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Growth and Convergence in ASEAN: A Dynamic Panel Approach

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ABSTRACT

This study investigates the issues of convergence and economic growth in the ASEAN. Preliminary graphical observations find strong evidence of β and σ convergence after the expansion of ASEAN membership. This results support the convergence theory that poor countries in ASEAN do catch up with the rich ones. The convergence and growth effects in the ASEAN integration is estimated by using the dynamic heterogenous panel approach namely Pooled Mean Group Estimator (PMGE). The empirical evidence supports unconditional and conditional convergence hypotheses in the ASEAN5 namely Indonesia, Malaysia, Singapore, The Philippnes and Thailand, for the 1960-2004 period. The ASEAN5 tends to converge to a steady state growth rate of per capita GDP with a speed of convergence of between 1.6% and 16.6%.

Keywords: Regional Economic Integration, ASEAN, Growth, Convergence, dynamic panel approach

INTRODUCTION

The main idea regarding the income convergence effect is based upon the neoclassical growth model developed by Solow (1956), Cass (1965) and Koopmans (1965). If all countries have access to the same 'preferences' such as technology, population rate and investment ratio (savings propensity) but differ in terms of

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their initial levels of per capita income (capital labour-ratio), then all countries should converge to the same steady-state. The Solow model predicts that both poor and rich countries will converge to the same levels of per capita income in the steady state but the poor countries will grow relatively faster than the rich countries[2]. This type of convergence is known as 'absolute β convergence', which Barro (1991) tests using cross sectional analysis and find that the convergence coefficient demonstrates a negative relationship with the average growth rate. However, if country heterogeneity is allowed in variables such as the investment ratio, population, educational attainment or other policy variables, then this type of convergence is said to be 'conditional β convergence'. This kind of convergence is said to converge to the same steady state growth rates but not necessarily to the same levels of per capita income. Hence, there is conditional β convergence if the coefficient of the initial per capita income is negatively related with the average growth rate.

Alternatively, 'σ convergence' is defined in terms of cross sectional dispersion of per capita income across countries (Barro and Sala-i-Martin, 1995). Essentially, the standard deviation of the log of per capita income that decreases over time is used to test for σ convergence. On the one hand, the presence of σ convergence suggests the equalization of income per capita across countries, on the other hand, it does not necessarily imply the presence of β convergence (Sala-i-Martin, 1996).

However, as far as the growth literature is concerned, there are very few studies available the convergence and growth issues covering the ASEAN region. Available literature tends to focus on individual countries in ASEAN and than compare it with leader countries such as the USA and Japan (see Lim and McAleer, 2004; Lee et al., 2005). Therefore, this study aims to provide preliminary evidence related to the convergence and growth by employing dynamic panel data in ASEAN5 (namely Malaysia, Indonesia, Singapore, Thailand and the Philippines) covering the period from 1960 to 2004. The main findings of this study not only filling the gap of the ASEAN studies regarding the convergence and growth literature, but also reeaxamine the development of ASEAN itself after the formation of ASEAN Free Trade Area.

LITERATURE REVIEW

Much of the growth literature is inspired by Barro (1991) Sala-i-Martin (1996) and Mankiw et al. (1992) who empirically tests the convergence theory based on

[2] This happens when capital and output in poor countries grow faster than the population growth rate. Moreover, marginal product of capital relative to labour is higher in the poor countries than in the rich ones, and therefore the poor will accumulate more capital and grow at a faster rate than the rich.

the Solow Growth Model (Solow, 1956; Swan 1956). The convergence theory, based on the neoclassical framework, predicts that both poor and rich countries will converge to their steady state. Since then there have been many empirical studies of the augmented Solow model—using different data, countries, and methodology—with various series of variables that are predicted to have relationship with growth. According to Sala-i-Martin (2002), the convergence issue has become more important because people want to know whether the standard of living for those in poor nations has been improved or has increased more rapidly than that of the richer countries, or conversely whether the rich are getting richer, and the poor are becoming poorer.

