A Composite Index of Economic Integration in the Asia-Pacific Region*

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Abstract

This paper measures economic integration in the Asia-Pacific (AP) region using a composite index. The weights of the index are obtained from a two-stage principal component analysis. In the first stage, we obtain a convergence index to measure the convergence of AP sample countries' main macroeconomic indicators. In the second stage, we use the indicators of trade, FDI and tourism, as well as the convergence index, to compute the weights for the composite index. From a balanced panel data covering 17 representative AP economies from 1990 to 2005, we find that economic integration in the region has increased during the period 1990-2005. Among the 17 sample economies, Singapore and Hong Kong are the most integrated with the AP region while the Indonesia and China are the least.

Keywords: Asia-Pacific region, economic integration, composite index, principal component analysis

JEL Classification: C43, F15, R11

1 Introduction

The process of economic integration is commonly defined as the freer movement of goods, services, labour, and capital across borders. The degree of economic integration can be analyzed at a bilateral, regional, and global level. The trend towards regional trading arrangements (for instance, the European Union, ASEAN, the NAFTA) has created a need for measures of economic integration within that region, which in turn allow for comparisons across different regions. There are many single variable measures of regional economic integration, but relatively little work has been done in developing a composite index of economic integration.

Even though the Asia-Pacific (AP) region is not covered by a single trading agreement, there is much anecdotal evidence to suggest that it is becoming more integrated. As defined by the Asia Pacific Economic Cooperation (APEC) membership, the region consists of not only developed economies such as the US, Japan, Canada, and Australia, but also emerging markets such as South Korea and ASEAN, plus an emerging superpower in the form of China. It is well known that parts of the region are already highly integrated through production networks that trade intermediate and finished goods across borders, often within the same firm. Since 1998, many economies in the AP region have negotiated bilateral and sub-regional Free Trade Agreements with partners in the region as well as outside the region. APEC leaders have also endorsed a proposal to investigate the idea of a Free Trade Agreement of the Asia Pacific (FTAAP), which if successful, would constitute the largest regional trading bloc in the world. The main purpose of this paper is to construct a composite index of economic integration that will show the extent of integration not only for the Asia Pacific region as a whole, but also the degree of integration of individual economies with the region.

There is a vast literature attempting to measure indicators/variables from different economic and sociological dimensions using a composite index by looking at a number of independent indices. For example, the United Nations Development Programme (UNDP) periodically reports the "Human Development Index" (HDI); similar to HDI, the European Union (EU) reports the Lisbon Strategy Indices (LSI) measuring the comprehensive development level of EU member economies; likewise, the consulting firm, A.T. Kearney (2002, 2003) has a simple composite globalization index based on indicators of economics, technology, demography, and politics. All of these indices are constructed by non-parametric methods, that is, the weights used among indicators are determined subjectively by experts based on their knowledge about the relative importance of each indicator (or sub-index). A different way of constructing a composite index is to use parametric methods where the weights among indicators or sub-indices are determined by the relative variation among those indicators. The most popular parametric method is known as Principal Component Analysis (PCA). Dreher (2006) and Heshmati (2003, 2006), for example, use PCA to determine the weights of sub-indices of a composite globalization index. Common Factor Analysis is another frequently applied parametric method (for example, Andersen and Herbertsson, 2003).

Though much research has been done on the integration of the member economies under a given trade/political agreement such as ASEAN (see, Batra, 2006) and NAFTA (Acharya, et al., 2002), there has been little research on the economic integration of the AP region as a whole.

We attempt to use a composite index to measure the dynamics of AP economic integration. In section 2, we describe our methodology of constructing a composite index from multi-dimensional data. In section 3, we provide a description of the data and rationale for the chosen indicators and a sub-index measuring the convergence of sample economies. Section 4 reports the sub-index as well as the composite index. Section 5 concludes with the main results and discusses possible extensions of the research.

2 Methodology

To include as much as possible information from a multi-dimensional dataset into a composite index, the key task is to allocate reasonable weights to the included indicators or sub-indices. A good index should still carry the essential information in all the indicators but not be biased towards one or a few of the indictors.

As mentioned in the last section, there are both non-parametric and parametric methods to construct composite indices.

The non-parametric methods are directly assigned weights to those included indicators based on researchers' prior beliefs about the relative importance of the indicators (i.e. assign higher weights to more important indicators). Examples of non-parametric indices include the UNDP's HDI and EU's LSI.

On the other hand, parametric methods assume there is some structure behind the variation of the included indicators and hence the weights for these indicators are determined by the covariation between them on each dimension of the structure. The commonly applied parametric methods are the Common Factor Analysis (CFA) and the Principal Components Analysis (PCA).

CFA attempts to simplify complex and diverse relationships by assuming that there exist some latent common variables in a set of observed variables. That is to say, CFA attempts to explain each of the original variables by the set of unobserved Common Factors (CF). The loadings of the original variables on each CF reveal their relative importance in the dimension represented by the corresponding CF.

Originally introduced by Pearson (1901) and independently developed by Hotelling (1933), PCA transforms the original set of variables into Principal Components (PC) which are orthogonal to each other. Each PC is a linear combination of all the included indicators. The first PC accounts for the largest amount of the total variation (information) in the original data (in the following, the second PC explains the second largest variation and so on). And the (normalized) loadings in a PC are the weights of the corresponding indicators in the dimension represented by that PC.[1]

The final weight assigned to each indicator in a composite index is its loading in each dimension of the selected CFs or PCs weighted by the relative importance (accountability of the total variation of the original data) of that factor or component.

While non-parametric methods are simple to construct and allow for ease of comparison over time, they suffer from the subjective assignment of weights, which often lack a theoretical basis. Changing the weights on a non-parametric index even slightly can dramatically alter the final index.

Parametric methods, on the other hand, are statistically sound since the weights are determined by the sample indicators themselves. Furthermore, from an empirical point of view, PCA is often preferred to CFA for two reasons. First, PCA is simpler to apply mathematically since no assumptions are attached to the raw data (i.e. the underlying common factors) (Stevens, 1992); secondly, PCA does not have to account for factor indeterminacy, which is a troublesome feature of CFA (Steiger, 1979). PCA is widely used in research on indices and we have chosen this method for the construction of a composite index of economic integration in the Asia Pacific region.

