Financial integration in Asia Pacific region

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Abstract

The purpose of this paper is to judge the degree of financial integration of groups of countries within the Asia Pacific as a criteria for forming a monetary union. The empirical results suggest that the practical approach is to start a common currency union with small sub-group i.e. East Asia before expanding the whole region.

Keywords: financial integration, monetary union, East Asia, Asia Pacific

1. Introduction

Over the last decades Asia Pacific region has characterized by wide scope of economic development stages, extraordinary growth and severe crises. While some nations could make remarkable progress in their economic development and rapidly increase their relation within the region and with the rest of the world, others did far less participate in the dynamic development process so that the countries in Asia Pacific ranged from highly industrialized to developing countries. Since the late 1980s, the East and Southeast Asian countries have formed the most dynamic economic region in the world. Their economic growth rates exceeded by far those of OECD countries and other developing countries in Latin America or Africa. China, for example, has recorded an average GDP growth rate greater than 10% in the last five years of the 20th century. During the period 2000-2005, China's average growth rate has been approximately 8-9% per year, while US growth has been 3 to 4% and the Euro zone rate of growth has been around 1%. Before the Asian financial crisis, the Asia's Four Dragons i.e. South Korea, Taiwan, Hong Kong, and Singapore were able to maintain the average GDP growth rates of higher than 6% for a long period of time. There was even suggestion that by the turn of the century the region would consist of NIEs. However, the financial crisis in 1997/98 has brought the whole region to a sudden stop in the mid of the period of a booming economy and a deepening interaction between the region's countries. The inadequacy and ineffectiveness of the current regional organizations such as ASEAN and APEC in assisting countries in the region in development process in general and especially in the case of crisis in particularly together with the successful introduction of the EMU in 1999 emphasize the need for more close legally binding region-wide organization like NAFTA or EMU and hence strengthen the idea of establishing an Asian Monetary Union, which can be seen as a new axis passing through the Pacific Ocean between North America and Asia in the world economy.

In this situation the logical question is whether the Asia Pacific as the whole or which part of the region does satisfy best the conditions for forming a currency union. Although there are a number of the so-called Optimum Currency Areas (OCA) criteria due to the contributions of many researches since the seminal contributions of Robert Mundell in 1961, the paper, however, is concentrated on the financial integration in

the region as one of the most important conditions for creating a common currency union[1]. The increase of financial integration in the region obviously brings many benefits such as greater competition, lower costs of capital, longer maturity of financing, greater liquidity in traded securities, more efficiency in risk management. In other words, high degree of financial integration can assist a country in the region in developing its financial sector, making resource allocation more efficient and the economy more resilient to shocks. It is more important for the Asia Pacific because of the diversity of economic development of countries in the region and consequences of the recent financial crisis which they still do not totally overcome. The degree of financial integration of several parts within Asia Pacific i.e. the suitability of groups of countries in the region for forming a monetary union is judged by the comparisons of East Asian countries with the countries in the whole Asia Pacific and group of American countries. This objective is achieved by using five methodologies including Saving-Investment correlation analysis, Principal Component Analysis (PCA), Cluster Analysis, Cointergration analysis and International Capital Asset Pricing Methodology (ICAPM).

In this paper the East Asian countries (henceforth EA-9) include nine countries such as Indonesia, Malaysia, the Philippines, Singapore, Thailand, China, Hong Kong, Japan and South Korea. The Asia Pacific region (or AP-15) consists of 15 countries including EA-9, India, Australia, New Zealand, Canada, Mexico and the United States. The Americas mean the Latin American Integration Association (LAIA, formerly Latin American Free Trade Area), whose members are Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela.

All analyses are conducted using the annual data drawn from the IMF, International Financial Statistics CD-ROM, 2008 and Direction of Trade Statistics CD-ROM, 2008; the WB, Development Indicators, 2005, 2008 and the Penn World Table with the sample period ranging from 1970 to 2007. However, the monthly data from 1990s to 2007 from Datastream and Bank of International Settlement are used for cointegration and ICAPM analyses.

The empirical results in this paper show that the financial environment in Asia Pacific region is quite integrated. The degree of financial integration in East Asian countries is higher in comparison with that in Asia Pacific Rim suggesting that it is better to start creating a monetary union with East Asia before expanding the whole region.

Besides an Introduction and Conclusion, the paper involves two sections. Section 2 gives a survey of related literature. Section 3 presents briefly the methodologies and empirical results.

2. Literature review

2.1 Saving-investment correlation analysis

The correlation of saving and investment is introduced by Feldstein and Horioka (1980). They examine the average investment and saving to GDP rates over time for a cross-section of 16 OECD countries. Coakley *et al*. (2004) re-examine the Feldstein-Horioka puzzle for a panel of 12 OECD cuntries with quarterly data. Payne and Kumazawa (2007) extends the work of Coakley *et al*. for a sample of 47

[1] The distinguished meaning of the Optimum Currency Area (OCA) Theory initiated by Robert Mundell in 1961 is that it can be served as a useful analytical tool for evaluating whether the country is suitable for joining a monetary union. Please see another paper in this journal for descriptions and evaluation of other OCA criteria.

developing countries.

Chan and Bharumshah (2003) review the evidence on saving-investment correlations to examine the extent of capital mobility focusing on ten Asia Pacific nations. They note that capital movemenent have been highly mobile in the Pacific Rim. Huang and Guo (2006) evaluate the capital mobility in eight East Asian emerging markets and find that financial integrtion has been strengthened following their liberalization. Applying the method in Kim (2001), Kim et al. (2007) conclude that the capital mobility in East Asia is still lower than that in the the OECD countries.

2.2 Principal component analysis

Goto, J. and K. Hamada (1994) analyze five key macroeconomic variables to evaluate the degree of confluence of these variables within the region and they hypothesize that the preconditions for Asian economic integration are suitable. Goto (2003) considers seven macro-economic variables and again finds an evidence strongly supports the case for monetary integration in East Asia.

Takagi and Hirose (2004) conduct analysis for 11 East Asia countries using 5 variables. Kawai and Montonishi (2005) analyze the real, financial and price variables to measure the degree of confluence of these variables within East Asia and vis-à-vis non-East Asian economies. The results show that the degree of emerging East Asia's real economic interdependence with Japan is greater than with the United States, while the degrees of its nominal interdependence with Japan and the United States are equally strong. Real economic activity of East Asian economies exhibits strong regional interdependence, with the exception of China.

