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**The Analysis of Income per Capita Convergence
on ASEAN *Plus Three* (APT) Countries**

Any Fatiwetunusa

Central Bureau of Statistics (BPS)
South Sumatera
anypoenya@gmail.com

Syamsurijal

Universitas Sriwijaya
syamsurijalkadir@gmail.com

Sa'adah Yuliana

Universitas Sriwijaya
saadah_yuliana@yahoo.com

Abstract

The main objective of this study is to test the convergence of income per capita in APT countries through three models: absolute convergence, conditional convergence and sigma convergence. Regression analysis of panel data from 13 APT countries during the period of 2001-2014 is used to analysed to study problem. In absolute convergence model, the growth of real GDP per capita and initial real GDP are used as the variables, meanwhile, 8 variables such as the growth of real GPD per capita, initial real GDP per capita, labor force ratio, value added in agricultural sector, value added in industrial sector, terms of trade, foreign direct investment and internet users ratio are analyzed in conditional convergence model. According to the Solow model, the economies of the countries will converge in which the growth of income per capita of developing countries will be higher than those of developed countries. The economies will be convergent if the countries tend to move to a similar steady state resulting in smaller gap between the countries. Based on the results of absolute convergence and conditional convergence models, APT countries is converging with the rate of 2% and 2.2%. This is consistent with the results of sigma convergence model that shows a declining trend in the dispersion of real GDP per capita in APT regions. The growth of real GDP per capita is influenced by initial GDP per capita, labor force ratio, value added in agricultural sector, value added in industrial sector, terms of trade, foreign direct investment and internet users ratio. Developed countries such as Singapore, Brunei

Darussalam and South Korea experience the impact of high real GDP per capita growth. On the contrary, Indonesia, Laos, Vietnam and The Phillipines undergo the impact of low GDP per capita growth.

Keywords: Convergence, Labor Force, Terms of Trade, Foreign Direct Investment, Panel Data

INTRODUCTION

Economic development can be defined as a process undertaken by the state in order to develop economic activities and living standards of the community. This economic development process leads to an increase in real income per capita of a country's population in the long term (Arsyad, 2015). The increase reflects additional income and improvements in people's economic welfare.

The cooperation of the Association of Southeast Asian Nations (ASEAN) was a geopolitical and economic organization that established on August 8th, 1967. In 1997, ASEAN cooperation was expanded with much more developed countries such as China, Japan and South Korea, then becomed ASEAN Plus Three (APT). In APT, doing cooperation in trade, investment, finance and banking, technology transfer, telematics technology, e-commerce, industry, agriculture, small and medium enterprises, tourism, business networks, science and technology (The ASEAN Secretariat, 2016). Based on income per capita, Brunei Darussalam, Singapore, South Korea and Japan are included in the category of high income countries according to the World Bank. While Thailand, Malaysia, and China including the upper middle income countries and other member countries are still including in lower middle income.

According to Solow's (1956) model, if developed countries have reached full employment conditions, they would be difficult to change or improve their economic condition, since they have reached the maximum conditions in all aspects. While developing countries will continue to change into the steady state. The addition of new capital through investment will increase the income of the country, so it will continue to move towards its steady state. If the process occurs in the economies of countries then it will create a convergence process, where the movement of income of each country is going in the same direction.

There are generally two main concepts of income convergence in the literature namely sigma (σ) convergence and β convergence (Rey and Montouri, 1999). The usefulness of sigma convergence (sigma convergence) is to measure the dispersion of per capita income growth. According to Ray (1998), beta convergence (β convergence) can be measured in absolute and conditional terms to determine the effect of factors that are predicted to determine convergence.

This study will examine whether the process of convergence submitted by Solow occurs in the economic conditions of countries in the APT region. In other hand, the entry of developed countries into ASEAN can effectively assist the

development of developing countries in the ASEAN region itself, besides, such cooperation can also increase competition among member states.

LITERATURE REVIEW

Solow Neoclassical Growth Model

Convergence is defined as the tendency of a poor economy to grow with a high per capita income level compared to a rich economy, so that the economy will develop to reduce the gap in aligning itself with an advanced economy (Barro, 2015). The economy can be called as convergent if the countries tend toward the same steady state point so that the income gap between countries is getting smaller.

The concept of convergence of per capita income between countries can not be separated from the concept of economic growth. The Solow growth model (1956) makes an important contribution to economic growth using the Cobb-Douglas production function. The Solow model uses the assumption of constant return to scale and diminishing return on each input and positive substitution elasticity between inputs. The Solow Growth Model predicts that the economy tends to converge in a steady state, ie a balanced path in which each variable in the model grows at a constant rate.

Dynamic Solow-Swan Growth Model

Barro and Sala-I-Martin (2004) stated that capital consists of all physically identifiable inputs, such as machines, roads, computers, and buildings. Input has a general characteristic of physical goods required in producing a good, not consumed, and can still be used for subsequent production. This capital input is a determinant of the output of the economy, while labor is the input that represents and is closely related to the physical human being. The inputs include the amount of labor, the amount of time spent working in relation to the physical strength, health conditions, and skills possessed by the workers. Input labor varies over time due to the influence of population growth, changes in labor force participation rate, shifts in the amount of time worked, skills improvement and work quality.

Endogenous Growth Model

The catch up model of the endogenous growth theory argues that technological developments in a country will depend on how far the technological level lags behind the most developed country (Lucas, 1988). The technology transfer function of this model suggests that the further the technological level of a country lags behind the most developed country, the faster its technological development will be. The reason for this argument is simple, if a country has a far away economic downturn, then the country can do the technology inexpensively so that it will have a fast rate of technological development. Even some technology transfer is much cheaper than other transfers (like imitation

technology for example). But if a country already has a high level of technology, all the country can do is improve its technology knowledge by investing in the creation of new ideas, something much more expensive than technology transfer or imitation. For this reason, the pursuit model of endogenous growth to the convergence hypothesis, low-tech states will take the greatest advantage in technology transfer so that it will experience the fastest per capita output growth.

Balanced Development Strategy

Lewis (1954) emphasized the need for balanced development based on the benefits that be gained from the interdependence of the various sectors, namely between the agricultural sector and the industrial sector, and between the domestic and foreign sectors. According to Lewis (1954), there will be many problems if the development effort is focused on one sector only. Without the balance of development between various sectors will lead to instability and disruption to the smooth economic activities so that the development process is inhibited. If the industrial sector undergoes rapid growth, then the sector will be able to absorb surplus food production and surplus labor. The increase in production of the industrial sector is an import substitution, so the savings can be used to import agricultural goods. However, if it is not an import substitution, while the agricultural sector is not developing, the price of agricultural goods will rise or imports will increase, resulting in a deficit in the balance of payments. However, if the export sector develops, the deficit can be avoided as an increase in imports will be offset by an increase in exports.