The rate of convergence has been a crucial focus of debate since different methodologies have produced different results. For instance, Sala-i-Martin (1996) employed OLS estimation in cross section analysis and found that the speed of convergence was about 2% per year, meanwhile Islam (1995) proposed a panel approach with the inclusion of time invariant country characteristics using Fixed Effects or LSDV[3], and found an extremely high rates of convergence between 3.8% and 9.1%. Alternatively, recent studies have been focusing on the dynamic growth equation in panel estimation by using the Generalised Methods of Moments (GMM) with first difference and the system GMM estimator. The GMM system, which is said to be preferable,[4] yields a speed of convergence about 2% to 4% per annum (see Arrelano and Bover, 1995; Caselli et al., 1996; Blundel and Bond, 1998; Bond et al., 2001).

Recently, some studies have used provincial data to examine the convergence rate. For instance, Ralhan and Dayanandan (2005) apply a GMM first differences technique using Canadian data from 10 provinces for the period 1981 to 2001, and found that the speed of convergence is about 6% to 6.5%. Meanwhile Badinger et al., (2002) estimates the speed of convergence of 196 European NUTS2[5] regions over the period 1985 to 1999 to be 6.9% using the system GMM approach. Similarly, Weeks and Yao (2002) investigate convergence income across provinces in China before and after the reformation period using the system GMM and found that the speed of convergence before the reform period was 0.41%, but there was divergence at a rate of 2.23% during the reform period.

There are also some studies related to the ASEAN countries which have generally analysed income convergence hypothesis in individual countries and compared the results with a leader countries such as Japan and the USA. Lee, Lim and Azali (2005) use the Augmented Dickey Fuller (ADF) test in time series analysis

[3] see also Dela Fuenta (1996); and Tondl (1999)

[4] Caselli et al. (1996) using GMM with first difference found the convergence rate was 10% which similar to LSDV approach.

[5] Nonmenclature of Territorial Units for Statistics 2 (NUTS2)

on ASEAN5 data for the period 1960–1997. They found evidence of divergence of income between Japan and each ASEAN5 country. However, after employing jointly crash and changes, they obtained income convergence between the leader country and Singapore, whereas the other four remained unchanged.

METHODOLOGY

Convergence studies used to be estimated by Ordinary Least Squares (OLS) estimation in cross section analyses (see Barro and Sala-i-Martin, 1991; Levine and Renelt, 1992; de la Fuenta, 1996; Fagerberg and Verspagen, 1996; and Tondl, 1999). However, there are many critics have argued that OLS estimation leads to biased results in which regressors are correlated with the error term. In response to these criticisms, Islam (1995), using Fixed Effect Model (FEM) or Least Square Dummy Variables (LSDV), proposed to set up the analyses within a panel framework in order to control for the individual specific effects such as country characteristics, which are time invariant. However, the convergence rates using this method are found to be extremely high—up to 20% (see also de la Fuenta, 1996; Tondl, 1999).

For this study, the dynamic growth model is applied as proposed by Bassanini, Scarpetta and Hemmings (2001) presented in the following equation:

$$\begin{aligned}\Delta \ln y_{i,t} &= a_{0,i} - \Phi_i \ln y_{i,t-1} + a_{1,i} \ln sk_{i,t} - a_{2,i} \ln n_{i,t} + a_{m+1,i} t \\ &+ b_{1,i} \Delta \ln sk_{i,t} + b_{2,1} \Delta \ln n_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

where Y_{t-1} is the lagged dependent variable which measures the convergence effect which Φ is a covergence parameters, *sk* is the share of investment in GDP, *n* is population growth, and *t* is time trend. The coefficient *b* captures short term dynamics and ε is a country-specific error term.

THE POOL MEAN GROUP ESTIMATION (PMGE)

The empirical analysis is based on a panel data set for five ASEAN countries, mainly from Penn World Tables 6.2 database over the period of 1960 to 2004. The analysis includes a dummy for ASEAN as a proxy for regional economic integration in ASEAN (formed in 1967), and a dummy for AFTA as a proxy for the ASEAN Free Trade Area (established in 1992).