2.3 Cluster analysis

Takagi and Hirose (2004) use three methods of cluster analysis to examine the economic similarities of 11 East Asian countries in order to judge the degree of financial integration. Kawai and Motonishi (2005) apply similar technique to judge the degree of closeness among East Asian countries using real macroeconomic, financial and price variables. Toan (2007) seeks the empirical evidence on the readiness of East Asian countries for a currency and finds that the possibility of forming a currency union in East Asia in the near future is not strong.

Herrero *et al*. (2002) assess financial sector development in Latin America, both in the banking system and in the capital markets. A comparison of the Asian and Eastern European emerging regions shows that Latin America lags behind Asia in terms of financial development and compares slightly unfavorably with Eastern Europe. Dorruccil *et al*. (2002) find that Latin America is currently less economically integrated than the EMU.

2.4 Cointegration analysis

Siklos and Ng (2001) find that integration of stock markets in Asia-Pacific region is largerly a feature of the post-1987 US stock market crash and intensified during the 1990s. Weber (2006) addresses the question of macroeconomic integration in the Asian Pacific region and finds the convergence definition is partly met.

Yang *et al*. (2003) review the relationship among US, Japanese and ten Asian stocks markets with the particular attention to the 1997-1998 Asian financial crisis and reveal that long-run cointegation relationships among these markets are strengthened during the crisis and that these markets have been more integrated after the crisis than before the crisis. Click and Plummer (2005) examine the stock markets integration in ASEAN-5 in the aftermath of the Asian financial crisis and conclude that ASEAN-5 stock

markets are integrated in the economic sense, but that integration is far from complete. Sato and Zhang (2006) assess the feasibility of forming a monetary union in East Asia and show that the short-run common business cycles are found in some pairs of ASEAN.

Chen *et al*. (2002) investigate the dynamic interdependence of the major stock markets in Latin America and find that there is one cointegrating vector which appears to explain the dependencies in prices and they suggest that the potential for diversifying risk by investing in different Latin American markets is limited.

2．5 International Capital Asset Pricing Model (ICAPM)

A study by Gerard *et al*. (2003) examine the integration of East Asian stock markets with the US and world markets and concludes that there was strong evidence of market integration in East Asia. Following the model as in Yang *et al*. (2005), Chi *et al*. (2006) find that the market in 11 countries of East Asia are more financial integrated within the region and with the Asian leading market (Japan) than with the global leading market (the USA).

Mo and Vu (2007) develop an ICAPM to study the risk dynamics and pricing in international economies through a joint analysis of the time series returns and option prices on three equity indexes underlying three economies. They find that the three economies contain different risk profiles and also price risks differently. Japan contains the largest idiosyncratic risk component and smallest global risk component. Investors in the Japanese market also price more heavily against future volatility increases than against future market downfalls.

In summary, Section 2 briefly reviews the previous papers related to financial integration, which is an important criteria to be considered whether the countries are suitable for forming a monetary union. The detailed explanations and empirical results are presented in the following section.

3． Methodologies and empirical results

3．1 Saving-investment correlation analysis

In this paper the degree of capital mobility is measured using investment-saving equation as in Feldstein and Horioka (1980). A high correlation between national saving and investment would imply a low degree of capital mobility and hence indicate that the country is less suitable for joining a common currency area.

The results for both cross-sectional and panel data estimation of S-L are presented in Table 1. The cross-sectional regression results are calculated using the OLS estimation method based on equation (1). Cross-sectional data are constructed by taking the averages of saving and investment rates as of GDP over different time period. For panel data equation (2) is applied using GLS estimation method.

$$(I/Y)_i = \alpha + \beta (S/Y)_i + \varepsilon_i \qquad (1)$$

$$(I/Y)_{it} = \alpha_i + \beta_i (S/Y)_{it} + \varepsilon_{it} \qquad (2)$$

Table 1 points out that for both OLS and GLS methods, the regressions of the whole period as well as of two sub-periods for EA-9 are lower then that for AP-15 indicating that EA-9 has higher degree of capital mobility. The results also show that the S-I correlations decrease from the highest level for the first sub-period (from 1970 to 1990) to the middle level for the whole period and to the lowest level for the second sub-period (from 1991-2007) i.e. the capital mobility in the region has been increased over the last decades.

Table 1 : Saving -Investment correlations

		OLS	St Er.	GLS	St. Er
EA-9	1970-2007	0.5195	0.0381	0.5859	0.0335
	1970-1990	0.5196	0.0550	0.6110	0.0452
	1991-2007	0.5195	0.0525	0.5837	0.0452
AP-15	1970-2007	0.5793	0.0256	0.6420	0.0232
	1970-1990	0.5863	0.0352	0.6585	0.0316
	1991-2007	0.5706	0.0372	0.6239	0.0342
Americas	1970-2007	0.2004	0.0267	0.2086	0.0247
	1970-1990	0.2355	0.0380	0.2418	0.0313
	1991-2007	0.1651	0.0374	0.1850	0.0367

3.2 *Principal component analysis*

The Principal Component analysis models the variance structure of a set of observed variables using linear combinations of the variables. The logic of this approach is that if a set of p variables are perfectly correlated, the first component explains all the variance. If they are mutually independent and have an identical variance, the first and any other component explain 1/p of the total variance. The higher the correlation of a set of variables is, the higher of variance explained by the first principle component to the

Table 2 : Total variance explained by first three principal components

	Period	EA-9			AP-15		
Variable		PC1	PC2	PC3	PC1	PC2	PC3
Real GDP	1970-2007	0.45	0.59	0.69	0.31	0.48	0.59
Real Consumption	1970-2007	0.45	0.63	0.73	0.32	0.47	0.59
Real Investment	1970-2007	0.38	0.53	0.67	0.23	0.41	0.52
Real Money supply	1992-2007	0.42	0.59	0.73	0.27	0.44	0.58
REER	1993-2007	0.33	0.56	0.78	0.27	0.50	0.66
GDP Deflator	1979-2007	0.47	0.66	0.79	0.46	0.59	0.71
CPI	1986-2007	0.57	0.77	0.87	0.42	0.68	0.80
WPI	1984-2007	0.42	0.63	0.79	0.27	0.52	0.67

