Fixed Effects

	1	2	3	4	5	6	7	8	9
wx	71.872						-41.032		
	(0.42)						(-0.26)		
wm		69.597						-3.864	
		(0.36)						(-0.02)	
wt			108.843						-8.087
			(0.53)						(-0.04)
IIT_2				1.762*					
				(2.10)					
IIT_3					2.312*				
					(2.78)				
IIT_4						2.387*	2.455*	2.390*	2.397*
						(2.73)	(2.63)	(2.62)	(2.59)

Notes: i) See the note in Table 3.A.

ii) The values in parentheses are t-ratios. The significance of the estimated coefficients are denoted by * indicating significance at 5 % and **, at 1 %.

4-C Panel Regression: Instrumental Variables Regression

	1	2	3	4	5	6
wx	260.932			-67.296		
	(0.91)			(-0.26)		
wm		450.600			-116.438	
		(0.84)			(-0.26)	
wt			340.794			-87.802
			(0.90)			(-0.26)
IIT_4				2.796**	2.797**	2.796**
				(2.92)	(2.89)	(2.90)

Notes: i) See the note in Table 3.A.

ii) The values in parentheses are t-ratios. For the instrumental variables estimation, z-ratios are reported instead. The significance of the estimated coefficients are denoted by * indicating significance at 5 % and **, at 1 %.

This finding suggests that demand spillover effects, if any, must not be large. If demand spillovers are a major channel of synchronization of the business cycle, then the volume of trade should be important. The fact that trade intensity is not significant in explaining business cycle co-movements demonstrates the unimportance of the demand spillover channel.

V. Policy Coordination and Business Cycle Co-Movements

In the previous section, we found that intra-industry trade is most important in explaining synchronization of the business cycle. Further we found that the channel of demand spillovers was empirically weak in explaining co-movements of outputs. However, the results in Section 4 do not necessarily indicate that there is a causal effect of intra-industry trade on business cycle co-movements of outputs. This is especially so because, to the extent that monetary and fiscal policy shocks themselves directly affect business cycles, policy coordination between countries can generate higher business cycle synchronization. If greater intra-industry trade makes it necessary to cooperate more in terms of policy, the omission of policy shocks can generate a spurious result.

Below we will try to control the effects of policy shocks and investigate if intra-industry trade is still an important factor for business cycle co-movements. In measuring the degree of fiscal policy coordination, we first calculate the ratio of budget deficit to GDP for each country and then calculate the correlation coefficient of this ratio across each pair of countries. In measuring the degree of monetary policy coordination we follow similar steps: we first calculate the M2 growth rate for each country and calculate the correlation coefficient of the M2 growth rates across each pair of countries.[7)]

7) Clark and van Wincoop (1999) used a different proxy for policy coordination. They measured the difference in the monetary policy of two countries by the standard deviation of the interest rate differential and the difference in fiscal policy by the budget deficit differential. In

<Table 5> reports the same regression results as in <Table 4>, except that policy coordination is explicitly considered. The results for the pooled regression in <Table 5-A> indicate that the overall conclusions of <Table 4-A> in interpreting the effects of trade intensity and intra-industry trade on business cycle co-movements are preserved. In particular, adding the policy coordination variables

<Table 5> The Effects of Trade Intensity and Intra-industry Trade on Co-movement with the Government Policies Explicitly Considered

5-A Pooled Regression

	1	2	3	4	5	6	7	8	9
wx	4.903						-63.409		
	(0.04)						(-0.55)		
wm		18.181						-33.424	
		(0.15)						(-0.27)	
wt			24.363						-77.346
			(0.17)						(-0.50)
IIT_2				0.405					
				(0.89)					
IIT_3					0.664				
					(1.64)				
IIT_4						0.733	0.830	0.768	0.836
						(1.60)	(1.67)	(1.59)	(1.65)
Bd_corr	0.207	0.207	0.203	0.244	0.240	0.236	0.260	0.239	0.255
	(1.16)	(1.19)	(1.15)	(1.39)	(1.45)	(1.42)	(1.49)	(1.41)	(1.47)
M_corr	-0.009	-0.008	-0.010	-0.001	-0.053	-0.052	-0.045	-0.054	-0.051
	(-0.04)	(-0.04)	(-0.05)	(-0.01)	(-0.27)	(-0.27)	(1.71)	(-0.27)	(-0.26)

Notes: See the note to Table 3.A. Two added regressors, bd_corr and m_corr are measures of the fiscal and the monetary policy coordination respectively.

our case, the interest rate is not available for many countries and hence we used the monetary growth rate instead. Further using the standard deviation instead of the correlation coefficient does not change our major results in Section 4.