The powerful method in pooled cross country time series namely the Pooled Mean-Group Estimator (PMGE) proposed by Pesaran, Shin and Smith (1999) is used to explain cross-country differences in growth as well as growth performances in the long-run over period. PMGE allows for heterogeneity in the short term

coefficients, but restricts the long-run coefficients to be the same for all countries (Pesaran et al., 1999).

In PMGE, the long run coefficient (*a*'s) will be identical for all countries, however, the intercept, the speed of convergence and the short run coefficient (*b*'s) will differ. The Hausman Test (Hausman, 1978) is used to test the null hypothesis of homogeneity in the long run parameters[6].

Hence, after imposing the long run homogeneity restrictions, the estimated growth equation is as follows:

$$\Delta \ln y_{i,t} = -\Phi_i \left\{ \Delta \ln y_{i,t-1} - \theta_1 \ln sk_{i,t} + \theta_2 n_{i,t} \sum_{j=3}^{m} \theta_j \ln V_{i,j,t} - a_{m+1} t_i - \theta_{0,i} \right\} +$$

$$b_{1,i} \Delta \ln sk_{i,t} + b_{2,i} \Delta \ln n_{i,t} + \sum_{j=3}^{m} b_{j,i,t} \Delta V_{i,j,t} + \varepsilon_{i,t} \qquad (2)$$

where $\theta_s = a_{s,i} / \Phi_i$

Dummies for the ASEAN free trade area are included which represent into three types of dummies: the AFTA dummy is for the twelve years (1993 to 2004) after the free trade was launched; an AFTA97/98 dummy for the period of 1997–1998 where financial crisis hit the region; and an AFTA00 dummy is for the period of 2000-2004, which was a recovery period in most of the region's countries. The ASEAN dummy represents the period when all five countries in Southeast Asia formed the ASEAN in 1967. Finally, the time trend and country specific terms as presented in the equation will also be included[7]. In addition, the long run homogeneity restrictions ($\theta_s = a_{s,i} / \Phi_i$) are checked by the Hausman Test as proposed by Pesaran and Smith (1996) applied in the model selection of specification.

EMPIRICAL ANALYSIS AND DISCUSSIONS

Before empirical testing is applied, a graphical overview will be presented to provide preliminary indication of expected results. Then, the empirical analysis of ASEAN5 and ASEAN8 will be carried out by using the equation derived in the previous section.

[6] However, the hypothesis of homogeneity in the long run parameters cannot be assumed priori and should be tested empirically in all specifications.

[7] Bassanini and Scarpetta (2001) replace the time trend with 5-year time dummy and tested with the null of homogeneity of time dummies across country.