The Americas

Variable		PC1	PC2	PC3
Real GDP	1970-2007	0.38	0.52	0.64
Real Consumption	1970-2007	0.31	0.49	0.61
Real Investment	1970-2007	0.35	0.50	0.61
Real Money supply	1992-2007	0.29	0.48	0.62
REER	1993-2007	0.34	0.57	0.72
GDP Deflator	1991-2007	0.48	0.65	0.76
CPI	1986-2007	0.54	0.72	0.80
WPI	1989-2007	0.48	0.66	0.80

Note:
(1) Variables are in the log first differences
(2) REER= Real Effective Exchange rate; GDP = Gross Domestic product ; CPI=Consumer price index, WPI= Wholesale price index PC = Principal Component
(3) WPI data for China, Ecuador and Paraguay are not available
(4) REER data for Peru is not available

total variance. In this case variables are more closely interelated and the degree of financial integration is higher and hence the countries can be seen as a better condidate for a monetary union.

To consider the contribution of each macroeconomic variable to the principal components, the so-called loading factors are examined. The loading factor equals the correlation coefficient between a principal component and the original variable. The sum of the squares of loading factors of a component equals to its characteristic root. In this section, loading factors also can be interpreted as the correlation coefficients between the first principal component and the corresponding country variable.

In this paper, eight macroeconomic variables are defined in term of log first difference with different sample periods due to the lack of available data.

Table 2 shows that EA-9 has higher percentage of total variance explained by the first three principal components than AP-15 and the Americas (for five cased from the total of eight cases). Although the Americas have higher percentage than EA-9 in cases of REER and GDP deflator, the differences are very small. This situation means that the macroeconomic variables are more integrated within the EA-9 than within AP-15 and the Americas.

Table 3 : Loading factors

Variable	Real GDP		R.Consumption		R.Investment		R.Money supply	
Period	1970-2007		1970-2007		1970-2007		1992-2007	
Country	EA-9	AP-15	EA-9	AP-15	EA-9	AP-15	EA-9	AP-15
Indonesia	0.42	0.38	0.37	0.36	0.40	0.39	0.26	0.25
Malaysia	0.38	0.34	0.38	0.30	0.46	0.46	0.47	0.44
Philippines	0.15	0.14	0.30	0.30	0.26	0.25	0.38	0.34
Singapore	0.41	0.38	0.41	0.34	0.13	0.13	0.38	0.38
Thailand	0.39	0.39	0.44	0.40	0.41	0.40	0.44	0.44
China	-0.05	-0.04	-0.04	-0.01	-0.10	-0.11	-0.06	0.10
Hong Kong	0.35	0.29	0.29	0.23	0.37	0.35	0.33	0.34
Japan	0.19	0.19	0.09	0.09	0.23	0.22	0.14	0.05
Korea	0.39	0.35	0.40	0.33	0.39	0.40	-0.40	0.29
Australia		-0.27		-0.35		-0.10		-0.02
New Zealand		-0.17		-0.21		0.12		0.03
India		0.20		0.22		0.04		0.19
Canada		0.02		-0.07		0.06		-0.05
Mexico		0.04		0.01		-0.02		0.10
USA		0.12		-0.04		0.06		0.15

Variable	REER		GDP Deflator		CPI		WPI	
Period	1993-2007		1979-2007		1986-2007		1984-2007	
Country	EA-9	AP-15	EA-9	AP-15	EA-9	AP-15	EA-9	AP-15
Indonesia	0.49	0.10	0.14	0.07	0.01	-0.03	0.34	0.20
Malaysia	0.15	0.23	0.21	0.11	0.30	0.19	0.51	0.48
Philippines	0.11	0.29	0.15	0.11	0.38	0.33	0.06	0.17
Singapore	0.33	-0.01	0.40	0.32	0.34	0.29	0.28	0.34
Thailand	0.46	-0.01	0.41	0.29	0.36	0.28	0.49	0.43
China	0.31	-0.17	0.15	0.07	0.22	0.20	na	na
Hong Kong	0.18	-0.43	0.43	0.33	0.41	0.37	-0.08	-0.03
Japan	-0.06	0.01	0.42	0.32	0.39	0.34	0.32	0.36
Korea	-0.52	-0.02	0.44	0.34	0.39	0.34	0.44	0.34

Australia	0.42	0.29	0.15	0.07
New Zealand	0.36	0.25	0.11	-0.06
India	0.06	0.26	0.30	0.14
Canada	0.31	0.31	0.21	0.12
Mexico	-0.10	0.15	0.10	-0.12
USA	-0.42	0.34	0.28	0.34

Table 3 presents the loading factors i.e. the correlation coefficient between the first principal component and the original variable for EA-9 and AP-15. The results show that with some exceptions the correlations decrease generally from EA-9 to AP-15. The higher correlation that one country has in EA-9 than correlation of similar country has in AP-15 shows that the East Asia-9 is a better option to form a monetary union than other group.

China has the negative correlations or lower positive correlations than other countries indicating that its macroeconomic variables do not go together with those of other countries and China is less integrated with other countries within the region.

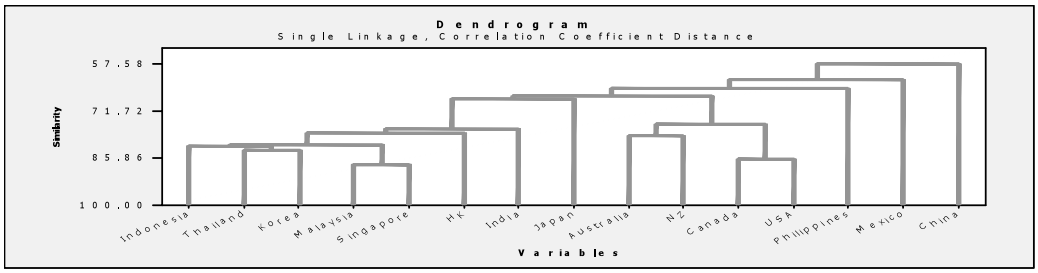
3．3 Cluster analysis

Cluster analysis is a general term for a set of exploratory data analysis techniques that seeks to find clusters in data. Assume that there are n objects to be groups. At the first step, each object forms its own cluster so that the number of clusters is equal to the number of objects. Next, the two clusters having the smallest distance are fused to form a new cluster, reducing the number of clusters by one. The process continues until a single cluster containing all n objects is formed. The results can be summarized by the use of tree-like diagram called a dendrogram.