Previous Research

Chikte (2011) conducted a study of convergence of earnings in India from 1970 to 2005. There has been a sigma divergence in the research period for per capita income. The same thing is true of using conditional convergence models, that there is a per capita income divergence using income per capita control variables, population growth, literacy rates, number of credits, and government spending.

Mutaqin and Ichihashi (2012) conducted a study to analyze the income convergence ratio from 1990 to 2009 using panel data analysis of ASEAN countries and Eurozone (Euro Area) members. The control variables used in the conditional convergence model are the rate of inflation, interest rate, exchange rate, government budget, and government debt. The results suggest that both the Eurozone and ASEAN are conditional or absolute experiencing convergence of income among countries included in each region.

Kaitila (2014) conducted a study on the convergence of per capita GDP of the EU member states of the period 1960-2012. Using the convergence of GDP per capita sigma convergence, the result is convergence will become faster when GDP growth also increases. In the research period of 1960 to 2012, there was a per capita GDP convergence among the EU member states but this

convergence process got shocked from the global financial crisis at the end of 2012.

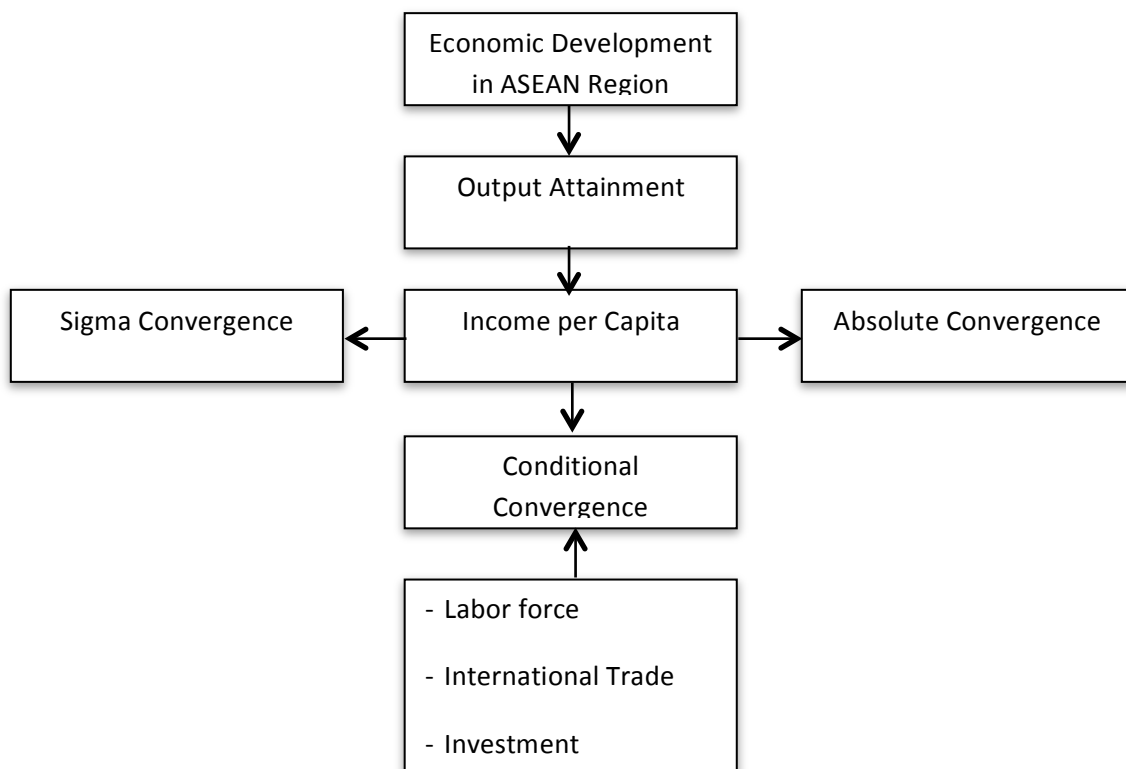
Barro (2015) conducted a convergence study using panel data of 28 countries. The estimation results from 1870 to 2005 are 2.6% for the annual conditional convergence rate. The result is not much different from Convergence Iron Law which states that the annual conditional convergence rate for GDP per capita is 2% per year. The annual conditional convergence rate of 2.6% means it takes 35 years to remove half the initial gap for poor countries to follow GDP growth per capita of developed countries. Or in other words, it takes 90 years to remove 90% of the initial gap in GDP growth per capita of poor countries against developed countries.

Dey and Neogi (2015) conducted research on convergence of per capita GDP using sigma convergence and absolute convergence. Observations were made on China and 7 (seven) countries joined in the South Asian Association for Regional Cooperation (SAARC) from 1970 to 2011. Using panel data, convergence occurred among SAARC member countries and with the cooperation between China with SAARC has had a positive effect with the acceleration of time range of convergence attainment. Looking at the value of the coefficient of variation decreasing from 1970 to 2011, and the significant absolute convergence coefficient in the model used becomes evidence that the convergence process has occurred.

Theoretical Framework

Theoretical framework in this study is arranged as below.

Figure 1. Theoretical Framework



As a region, the welfare of the APT population depends heavily on the income per capita of each country as a result of the economic development process. Through this research will show how the pattern of income per capita APT region is, how fast the convergence or divergence that occurs, and what factors influence it. Countries that can take advantage of the economic globalization well will produce an increase in output, but for countries that can not compete with other countries will cause the country to become poorer.

Panel data analysis was conducted on 13 countries in the APT region from 2001 to 2014, to see whether the economic development process has been heading towards convergence or divergence.

Hypothesis

Hypothesis in this study is as follows:

H₁ : The initial real GDP per capita has a negative effect on growth of real GDP per capita.

H₂ : The ratio of labor force, the added value of the agricultural sector, the value added of the industrial sector, the terms of trade (TOT), the foreign direct investment (FDI), and the ratio of internet users have a positive effect on growth of real GDP per capita.

METHODS

Research Scope

The object of this study is APT countries, such as Cambodia, Myanmar, Laos, Vietnam, Philippines, Indonesia, Thailand, Malaysia, Brunei Darussalam, Singapore, China, South Korea, and Japan in period 2001 until 2014.

Type and Source of Data

This study uses secondary data, which is originated from World Bank publication in the form of World Development Indicators and data that is originated from Central Bureau of Statistic (BPS) publication in the form of Indonesia Economic and Statistic indicator.