In particular, our PCA method is similar to that used in the "Trade and Development Index" (TDI) constructed by the United Nations Conference on Trade And Development (UNCTAD). Suppose there is a multi-dimensional data $X_{T\times p}$,[2] where T is the total number of periods and p is the number of the indicators (dimensions). $R_{p\times p}$ is the correlation matrix of the p indicator series. Define λ_i $(i = 1, ..., p)$ as the i^{th} eigenvalue and $\alpha^i_{p\times 1}$ $(i = 1, ..., p)$ as the i^{th} eigenvector of the correlation matrix $R_{p\times p}$ respectively, given the

[1] The normalization is to make the squared loading of each indicator in any PC to be unity.

[2] In general, the components of matrix X are the normalized transformation of the raw data to avoid the problem of heterogeneous scales.

property of eigenvalue and eigenvector, we know, λ_i should be the solution of the determinant $|R\text{-}\lambda I|=0$ (where $\lambda = (\lambda_1, ..., \lambda_p)'$, and I is the $p \times p$ identity matrix), and the corresponding (normalized) eigenvector α^i can be solved by,$(R\text{-}\lambda_i I)\alpha^i = 0$, subject to $\alpha^{i'}\alpha^i = 1$ (normalization condition). Without loss of generality, assume $\lambda_1 > \lambda_2 > ... > \lambda_p$, and denote the i^{th} principal component as PC_i, then

$$PC_i = X\alpha^i \tag{1}$$

and

$$\lambda_i = var(PC_i) \tag{2}$$

Therefore, the first principal component is the linear combination of the initial indicators which has the biggest variance. The second PC is another linear combination of the indicators which is orthogonal to the first PC (since the eigenvectors are orthogonal to each other) and has the second biggest variance. Following this order, the p^{th} PC is a linear combination of the indicators which is orthogonal to all the other PCs and has the smallest variance. In other words, the PCA is a method to represent a $p-$dimensional data by p orthogonal PCs, with the first i PCs carry the biggest i variances (information) of the initial data.

Thus, our index will be constructed by the PCs and their relative importance (accountability of the variance),

$$Ind = \frac{\sum_{i=1}^{i=p} \lambda_i PC_i}{\sum_{i=1}^{i=p} \lambda_i} = \frac{\sum_{i=1}^{i=p} \sum_{j=1}^{j=p} \lambda_i \alpha_j^i x_j}{\sum_{i=1}^{i=p} \lambda_i} = \sum_{j=1}^{j=p} w_j x_j \tag{3}$$

where x_j $(j = 1, ..., p)$ is the j^{th} column (indicator series) of the matrix X, and the final weight[3] of indicator j is given by

[3] In general, the sum of weights is not, but very close to, unity due to the fact that PCA normalizes the mode of each eigenvector is unity.

$$w_j = \frac{\sum_{i=1}^{i=p} \lambda_i \alpha_j^i}{\sum_{i=1}^{i=p} \lambda_i} \tag{4}$$

However, we should still be aware of a problem when using PCA. Since the weights are determined by the correlation between indicators, if there are some indicators which are highly inter-correlated, the weights may be biased towards these indicators (Mishra, 2007). A method to overcome this problem is to adopt a two- (or multi-) stage PCA. That is, one needs to group the highly inter-correlated indicators together and construct a composite sub-index first, then use this sub-index with the rest of the indicators to construct the final composite index. In this paper, we apply a two-stage PCA strategy.

3 The Data and Descriptive Statistics

Most research on economic integration is based on the following four indicators: trade, FDI, portfolio capital flows, and income payments and receipts (for instance, Keohane and Nye 2000, Kearney 2003, Bhandari and Heshmati 2005, Heshmati 2006). Other indicators that have been applied include: the flow of people, i.e. international tourism (Acharya, et. al. 2002), GDP per capita (Heshmati and Oh 2005), and the relative size of the agriculture sector to GDP (Cahill and Sanchez, 1998).

Given data availability, we have chosen the following eight indicators: the absolute deviation of real GDP per capita, the non-agriculture sectoral share (to GDP), the urban resident ratio, the life expectancy, and the education expense share (to GNI); the AP regional imports and exports share (to GDP); the intra-AP FDI interflow share (to Gross Capital Formation); and the intra-AP tourist inflow (per one thousand people).[4] The data sources are

[4]We want to emphasize the fact that no indicators can sufficiently reflect economic integration individually. So do ours. However, the process of integration, if any, must be reflected from various macroeconomic aspects which are (theoretically, at least) captured by our selected indicators. And that is the reason why we try to measure integration from

listed in Table 1. These data are collected from 17 representative economies in the AP region, as follows: Japan, Republic of Korea, People's Republic of China, Hong Kong, and Chinese Taipei from East Asia; Vietnam, Thailand, Philippines, Indonesia Singapore, Malaysia from Southeast Asia; United States (US) and Canada from North America; Chile and Mexico from Latin America; and Australia and New Zealand from Oceania. The data starts from 1990 and ends at 2005. Missing data was approximated using standard interpolation and extrapolation techniques.

The first five deviation indicators are grouped together since they may be highly inter-correlated macroeconomic variables. We have labeled the sub-index of these five indicators as a "convergence index"(CI) since the dispersion in these five indicators is expected to narrow over time if economies are virtually integrating. In particular, the absolute deviation of real GDP per capita measures dispersion of overall welfare of the sample economies, that of the non-agriculture sectoral share measures the dispersion of industrialization levels, that of the urban residents ratio measures the dispersion of modernization levels (since most industrial and business activities occur in urban areas), that of the life expectancy approximates the dispersion of inputs in health, and the education expenses approximates the dispersion of investment in human capital (which is believed to be a key factor accounting for long run economic growth). Figures 1 a-e illustrate the aggregate performance of the indicators respectively using 1990 as the base year. The indicators are obtained as follows,

$$Dev.Indicator_t = 100 - \frac{Abs.Dev._t}{Abs.Dev._{1990}} * 100 \qquad t = 1990, ..., 2005. \qquad (5)$$

Therefore, compared to the base year (1990) indicator which is normalized to zero, a positive indicator implies the absolute deviation of that year

various dimensions rather than a single aspect.

is smaller than that of the base year, i.e., there has been convergence compared to 1990; a negative number would imply the opposite, which is greater divergence. A higher score implies a higher level of convergence, while lower means the opposite. Figures 1b and 1c clearly show that the indicators of non-agriculture sectoral share and urban resident share are consistently converging across the sample economies over time; Figures 1d and 1e show that the life expectancy and education expense ratio are volatile in level; finally, in Figure 1a the indicator of real GDP reveals the gap in real income (welfare) among sample economies has been getting wider over time, suggesting economic divergence.

