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The Role of Domestic Private Investment in Promoting Per Capita Income Convergence amongst ASEAN-5 Economies

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Abstract

Using data spanning 1980-2014, this study investigates the phenomena of per capita income convergence across a panel of ASEAN-5 economies. The study also delves on the role of domestic private investment in facilitating per capita income convergence amongst the economies. Employing SURADF test to investigate per capita income convergence of the countries to the group average, it was observed that, as opposed to Malaysia and Singapore, economies of Indonesia, Philippines and Thailand tend convergence to the group average. On the impact of gross domestic investment on per capita income convergence, results from system Generalized Method of Moments (GMM) indicate that GDP gap ratio between a pair of economies tend to diminish with a reduction in the gross domestic investment gap ratio between the economies.

JEL Classification*: *E31, E52, E58

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1. Introduction

One of the major implications of neoclassical growth theory is that relatively poor economies, with low initial per capita, tend to grow faster than relatively richer ones to a point where convergence in per capita income across world economies would be achieved. On the whole, the economic convergence proposition rests upon two assumptions: diminishing marginal return on physical capital and technological gap (Khan & Kumar, 1993).

One of the assumptions of neoclassical growth model of Solow (1956) is that relatively poor economies have low capital to labour ratios compared to the richer ones. As a result, capital investment in such economies with low capital-labour ratios is expected generate higher returns on capital than in the relatively richer economies. Furthermore, in search for higher returns on investments, international capital flows from economies with relative capital abundance to economies where relative capital scarcity exists. Consequently, poor economies would grow faster than the richer ones. Investment is very central the idea convergence. This is the case because the rate of return on investment is an important determinant of catch-up among economies. Therefore, the high the volume of investment in a low-performing economy, the higher the chances that the economy would do better in terms of catch-up.

The second basis for income convergence has to do with technology transmission. Richer economies have high stock of technology relative to the poor ones and as a result technology is transferred from richer economies to the poor ones. However, the rate of technology absorption of a country is a positive function of technology gap between the economy and world technology stock. Hence, relatively poor economies would growth faster than the richer ones.

Recent decades have witnessed proliferation of studies aimed at testing the validity of convergence hypothesis as well as exploring on various determinants of convergence. By and large, it can be said that results emanating from cross-section and panel data studies are supportive of the convergence hypothesis. Prominent among cross-section based studies include: Kormendi and Meguire (1985), Baumol (1986), Grier and Tullock (1989), Barro and Sala-i-Martin (1992) and Rodríguez-Pose, Psycharis and Tselios (2012). On the other hand, Knight, Loayza and Villanueva (1993), Islam (1995), McCoskey (2002), Weeks and Yao (2003) and Lei and Tam (2010) are among the famous studies that used panel data. In contrast to cross-section and panel data related studies, time-series based studies, such as Carlino and Mills (1993), Aubyn (1999), Cellini and Scorcu (2000) and Habibullah, Dayang-Affizzah and Puah (2012), reported more conflicting findings. However, despite such efforts, there appears to be an apparent neglect on investigating the role domestic investment in determining per capita income convergence in general and particularly ASEAN-5 economies. Therefore, this study seeks to examine the role of domestic investment in achieving per capita income convergence amongst the ASEAN-5 countries. The paper further delves on the performance of individual economies in terms of achieving convergence the group average. In addition to conventional unit root testing procedures, the paper utilized an alternative approach based on seemingly unrelated regression augmented Dickey-Fuller (SURADF).

ASEAN-*5* comprises of: Indonesia, Malaysia, Philippines, Singapore and Thailand. The economies are pioneer member of Association of Southeast Asian Nations (ASEAN). Present membership composition of the association is made up of 10 economies, the additional ones being Brunei, Cambodia, Lao DPR, Myanmar and Vietnam. ASEAN-*5* economies are considered suitable sample for the fact that the economies for a couple of reasons. The countries are the pioneer members of the association, and as a result forming a better sample to explore the extent to which the association achieve its first objective of accelerating "the economic growth, social progress and cultural development in the region through joint endeavours ….". Given the fact that one of the cardinal objectives of establishing the group has to with achieving economic growth, and by extension economic convergence, investment is required.

To provide some insight on economic performance amongst ASEAN-5 countries, the rankings of 10 year average per capita GDP of the countries over the period 1960-2014 are presented in Table 1. For the entire period under review, Singapore maintained the lead in terms of average annual per capita GDP. The economy has not been overtaken throughout the period. As for the Malaysian economy, it was also observed that the economy maintained consistent performance, ranking second for the whole sample period.