5-B Panel Regression: Fixed Effects

	1	2	3	4	5	6	7	8	9
wx	63.136						-12.516		
	(0.25)						(-0.07)		
wm		118.920						284.283	
		(0.33)						(1.08)	
wt			128.833						126.906
			(0.38)						(0.51)
IIT_2				2.782					
				(2.96)					
IIT_3					3.112				
					(3.42)				
IIT_4						3.402	3.411	3.587	3.401
						(3.46)	(3.31)	(3.62)	(3.36)
Bd_corr	0.136	0.120	0.107	0.270	0.150	0.129	0.136	0.005	0.066
	(0.50)	(0.43)	(0.37)	(1.44)	(0.87)	(0.75)	(0.66)	(0.03)	(0.30)
M_corr	-0.224	-0.248	-0.253	-0.318	-0.306	-0.327	-0.321	-0.466	-0.387
	(-0.69)	(-0.72)	(-0.75)	(-1.34)	(-1.38)	(-1.48)	-1.30	(-1.83)	(-1.51)

5-C Panel Regression: Instrumental Regression

	1	2	3	4	5	6	7	8	9
wx	299.968						-195.551		
	(0.65)						(-0.54)		
wm		-1819.219						2411.624	
		(-0.35)						(0.23)	
wt			742.646						-440.202
			(0.60)						(-0.47)
IIT_2				3.492					
				(0.88)					
IIT_3					1.930				
					(0.86)				
IIT_4						2.141	3.537	4.980	3.411
						(0.87)	(3.24)	(0.68)	(2.77)
Bd_corr	0.053	0.970	-0.146	0.341	0.192	0.180	0.263	-0.866	0.374
	(0.16)	(0.44)	(-0.23)	(1.46)	(1.05)	(0.99)	(1.00)	(-0.19)	(0.75)
M_corr	-0.371	0.640	-0.573	-0.377	-0.283	-0.298	-0.251	-1.541	-0.135
	(-0.95)	(0.26)	(-0.84)	(-1.30)	(-1.17)	(-1.21)	(-0.84)	(-0.29)	(-0.25)

does not change the estimated coefficients of other variables and their significance. The coefficients of the monetary and the fiscal policy co-ordination are always insignificantly different from zero, though the t-ratio is generally larger for the fiscal policy coordination. The results for the panel regression with fixed effects, whether using instrumental variables or not, also generally conform to the results in Section 4. These results suggest that the effect of intra-industry trade on co-movement of outputs is not explained by a higher degree of policy coordination between countries.

VI. Conclusion

Korea's increasing trade with other Asian countries induces the Korean economy to become more and more integrated with the other economies in the region. The business cycle of Korea seems to be continuously influenced by other economies in Asia, especially as trade within the region grows relatively more important. In particular, we have found in this paper that intra-industry trade is the major channel by which Korea's business cycle becomes synchronized with other Asian economies.

Unlike other studies in the literature, however, we find that increasing trade itself does not necessarily lead to more synchronization of business cycles. This has an important implication for considerations of adopting a currency union. It has been argued that, by endogenously increasing trade, joining a currency union can be *ex post facto* justified. In order for this argument to be valid, one important precondition is that increased trade must foster more co-movements of business cycles. Our finding suggests that this is not true for the Korean economy: business cycle co-movements are strengthened only when increased trade is accompanied by more intra-industry trade. This is a warning for caution in searching for appropriate partners in forming a currency union. While a currency union may increase trade afterwards, if mainly inter-industry trade occurs, business cycle co-movements can be weakened and the currency union become undesirable *ex post facto*.

While the intensity of Korea's trade with most other Asian economies is increasing in the region, the measure of intra-industry trade increases only for a subset of countries. Hence in order to predict the evolution of Korea's business cycle co-movements with other Asian

countries, it is of utmost importance to analyze what factors contribute to determining whether inter- or intra-industry trade occurs. This will be a subject for future research.

References

Alesina, Alberto and Robert J. Barro, 2000, "Currency Unions," NBER Working Paper 7927.

Barro, Robert, 2001, "A Yankee Imperialist Offers Asia a Road Map," *Business Week*, June 11.

Bayoumi, Tamin and Barry Eichengreen, 1997, "Ever Closer to Heaven? An Optimum-Currency-Area Index for European Countries," *European Economic Review* 41, pp. 761-770.

Bayoumi, Tamin, Barry Eichengreen and Paolo Mauro, 2000, "On Regional Monetary Arrangements for ASEAN," *Journal of the Japanese and International Economies* 14, pp. 121-148.

Bayoumi, Tamin and Paolo Mauro, 2001, "ASEAN Regional Currency Arrangements," *The World Economy* 24, pp. 933-954.

Bergsten, C. Fred, 2000, "Toward a Tripartite World," *The Economist*, July 15.

Bird, Graham and Ramkishen S. Rajan, 2001, "Regional Arrangements for Providing Liquidity in a Financial Crisis: Developments in Asia," Discussion Paper No. 127, Center for International Economic Studies, Adelaide University, Australia.