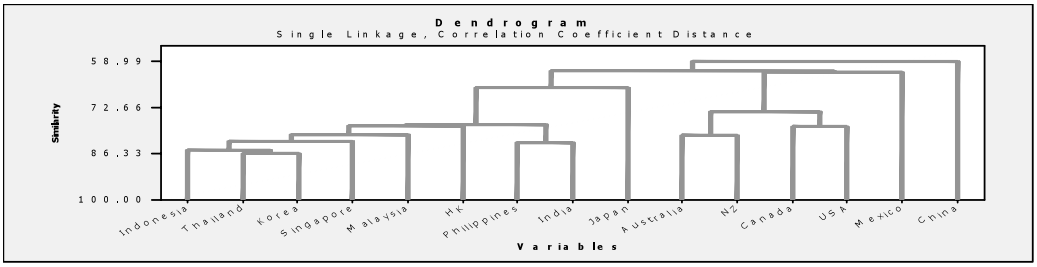
There are several methods for calculating the distance between clusters such as complete linkage (or furthest neighbor) method, the average linkage method and the single linkage (or the nearest neighbor) method. The single linkage method using the same macroeconomic variables as in PCA is applied in this paper.

Table 4 : Graph for Single linkage method

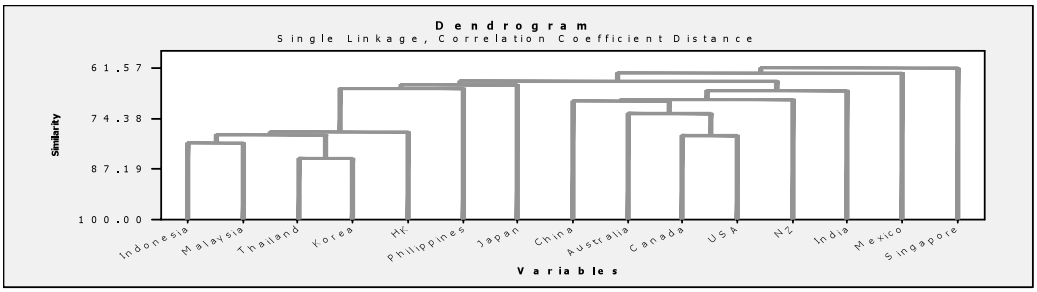
1 . Real GDP (1970-2007)



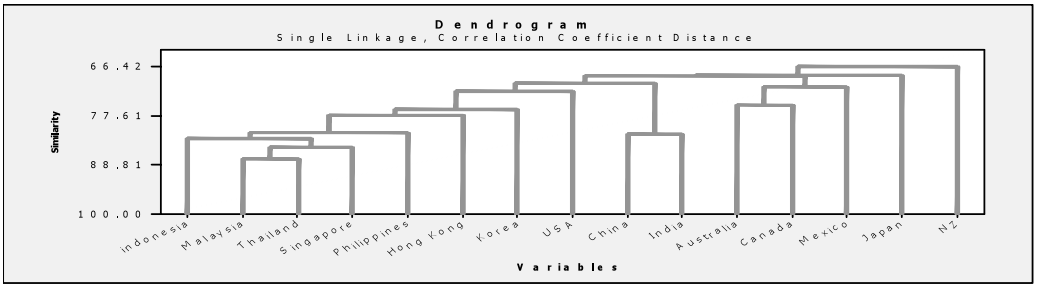
2 . Real Consumption (1970-2007)



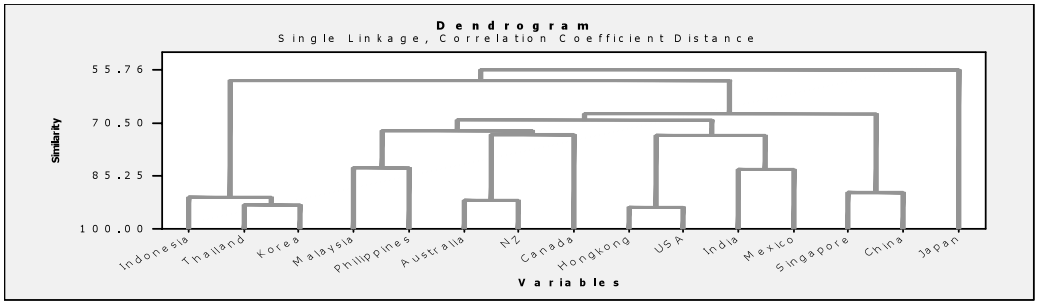
3 . Real Investment (1970-2007)



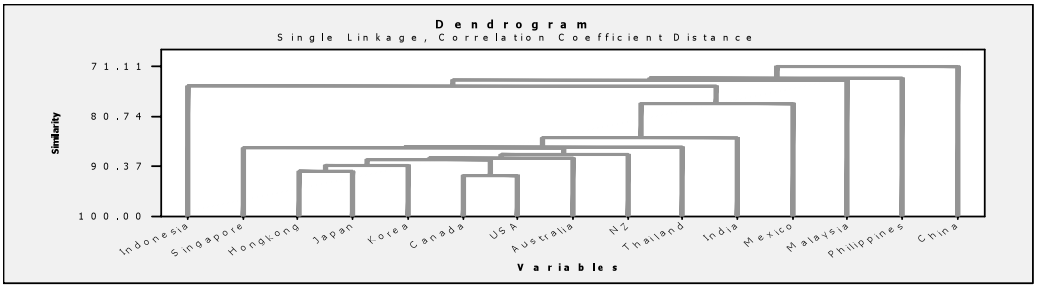
4 . Real Money supply (1992-2007)