Table 1
Real GDP per capita ranking ASEAN-5 economies

Country	1960-69	1970-79	1980-89	1990-99	2000-09	2010-14
Indonesia	5	5	5	4	4	4
Malaysia	2	2	2	2	2	2
Philippines	3	3	4	5	5	5
Singapore	1	1	1	1	1	1
Thailand	4	4	3	3	3	3

Philippines on the other hand ranked third, next to Malaysia, for the decades 1960-1969 and 1970-1979 before being overtaken to rank forth for the subsequent decade – 1980-1989 – by the Thailand economy. Prior to overtaking Philippines in 1980-1989 to rank third for the rest of period under review, the Thailand economy ranked forth for the decades 1960-1969 and 1970-1979. Finally, for the first three decades reviewed (1960-1969, 1970-1979 and 1980-1989) Indonesia ranked fifth and forth for the last three decades. The ranking provided above may not be unrelated to the capital stock available in each economy and rate of return on investment.

Furthermore, figure one shows plots for the standard deviation, as a measure of convergence, for both per capita income and gross domestic fixed capital formation over the period under review for the ASEAN-5. As can be observed, both measures depicts similar pattern, except for the period 1998 to 2002, when the convergence in gross domestic capital formation increased as shown by fall in the standard deviation.

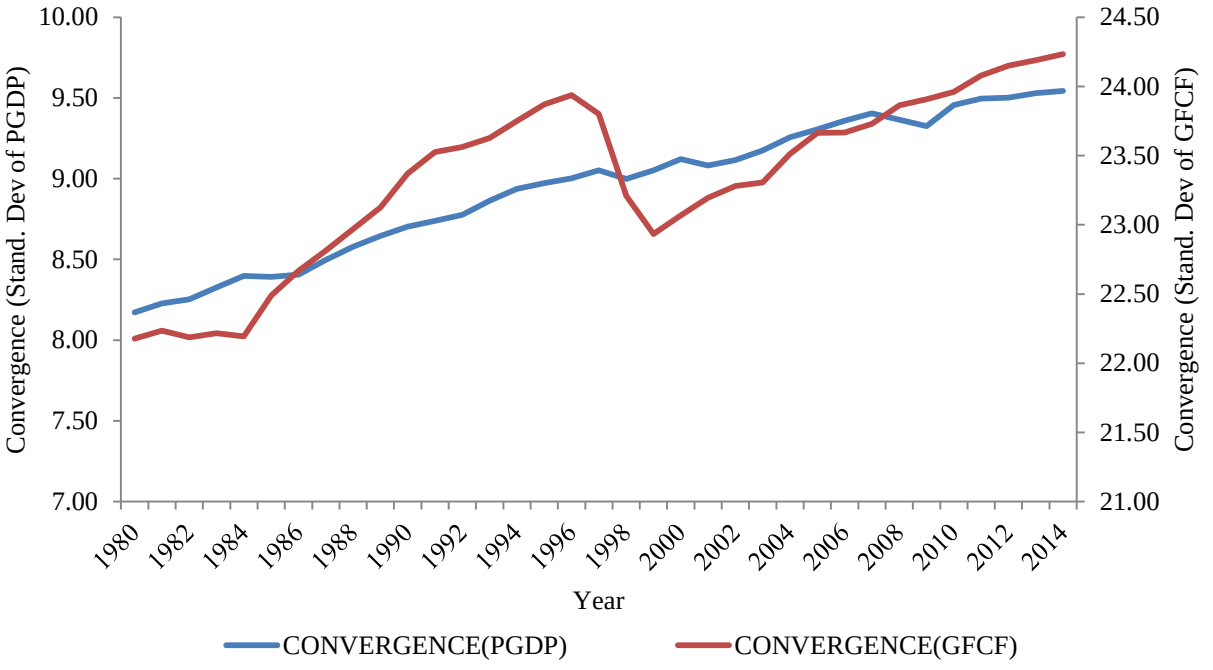

Figure 1
Convergence in per capita GDP and gross fixed capital formation, 1980-2014

The rest of the paper is structured into three sections. Section two hosts methodology. Section three contains empirical results. Finally, section four provides policy implications and conclusion.

2. Methodology

Data

Data covering the period 1980-2014 on the variables of interest were obtained from the World Bank. Our choice of timeframe for the study was mainly influenced by data availability. In order to remove the inherent cyclical effect present in most macroeconomic time series data, we follow the common practice of averaging data points over five year non-overlapping periods. Thus, arriving at seven observations per variable for each panel member.

