2-2004

Trade, International Business Cycles, and the Optimum Currency Area

Yu-Feng L. Lee
Southern Illinois University Carbondale

Trade, International Business Cycles, and the Optimum Currency Area

Yu-Feng L. Lee
Department of Economics
Southern Illinois University
Carbondale, IL 62901

February 2004

Abstract

This paper studies the co-movement of intra-Asian business cycles. Based on the regional bilateral trade statistics and using three de-trending techniques to examine several macroeconomic fundamentals, the negative trade effects prevailing in the cases of economic activity such as real GDP and industrial production indicate that tighter intra-Asian trade may most likely lead to more idiosyncratic business cycles and hence lower correlations of economic activity between Asian nations. Given this result, it is believed that for the foreseeable future, the creation of an Asian-Pacific monetary union and the corresponding currency area may be unsuitable and will not be recommended.

JEL: F02, F15, F41

I. Introduction

After the outbreak of financial turmoil in mid-1997, the domino effect of consecutive market meltdown throughout East Asia signaled significant financial issues regarding the multiple and dynamic connections of Asian-Pacific economic operations and intra-Asian business cycles. Rather than a series of isolated events, these intra-regional near-synchronous shocks, in fact, reveal a tight economic linkage across the Pacific Rim, as reflected by the recent growing and intensive intra-Asian trades.

International openness, namely the level at which an economy is open to its counterparts, is the research core of McKinnon (1963) in his study of the theory of the optimum currency area. McKinnon proclaimed that, fundamentally, if two countries were open to each other, it would be suitable for them to arrange trade freely and correspondingly fix their exchange rate. The principal logic of McKinnon's statement suggests, first, that bilateral exchange of two nations is purely voluntary. And, more importantly, the flows of trade imply the interaction of economic activities through which changes occurring in one nation will most likely pass over into another.

Previous researchers working in the context of trade and the international business cycles have not reached a consensus that countries with large degree of openness will most likely result in correlated business cycles. Particularly, in recent research conducted by Kose, Prasad, and Terrones (2003), globalization does not necessarily lead to an increase in the degree of synchronization of business cycles. By employing OLS and Instrumental Variable regression models, Kose et al. found evidence that trade and financial-market integration enhanced global spillovers of macroeconomic fluctuations. As contrary to conventional wisdom, they concluded that trade openness seemed to have

a weak negative effect on output correlations, which suggest that more open economies tended to be more vulnerable to external shocks.

Frankel and Rose (1996, 1997, 1998), in contrast to the findings of Kose et al., claimed that countries closely and intensively trading with one another tend to have high correlations in their business cycles[1]. They, by applying McKinnon's "openness" standard, emphasized that the more nations integrate and mutually trade goods and services, the greater the chances for these nations to constitute an optimum currency area. Having said that, Frankel and Rose further declared, from a case study of the European Monetary Union (EMU), a country in general would tend to satisfy the Optimum-Currency-Area criteria for entry into a currency alliance ex post than ex ante[2].

Eichengreen and Bayoumi (1996) likewise uncovered the occurrence of a positive economic relationship between Asian-Pacific trade and intra-regional business cycles. By decomposing the structure of regional shocks and comparing all the structural (shock) elements with those of Western Europe, they concluded that the Asian-Pacific Rim in essence has the potential to compose an optimum currency and monetary union. According to their study, economic disturbances which appear to be symmetric across intra-Asia are fairly similar to those experienced by European states that are at present undertaking the formation of an economic/currency league. However, if drastic intra-Asia internal political and historical differences are considered (unlike the West

[1] These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Norway, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The sample period is from 1959 to 1993.

[2] Specifically, Frankel and Rose used Sweden as the sample country to discuss the feasibility of joining the European currency union.

European system which is somewhat compatible), they believed the creation of an Asian-Pacific monetary zone might not be currently desirable.