The second part of our index construction involves the collection of economic integration indicators. We have chosen commonly used indicators that measure flows of goods (trade), capital (FDI), and people (tourists) in a region. To avoid bias, we have netted out flows among AP economies that are parts of a sub-regional unit. In particular, the sub-regional units we exclude are so called "Great China Economic Ring" (including Chinese Taipei, Hong Kong, and China), ASEAN, NAFTA, and Australia and New Zealand. In order to obtain the data that conveys the "pure" information of AP regional integration, the value/number of trade and FDI are calculated as the total interflows intra-AP representative economies *net of* those from other members of the excluded sub-regional units, and the number of tourists (per one thousand population) is calculated as a inflow (after net of sub-regional unit) due to unavailability of outflow data. For instance, we *exclude* the China's FDI interflows with Hong Kong and Chinese Taipei when we calculate the total AP regional FDI inflows to and outflows from China. Otherwise, ignoring the effects of sub-regional agreements may seriously overstate the level of integration in the AP region. For example, Mexican trade and FDI inflow increased rapidly after it became a member of NAFTA in 1992. However, most the growth was due to increasing business with the US and Canada rather than with the economies outside of NAFTA. A global economic integration index for Mexico that does not exclude the effects of NAFTA will provide a false reading of Mexico's integration with the world. Most of the literature measuring country global integration ignores the effects of regional agreements on an economy's broader integration with the world, and hence provides an inaccurate reading of globalization.

Figures 2-4 respectively illustrate the total (in-AP) regional imports and exports share (to regional GDP), the total (in-AP) regional FDI interflow share (to regional Gross Capital Formation), and the total (in-AP) regional tourist share (to total annual international tourists hosted by all AP sample economies). As illustrated in Figures 2 and 4, the trade share and tourist share have both increased steadily over time, implying stronger links in goods and demographic flows in the AP region. However, FDI flow share is rather volatile with a decreasing trend. It started from slightly below 5% in 1990 and finally dropped to slightly above 2% in 2005. There are two reasons that may account for the declining FDI. First of all, even though there has been a large increase in FDI in many AP economies, much of the increase has been due to investment from economies belonging to a sub-regional trade agreement, e.g. NAFTA. Another factor worth noting is the growing volume of FDI inflow from the tax havens such as the Cayman Islands and the British Virgin Islands. Even though much of this inflow may in fact originate from AP economies, we are unable to make this determination based on the available data. It is likely, therefore, that the investment measure of AP integration is understated.

4 The Convergence Index and Composite Index

What are the properties of a good composite index of economic integration? Intuitively, at least two characteristics should be possessed by the index. First, the index should not exhibit a high degree of volatility. Since economic integration is usually a gradual process, a representative index should reflect such modest pace of change as economies become tied to each other. Second, the index should not be biased towards any of the indicators, i.e. the weight of any indicator should not be so high that it dominates the overall index. After obtaining values for the indicators and computing the composite index, we can show whether our composite index has the two desirable properties.

In the first stage, we compute the weights for the five deviation indicators and calculate the CI. Table 2 reports the summary of PCA for CI indicators. The weights of the five deviation indicators are derived by eq (4). The deviation indicator of education expense ratio is assigned the highest weight (0.37), followed by non-agriculture share (0.24), with the weights for life expectancy and real GDP per capita are roughly the same, at 0.20 and 0.19 respectively, and urban resident ratio is assigned the lowest weight (0.10).

Using the weights, we can compute the CI for the AP region as well as each economy in the sample. Due to space limitations, we only provide the CI for the AP region as a whole in figure 4.[5] Starting from 1990 as the base year with CI normalized to zero, the CI series fluctuates over time, peaking at 8.12 in 1998 and falling to -3.72 in 2005. This pattern of fluctuation seems reflect the fact of the South East Asia Economic Crisis in late 1997.

In the second stage, we use PCA again to compute the weights for the other three indicators (trade, FDI, and tourists) with the CI. The summary of the second stage PCA is reported in Table 3. PCA assigns the biggest weight to CI (0.38), followed by tourist inflows (0.31) and trade flows (0.25), and the smallest weight (0.11) to FDI. Though the weights are not evenly distributed, none of the indicators is dominant which satisfies our "non-dominant" property. We show in Figure 6 the movement of the composite index for AP region from 1990 to 2005. This figure clearly shows the composite index is upward sloping (with small volatilities, though) implying that the economic integration is strengthening over time even after filtering out the effects of

[5] The detailed CI of each sample country can be provided upon contacting the authors.

sub-regional agreement effect. The overall fluctuations in the index are relatively modest, which satisfies the property of an index reflecting a "smooth" integration process.

The sample economies' integration indexes are shown in Table 4. Due to space limitations, only six sample economies are reported (US, Canada, China, Japan, Thailand, and Australia). The annual growth rate of the integration (shown in the parentheses of table 4) level are calculated as,

$$g_t = (\frac{I_t}{I_{t-1}} - 1) * 100\% \qquad t = 1991, ..., 2005. \tag{6}$$

where g_t and I_t is the growth rate and integration index in year t respectively.

According to the integration index reported in Table 4, the Thailand is the most integrated in the AP region among the 6 economies in 1990. But Australia had taken away this title sicne 1994. Japan's integration level has been fluctuating in the first nine years and increasing in the most recent 7 years; China is consistently below the integration average which may be a result of the relatively closer local integration with Hong Kong, Macao, and Chinese Taipei, as well as diversification of trade and investment towards the EU. NAFTA economies are the least integrated in the AP region, likely because of the bias for trade and investment within the NAFTA region. Interestingly, even though Canada is very low in the integration ranking compared to other AP economies, the Canadian economy has nevertheless become more integrated (overall) with the AP region over the period studied.

Table 5 reports the dynamic performance of the composite index and its indicators for a single economy, using Canada as an example. Canada's economic integration with AP market had increased with some volatilities during 1990–2005, with the integration level of -11.56 in 1990 which increased to 12.40 in 2005. The integration trend can be mainly attributed to the fact that the gaps between Canadian life expectancy and education expense ratio are diminishing over time and recent resurgence of trade share in AP region (for example, a fast trade growth with China after China's entry of WTO in 2001).