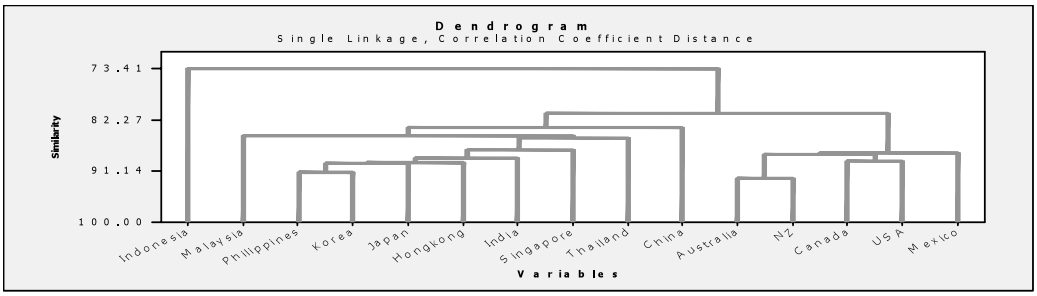
5 . Real effective exchange rate (1993-2007)



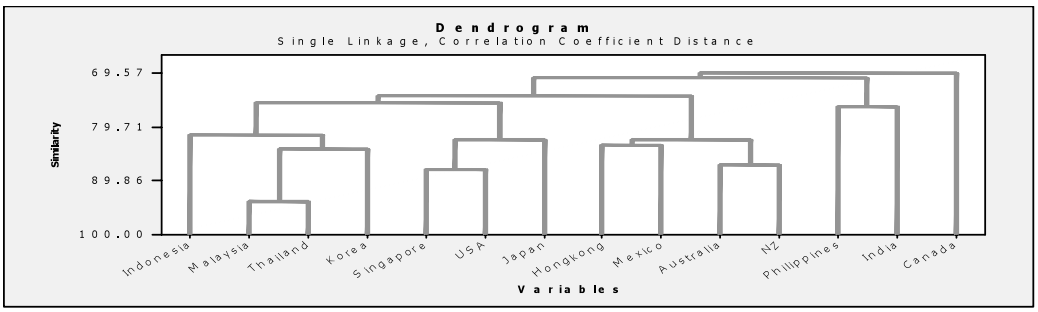
6 . GDP Deflator (1979-2007)



7 . Consummer price index (1986-2007)



8 . Wholesale price index (1984-2007)



The results in Table 4 show that for four real macroeconomic variables (i.e. Real GDP, Real Consumption, Real Investment and Real Money supply) countries within EA-9 are close and found as one cluster. However, China is usually remained outlined indicating that it does not intergrated with the region as other countries. Four more industrialized countries i.e. Australia, New Zealand, Canada and the United States are closed and formed another cluster. The same result can be seen in the dendrogram using data on CPI. For remaining variables (i.e REER, GDP Deflator and WPI) the groupings are somewhat vague and cannot clearly establish a core cluster.

3. 4 Cointegration analysis

The concept of cointegration, introduced by Granger (1981, 1986) and further developed by Engle and Granger (1987), incorporates the presence of non-stationarity, long-term relationships and the short-run dynamics in the modeling process.

In order to test whether the two market indices are cointegrated, it is necessary to determine that each

financial time series is integrated of order one. If two series are integrated of order one and they have a linear combination, which is stationary without requiring differencing then in this case they are said to be cointegrated.

Testing for unit roots is conducted by performing the Dickey and Fullers ADF three-model tests (1981). The Johansen Multivariate Maximum Likelihood cointegration test (1988, 1994) is used, once it is found that each series contains one unit root. The Akaike information criterion is used to select the optimum number of lags. For interpreting cointegration test results Kasa (1992) methods are applied.

Kasa (1992) notes that if n variables have p cointegrating relationships in stock market then they have n－p common trends, the number of which can range from one to n. It means that the markets can be considered from perfect integration (if n－p＝1) to complete segmentation (when n－p＝n). If the markets are cointegrated in the econometric sense, then they are also can be considered integrating in the economic sense.

The results of cointergating test are given based on the trace statistic test and maximal eigenvalue test. Suppose that there are n variables with p cointegrating relationships. The maximal eigenvalue test the null hypothesis that the number of cointegrating vectors p with p from 0 to n-1 against to alternative of p +1 cointegrating vectors. The trace statistic tests the null hypothesis that the number of cointegrating vectors is less than or equal to p against a general alternative.

In this paper, the cointegration test is conducted using monthly data of composite stock price indices in natural logarithm with the sample period ranging from February 1991 to December 2007[2].

The ADF test finds that all data series are I(1) and therefore cointegration analysis is appropriate. It is impossible to conduct a cointegration analysis with more than 12 variables using Eviews so that for Asia Pacific-15 a separate cluster analysis is carried out prior to the cointegration analysis to identify two subgroups of 12 countries. AP12-A includes EA-9 plus Australia, Canada and Mexico and AP12-B consists of EA-9 plus India, New Zealand and the United States.

Table 4 : Cointegration test results

East- Asia 9							
Trace Test				Maximum Eigenvalue Test			
Hypothesized		Trace	0.05	Hypothesized		Max-Eig	0.05
No. of CR(s)	Eigenvalue	Statistic	Crit. Value	No. of CR(s)	Eigenvalue	Statistic	Critical Value
None*	0.480	474.150	228.298	None*	0.480	474.150	228.300
At most 1*	0.382	349.360	187.470	At most 1*	0.382	349.360	187.470
At most 2*	0.323	257.350	150.559	At most 2*	0.323	257.350	150.560
At most 3*	0.269	182.810	117.708	At most 3*	0.269	182.810	117.710
At most 4*	0.208	122.930	88.804	At most 4*	0.208	122.930	88.804
At most 5*	0.152	78.413	63.876	At most 5*	0.152	78.413	63.876
At most 6*	0.118	46.937	42.915	At most 6*	0.118	46.937	42.915
At most 7	0.067	23.029	25.872	At most 7	0.067	23.029	25.872
At most 8	0.050	9.884	12.518	At most 8	0.050	9.884	12.518
No. of lags	11			No. of lags	11		
No. of CR	8			No. of CR	8		

[2] See 3.5 for the list of stock indices

AP-12A(EA plus Australia, Canada and Mexico)