In one of their previous work, Enders and Hurn (1994), studying the linkage between common economic trends and real exchange rates in the Pacific region, confirmed that under the basic assumption that economic fundamentals determine global exchange rates, if the economic forcing variables (i.e. fundamentals such as national income, imports and/or exports) within a specific region are sufficiently correlated, the real rates of exchange within this region will converge to a common trend. In other words, the Enders-Hurn findings imply that countries joining in the arrangement of a currency area would be feasible, given that the regional business cycles appear symmetrically.

Canova and Dellas (1993) adopted a relatively preliminary approach, attributing international business cycle symmetry to trade interdependence. They tested global stochastic trade patterns and verified a non-negative nature of international economic links, claiming "the higher the degree of trade interdependence, … the stronger is the covariation of cyclical output" (Canova and Dellas, 1993: 45). Manifestly, Canova and Dellas' experiment indicates that any region within which homogeneous output variability prevails through intensive trades will tend to obtain greater likelihood in establishing an optimal economic/currency union.

The objective of this paper is to analyze the co-movement of intra-regional business cycles in the Asian-Pacific basin. If common business cycles exist across Asian countries, as Eichengreen and Bayoumi suggested in their discussions of the Asian experience, then the regional economic island might be suitable to emerge. It implies that

the establishment of optimum currency area in the Asian-Pacific rim may be desirable and will be recommended. However, if Asian regional business cycles do not appear symmetrically, the adoption of a regional currency union is believed to be sub-optimal.

II. Data

Three sets of data – the real GDP index, the index of domestic volume of industrial production, and the unemployment rate – are studied. All data are quarterly, covering eleven Asian-Pacific economies: Australia, China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand, and the region's largest trading partner, the United States over the 1988~2001 time period. As investigated in Frankel and Rose (1996, 1997, 1998), international correlations of these sample nations will be measured in pairs over four identical time spans. Accordingly, the total sample period of fourteen years is evenly divided into four sub-periods of fourteen quarters: 1988Q1~1991Q2, 1991Q3~1994Q4, 1995Q1~1998Q2, and 1998Q3~2001Q4. This division will result in a total of 168 observations for each sub-period for twelve selected nations (154 total observations for each sub-period for eleven Asian nations with the U.S. excluded), and a total number of 672 observations (616 with the U.S. excluded). Meanwhile, there will be 66 bilateral country-pair correlations [= (12 x 11) / 2] (55 bilateral country-pair correlations [= (11 x 10) / 2] with the exclusion of the U.S.).

III. Empirical Methodology

To appropriately examine the international co-movement of business cycles in the Asian-Pacific region, a couple of procedures will be followed. First, two selected economic variables, i.e. the national real GDP index and the index of domestic volume of industrial production are transformed into natural logarithms. Second, each variable is de-trended so as to unveil the business cycle fluctuations. As stated in Frankel and Rose (1997, 1998), due to the unavailability of consensus about the optimal de-trending methods, I will primarily concentrate on the analysis of three distinct de-trending techniques. Note that these techniques are partly employed in the studies conducted by Frankel and Rose (1996, 1997, 1998).

The first de-trending technique used is the fourth-differencing method. Under this method, the fourth-difference of the natural logarithm of each variable is taken (i.e. a subtraction of the fourth lag of, say, real GDP, from its present value). Then taking each resulting variable multiplying by 100, the rate of growth can then be determined. For the second technique, I intend to de-trend these variables by examining the residuals from the regression model on a linear time trend, a quadratic time trend, and using three quarterly dummies. Finally, the renowned Hodrick-Prescott (HP) filter is imported as the third de-trending technique. Note that under this de-trending method, two major hypotheses made by Hodrick and Prescott (1980) are considered. First, the trend is stochastic but moves smoothly over time (the smoothing parameter is conventionally chosen to be 1600 for quarterly data). Second, the trend and cycle are independent.