Table 6 reports the ranking of AP economic integration for the 17 AP sample economies. Consistent with anecdotal evidence, the level of economic integration in the AP region is growing. Interestingly, the relative ranking of AP economies has not changed significantly over time. Hong Kong and Singapore are consistently ranked as the economies most closely integrated with the AP region while Indonesia and China is the least. As the international hubs for goods and services, Hong Kong and Singapore consistently keep in the top. Indonesia is left behind in the integration process mainly due to a persistent FDI withdrawal thanks to the instability of its economic and political environment. It is surprising that China appears in the bottom as well. The main reason attributes to the sub-regional integration within the "Greater China Economic Ring". For example, more than 70% of China's FDI inflow is from the investors having Chinese background (mainly from Hong Kong and Chinese Taipei), and its bilateral trade with Hong Kong accounts for at least one fourth of its total trade value. Table 6 also shows that the top 5 economies which had integrated most rapidly with the Asia Pacific region between 1990 and 2005 are Hong Kong, New Zealand, Vietnam, Canada, and Australia whereas the bottom 5 are Chile, Chinese Taipei, Indonesia, Mexico, Singapore. Surprisingly, Singapore is the on the very bottom but it still nails the 2nd position as the most integrated economy in AP. Furthermore, this table shows that only the bottom 5, out of 17 economies, were less integrated with AP region in 1990 than in 2005 and these falls in integration are not significant relative to the improvement. This fact reveals that the whole region had been actually integrating during 1990-2005.

5 Conclusion and Discussion

This paper measures the economic integration in the Asia-Pacific region by construction of a composite index. The weights of the index are obtained from a two-stage PCA. In the first stage, we obtain a convergence index to measure the dispersion of AP sample economies' main macroeconomic indicators. In the second stage, we use the indicators of trade, FDI and tourism as well as the convergence index to compute the composite index.

Overall, we find that though economic convergence in the AP region has fluctuated during 1990 to 2005, the economic integration has been steadily growing. Among the 17 sample economies, Hong Kong and Singapore are the most integrated with the AP region while the Indonesia and China are the least.

Though the PCA has many good properties in constructing indices for multi-dimensional data, there are some shortcomings that we need to note. For instance, the weights in PCA are completely determined by sample data, i.e. they are sample-dependent. Adding more data from new years or new dimensions will change the weights so that the new index cannot be directly compared with the old index. This problem can be overcome, however, by using "chained index" to account for the different weights used in different years. This is particularly important if the index is used in time series comparisons, for example as an annual measure of the state of Asia Pacific regional integration.

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Table 1: Data Category and Source

Category	Sub-category	Source
Economic Convergence	Real GDP per Capita	World Development Indicator 2007 and Statistical Yearbook 2007 (Chinese Taipei)
	Agriculture Sectoral Share	
	Urban Residents	
	Total Population	
	Life Expectancy	
	Education Expense Ratio (to GNI)	
Trade share	Nominal GDP	United Nations Common Database and Statistical Yearbook 2007 (Chinese Taipei)
	Exports	World Trade Analyser
	Imports	
FDI flow share	Gross Capital Formation	United Nations Common Database and Statistical Yearbook 2007 (Chinese Taipei)
	FDI flow	1. United States Census Bureau for U.S. data 2. CANSIM for Canadian data 3. ASEAN Statistical Yearbooks for the ASEAN-6 countries 4. economy-specific statistical yearbooks
International Tourists share	Total International Tourists Inflow and Intra-AP Inflow	Same as above