Trace Test				Maximum Eigenvalue Test			
Hypothesized		Trace	0.05	Hypothesized		Max-Eig	0.05
No. of CR(s)	Eigenvalue	Statistic	Crit. Value	No. of CR(s)	Eigenvalue	Statistic	Critical Value
None*	0.914	1975.200	374.908	None*	0.914	466.640	80.870
At most 1*	0.841	1508.600	322.069	At most 1*	0.841	348.800	74.837
At most 2*	0.780	1159.700	273.189	At most 2*	0.780	287.560	68.812
At most 3*	0.596	872.190	228.298	At most 3*	0.596	172.020	62.752
At most 4*	0.594	700.170	187.470	At most 4*	0.594	171.140	56.705
At most 5*	0.508	529.040	150.559	At most 5*	0.508	134.630	50.600
At most 6*	0.472	394.400	117.708	At most 6*	0.472	121.320	44.497
At most 7*	0.408	273.080	88.804	At most 7*	0.408	99.622	38.331
At most 8*	0.307	173.460	63.876	At most 8*	0.307	69.598	32.118
At most 9*	0.242	103.860	42.915	At most 9*	0.242	52.631	25.823
At most 10*	0.135	51.228	25.872	At most 10*	0.135	27.626	19.387
At most 11*	0.117	23.602	12.518	At most 11*	0.117	23.602	12.518
No. of lags	12			No. of lags	12		
No. of CR	0			No. of CR	0		

AP-12B(EA9 plus India, New Zealand and the USA)

Trace Test				Maximum Eigenvalue Test			
Hypothesized		Trace	0.05	Hypothesized		Max-Eig	0.05
No. of CR(s)	Eigenvalue	Statistic	Crit. Value	No. of CR(s)	Eigenvalue	Statistic	Critical Value
None*	0.826	1658.500	374.908	None*	0.826	332.330	80.870
At most 1*	0.814	1326.200	322.069	At most 1*	0.814	319.920	74.837
At most 2*	0.711	1006.300	273.189	At most 2*	0.711	235.580	68.812
At most 3*	0.609	770.700	228.298	At most 3*	0.609	178.530	62.752
At most 4*	0.559	592.170	187.470	At most 4*	0.559	155.770	56.705
At most 5*	0.510	436.400	150.559	At most 5*	0.510	135.430	50.600
At most 6*	0.390	300.970	117.708	At most 6*	0.390	94.004	44.497
At most 7*	0.271	206.970	88.804	At most 7*	0.271	60.175	38.331
At most 8*	0.235	146.790	63.876	At most 8*	0.235	50.968	32.118
At most 9*	0.189	95.825	42.915	At most 9*	0.189	39.706	25.823
At most 10*	0.153	56.119	25.872	At most 10*	0.153	31.565	19.387
At most 11*	0.121	24.555	12.518	At most 11*	0.121	24.555	12.518
No. of lags	12			No. of lags	12		
No. of CR	0			No. of CR	0		

Note
*denotes rejection of the hypothesis at the 0.05 level
CR: Cointegrating relations

The results in Table 4 on monthly data on Stock market indices show that countries in EA-9 are cointegrated as their number of common trends is equal 1. However, the two largest subgroups AP-12 are segmented as the cointegration vector is zero for both cases.

3. 5 International Capital Asset Pricing Model (ICAPM)

Applying the same equation in Chi *et al*. (2006), monthly data on the most popular composite stock indices with sample period from February 1991 to December 2007 are used in this part.

$$E(r_{it}-r_{ft}) = \alpha\,[\,\beta_i\,E(r_{mt}-r_{ft})] + \Sigma\gamma_i\,D_i + \varepsilon_{it}$$

Where, r_{it}, r_{ft}, r_{mt} are the rates of return of risky asset, the risk-free asset and the return of the market

portfolio; i and t indicate country and time; β_i is computed separately as $cov(r_{it}, r_{mt})/var(r_{mt})$; D_i and ε_{it} are the dummy variable for country i and the error-term, respectively; α and γ_i are the regression coefficients of β_i $E(r_{mt}-r_{ft})$ and country dummies, respectively. α is a measure of market efficiency in the market. γ_i indicates the country-specific effects that remain after the market risk of an asset is controlled.

The hypothesis is that if the financial markets are efficient and perfectly integrated, α should be close to 1 and the country dummies (γ_i) are not significantly different from 0. The empircal model is estimated using OLS method and the results have been corrected for heteroskedasticity.

The return of risky asset are the rate of return of the most popular indices of stock markets in the region. The stock market indices for Asia Pacific region are Indonesia DS-market index[3], KLCI Composite, Philippines SE Composite, Singapore All Sing Equities, Thailand DS-market, Sanghai SE Composite, Hang Sen, Nikkei 225 Stock Average, Korea SE Composite, S&P/ASX 500, New Zealand DS-market, India BSE National 200, Canada DS-market, Mexico IPC (Bolsa), S&P 500 Composite. For the Americas, they are Argentina DS-market, Brazil Bovesap, Chile DS-market, Columbia DS-market, Ecuador Ecu, Lima SE Selective, Venezuela DS-market.

The weighted average portfolio is computed using all stock market indices within the group with country's GDP in 1999, which is the middle of the whole sample period, as weights. The Nikkei 225 stock average index and S&P 500 Composite index are used as the Japanese market portfolio and the US market portfolio, respectively.

The US treasure benchmark bond 10 year and Japan Benchmark bond 10 year are considered as the risk free rates. The Japan Benchmark bond 10 year is used as the risk free rate for the weighted average market portfolio.

Table 5 on correaltions of return indices shows that in general, the correlations between East Asian stock markets with the US market are higher than the correlations they have with Japan indicating that they are more strongly interelated with themselves and with the US market than with the Japanese market.

Table 5 : Correlations of Return Indices

EA-9	Ind	Mal	Phil	Sin	Thai	Chi	HK	Jp	Kor
Indonesia	1								
Malaysia	0.42	1							
Philippines	0.55	0.54	1						
Singapore	0.49	0.58	0.66	1					
Thailand	0.48	0.50	0.62	0.57	1				
China	0.03	0.05	0.04	0.02	0.00	1			
Hong Kong	0.42	0.51	0.55	0.69	0.51	0.05	1		
Japan	0.25	0.08	0.20	0.34	0.19	0.00	0.28	1	
Korea	0.41	0.34	0.35	0.48	0.51	-0.04	0.48	0.39	1
Average	0.33								

[3] DS-market index is composite index calculated by Datastream.