Empirical model

In the standard literature of economic convergence, GDP deviations are calculated using three alternatives: deviation of individual economies from their group average; difference between the GDP of a particular country and that of a chosen reference economy; and pair-wise output differences of all possible pairs for a given sample of economies.

Following Ben-David (1993) and Ben-David and Bohara (1997), for a sample of n economies with annual per capita GDP given by y_{it} and its average as $\bar{y}_t$, convergence or divergence of incomes can be described by an estimation of Equation [1]

[1] $$y_{i,t} - \bar{y}_t = \Phi(y_{i,t-1} - \bar{y}_{t-1}) + \epsilon_{i,t},$$.

If $\Phi < 1$, it shows evidence of per capita income convergence. Letting $z_{it} = y_{it} - \bar{y}_{it}$ and $z_{i,t-1} = y_{i,t-1} - \bar{y}_{t-1}$, Equation [1] can be written as

[2] $$z_{it} = \Phi z_{i,t-1}.$$

Furthermore, Equation [2], according to Nelson and Plosser (1982), can be presented in an ADF framework as

[3] $$z_{it} = \Phi_i z_{i,t-1} + \sum_{j=1}^{p} \delta_{i,j} \Delta z_{i,t-j} + e_{i,t}$$

Therefore, testing the hypothesis that $\Phi < 1$ narrows down to a unit root test using ADF approach.

In this study, seemingly unrelated regression ADF (SURADF) procedure is employed to test the convergence hypothesis using equation [3]. SURADF was proposed in Breuer, McNown and Wallace (2001, 2002). The approach entails performing ADF unit root test within the framework of SUR. The method offers a number of advantages over single equation ADF and other traditional panel data unit root testing procedure. The main disadvantage associated with SURADF method is the lack of standard distribution. Simulations using the underlying dataset have to be carried out in the course of using the method. Critical values for the SURADF test were generated by simulation using 10,000 replications using the underlying dataset. Two alternatives are commonly employed in testing the hypothesis that $\Phi < 1$ in economic convergence literature: One, employing the traditional time-series based single equation ADF test. Two, pooling data to perform a panel data based unit root test, as ones due to Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003). However, both single equation ADF test and traditional panel data unit root testing procedures suffer some drawbacks.

At least within the context of testing the convergence hypothesis across a sample of economies located within a given region, conclusions based single equation ADF may be erroneous. This is the case because such economies, as the case of ASEAN-5, are very much unlikely to be independent. As noted in Ben-David and Bohara (1997), in such instances, the error covariance structure of ϵ_{it} is not a diagonal one. This by implication implies that shocks transmit across sampled countries and thus results based on single equation ADF test can be inaccurate. As for the traditional

panel data based unit root test procedures, rejecting the null hypothesis that a given series does not contain a unit root does not mean that the series are independently stationary for each of the panel members. In other words, traditional panel unit root testing methods cannot be used to detect the mix of I*(0)* and I*(1)*in a panel setting (Breuer *et al.*, 2001). Taking into account these issues, we resort to SURADF method to test the convergence hypothesis for the ASEAN-5 economies.

Given the assumption that marginal return on investment, and by extension economic growth, is a negative function of capital-labour ratio in a given economy, it is logical to believe that as the of capital-labour ratio of two economies converge, the growth rate gap between the economies diminishes. It is against this background that this study hypothesised that for any pair of countries, GDP gap ratio is a positive function of domestic capital formation gap ratio as depicted by Equation [4].

$$[4] \quad PGDPR_{ijt} = PGDIR_{ijt} + GFCER_{ijt} + TOPNR_{ijt} + \epsilon_{ijt}$$

where:

$PGDPR_{ijt} = |PGDP_{it} - PGDP_{jt}|/(PGDP_{it} + PGDP_{jt})$,
$GDIR_{ijt} = |PGDI_{it} - PGDI_{jt}|/(PGDI_{it} + PGDI_{jt})$,
$GFCE_{ijt} = GFCE_{it} + GFCE_{jt}/2$,
$TOPN_{ijt} = TOPN_{it} + TOPN_{jt}/2$,
ε_{it} is the error term and subscripts *i, j and t* account for data points for countries *i* and *j* in year *t*.