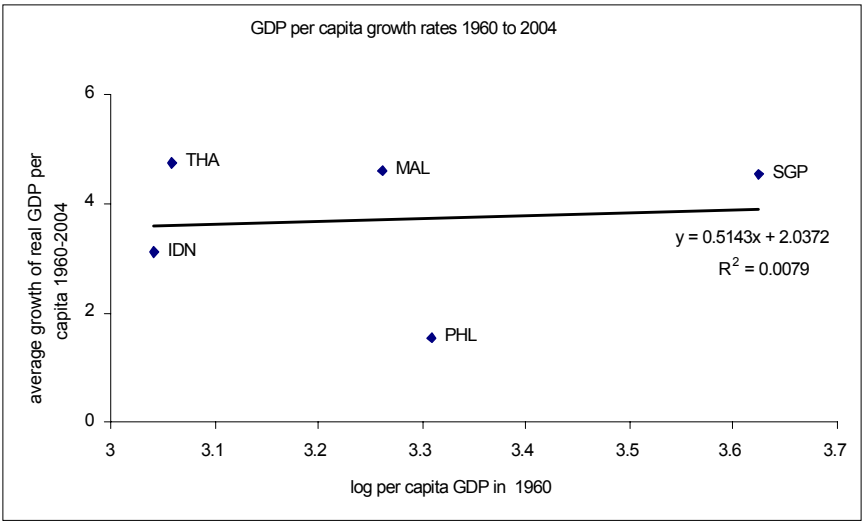

Figure 1 GDP per capita growth rates in ASEAN5 from 1960 to 2004

Convergence/Divergence: Graphical analysis

A scatter plot for ASEAN5 (Figure 1) provides a preliminary indication of income convergence/divergence in ASEAN for the period 1960 to 2004. Positive relationship between the log of GDP per capita in 1960 and the average growth rate shows that there is no evidence of (unconditional) β-convergence within the sample period.

In addition, Figure 3 presents a scatter plot after the formation of AFTA took place. From these figures, there is no evidence of income β-convergence before and after the formation of AFTA. However, the slope in Figure 2 is slightly flatter than that in Figure 3.

Figure 4 represents the evolution of the standard deviation of GDP per capita from 1960 to 2004. Before the formation of AFTA, the positive trend over time represents evidence of σ-divergence until 1997, when financial crisis hit most of the ASEAN countries. The subsequent trend of diminishment over time provides some evidence of σ convergence.

Further investigation found that there is evidence of σ-convergence as well as β-convergence after the expansion of ASEAN membership from five to ten[8] for

[8] However, in this study the countries involved are only nine in number, with Brunei having been dropped due to of lack of data.

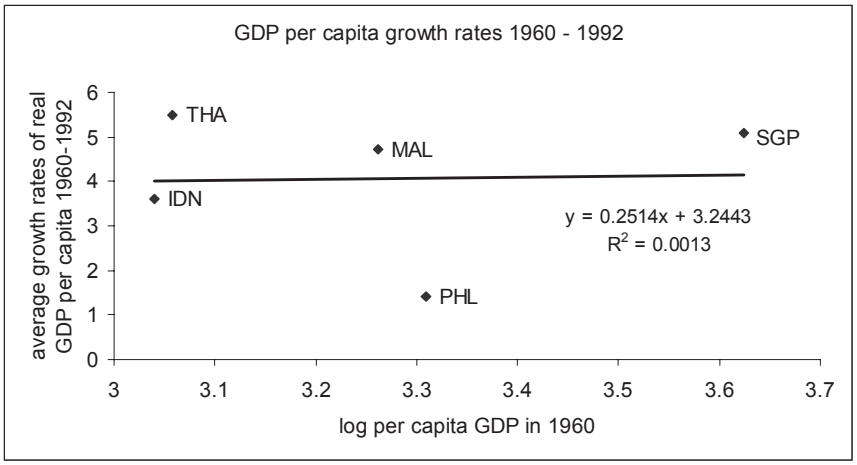

Figure 2 GDP per capita growth rates for ASEAN5 from 1960-1992 (Pre AFTA)

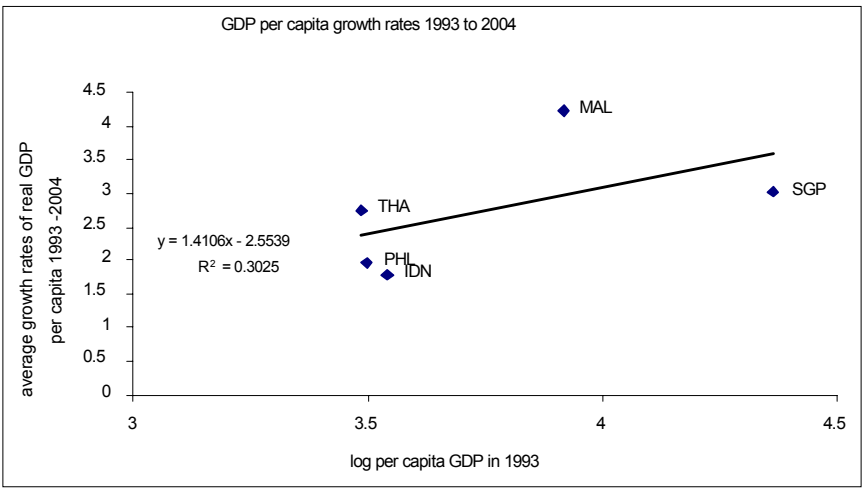

Figure 3 GDP per capita growth rates for ASEAN5 from 1993-2004 (Post AFTA)