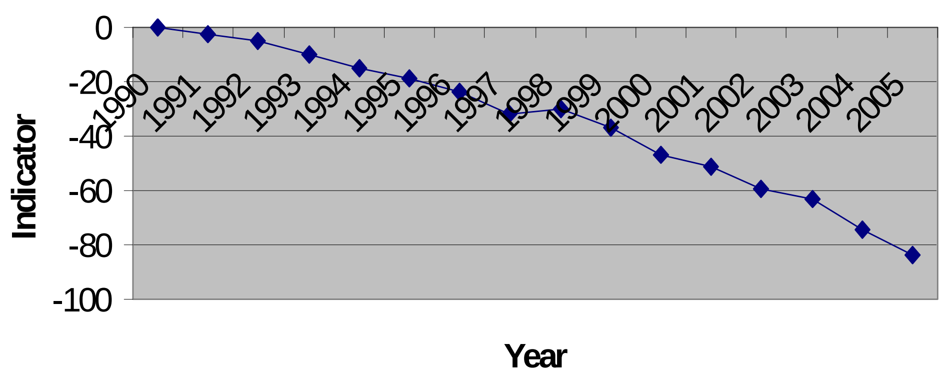


Figure 1a: The Absolute Deviation Indicator of Real GDP per Capita

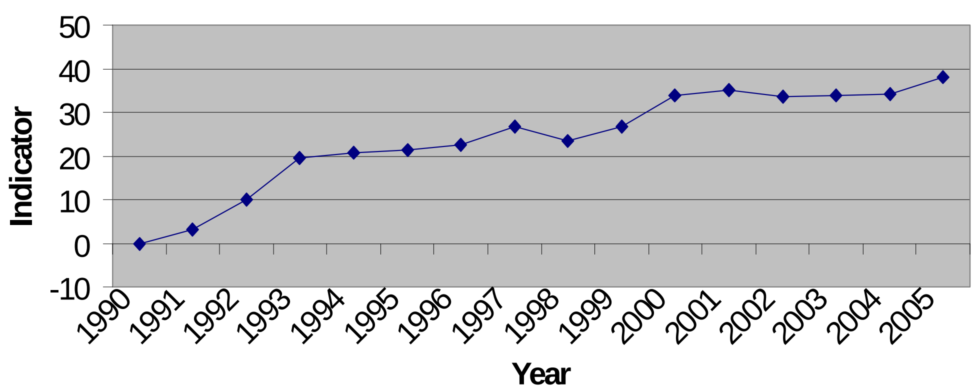


Figure 1b: The Absolute Deviation Indicator of Non-Agriculture Sectoral Share

Figure 1c: The Absolute Deviation Indicator of Urban Resident Ratio

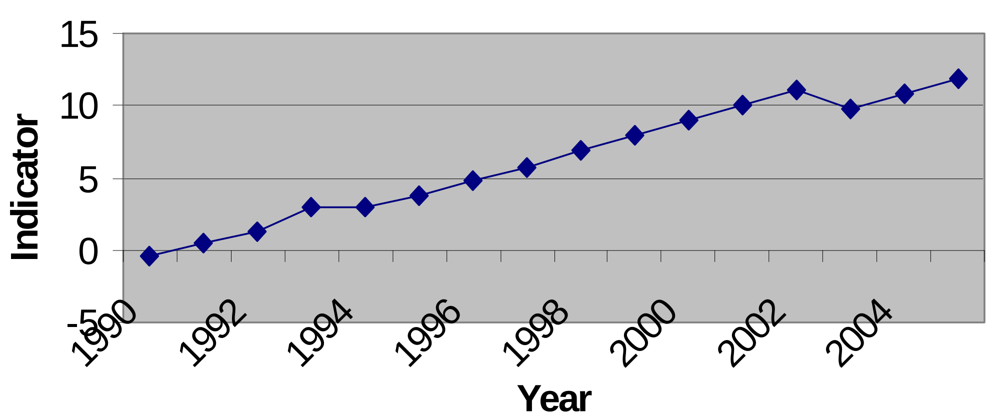
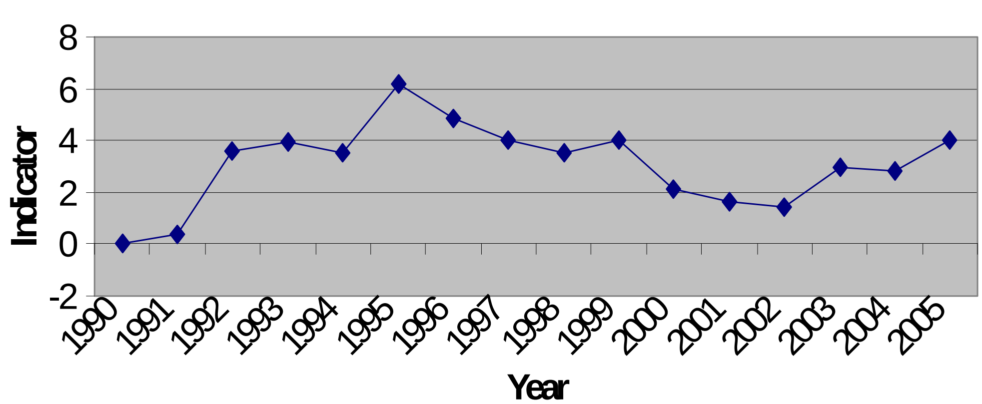


Figure 1d: The Absolute Deviation Indicator of Life Expectancy



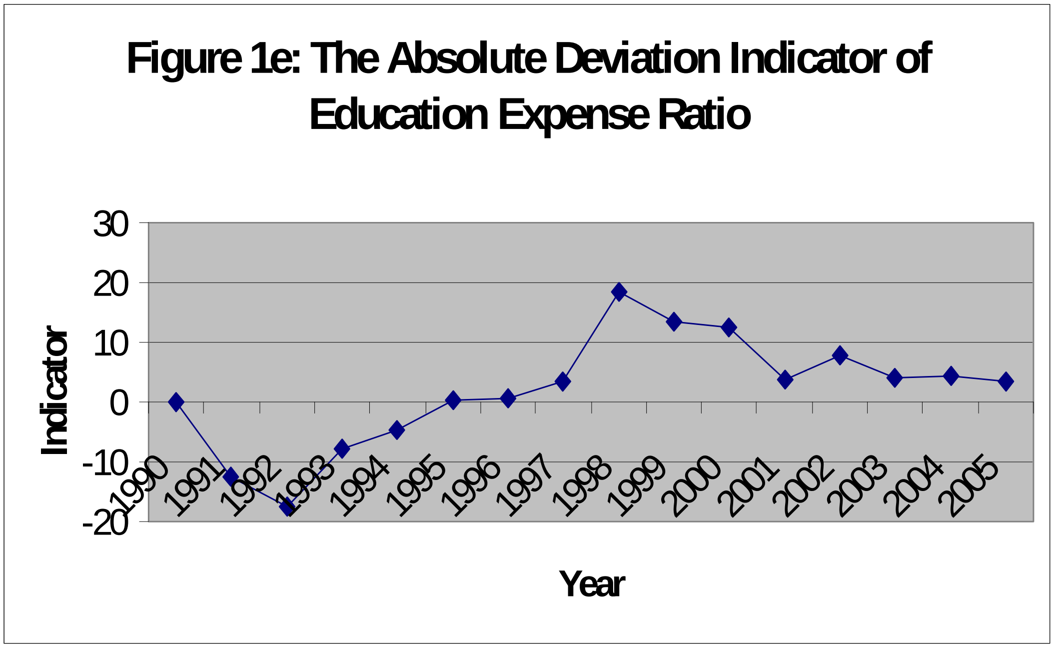


Figure 1e: The Absolute Deviation Indicator of Education Expense Ratio
Indicator
30
20
10
0
-10
-20
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

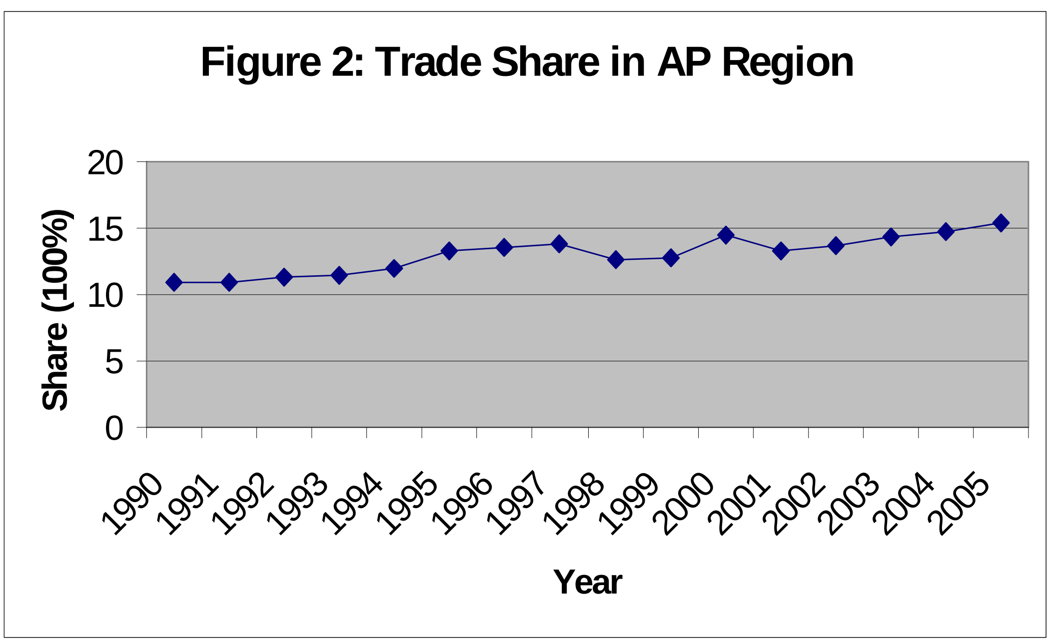


Figure 2: Trade Share in AP Region
Share (100%)
20
15
10
5
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