Data Analysis Techniques

In general, there are two main concepts of income convergence in the literature (Rey and Montouri, 1999). The two concepts are sigma (σ) convergence and beta (β) convergence. The usefulness of sigma convergence is to measure the dispersion of income growth per capita. The formula of calculating the sigma convergence is:

$$CV = \frac{\sigma}{\mu}$$

CV is the coefficient of natural logarithm variation of GDP per capita; σ is the standard deviation and μ is the mean of natural logarithm of GDP per capita APT region. If there is a decreasing of CV value over time, it implies that there has been a reduction in the GDP per capita inequality between countries.

The usefulness of beta convergence (β convergence) is to find out the effect of the factors that are predicted to determine convergence. Beta convergence is a necessary condition but not a sufficient condition for sigma convergence. Although not identical but empirically beta convergence will be verified when sigma convergence is also verified. One major advantage of beta convergence is dynamic analysis. If short-term observation is unable to provide an answer to the impact of public policy, then the impact can be seen in long-term trends.

Absolute Convergence

Absolute convergence can be identified by a negative and significant relationship between income growth per capita and initial income per capita(t-1). This statement can be written using the following equations (Islam, 1995; Barro, 2015; Li and Fang, 2016):

$$\ln\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \alpha + \beta \ln y_{i,t-1} + \varepsilon_{it} \dots\dots\dots (1)$$

$$\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + \varepsilon_{it} \dots\dots\dots (2)$$

Remarks formula:

α = intercept

β = regression coefficient of initial GDP per capita

$y_{i,t}$ = GDP per capita in country i year t

$y_{i,t-1}$ = GDP per capita in country i year t-1

ε_{it} = error term

Conditional Convergence

Conditional convergence indicates that within the specification of the model includes other variables besides the initial income of the period expected to affect the income growth rate. This concept suggest that convergence depends on structure or characteristics of each economy and this structural difference that make a difference to the income stability per capita of each economy (Rey dan Mountouri, 1999). Conditional convergence model can be written using the following equations (Barro and Sala-i-Martin, 2004; Mutaqin and Ichihashi, 2012):

$$\ln\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \alpha + \beta \ln y_{i,t-1} + \gamma_k \ln X_{k,i,t} + \varepsilon_{it} \dots\dots(3)$$

$$\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + \gamma_k \ln X_{k,i,t} + \varepsilon_{it} \dots (4)$$

Remarks formula:

α = intercept

β = regression coefficient of initial GDP per capita

$y_{i,t}$ = GDP per capita in country i year t

$y_{i,t-1}$ = GDP per capita in country i year t-1

ε_{it} = error term

The Model of Income per Capita Convergence

This study aims to analyze the convergence of per capita income countries APT. The data used are time series data from 2001 to 2014 and cross section in 13 countries. The panel data model used is as follows:

- a. Using the basis of equation (2), the absolute convergence model used in this study is:

$$\ln PDB_{i,t} - \ln PDB_{i,t-1} = \alpha + \beta \ln PDB_{i,t-1} + \varepsilon_{it} \dots\dots\dots (5)$$

- b. Using the basis of equation (4), the conditional convergence model used in this study if:

$$\ln PDB_{i,t} - \ln PDB_{i,t-1} = \alpha + \beta \ln PDB_{i,t-1} + \gamma_1 \ln AK_{i,t} + \gamma_2 \ln Pertanian_{i,t} + \gamma_3 \ln Industri_{i,t} + \gamma_4 \ln TOT_{i,t} + \gamma_5 \ln FDI_{i,t} + \gamma_6 \ln Internet_{i,t} + \varepsilon_{it} \dots\dots (6)$$

Remarks formula:

α = intercept

$\ln PDB_{i,t}$ = natural logarithm of GDP per capita country i year t

$\ln PDB_{i,t-1}$ = natural logarithm of GDP per capita country i year t-1

$\ln AK_{i,t}$ = natural logarithm ratio of labor force country i year t

$\ln Pertanian_{i,t}$ = natural logarithm of added value in real agriculture sector country i year t

$\ln Industri_{i,t}$ = natural logarithm of added value in real industry sector country i year t

$\ln TOT_{i,t}$ = natural logarithm of *Terms of Trade* (TOT) country i year t

$\ln FDI_{i,t}$ = natural logarithm *Foreign Direct Investment* country i year t

$\ln Internet_{i,t}$ = ratio natural logarithm of internet user country i year t

β = regression coefficient of initial GDP per capita

$\gamma_1 - \gamma_6$ = regression coefficient of control variable

ε_{it} = error term

Definition of Operational Variable

- a. Convergence in this study is defined as the tendency of a poor economy to grow with a high income per capita level compared to a rich economy, so that the economy will develop to reduce the gap in aligning itself with the developed economy. The economy is convergent if the countries tend to go toward the same steady state point so that the income gap between countries is getting smaller.
- b. GDP is the total revenue received by production factors in production process activities in each country APT region for a period (a year). While GDP per capita is the value of GDP per head or per one resident. This GDP per capita data is valued in United States Dollar (USD) in order to be used for comparison between countries. Real per capita GDP uses the base year of 2010.
- c. Potential GDP is the value of output or total revenue in each country APT region that should be generated if all resources are utilized at the full employment level.
- d. Actual GDP is the value of output or total revenue in each country APT region which in fact is generated.
- e. The ratio of the labor force is the ratio between the number of employed and unemployed population to the number of people aged 15 years old and above (working age) in each country APT region. The higher the labor force ratio means the higher the labor supply (supply) available to produce goods and services in each country APT region.
- f. The added value of the agricultural sector is the amount of added value generated by all business units in each APT country country in agriculture, forestry, hunting, fishery, cultivation, breeding, mining. The data used are real data with base year 2010 in USD unit.
- g. The added value of the industrial sector is the amount of value added generated by all business units in each APT region country in the industrial, processing, construction, electricity, water and gas sub-sectors. The data used are real data with base year 2010 in USD unit.
- h. Terms of Trade (TOT) is a comparison between the export trade price index of the import trade price index in each country APT region.
- i. Foreign Direct Investment (FDI) is an international capital flow where companies from each APT country state establish or expand their companies in other countries. Included in the FDI is ownership interest above 10%. This FDI data is valued in USD units to be used for comparison between countries.
- j. The ratio of Internet users is the ratio between the number of people who have used the internet in the last 12 months against the total population in each country APT region. The Internet can be accessed via computer, mobile phone, television and others. This variable is a proxy for the use of technology that can be used interstate.