The variables used in this study to estimate Equation [4] are GDP per capita (PGDP), gross domestic investment (GDI), government final gross consumption expenditure (GFCE) and trade openness (TOPN). With the exception of trade openness, which is measured as a total trade share of GDP, all other variables are measured in constant USD. Following Choi (2004, 2009), this study pooled series gap pairs for 10 possible pairs of countries in estimating the hypothesized relationship[†]

Equation [4] was estimated using Model 1, Model 2 and Model 3. Model 1 estimates the relationship between PGDPR and GFCF alone. Model 2 estimates the relationship between the variables of interest, controlling for TOPN. Finally, in Model 3 we control for both GFCE and TOPN. Generalized method of moments (GMM) proposed in Blundell and Bond (1998) was used in estimating the relationship. Parameter estimates using system-GMM are more consistent when handling data with shorter time span.

3. Empirical Results

Unit root test

Table 2 shows SURADF test results. The test was performed on the deviation series (y_{it}-$\bar{y}_t$) for each economy. For comparison purposes, we perform both ADF and SURADF tests on the series. As the table shows, the economies of Indonesia, Philippines and Thailand show evidence of convergence to the group average over the period 1960-2014. However in Malaysia and Singapore the null hypothesis of no convergence cannot be rejected over the sample period.

Table 2
Unite Root Test Results

Country	***t*-statistic**	**SURADF critical values**

[†] The pairs are: Indonesia-Malaysia, Indonesia-Philippines, Indonesia-Singapore, Indonesia-Thailand, Malaysia-Philippines, Malaysia-Singapore, Malaysia-Thailand, Philippines-Singapore, Philippines-Thailand and Singapore-Thailand

	ADF	SURADF	0.01	0.05	0.10
Indonesia	-4.356[1]*	-3.391[1]*	-2.706	-1.932	-1.498
Malaysia	-2.232[1]	-1.075[1]	-2.935	-2.154	-1.724
Philippines	-0.358[1]	-3.477[1]*	-2.796	-2.027	-1.605
Singapore	-0.890[1]	-1.560[1]	-2.903	-2.118	-1.691
Thailand	-2.316[1]	-1.831[1]**	-2.912	-2.197	-1.786

Note: a) * and ** indicate rejection of the null hypothesis that real per capita GDP of a particular economy is not converging to the group average at 5% and 10% levels of significance, respectively.
b) numbers in brackets represent the lags included to ensure that serial correlation is removed.
c) the critical values for ADF test statistic are: -4.143, for 1% level of significance; -3.497, for 5% level of significance; and -3.178, for 10% level of significance.
d) ADF test was carried out including both intercept and trend.
e) critical values for SURADF are generated by Monte Carlo simulation using 10,000 replications based on the underlying dataset.

System GMM estimation

Table 3 contains estimation results of Model 1, Model 2 and Model 3. Results for Model 1 show a positive relationship between the gap ratios of real GDP per capita and that of real gross domestic investment per capita. The relationship is statistically significant at 10 percent level of significance. According to the results, on the average, one percent increases in the level of real gross domestic investment gap ratio between two economies leads to a 0.17 percent increases in the GDP gap ratio amongst the ASEAN-5 economies. By controlling for trade openness in Model 2, the estimated parameter for gross domestic investment increases to 0.34. This suggests that the convergence is stronger after controlling for the average trade openness for each pair of economies. The relationship is also statistically significant at five percent level of significance. Model 3 that controls for the government final consumption expenditure and trade openness also indicate that lower GDP gap ratios are associated with low GDP gap ratio amongst the ASEAN-5 countries. On the average, a one percent decreases in the gross domestic investment gap ratio tends to lower real GDP ratio by 0.36 percent. The relationship is also statistically significant at five percent.

Table 3
System GMM estimates on the relationship between per capita income convergence and gross domestic investment

Regressors	Model 1	Model 2	Model 3
$LGDIR_{ijt}$	0.174 [0.090]**	0.341 [0.099]*	0.360 [0.103]*
$LOPN_{ijt}$		0.031 [0.005]*	0.033 [0.010]*
$LGFCE_{ijt}$			0.685 [0.420]
CONSTANT	-10.792 [2.240]*	-16.2397 [4.452]*	-28.606 [8.636]*

*Note:*a) * and ** indicates that a parameter estimate is statically significant at 5% and 10% levels of significance, respectively.
b) Numbers in brackets are standard errors.

4. Policy implications and conclusion

Findings from the study show a positive link between gross domestic investment gap ratio and real GDP gap ratio (convergence). This implies that gross domestic investment plays a significant role in facilitating per capita income convergence across ASEAN-*5*. In other words, as two economies become similar in terms of gross domestic investment, the GDP gap ratio between them shrinks. In line with this finding, it is recommended that governments in ASEAN-*5* should strengthen the existing investment promotion policies and create new incentives (both tax and non-tax) policies capable of enhancing domestic private investment in order to facilitate convergence across the economies.

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