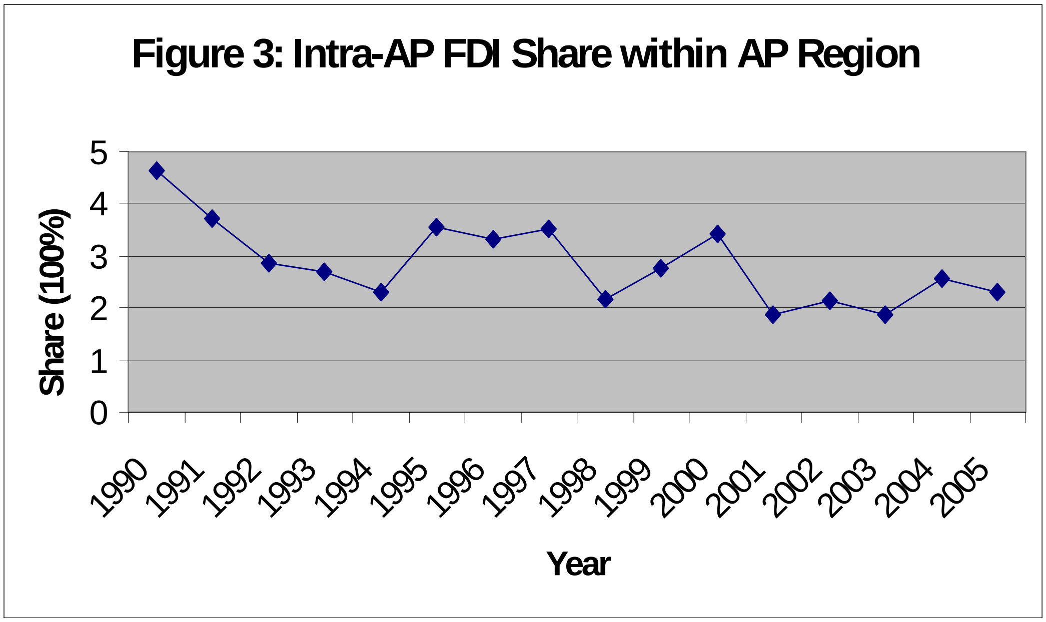


Figure 3: Intra-AP FDI Share within AP Region
Share (100%)
0
1
2
3
4
5
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

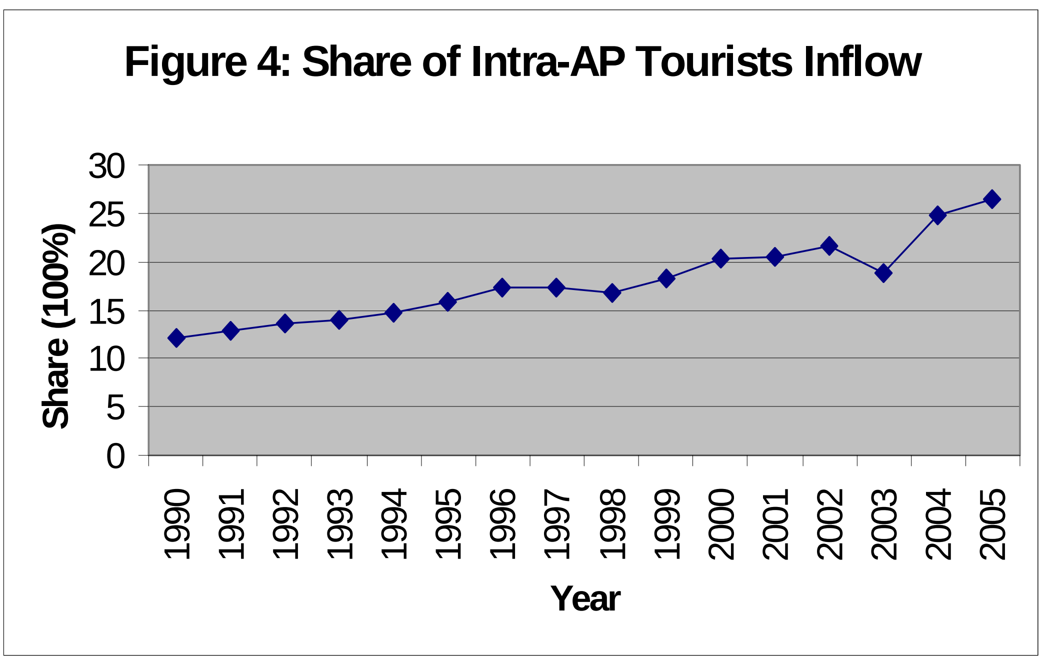


Figure 4: Share of Intra-AP Tourists Inflow
Share (100%)
0
5
10
15
20
25
30
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

Table 2: Summary of Principal Component Analysis for Convergence Index, n=272

Indicator	Eigenvector					Final Weight
	PC1	PC2	PC3	PC4	PC5	
gdp	0.4056	-0.5334	0.5168	-0.0355	0.5316	0.1938
nagri	0.5299	-0.0822	-0.2401	0.7838	-0.2012	0.2389
urb	0.4494	0.1272	-0.6757	-0.3909	0.4154	0.1010
life	0.5552	0.0497	0.2479	-0.4598	-0.6453	0.2049
edu	0.2109	0.8307	0.3967	0.1422	0.2965	0.3724
Eigenvalue	2.2146	1.0468	0.8650	0.4980	0.3756	

Abbreviations: the absolute deviation of real GDP per capita (gdp), of the non-agriculture sectoral share (nagri), of the urban resident ratio (urb), of lifetime expectancy (life), and of the education expense ratio (edu).

Table 3: Summary of the Principal Component Analysis for Composite Index, n=272

Indicator	Eigenvector				Weight
	PC1	PC2	PC3	PC4	
ci	0.0465	0.7305	0.6771	0.0754	0.3769
trade	0.7036	-0.0187	0.0507	-0.7086	0.2549
fdi	0.1931	0.6482	-0.7262	0.1228	0.1077
tour	0.6823	-0.2141	0.1072	0.6908	0.3087
Eigenvalue	1.7132	1.0973	0.8921	0.2974	

Abbreviations: the Convergence Index (ci), the in-AP regional imports and exports share (trade); the in-AP regional FDI inflow share (fdi); and the in-AP regional tourists share (tour).