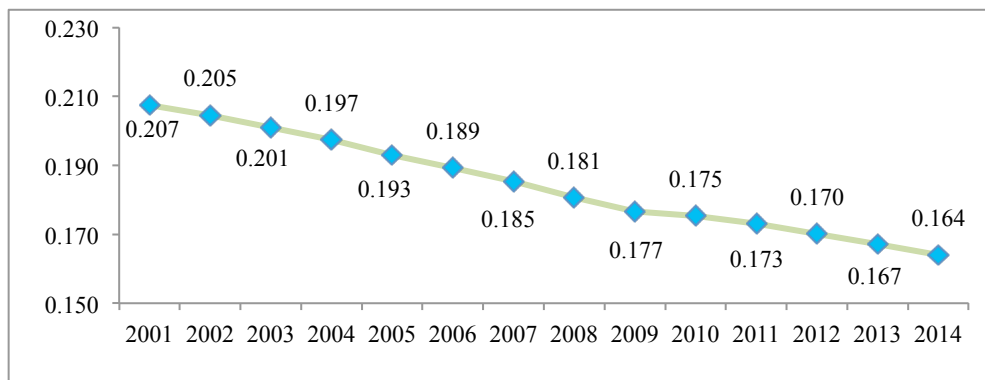
FINDINGS

Sigma Convergence

Sigma convergence analysis can be used to measure the dispersion rate of per capita income. Convergence occurs when the dispersion as measured by the standard deviation of the natural logarithm of real GDP per capita across countries declines over time. If income dispersion declines, it can be said that member countries of APT region tend to experience convergence of per capita income.

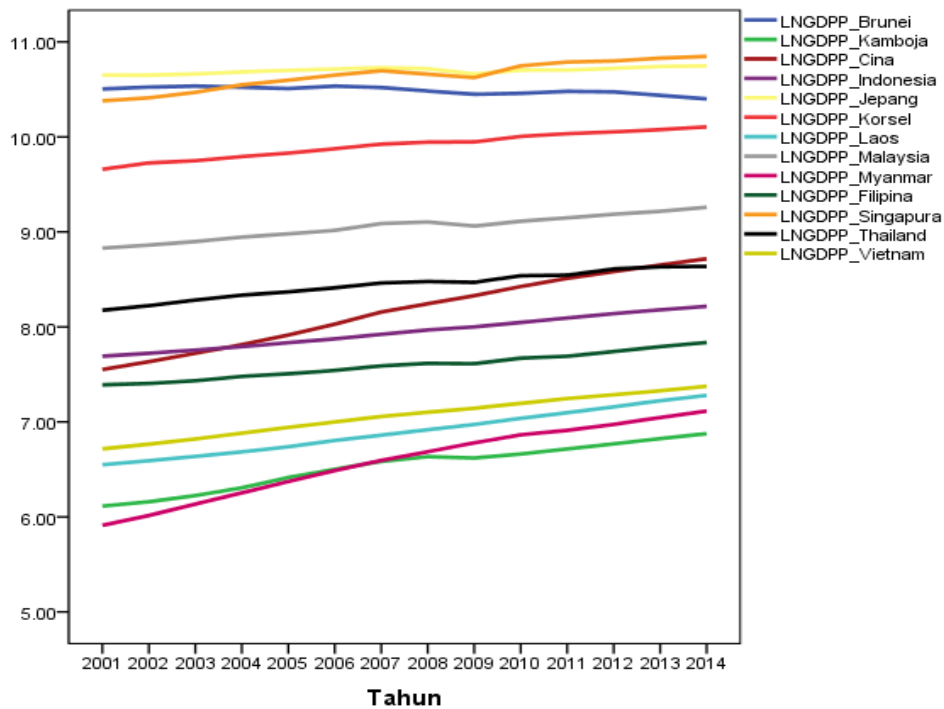
Figure 2 shows the development of natural logarithm variation coefficient values of real per capita GDP from 2001 to 2014. From the figure it can be seen that during the period 2001-2014, the dispersion of per capita income tended to decrease or in other words the sigma convergence at the level APT region. This is in line with research conducted by Barro and Sala-i-Martin (2004). There is a catching up effect, when developing countries succeed in pursuing developed countries as shown in Figure 3 that Singapore succeeded in pursuing Brunei Darussalam and Japan, China succeeded in pursuing Indonesia and Thailand, as well as Myanmar which succeeded in pursuing Cambodia. Catching up this effect keeps the real per capita GDP distance between countries narrow, thus affecting the dispersion value.

Figure 2. Income Sigma Convergence per Capita in APT Area on 2001-2014



Source: *The World Bank*, 2016 (managed)

Figure 3. Natural Logarithm real GDP Per Capita APT Countries on 2001-2014



Source: *The World Bank*, 2016 (managed)

Absolute Convergence

Equation 5 uses one independent variable that is the initial GDP per capita variable, while the dependent variable is the growth of real GDP per capita. Due to heteroscedasticity and autocorrelation of the fixed effect model, weighted by cross-section SUR. The result of regression of fixed effect model for absolute convergence with cross-section weighting of SUR is shown in Table 1. Based on the estimation result in Table 1, it is known that the estimated value of elasticity parameter of the growth of real GDP per capita on the initial GDP per capita is negative. This means that at the overall APT region level in the 2001-2014 period, initial GDP per capita is negatively correlated with the growth of real GDP per capita. That is, the initial GDP per capita formed over that period at the APT level overall reduces GDP growth per capita. The magnitude of the decline in GDP growth per capita because of the initial GDP per capita can be identified from the value of its elasticity of 0.020635. This indicates that every 1% increase in initial GDP per capita will decrease GDP growth per capita by 0.020635 percent with the assumption of *ceteris paribus*.