AP-15	Ind	Mal	Phil	Sin	Thai	Chi	HK	Jp	Kor	Aus	Nz	In	Ca	Mex
Indonesia	1													
Malaysia	0.42	1												
Philippines	0.55	0.54	1											
Singapore	0.49	0.58	0.66	1										
Thailand	0.48	0.50	0.62	0.57	1									
China	0.03	0.05	0.04	0.02	0.00	1								
Hong Kong	0.42	0.51	0.55	0.69	0.51	0.05	1							
Japan	0.25	0.08	0.20	0.34	0.19	0.00	0.28	1						
Korea	0.41	0.34	0.35	0.48	0.51	-0.04	0.48	0.39	1					
Australia	0.31	0.32	0.40	0.55	0.33	0.02	0.59	0.44	0.35	1				
New Zealand	0.34	0.35	0.38	0.49	0.31	0.08	0.44	0.37	0.31	0.70	1			
India	0.17	0.21	0.11	0.25	0.20	-0.06	0.23	0.13	0.23	0.20	0.10	1		
Canada	0.45	0.43	0.42	0.56	0.37	0.06	0.61	0.41	0.42	0.60	0.50	0.20	1	
Mexico	0.32	0.36	0.37	0.52	0.31	0.04	0.48	0.32	0.35	0.50	0.40	0.30	0.57	1
USA	0.41	0.32	0.39	0.57	0.36	0.03	0.56	0.43	0.42	0.60	0.50	0.20	0.72	0.51
Average	0.37													
The Americas	Are	Bra	Chi	Col	Ecu	Per	Ven							
Argentina	1													
Brazil	0.37	1												
Chile	0.44	0.53	1											
Columbia	0.31	0.27	0.29	1										
Ecuador	0.03	0.09	0.10	0.17	1									
Peru	0.51	0.44	0.58	0.33	0.01	1								
Venezuela	0.17	0.10	0.22	0.25	0.09	0.25	1							
Average	0.24													

Table 6 : ICAPM results

	Weighted average			Japanese Market			US Market		
AP-15	Coeff.	St. E	t-st	Coeff.	St. E	t-st	Coeff.	St. E	t-st
α	0.9997	0.029	34.100	1.0000	0.080	12.440	1.0049	0.048	20.770
Indonesia	0.0006	0.005	0.100	0.0080	0.006	1.289	0.0015	0.006	0.239
Malaysia	-0.0025	0.005	-0.540	0.0040	0.006	0.617	-0.0013	0.005	-0.230
Philippines	0.0010	0.005	0.220	0.0080	0.006	1.401	0.0022	0.005	0.396
Singapore	-0.0024	0.002	-1.060	0.0040	0.004	1.118	-0.0019	0.003	-0.550
Thailand	-0.0049	0.006	-0.880	0.0040	0.007	0.499	-0.0029	0.007	-0.430
China	0.0145	0.010	1.520	0.0160	0.010	1.652	0.0130	0.010	1.354
Hong Kong	0.0019	0.003	0.620	0.0100	0.005	1.993	0.0032	0.004	0.734
Japan	-0.0076	0.003	-2.200				-0.0084	0.004	-2.240
Korea	-0.0030	0.005	-0.650	0.0060	0.006	1.000	-0.0017	0.006	-0.310
Australia	0.0041	0.002	2.290	0.0080	0.002	3.507	0.0028	0.002	1.409
New Zealand	0.0009	0.002	0.380	0.0050	0.003	1.795	-0.0001	0.003	-0.020
India	0.0092	0.006	1.430	0.0130	0.007	1.972	0.0088	0.007	1.319
Canada	0.0030	0.002	1.450	0.0090	0.003	2.758	0.0023	0.002	0.967
Mexico	0.0113	0.004	2.620	0.0190	0.005	3.507	0.0117	0.005	2.389
USA	0.0020	0.002	1.180	0.0060	0.002	2.644			
R-squared	0.3308			0.0600			0.1503		
Adjusted RS	0.3274			0.0560			0.1461		

The Americas

α	0.9997	0.057	17.700				0.9911	0.112	8.875
Argentina	-0.0051	0.005	-1.040				0.0021	0.007	0.323
Brazil	0.0229	0.007	3.110				0.0325	0.010	3.387
Chile	-0.0005	0.003	-0.180				0.0033	0.004	0.913
Columbia	0.0031	0.004	0.720				0.0076	0.005	1.464
Ecuador	-0.0069	0.006	-1.170				-0.0039	0.006	-0.660
Peru	0.0088	0.005	1.860				0.0153	0.006	2.435
Venezuela	-0.0168	0.009	-1.920				-0.0086	0.010	-0.840
R-squared	0.3960						0.1042		
Adjusted RS	0.3924						0.0990		

Table 6 on ICAPM results shows that the coefficients of the market premium variables (meaning α) in three portfolios are all significantly different from 0 and close to 1, indicating that the stock markets in both Asia Pacific and American regions are efficient.

Within EA-9, with the exception of Japan and Hong Kong, all other East Asian countries do not have statistically significant country dummy for all three market portforlio showing that those countries are strongly integrated within region as well as with two leading market i.e. Japanese market and US market. The coefficients on country dummy of Hong Kong (0.01) is statistically significant in case of Japanese market portfolio i.e. Hong Kong is not correlated with Japan. The same situation happens to Japan in weighted average portfolio (-0.0076) and in US market portfolio (-0.0084) indicating that Japan is not correlated within the region and with US market.

The other remaining countries within AP-15 are correlated within region (as it is seen in weighted average portfolio) or with US market (as in US market portfolio) but not related with Japanse market (as in Japanese market portfolio).

With the exceptions of Brazil and Peru, other American countries are integrated within the region or with the US market.

In general, the empirical results show that East Asian capital markets are substantially integrated. This result indicates that the effectiveness of monetary policy to affect these economies might be limited in the long-run. Therefore, an abandon of independent monetary policy instrument, which is considered as one of costs for joining the monetary union, will probably not so destructive.