Calvo, A. Guillermo and Carmen M. Reinhart, 2002, "Fear of Floating," *Quarterly Journal of Economics* 117, pp. 379-408.

Canova, Fabio and Harris Dellas, 1993, "Trade Interdependence and the International Business Cycle," *Journal of International Economics* 34, pp. 23-47.

Clark, Todd and Eric van Wincoop, 1999, "Borders and Business Cycles," *Journal of International Economics*, forthcoming.

Dieter, Herbert, 2000, "Monetary Regionalism: Regional Integration without Financial Crises," CSGR Working Paper No. 52/00, Center for the Study of Globalization and Regionalization, University of Warwick,

May.

Dornbusch, Rudiger and Yung Chul Park, 1999, "Flexibility or Nominal Anchors?" in S. Collignon, J. Psiani Ferry, and Y.C. Park (eds.), *Exchange Rate Policies in Emerging Asian Countries*, Routledge, London, pp. 3-34.

Eichengreen, Barry, 1992, "Should the Maastricht Treaty Be Saved?" *Princeton Studies in International Finance*, No. 74, International Finance Section, Princeton University.

Eichengreen, Barry, 1997, "International Monetary Arrangements: Is There a Monetary Union in Asia's Future," mimeo.

Eichengreen, Barry, 2000, "Strengthening the International Financial Architecture: Where Do We Stand," *ASEAN Economic Bulletin* 17, pp. 175-192.

Eichengreen, Barry and Tamin Bayoumi, 1999, "Is Asia An Optimum Currency Area? Can It Become One?: Regional, Global and Historical Perspectives on Asian Monetary Relations," in S. Collignon, J. Psiani Ferry, and Y.C. Park (eds.), *Exchange Rate Policies in Emerging Asian Countries*, Routledge, London, pp. 347-366.

Frankel, Jeffrey and Andrew Rose, 1998, "The Endogeneity of the Optimum Currency Area Criteria," *The Economic Journal* 108, pp. 1009-1025.

Frankel, Jeffrey and Andrew Rose, 2002, "An Estimate of the Effect of Currency Unions on Trade and Income," *The Quarterly Journal of Economics* CXVII, pp. 437-466.

Grubel, H,G. and P.J. Lloyd, 1975, *Intra-industry Trade: the Theory and Measurement of International Trade in Differentiated Products*, London: MacMillan Press.

Imbs, Jean and Romain Wacziarg, 2002, "Stages of Diversification," *American Economic Review*, forthcoming.

Kenen, P. 1969, "The Theory of Optimum Currency Area: an Eclectic View," in R. Mundell and A. Swoboda, (eds.), *Monetary Problems of the*

International Economy, Chicago: University of Chicago Press.

Krugman, Paul, 1993, "Lessons of Massachusetts for EMU," in F. Giavazzi and F. Torres, (eds.), *The Transition to Economic and Monetary Union in Europe*, pp. 241-261, Cambridge University Press, New York.

Kwan, C.H., 2001, *Yen Bloc: Toward Economic Integration in Asia*, The Brookings Institution, Washington D.C.

Lee, Jong-wha, Yung Chul Park and Kwanho Shin, 2002, "A Currency Union in East Asia," mimeo.

McKinnon, Ronald, 2001, "After the Crisis, the East Asian Dollar Standard Resurrected: An Interpretation of High-Frequency Exchange Rate Pegging," in Joseph E. Stiglitz and Shahid Yusuf (eds.) *Rethinking the East Asian Miracle*, World Bank and Oxford University Press: pp. 197-246.

Mundell, R., 1961, "A Theory of Optimum Currency Area," *American Economic Review* 60, pp. 657-665.

Nicita, Alessandro and Marcelo Olarreaga, 2001, "Trade and Production, 1976-1999," Working Paper, the World Bank.

Ogawa, Eiji and Takatoshi Ito, 2000, "On the Desirability of a Regional Basket Currency Arrangement," NBER Working Paper No. 8002.

Rose, Andrew K. and Charles. Engel, 2000, "Currency Unions and International Integration," NBER Working Paper No. 7872.

Rose, Andrew K., 2000, "One Money, One Market: The Effects of Common Currencies on Trade," *Economic Policy* 30, pp. 9-45.

Summers, Robert and Heston, Alan, 1991, The Penn World Table (Mark 5): an expanded set of international comparisons, 1950-1988, *Quarterly Journal of Economics* 106, May, pp. 327-68.

Williamson, John, 1999, "The Case for a Common Basket Peg for East Asian Currencies," in S. Collignon, J. Psiani Ferry, and Y.C. Park (eds.), *Exchange Rate Policies in Emerging Asian Countries*, London: Routledge, pp. 327-343.

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