Table 1. Recapitulation of Parameter Estimation Result of Absolute Convergence *Fixed Effect Cross-Section SUR* Model

Dependent Variable is the growth of real GDP per capita				
Independent Variable	Coefficient	Standard Error	t-Statistic	Prob.
C	0,093715	0,004117	22,76289	0,0000
$\ln PDB_{i,t-1}$	-0,020635	0,001126	-18,33159	0,0000
Countries	$C_{fixed\ effect\ i}$		Contries	$C_{fixed\ effect\ i}$
Brunei Darussalam	-0,002678		Malaysia	0,0000119
Cambodia	-0,010290		Myanmar	0,004762
China	0,017041		Philipine	-0,011883
Indonesia	-0,005895		Singapura	0,014825
Japan	0,005152		Thailand	-0,003364
South Korea	0,009754		Vietnam	-0,008971
Laos	-0,008467			
F-statistic	314,3528			
R-squared	0,960513			
Number of Observations	182			
Cross-section	13			
Time period	14			

Source: *The World Bank*, 2016 (Managed)

The regression coefficient of initial GDP per capita has negative value and significant effect statistically mean not to reject hypothesis of this study which states that there is absolute convergence in APT region period 2001-2014. The regression coefficient of initial GDP per capita of 0.020635 implies that the absolute convergence rate of 2%. The results of this study are not much different with the results of Barro (2015). The convergent Iron Law states that the annual conditional convergence rate for GDP per capita is 2% per annum. The absolute convergence rate of 2% implies that the gap between actual GDP growth per capita and GDP per capita steady-state growth will be reduced by 2% per year. This means that the time it takes to close half of the initial halftime gap (halftime) for 33 years, or takes 110 years to cover 99% of the initial gap.

Conditional Convergence

The use of the conditional convergence model with equation 6, includes some independent variables besides initial GDP per capita, which is expected to affect the steady state. Associated with the influence of the initial GDP per capita on the growth of real GDP per capita, the important thing to be analyzed is how big the influence is. The magnitude of this effect can be seen through the estimation of the regression coefficient which shows the elasticity of the growth of real GDP per capita on initial GDP per capita.

Based on the estimation results in Table 2, it is known that the estimated value of the elasticity parameter of the growth of real GDP per capita on initial GDP per capita is negative. This means that at the overall APT region level in 2001-2014 period, initial GDP per capita is negatively correlated with the growth of real GDP per capita. That is, the initial GDP per capita formed over that period at the APT level overall reduces the growth of real GDP per capita. The

magnitude of the decline in the growth of real GDP per capita due to the initial GDP per capita can be identified from the value of elasticity of 0.021943. This indicates that any increase in initial GDP per capita of 1 percent will reduce the growth of real GDP per capita by 0.021943 percent with the assumption of *ceteris paribus*.

The initial GDP per capita in the fixed effect cross-section conditional convergence model of SUR is statistically significant to the growth of real GDP per capita, the research hypothesis that conditional convergence in the APT period 2001-2014 is not rejected. The regression coefficient of initial GDP per capita 0.021943 implies that the conditional convergence rate is 2.2%. This means that the time it takes to close half of the initial gap (halftime) for 31 years. In other words, it takes 104 years to cover 99% of the initial gap between the growth of real GDP per capita actual and the growth of real GDP per capita steady state. The results of this study are not much different with the results of Barro (2015).

Table 2. Recapitulation of Parameter Estimation Result of Absolute Convergence *Fixed Effect Cross-Section* SUR Model

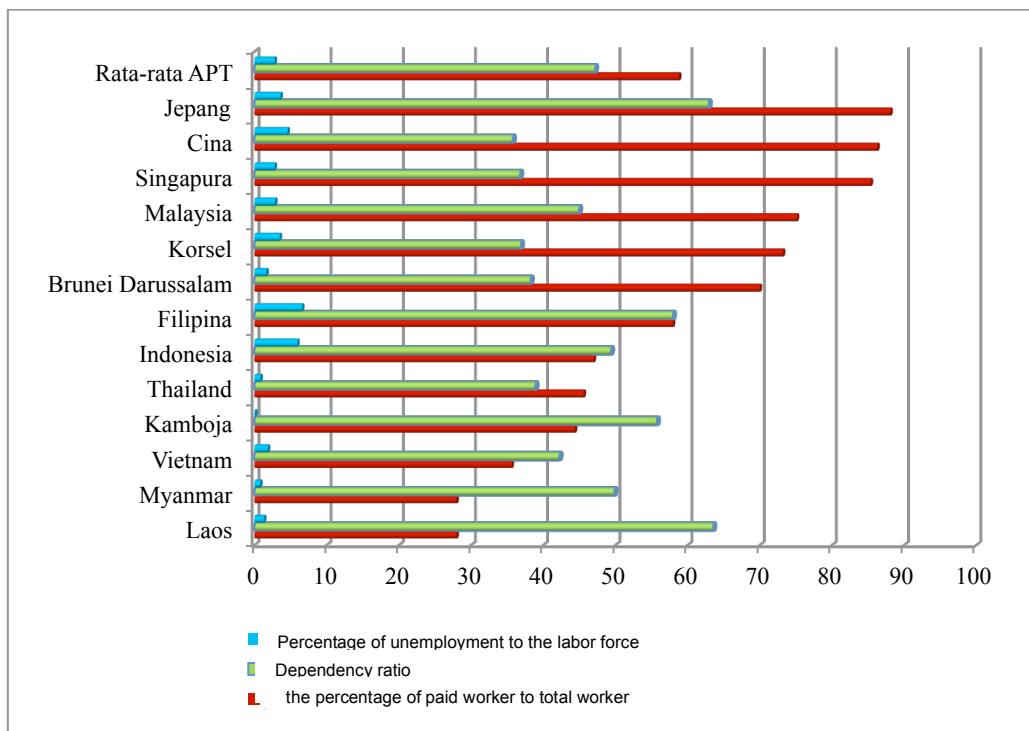
Dependent Variable is the growth of real GDP per capita				
Dependent Variable	Coefficient	Standard Error	t-Statistic	Prob.
C	-0,573027	0,035976	-15,92823	0,0000
$\ln PDB_{i,t-1}$	-0,021943	0,000687	-31,92000	0,0000
$\ln AK_{i,t}$	-0,001665	0,000135	-12,34425	0,0000
$\ln Algicultures_{i,t}$	0,042083	0,004216	9,980739	0,0000
$\ln Industries_{i,t}$	0,100785	0,00272	37,05603	0,0000
$\ln TOT_{i,t}$	-0,000129	0,0000084	-15,30780	0,0000
$\ln FDI_{i,t}$	0,000948	0,0000679	13,96475	0,0000
$\ln Internet_{i,t}$	0,000231	0,0000186	12,41143	0,0000
Countries	$C_{fixed\ effect\ i}$	Countries	$C_{fixed\ effect\ i}$	
Brunei Darussalam	0,339210	Malaysia	0,005308	
Cambodia	0,012377	Myanmar	0,054475	
China	0,237614	Phillipine	-0,385370	
Indonesia	-0,066853	Singapura	0,281545	
Japan	0,001142	Thailand	-0,050427	
South Korea	0,014479	Vietnam	-0,376430	
Laos	-0,067072			
F-statistik	251,879			
Adj. R-squared	0,963417			
Number of Observations	182			
Cross-section	13			
Time period	14			

Sources: *The World Bank*, 2016 (managed)

The rate of convergence of income per capita on this conditional convergence model is slightly faster than the rate obtained from the absolute convergence model. This indicates that the performance of the six control variables entering the conditional convergence model does not significantly accelerate the

convergence rate. There is inefficiency in the performance of developing country economies. Inefficiency makes the actual output lower than its potential output. This inefficiency causes the convergence rate to be slower. The six control variables estimated to affect the growth of real GDP per capita steady state also significantly influence statistically. It could be known from the probability value of each independent variable is smaller than the level of significance $\alpha = 0.05$.