After properly transforming these variables, the correlations for real economic activity between Asian-Pacific nations can be calculated. Following the regression model

developed by Frankel and Rose (1996, 1997, 1998), I formulate the intra-Asian economic linkage as:

$$\mathbf{Corr}(\alpha, \beta)_{ijt} = \mathbf{a} + \mathbf{b}\ \mathbf{TRADE}(\gamma)_{ijt} + \mu_{ijt} \qquad (1)$$

Corr(α, β)$_{ijt}$ denotes the correlation between country i and country j over time span t for economic activity α (corresponding to the three economic variables: real GDP, industrial production, and the unemployment rate), de-trended with technique β (corresponding to the three econometric methods: fourth-differencing, quadratic de-trending, and HP-filtering). **TRADE(γ)$_{ijt}$** stands for the natural logarithm of the average mutual trade intensity between country i and j over time span t, based on the share of international trade. That is, the bilateral trade intensity statistics which indicate degree of international openness, are derived from the equation of

$$ST_{ijt} = (X_{ijt} + M_{ijt}) / (X_{it} + M_{it} + X_{jt} + M_{jt}) \qquad (1a)$$

where ST_{ijt} is the share of international trade between country i and j. It is a ratio equivalent to the total volume of exports as well as imports from country i to country j at time t (i.e. $X_{ijt} + M_{ijt}$) to total foreign exports and imports engaged by country i and j (i.e. $X_{it} + M_{it} + X_{jt} + M_{jt}$) during the same period. As defined, the value of ST_{ijt} ought to be between zero and one, and a large ST_{ijt} indicates an intensive amount of regional bilateral trade. Lastly, μ_{ijt} expresses the disturbances on bilateral activity correlations above and beyond the influences of intra-regional trade. Parameters **(a, b)** are the pair of regression coefficients to be estimated.

From the above regression model, it is clear that there exist nine versions of endogenous variable (i.e. three economic activities multiplies three de-trending techniques) and one version of the exogenous variable (i.e. the share of international trade).

To clearly analyze the intra-Asian trade effects on correlations of economic activity between the sample nations, two plans are implemented in the econometric analysis. First, due to the issue of simultaneous causation, the instrumental variable (IV) estimates of parameter b are investigated rather than the traditional OLS estimates. Here, three instrumental variables are used for bilateral trade intensity: (i) the natural logarithm of the distance between the relevant pair of countries (for example, the (natural log of) distance between Shanghai, China and Tokyo, Japan), (ii) a dummy variable for geographic adjacency, and (iii) a language-dummy designating if the pair of nations share a common language. Each of them is expected to be correlated with mutual trade intensity, but unaffected by other conditions which influence the bilateral correlation of economic activity.

Second, since the intra-Pacific economic co-movement is the main concern, I will separate the entire analysis into two country-groups. One is the study including only the economic activity of eleven selected nations in the Pacific area. The other studies the intra-Asian economic relation with the region's largest trading partner – the United States.

The goal of this empirical analysis is to disclose the sign and the size of coefficient b. If the sign of b is positive, we conclude that there is co-movement of business cycles across Asian countries. As a result, any intention of intra-Asian nations

to compose a currency/economic union should not be problematic (presume all else being equal). It follows that more intensive intra-regional trade will most likely enhance the pace of regional economic/monetary integration. Nonetheless, if coefficient b turns out to be negative, which is generally referred as the Eichengreen-Krugman specialization effect, then it is suggested that intensive intra-regional trade could in fact lead to more idiosyncratic business cycles and thus lower correlations of regional economic activity. Finally, the size of b simply indicates the economic significance of intra-regional exchange in the Asian-Pacific area.

IV. Empirical Results

Ordinary Least Square (OLS) estimates of determinants of bilateral trade are reported in table (I). As observed, the log of distance is positively associated with trade intensity. This result surprisingly contrasts with the standard "gravity" models of international trade (where the case of standard "gravity" indicates that the closer the geographical distance of two countries, the more international trade these countries engage in). Unlike the trade configuration of EU and NAFTA, to reasonably explain this positive distance effect, one important factor can be drawn. That is, although Asian economies such as ASEAN trading alliance are intensifying member-trade, most Asian-Pacific business centers still import and export substantial amounts of goods and services from and to their distant trading partners like the United States, Japan, and China.