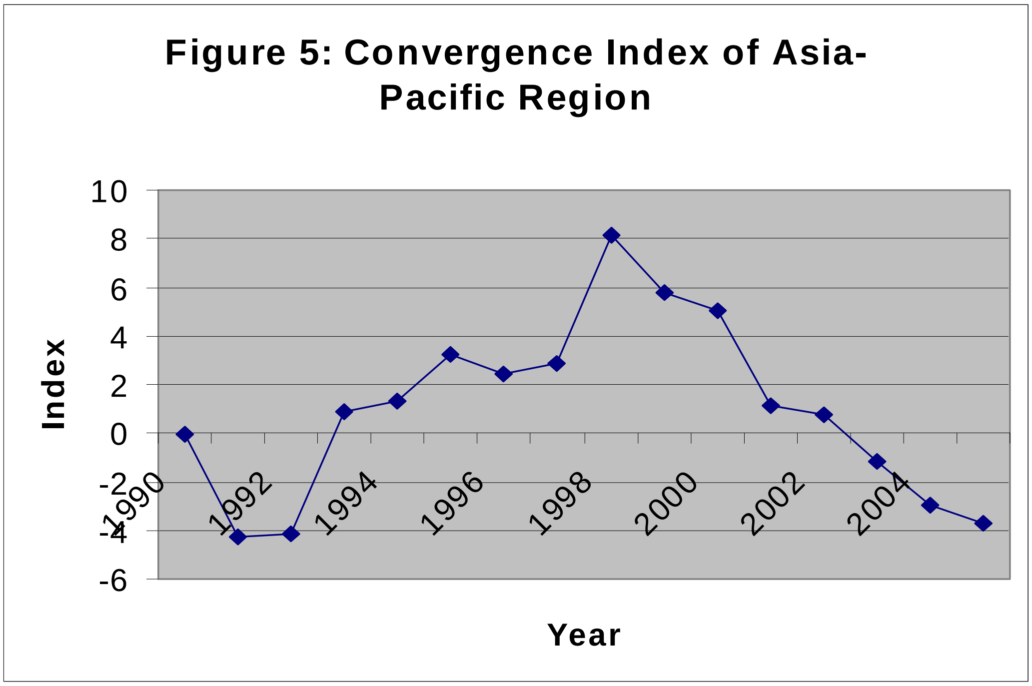


Figure 5: Convergence Index of Asia-Pacific Region
Index
Year
10
8
6
4
2
0
-2
-4
-6
1990
1992
1994
1996
1998
2000
2002
2004

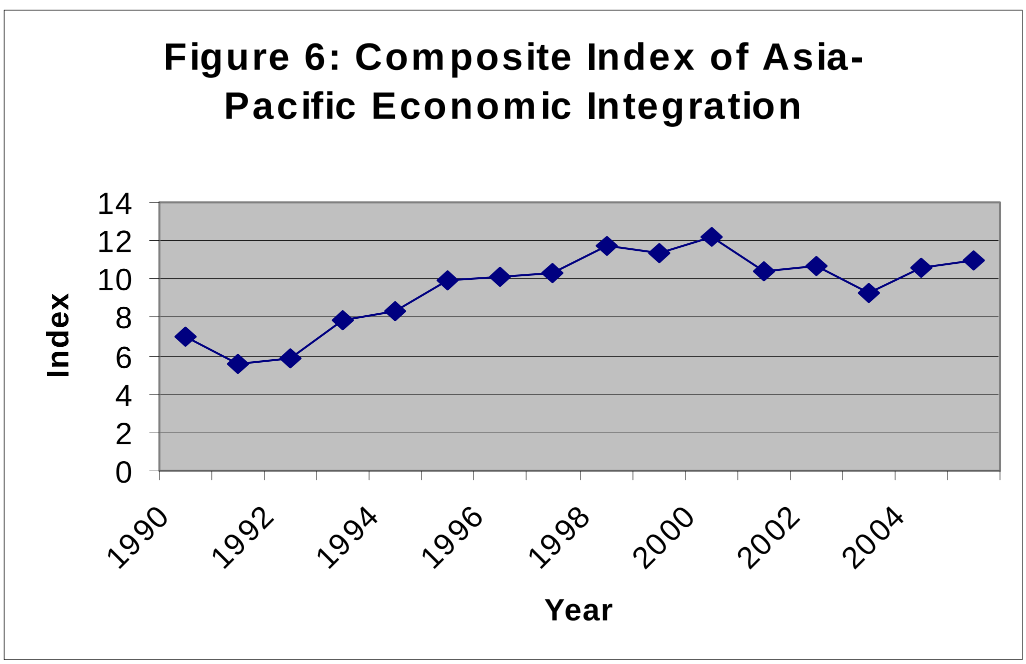


Figure 6: Composite Index of Asia-Pacific Economic Integration
Index
Year
14
12
10
8
6
4
2
0
1990
1992
1994
1996
1998
2000
2002
2004