Figure 4. Percentage of Unemployment to Work Force, Dependency Ratio, and Percentage of Paid Worker to Total Workers in Country APT in Year of 2014



Sources: *The World Bank* (2016)

The Effect of Labor Force Ratio on the Growth of Real GDP per Capita

The probability of t test statistic for the variable of labor force ratio in the fixed effect cross-section conditional convergence model SUR is smaller than the significance level $\alpha = 0.05$. This means that in the overall level of APT area, the labor force ratio in the period 2001-2014 significantly affects the growth of real GDP per capita. How big the influence of labor force ratio can be seen from the value of regression coefficient which is the elasticity of the growth of real GDP per capita to the ratio of labor force. The estimation result of elasticity parameter of GDP growth per capita on labor force ratio is negative. This is in line with research conducted by Perugini and Signorelli (2004). At the level of the APT region as a whole in the 2001-2014 period, the increase in the labor force ratio will reduce GDP growth per capita. The magnitude of the decline in GDP growth per capita because the increase in the labor force ratio can be identified from the estimated value of elasticity parameter of GDP per capita real growth to the

labor force ratio. The value of elasticity of GDP per capita growth on labor force ratio is 0.001665. That means, every 1 percent increase in labor force ratio that occurred in the period 2001-2014 will reduce the GDP per capita growth by 0.001665 percent with the assumption *ceteris paribus*.

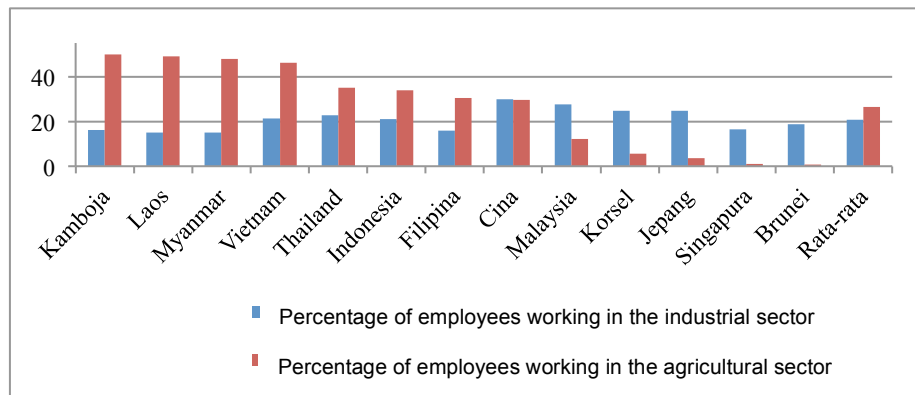
Labor is one of the factors that determine the economic growth. Different capital and labor combinations can be used to produce a certain level of output. If more capital is used, the labor required becomes less, and vice versa. In the NSB, the labor-intensive sector that uses more labor than capital has an important role to play.

This labor-intensive industry is mostly found in informal sector industries, i.e., small-scale goods and services production sector, individually or family owned, and using relatively simple technology. In the informal sector, the workforce is not tied up by a written contract, resulting in a large number of workers with employment status as unpaid family workers, especially for NSB. As shown in Figure 4, the percentage of workers paid in 2014 on average for the APT area is 58.82 percent, while the remaining 41.18 percent are unpaid workers or family workers. On average in 2014 for the APT region, the dependency ratio is less than 50 percent and the unemployment rate for the total workforce is 2.8 percent. This means that on average the number of dependent family members is less and the proportion that works is greater. When the proportion of family workers is a positive part of the workforce, it can not contribute to per capita income, thus affecting per capita income growth negatively.

The Effect of Value Added of Agriculture Sector on the Growth of Real GDP per Capita

Probability of t test statistic for agriculture value added variable in conditional convergence model fixed effect cross-section SUR is smaller than significance level $\alpha = 0,05$. At the overall level of APT area, the added value of agriculture sector that formed during period 2001-2014 significantly influenced the growth of real GDP per capita. Estimation of elasticity parameter of the growth of real GDP per capita to added value of agriculture sector is positive. This means that the added value of the agricultural sector is positively correlated with the growth of real GDP per capita. This is in line with research conducted by Kumar et al (2014). At the level of the APT region as a whole in the 2001-2014 period, the increased value added of the agricultural sector will increase the growth of real GDP per capita. The magnitude of the growth of real GDP per capita due to increased value added of the agricultural sector can be identified from the estimated value of elasticity parameter of the growth of real GDP per capita to the added value of agricultural sector. The value of elasticity of the growth of real GDP per capita to the added value of agriculture sector is 0.042083. That means, every 1 percent increase in value added agricultural sector that formed during 2001-2014 period will increase the growth of real GDP per capita by 0,042083 percent with *ceteris paribus* assumption.

Figure 5. Percentage of Employees in the States of APT Industry and Agriculture Sector in Year of 2014



Source: *The World Bank* (2016)

The balanced development across sectors, such as the agricultural sector with the industrial sector, as well as between domestic and foreign sectors is the importance parameter for nation's economy in APT area. The value creation of the agricultural sector can be an input for the industrial sector. The agricultural sector produces raw materials then processed by the industrial sector into higher value added products. Although the elasticity of GDP growth per capita to value added in the agriculture sector is less than the elasticity of GDP (real) growth per capita to the value added of the industrial sector, the agricultural sector still remains an important role. It shows in Figure 5, although Singapore is a developed country with high income per capita, Singapore still requires various types of natural resources which are produced from the agricultural sector to meet the needs of their country. Because Singapore is unable to meet the food needs by its own country, so they do supply of agricultural products through import trade. The import trade could open up opportunities for countries around Singapore to export agricultural products. At present, Indonesia has exported major commodities to Singapore such as potatoes, cabbage, and tomatoes.