Since the coefficient of log of distance appears to be positive, the estimate of geographic adjacency is negative. This means that countries sharing a common border are not necessarily trading more than others. As a matter of fact, many Asian nations

such as Japan, Indonesia, the Philippines and Thailand, over our sample period, trade less with their neighboring countries than with distant ones (Japan's biggest trading partner is the U.S.; Indonesia's heaviest trading volume is with Japan).

What is more, people speaking a common language in the Asian-Pacific region reinforce the area trade. Here, the official (national) language of each nation is the one represented by the language-dummy. It is believed that intra-Asian trade may be even stronger if a couple of popular dialects (for example, Malay and Cantonese) spoken in Southeast Asian countries are included.

Table (I): Estimates of Determinants of Bilateral Trade

	Log (Distance)	**Adjacency**	**Common Language**
Trade	0.27 (0.06)	-0.57 (0.12)	0.15 (0.09)

OLS estimates from

$$\text{Trade}(\varphi)_{i,j,t} = \delta_0 + \delta_1 \text{Log(Distance)}_{i,j} + \delta_2 \text{Adjacency}_{i,j} + \delta_3 \text{Language}_{i,j} + \varepsilon_{i,j,t}$$

Standard errors in parentheses. Intercepts not reported.

Table (II) reports the instrumental variable estimates of effect of trade intensity on economic activity correlation. It is tabulated in column Three and Four, where column Three includes the study of all eleven Asian sample nations and the region's largest trading partner, the U.S.; the fourth column records the same analysis however excluding the U.S.

From this table, it is apparent that the effect of bilateral trade on the bilateral activity correlation is not well determined. The coefficients disagree in sign and magnitude depending on the measure of economic activity and de-trending technique used to calculate the correlation. As we read the third column more carefully, the coefficients of all three economic activities possess the same sign under quadratic de-trending and HP-filtering methods. While bilateral trade negatively affects the correlation of bilateral real GDP and industrial production, it imposes a positive impact on the correlation of unemployment. As discussed earlier, negative coefficients mean that the intra-Asian economic region is comparably more suitable for the Eichengreen-Krugman specialization. Such specialization in turn suggests that more intense trading relations would lead to more distinctive business cycles and consequently lower correlations of economic activity. On the other hand, intensive trade across countries indicates a highly correlated unemployment pattern in the Pacific Rim. This effect is statistically significant when the HP-filtering technique is used and strongly positive even under the fourth-differencing de-trending method.

For the fourth-differencing de-trending technique, the effects of bilateral trade on the correlation of industrial production and the unemployment rate consistently agree in sign as did those under quadratic de-trending and HP-filtering methods. The most disputable result is the sign of the trade coefficient when the bilateral correlation of real GDP is regressed. Fundamentally, this result means, unlike the others, that positive bilateral trade links tend to bring about greater correlation in countries' business cycles. It is checked in a couple of different ways (for example, the model is first regressed with

the natural logarithms trade intensity, then regressed with non-natural logarithms trade intensity), and the sign of b is unchanged.

Having said that, as we refer to the last column of the table, it allows us to conclude that the effect of trade intensity on economic activity correlations between eleven Asian countries is not firmly established. Like the results of column Three, the sign and magnitude of coefficient b vary as the bilateral correlation of economic activity and de-trending method change. However, with the U.S. trade excluded, the values of coefficient b as compared to those of column Three are less robust.

There is one thing worth noting. Across all three de-trending techniques, the sign of coefficient b under two columns appears to be the same, except for the two under HP-filtering method: de-trending real GDP and industrial production. These positive estimates (0.01 and 3.9) under the fourth column are opposite in sign to those in column Three. To be cautious, they are checked in different ways (natural log trade intensity and non-natural log trade intensity), and their results stay consistently non-negative.