the period 1993 to 2004 as presented in Figures 5 and 6. The trends for the standard deviation of log per capita GDP between the original members and the new ASEAN members also coincide with each other, indicating that the income gap between these two groups of economies has been narrowing over time. The fact that convergence theory predicts that poorer countries grow faster than relatively rich

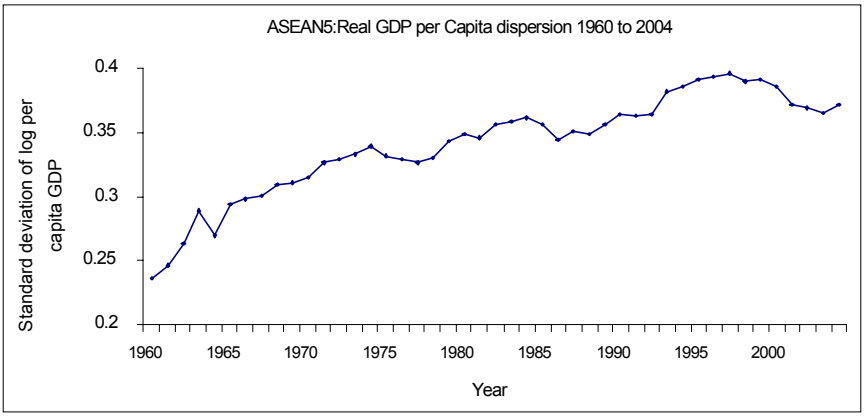

Figure 4 Real GDP per Capita dispersion in ASEAN5 (1960 to 2004)

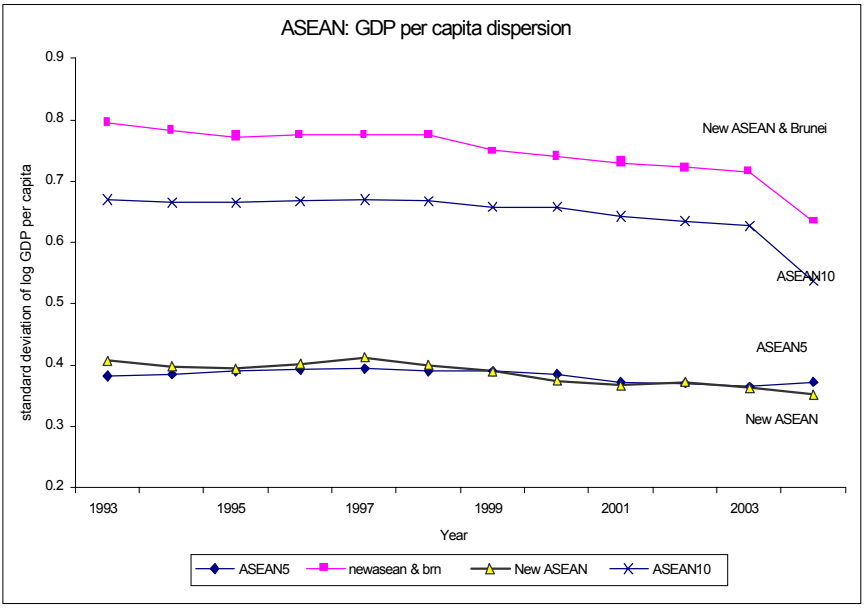

Figure 5 GDP per capita dispersion in ASEAN (1993-2004)

ones may explain these phenomena. The same pattern also appears in Figure 6 as the line trend indicates a negative relationship between the average growth rates and the initial GDP per capita in 1993.