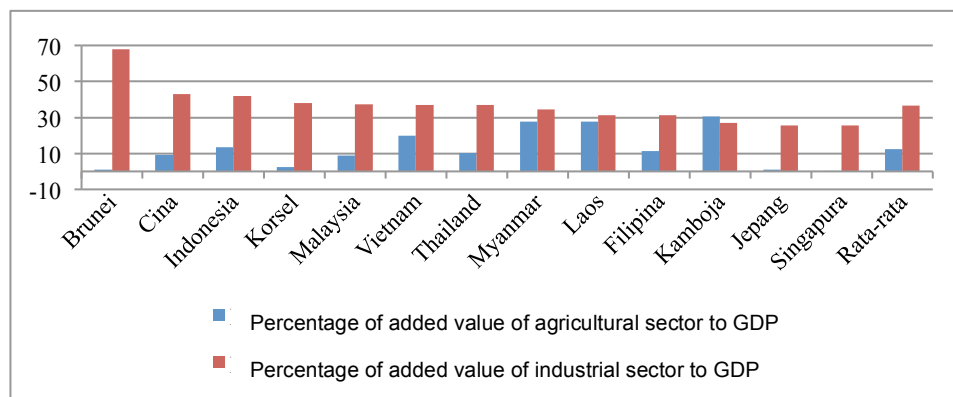
In addition to providing inputs for the industrial sector, the agricultural sector also has an important role, especially for the developing countries in absorbing labor. As Figure 5 shows, the agricultural sector absorbs more labor than the industrial sector on average for the APT area in 2014. The percentage workers in the agricultural sector is more dominant in Cambodia, Laos, Myanmar, Vietnam, Thailand, Indonesia, Philippines, and China.

The Effect of Value Added in Industrial Sector on GDP Growth per Capita

The probability of t-test statistic result for value added of industrial sector variable in conditional convergence model of fixed effect cross-section SUR is smaller than significance level $\alpha = 0,05$. This means that in the overall level of

the APT area, the value added of industrial sectors formed during 2001-2014 period significantly affects the GDP (real) growth per capita. Estimation of elasticity parameter of GDP growth per capita real to industry value added is positive. This is in line with research conducted by Delgado, Porter, and Stern (2014). This means that the added value of the industrial sector is positively correlated with the growth of real GDP per capita. It can be said that at the level of APT area as whole in the period 2001-2014, the increase of industrial sector's value added will increase the growth of real GDP per capita. The magnitude of the growth of real GDP per capita due to the increase of value added of industrial agriculture sector can be identified from the estimated value of elasticity parameter of the growth of real GDP per capita to industrial value added. The value of elasticity of the growth of real GDP per capita to industrial value added is 0,100785. That means, every 1 percent of increasing in value added industrial sector formed during 2001-2014 period will increase the growth of real GDP per capita by 0,100785 percent with *ceteris paribus* assumption.

Figure 6. Percentage of Value Added of Agriculture and Industry Sector to GDP in APT Countries Year of 2014



Source: *The World Bank* (2016)

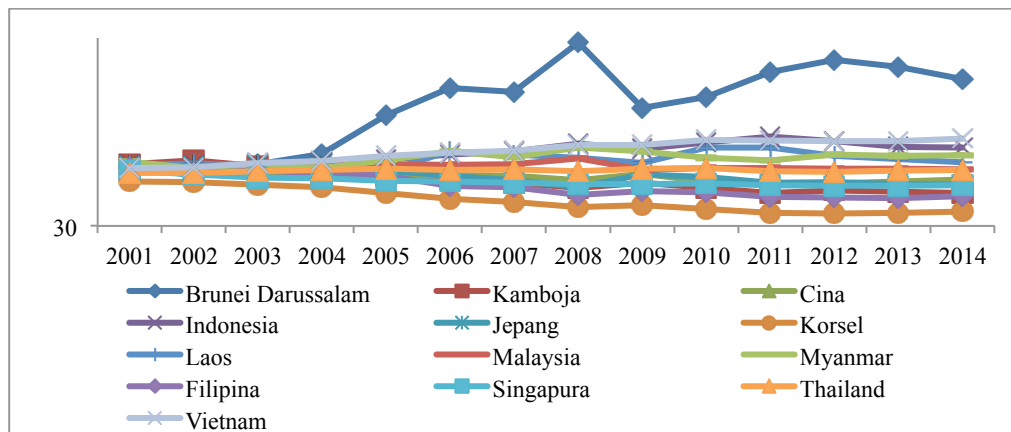
The production sector can grow rapidly if supported by input from agricultural sector or FDI that is invested in industrial sector. Furthermore, the surplus industry sector can support TOT performance through export increase. As seen in Figure 6, that the average of the industrial sector in APT area has a greater proportion than the agricultural sector to GDP. The results in the industrial sector can increase the value added of raw materials produced by the agricultural sector. Especially for Japan and Singapore as the dominant country with their value-added creation comes from the service sector. Because of the large portion of the industrial sector to GDP, it causes a positive relationship in both sectors.

The Effect of Terms of Trade (TOT) on the Growth of Real GDP per Capita

The probability of t test statistic result for TOT variable in conditional convergence model of fixed effect cross-section SUR is smaller than significance level $\alpha = 0,05$. This means that in the overall level of APT, TOT which is formed during the period 2001-2014 significantly affect the growth of real GDP per capita. How big the effect of TOT can be seen from the value of regression coefficient which is the elasticity of the growth of real GDP per capita to TOT. The estimation result of elasticity parameter of the growth of real GDP per capita to TOT is negative. This is contrast with research conducted by Barro (2015).

At the level of the APT area as whole in the 2001-2014 period, the decrease in TOT will increase the growth of real GDP per capita. The magnitude of the growth of real GDP per capita due to the decrease in TOT can be identified from the estimated value of elasticity parameter of the growth of real GDP per capita to TOT. The value of elasticity of the growth of real GDP per capita to TOT is 0.000129. That means that every 1 percent of a decrease in TOT occurring during 2001-2014 period will increase the growth of real GDP per capita by 0.000129 percent, ceteris paribus.

Figure 7. The Development of TOT in APT Countries in year of 2001-2014



Source: *The World Bank* (2016)

The Rapid growth of industrial sectors can support TOT's performance through increased exports. As shown in Figure 7, the TOT value tends to decrease, which means that the value of import trade is greater than the value of the export trade. When the domestic production sector has not been able to meet the aggregate demand, this shortfall will be covered by imports, because if it is not done, it will cause a scarcity that will eventually increase inflation. Import will be done if the goods can not be provided by the domestic production sector.