Table (II): Instrumental Variable Estimates of Effect of Trade Intensity on Bilateral Activity Correlation

Economic Activity	De-Trending	*Including the U.S.*		*Excluding the U.S.*	
Real GDP	**4th Differencing**	7.4	(0.06)	4.3	(0.05)
Ind Prod	**4th Differencing**	-5.2	(0.05)	-1.5	(0.04)
Unemployment	**4th Differencing**	9.4	(0.06)	8.4	(0.04)
Real GDP	**Quadratic**	-2.7	(0.06)	-1.4	(0.05)
Ind Prod	**Quadratic**	-6.9	(0.05)	-2.2	(0.04)
Unemployment	**Quadratic**	10.2	(0.06)	7.8	(0.04)
Real GDP	**HP-Filter**	-0.3	(0.00)	0.01	(0.00)
Ind Prod	**HP-Filter**	-11.2	(0.09)	3.9	(0.08)
Unemployment	**HP-Filter**	67.1	(0.11)	52.3	(0.08)

Instrumental Variable (IV) estimates of b (multiplied by 100) from

$$\text{Corr}(\alpha, \beta)_{ijt} = a + b\,\text{TRADE}(\gamma)_{ijt} + \mu_{ijt}$$

Instrumental Variables for trade intensity are: (i) natural log of distance; (ii) dummy variable for geographic adjacency, and (iii) dummy variable for common language
Standard errors in parentheses. Intercepts not reported.

V. Conclusion

In this paper, it is argued that trade links (i.e. bilateral share of trade) and economic activity links are the proper Optimum-Currency-Area (OCA) criteria for evaluating the appropriateness of monetary/economic union in the Asian-Pacific Rim. According to the findings of Frankel and Rose (1996, 1997, 1998), countries closely and intensively trading with one another tend to have high correlation in their business cycles. Intensive trade links and high economic activity correlations then mean the establishment of an OCA can be desirable and appropriate. From their investigation of the EMU's experience, strongly positive intra-regional trade effects (i.e. positive signs of b) on correlated economic activity are direct evidence in support of adoption of an OCA.

From Table (II), the results of our regression model indicate an inconsistent pattern. The undetermined sign of bilateral trade estimates fails to confirm the appropriateness of forming an Asian-Pacific OCA. Generally speaking, from the entire empirical study, the negative trade effects relatively dominate the positive ones, especially under the activities of real GDP and industrial production. Such negative domination implies that tighter intra-Asian trade may most likely lead to more idiosyncratic business cycles and hence lower correlations of economic activity between nations (i.e. the Eichengreen-Krugman specialization effect). Given this reason, it is believed that for the foreseeable future, the creation of an Asian-Pacific monetary union and corresponding currency area may be unsuitable and will not be recommended.

Reference

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

Eichengreen, Barry and Bayoumi, Tamim. "Is Asia an Optimum Currency Area? Can It Become One? Regional, Global and Historical Perspectives on Asian Monetary Relations." University of California at Berkeley Working Paper, December 1996.

Enders, Walter and Hurn, Stan. "Theory and Tests of Generalized Purchasing – Power Parity: Common Trends and Real Exchange Rates in The Pacific Rim." *Review of International Economics*, 1994, 2, 2, pp. 179-190.

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

_____. "Is EMU More Justifiable Ex Post Than EX Ante?" *European Economic Review*, 1997, 41, pp. 753-760.

_____. "Economic Structure and the Decision to Adopt a Common Currency." University of California at Berkeley Working Paper, August 1996.

Hodrick, R. and Prescott, E. "Post-War U.S. Business Cycles: An Empirical Investigation." Mimeo, Carnegie-Mellon University, 1980.

Kose, Ayhan M., Prasad, Eswar S., and Terrones, Marco E. "How Does Globalization Affect the Synchronization of Business Cycles?" *American Economic Review* (Papers and Proceedings), May 2003, 93, 2 pp. 57-62.

McKinnon, Ronald I. "Optimum Currency Areas." *American Economic Review*, 1963, 53, pp. 717-725.