4. Conclusion

Financial integration is obviously one of the most important conditions for establishing a monetary union. The high degree of financial integration is desirable as it brings many benefits to the region. Using several methodologies, the paper evaluates the degree of financial integration based on the comparisons of two groups within the Asia Pacific and a group of American countries. The empirical results show that the degree of financial integration in East Asian countries is higher than that in the whole region and the Americas. It means that the practical approach to establish the monetary union is start with the small group i.e. East Asia-9 before expanding the whole region (Asia Pacific 15).

While from an economic point of views the Asia Pacific region is unquestionably does satisfy many OCA criteria in an general and financial integration in particular, there are a number of obstacles to overcome. The most important factor is that the leaders should develop political will to commit a monetary union from

inception to implementation to institutional permanence because monetary union is not only the adoption of a common currency but the willingness to place a regional interests ahead of sovereign concerns, a political and social arrangement that will affect not only macroeconomic policies but also social policies. When the monetary union does become an overall widely-accepted objective of the whole region the policymakers must also willingly establish regional institutions capable of managing political, economic and social aspects of monetary union.

Although at this moment many may argue that it is still too early for the Asia Pacific to think about a monetary union, if the region will be able to overcome those obtacles then the prospects for Asian Monetary Union will be brightened.

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References

Chan. T. H, Baharumshah, A. Z. (2003), "Measuring Capital mobility in the Asia Pacific Rim", *Mira Paper 2208*, http://mpra.ub.uni-muenchen.de/2208

Chen, G., Firth, M., Rui, O. (2002), "Stock market linkages: Evidence from Latin America", *Journal of Banking and Finance*, Vol. 26, pp. 1113-1141

Chi, J., Le, K. and Yong, M. (2006), "Stock market integration and financial crisis: The case of Asia", *Pacific Economic Review*, Vol. 11, No. 4, pp 513-526.

Click, R.W. and Plummer, M. (2005), "Stock market integration in Asean after the Asian financial crisis", *Journal of Asian Economics*, Vol.16, pp. 5-28

Coakley,J.F., Fuertes, A.M. and Spagnolo, F. (2004), "Is the Feldstein-Horioka puzzle history?", *The Manchester School*, Vol. 72, pp. 569-590

Dorrucci, E., Firpo, S., Fratzscher, M. and Mongelli, F.P. (2002), "European integeation: What lessions for other regions? The case of Latin America", *European Central Bank Working paper series No. 185*

Feldstein, M.S. and Horioka,C.Y. (1980), "Domestic saving and International Capital flows", *Economic Journal*, Vol. 90, pp. 314-329

Fujiki, H, Hagiwara, A.R. (2007),"Financial Integration in East Asia", Working Paper 2007-30, http://www.frbsf.org/publications/economics/papers/2007/wp07-30bk.pdf

Gerard, B.,Thanyalakpark. K, and Batten, J.A. (2003), "Are the East Asian Market integrated? Evidence from the ICAPM", *Journal of Economics and Business*, Vol. 55, pp. 585-607

Goto, J. (2003), "Financial Cooperation in East Asia and Japan's role", paper presented at Euro 50 Group Roundtable, 11-12 June 2003, Tokyo

Herrero, A.G., Santillan, J., Gallego, S., Cuadro, L. and Egea, C. (2002), "Latin American financial development in perspective", paper presented Madrid Seminar of the Euro-system and Latin American

Central Bank, 23 May 2002, Madrid.

Huang, Y. and Guo, F. (2006), "Is currency union a feasible option in East Asia? A multivariate structural VAR approach", *Research in International Business and Finance*, Vol. 20, pp 77-94

Huang, Y. and Guo, F. (2006), "An empirical examination of capital mobility in East Asia emerging markets", *Global Economic review*, Vol. 35, pp 97-111

Kasa, K. (1992), "Common stochastic trends in international stocks markets", *Journal of Monetary Economics*, Vol. 29, pp 95-124

Kim, S, H. (2001), "The saving-investment correlation puzzle is still a puzzle", *Journal of International Money and Finance*, Vol. 20, pp 1017-1034

Kim, S, Kim, S.H., Wang.Y. (2006), "Financial integration and consumption risk sharing in East Asia", *Japan and the World Economy*, Vol. 18 , pp 143-157

Kim, S, Kim,S.H., Wang.Y. (2007), "Saving, Investment and international capital mobility in East Asia", *Japan and the World Economy*, Vol. 19 , pp 279-291

Kim, S., Lee, J K.Shin. K. (2006), "Regional and Global Financial Integration in East Asia", MPRA paper No. 695,

Ng, T.H. (2002), "Should the Southeast Asian Countries form a currency union?", *The Developing Economies*, Vol. 40, No. 2, pp 113-134

Mo. H, Wu, L. (2007), "International capital asset pricing: Evidence from options", *Journal of Empirical Finance*, Vol. 14 , pp. 465-498

Payne, J., Kumazawa, R. (2007)," Capital Mobility and the Feldstein-Horioka puzzle: Re-examination of less developed countries?", *The Manchester School*, Vol. 74, pp. 610-616

Sato, K, Zhang, Z. (2006), "Real Output Co-movements in East Asia: Any Evidence for a Monetary Union?", *The World Economy*, Vol. 8, pp. 1671-1689

Siklos, L. and Ng, P. (2001), "Integration among Asia-Pacific and international stock market: common stochastic trends and regime shifts", *Pacific Economic Review*, Vol. 6, No. 1, pp 89-110

Yang, D. Y. *et al*. (2005), "Financial integration in East Asia", *ASEAN Secretariat*, working report

Toan, Ng. (2007),"East Asian Currency Area: A fuzzy cluster analysis of homogeneity", Depocen working paper No. 2007/10.

Takagi, T and Hirose, K. (2004), "A multivariate approach to grouping financially integrated economies" in Brouwer, G and Kawai, M (eds) "*Economic linkages and implications for exchange rate regimes in East Asia*", Routledge, pp 131-152

Weber, E. (2006), Macroeconomic Integration in Asia Pacific Common Stochastic Trends and Business Cycle Coherence", SFB 649 Discussion Papers 2006-039,