Table 4: Integration Index of Representative Economies and the AP Region

Country / Year	U.S.	Canada	PRC	Japan	Thailand	Australia	AP Region
1990	5.80 ---	-11.57 ---	-11.61 ---	11.74 ---	32.30 ---	19.09 ---	7.02 ---
1991	4.73 (-18.4)	-15.02 (+29.9)	-11.12 (-4.25)	13.12 (+11.72)	29.43 (-8.88)	25.74 (+34.88)	5.59 (-20.28)
1992	1.89 (-60)	-14.92 (-0.69)	-10.63 (-4.35)	15.19 (+15.79)	31.21 (+6.04)	29.90 (+16.14)	5.82 (+4.08)
1993	4.43 (+134.18)	-9.15 (-38.64)	-7.76 (-27.05)	17.92 (+17.96)	35.63 (+14.17)	27.60 (-7.69)	7.87 (+35.19)
1994	3.63 (-18.2)	-4.13 (-54.88)	-5.10 (-34.26)	16.55 (-7.63)	33.12 (-7.06)	33.15 (+20.11)	8.36 (+6.18)
1995	9.76 (+169.21)	-1.12 (-72.83)	-7.09 (+39.03)	14.39 (-13.06)	36.12 (+9.07)	37.46 (+12.99)	9.90 (+18.5)
1996	9.63 (-1.35)	1.54 (-237.64)	-8.28 (+16.8)	13.46 (-6.42)	38.68 (+7.09)	44.35 (+18.4)	10.10 (+1.94)
1997	10.61 (+10.11)	0.14 (-91.06)	-8.34 (+0.7)	13.85 (+2.88)	38.20 (-1.24)	39.44 (-11.07)	10.34 (+2.4)
1998	7.65 (-27.87)	5.53 (+3901)	-7.06 (-15.33)	12.92 (-6.72)	37.97 (-0.61)	39.00 (-1.11)	11.70 (+13.17)
1999	7.00 (-8.52)	5.33 (-3.57)	-8.47 (+19.97)	14.02 (+8.53)	37.64 (-0.85)	39.03 (+0.08)	11.36 (-2.93)
2000	9.09 (+29.87)	8.05 (+51.01)	-7.75 (-8.52)	14.35 (+2.36)	40.99 (+8.9)	45.88 (+17.55)	12.22 (+7.56)
2001	9.27 (+1.99)	12.30 (+52.8)	-7.91 (+2)	13.42 (-6.49)	39.32 (-4.08)	44.52 (-2.97)	10.38 (-15.05)
2002	6.87 (-25.88)	12.10 (-1.64)	-6.69 (-15.37)	15.26 (+13.67)	37.99 (-3.39)	44.80 (+0.64)	10.66 (+2.72)
2003	7.10 (+3.39)	9.43 (-22.04)	-5.55 (-16.98)	14.67 (-3.81)	37.99 (+0.02)	41.58 (-7.21)	9.27 (-13.04)
2004	6.98 (-1.69)	12.67 (+34.36)	-5.18 (-6.8)	16.42 (+11.92)	40.52 (+6.66)	42.22 (+1.56)	10.58 (+14.15)
2005	5.89 (-15.59)	12.40 (-2.12)	-4.03 (-22.23)	17.73 (+7.96)	41.26 (+1.82)	42.44 (+0.51)	10.96 (+3.59)

Note: values in parentheses are the percentage growth rate of the economic integration index. "+" indicates a positive growth and "-" indicates a negative growth, "--" means not applicable.

Table 5: The Economic Integration Index of Canada

Year	Convergence Index (0.38)					Trade (0.27)	FDI (0.22)	Tour (0.07)	CEII
	gdp (0.19)	nagi (0.24)	urb (0.10)	life (0.20)	edu (0.37)				
1990	-47.45	4.77	37.54	-29.60	-138.5	5.37	1.84	33.07	-11.56
1991	-37.85	6.07	38.49	-25.34	-169.1	5.37	1.07	32.21	-15.02
1992	-35.70	12.69	39.41	-14.87	-180.8	5.70	0.67	32.54	-14.92
1993	-36.95	22.95	39.29	-16.61	-145.4	5.79	2.34	32.22	-9.15
1994	-45.50	25.03	41.27	-13.52	-121.3	6.06	2.32	37.69	-4.13
1995	-49.08	28.29	42.19	-12.59	-120.7	6.91	2.16	46.09	-1.12
1996	-46.47	33.48	42.49	-10.13	-117.8	6.09	1.23	51.61	1.54
1997	-50.15	34.19	42.79	-8.16	-115.6	6.39	0.88	46.08	0.14
1998	-73.19	33.87	43.16	-5.31	-45.53	6.03	2.40	36.23	5.53
1999	-87.5	35.25	43.5	-5.89	-42.37	5.83	0.56	38.04	5.33
2000	-96.02	39.60	43.85	-3.12	-28.48	6.07	1.05	40.17	8.05
2001	-107.0	41.35	44.98	-2.23	12.83	5.64	2.66	36.67	12.30
2002	-112.4	41.05	46.15	-0.75	12.30	5.81	3.82	36.57	12.10
2003	-115.3	41.43	44.96	1.08	17.77	5.51	0.15	27.24	9.43
2004	-115.9	41.7	46.1	3.67	14.9	6.72	1.85	36.71	12.67
2005	-125.0	45.48	47.22	4.67	12.68	6.91	0.19	37.94	12.40

Note: 1. Abbreviations: the absolute deviation of real GDP per capita (gdp), of the non-agriculture sectoral share (nagri), of the gross capital formation ratio (gcf), and of the urban resident ratio (urb); the in-AP regional imports and exports share (Trade); the in-AP regional FDI inflow share (FDI); and the in-AP regional tourists share (Tour); and the Composite Integration Index (CEII)

2. The values in parentheses are the indicator weights of the CI or CEII.

Table 6: Ranking of the Economic Integration with the Asia Pacific Market

Asia-Pacific Economies	1990		1997		2005		1990-2005	1990-2005
	CEII	Ranking	CEII	Ranking	CEII	Ranking	Integration Improvement	Ranking
Hong Kong, China	226.02	2	323.64	1	625.69	1	399.67	1
New Zealand	30.35	7	49.59	5	63.58	5	33.23	2
Viet Nam	-23.64	17	-7.45	15	6.75	14	30.39	3
Canada	-11.57	14	0.14	14	12.4	12	23.97	4
Australia	19.09	10	39.44	7	42.44	7	23.35	5
Republic of Korea	46.45	5	48.76	6	69.61	4	23.16	6
Thailand	32.30	6	38.2	8	41.26	8	8.96	7
P.R. China	-11.61	15	-8.34	16	-4.03	16	7.58	8
Japan	11.74	11	13.85	12	17.73	10	5.99	9
Philippines	8.24	12	15.7	11	11.2	13	2.96	10
Malaysia	50.13	4	60.29	4	51.44	6	1.31	11
United States	5.80	13	10.61	13	5.89	15	0.09	12
Chile	28.79	8	32.74	9	28.42	9	-0.37	13
Chinese Taipei	79.93	3	94.95	3	79.29	3	-0.64	14
Indonesia	-19.51	16	-20.39	17	-25.79	17	-6.28	15
Mexico	20.53	9	20.03	10	12.83	11	-7.70	16
Singapore	323.04	1	267.94	2	277.78	2	-45.26	17

Note: 1. Abbreviations: the absolute deviation of real GDP per capita (gdp), of the non-agriculture sectoral share (nagri), of the gross capital formation ratio (gcf), and of the urban resident ratio (urb); the in-AP regional imports and exports share (Trade); the in-AP regional FDI inflow share (FDI); and the in-AP regional tourists share (Tour); and the Composite Integration Index (CEII)

2. The values in parentheses are the indicator weights of the CI or CEII.