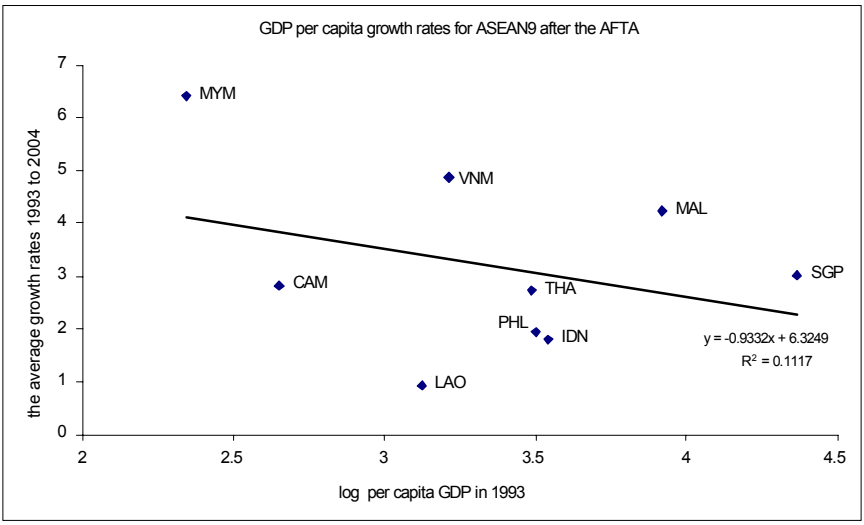

Figure 6 GDP per capita growth rates in ASEAN9 (post AFTA)

Unconditional Convergence in ASEAN5

Table 1 presents the results for unconditional convergence in the ASEAN5 by employing the Pooled Mean group Estimation. In this estimation, a simple AR(1) model which includes the lagged dependent variable and dummies for ASEAN and AFTA is estimated. Both coefficients on the dummy variables are positive but

Table 1 Unconditional convergence with the ASEAN dummy: 1960 – 2004

Dependent Variable: Log of GDP per capita					
	Coefficient	**St.error**	**t-ratio**	**Hausman test**	**p-value**
ASEAN	0.836	0.193	0.333	1.22	0.27
AFTA	0.040	0.127	0.316	1.24	0.26
Constant	0.122***	0.038	3.229		
Convergence coefficient	-0.038***	0.012	-3.033		
No of observations	215				
Log likelihood	512.261				

Notes: ***, **, * denote 1%, 5% and 10% level of significance respectively. The Hausman test accepted the null hypothesis that the homogeneity restriction imposed in the long run coefficient.

insignificant. However, the convergence effect is negative and significant at about 3.8% which suggests evidence of unconditional effects in the ASEAN dummy for about 45 years starting in 1960. The Hausman test of the homogeneity assumption for the long run coefficient (in this model, only dummies for ASEAN and AFTA) is accepted.

Conditional Convergence in the ASEAN5

Table 2 presents the conditional convergence analysis which includes not only convergence variable (the lagged dependent variable) but also the additional variables as in the Solow model, namely the sum of population growth, exogenous growth and depreciation ($n+g+d$), as well as the log share of investment (physical capital). In column (1) both coefficients have the expected sign and are highly significant, with the coefficient for population growth being negative and the investment share positive. This confirms the results of earlier findings such as Caselli et al. (1996), Bond et al. (2001), and Bassanini et al. (2001) albeit from a different sample of countries and methods. The convergence coefficient, which

Table 2 Conditional convergence with and without ASEAN dummy from 1960 to 2004

Dependent Variable: log of GDP per capita								
	(1)		(2)		(3)		(4)	
(n+g+d)	-0.055***	(0.019)	-0.163***	(0.033)	-0.283***	(0.085)	-0.538***	(0.255)
Sk	0.004***	(0.001)	0.012***	(0.003)	-0.009	(0.007)	-0.050	(0.033)
ASEAN					0.880**	(0.352)	1.413***	(0.670)
AFTA			0.126	(0.023)	-0.050	(0.149)	-0.131	(0.798)
AFTA97/98							-1.407*	(0.817)
AFTA (2000-04)							-0.773	(0.523)
Convergence coefficient	-0.166***	(0.051)	-0.067	(0.061)	-0.022**	(0.010)	-0.016**	(0.008)
Trend	0.003***	(0.001)						
Constant	0.563***	(0.176)	0.263	(0.226)	0.091**	(0.034)	0.087**	(0.034)
No. Observation	208		213		218		218	

Notes: ***, **, * denote 1%, 5% and 10% level of significance respectively. The numbers in parentheses are the Standard errors. All regressions include short-run dynamics terms. The Hausman test accepted the null hypothesis that the homogeneity restriction imposed in the long run coefficient.

represents the speed of adjustment, is negative and highly significant, suggesting that the GDP per capita in the ASEAN5 countries will converge to the common steady-state path at 17% per annum. The Hausman test also fails to reject that the homogeneity restriction has been imposed in the long run coefficient. However, the individual speed of convergence for ASEAN5 member's ranges from the low of 4 percent for Thailand followed by Indonesia (13%), Singapore (14%), and The Philippines (17%) to the highest of Malaysia of about 35%.

The three specifications present the estimation of conditional convergence but with the inclusion of dummies such as ASEAN, AFTA, AFTA97-98 and AFTA00-04. In column (2), the dummy for AFTA is positive but insignificant and the convergence coefficient, even though negative, is also insignificant. However, with the inclusion of the ASEAN and AFTA dummies in column (3) results in only the coefficient of the ASEAN dummy being positive and significant. This estimation implies that the positive growth after the five ASEAN countries formed the regional corporation in 1967 until 2004 led to a positive growth in per capita GDP. The convergence coefficient is also significant at about 2.2%. Finally, in the last specification, all ASEAN/AFTA dummies are included, however only the coefficients for ASEAN and AFTA97-98 are significant. The AFTA dummy shows no effect on growth. This result is quite similar to Vanhoudt (1999) and Vamvakidis (1999), who found that regional economic integration through RTA or FTA has no impact on growth. The coefficient for the ASEAN dummy is positive and higher than in the specification (3) showing a positive growth in income per capita with ASEAN membership. Conversely, the dummy for AFTA 97/98 is negative which reflects that for two years, during the financial crisis, income per capita in the ASEAN countries was decreasing. This result is quite similar to Barro (2001), who found that South Korea and the ASEAN countries (except Singapore) experienced a sharp initial decline in GDP per capita for about one year and sharply appreciated in 1998 which was described as a V-pattern of GDP growth.

In summary, there is evidence of unconditional as well as conditional convergence in ASEAN for a panel spanning 1960 to 2004. The speed of convergence ranges from 1.6% to 16.6%. The formation of ASEAN was positively associated with growth. However, the free trade area in ASEAN did not have any significant impact on growth.

CONCLUSIONS

In this study, convergence and growth effects in the ASEAN region are estimated using a dynamic, heterogeneous panel approach, namely pool mean group estimation. The panel was estimated in two stages, where both covered the full period from 1960 to 2004 for the five original members in ASEAN. The first stage tests for unconditional convergence hypothesis, meanwhile, the second stage

includes population growth and the share of capital to test for conditional hypothesis.

In preliminary graphical observation, β and σ convergence were examined to see whether intra regional inequality increased or decreased, particularly after the AFTA was launched. The evidence found neither of β nor σ-convergence in ASEAN5 throughout the period 1960 to 2004. However, a scatter plot of GDP per capita revealed that there is evidence of β and σ-convergence during the period of AFTA (1993-2004). Based on graphical observation, after the expansion of ASEAN membership, the income gap between regions appears to have been decreasing. This results support the evidence that poor countries in the ASEAN do catch up with the rich ones.

The econometric application supports both the unconditional and the conditional convergence hypotheses. Hence, the ASEAN5 tend to converge to a steady state growth rate of per capita GDP with a speed of convergence of between 1.6% and 16.6%.

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