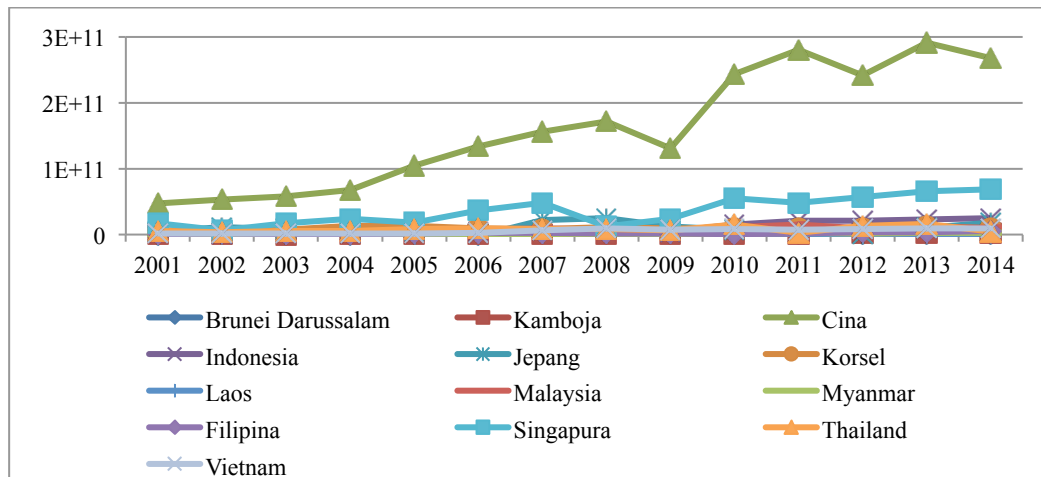
For the APT area countries, most of these import commodities meet demand in the oil and gas sector (oil and gas) and non-oil, agriculture, processing industries, mining and others. Imported capital goods can be used in the production process. The declining TOT value reflects the increasing of the dependency of the domestic sectors on foreign countries. In the long term, the

domestic production sector needs investment in order to provide the goods which are needed. But it requires a lot of funds. In the short term, imports provide a solution to curb the further impact of inflation due to scarcity. As a result, TOT variables are negatively associated with GDP growth per capita.

The Effect of FDI on GDP Growth per Capita

The probability of t test statistic result for FDI variable in conditional convergence model of cross-section SUR model is smaller than significance level $\alpha = 0,05$. This means that in the overall level of APT area, FDI which is formed during the period of 2001-2014 significantly affects the growth of real GDP per capita. How big the effect of FDI can be shown from the value of regression coefficient which is the elasticity of the growth of real GDP per capita to FDI. Table 2 shows that the estimated elasticity parameter of the growth of real GDP per capita on FDI is positive. This is in line with research conducted by Jawaid and Raza (2012). At the level of the APT area as a whole in the 2001-2014 period, an increase in FDI will increase the growth of real GDP per capita. The magnitude of the growth of real GDP per capita due to the increase of FDI can be identified from the estimated value of elasticity parameter of the growth of real GDP per capita to FDI. The value of elasticity of the growth of real GDP per capita to FDI is 0.000948. That means that every 1 percent increase in FDI which is formed during 2001-2014 period will increase the growth of real GDP per capita by 0.000948 percent with ceteris paribus assumption.

Figure 8. The Development of FDI in APT Countries during 2001-2014



Source: *The World Bank* (2016)

Capital deepening is the addition of new capital for the production process with higher quality or higher productivity, thus increasing the ratio between capital and labor and also capital with other factors of production. Capital deepening can be accumulated through domestic and foreign investment. Foreign

investment or FDI is a solution when domestic investment has not been able to increase domestic capital accumulation in increasing the production capacity. FDI can help the domestic production sector to produce goods and services that can not be provided by the domestic production sector. FDI is also a solution to accelerate in terms of technology adaptation that is not owned by the domestic production sector. The transfer of this technology can be negotiated to entry the foreign investment into the domestic territory. FDI can increase labor absorption while improving output outcomes, thus positively associated with GDP growth per capita. The foreign sector plays a very important role in increasing the GDP growth per capita of APT area, especially in the export trading activities of import and foreign investment.

As shown of Figure 8, China and Singapore are the most attractive countries for foreign countries to be embraced in investment cooperation. Given the belief that the country can generate positive returns on investment, it is also supported by a favorable and conducive investment climate. With a substantial capital injection from FDI, the technology transfer process from abroad can be faster. Because if it is not through FDI, the domestic sector will take a long time and a much cost to research new innovations in order to increase production capacity.

The Effect of Internet User Ratios on the Growth of Real GDP per Capita

By using the basic information contained in Table 2, it is known that the probability of the t test statistic result for the internet user ratio variable in the conditional convergence model is smaller than the significance level $\alpha = 0.05$. This means that in the overall level of APT area, the variable ratio of internet users which is formed during 2001-2014 period significantly affects the growth of real GDP per capita. How much effect of the variable ratio of internet users can be seen from the value of the regression coefficient which is the elasticity of the growth of real GDP per capita to the internet users ratio. Estimation of elasticity parameter of the growth of real GDP per capita to internet user ratio is positive. This is in line with research conducted by Celbis and Crombrugge (2016). At the level of the APT area as whole in the 2001-2014 period, an increase in the internet users ratio will increase the growth of real GDP per capita. The large increase in the growth of real GDP per capita due to the increase in the ratio of internet users can be identified from the estimated value parameter elasticity of the growth of real GDP per capita to the internet users ratio. The value of elasticity of the growth of real GDP per capita to internet user ratio is 0.000231. That means that every 1 percent of an increase in the ratio of Internet users which formed during the period 2001-2014 will increase GDP growth per capita by 0.000231 percent with the assumption *ceteris paribus*.

Low-tech countries will benefit greatly in technology transfers that will get a rapid growth in output per capita. But the diffusion of this technology can not happen instantaneously, but can be confounded through international trade, investment, licensing, consultation and communication. Communication between countries can be done through internet connection. With an open economic system in APT area countries, it can ease the e-commerce trading

transactions and expand market share. The positive effects will accelerate and facilitate the export of imports between countries. However, this internet connection can not stand alone, at least three major infrastructures are electricity, telephone, and road which should be establish. The more internet users reflect the better infrastructure be available. The closer and easier the internet users to obtain information in order to imitate the technology.

Table 3. Percentage of Internet Users, Number of Servers, Population Density, Area and APT Countries Infrastructure Index 2014

No.	Countries	Percentage of internet users (%)	Total Server	Population density (People/Km ²)	An Area (Km ²)	Infrastructure Index
1	Japan	89,11	115.904	349	364.560	4,0969
2	South Korea	87,56	109.841	517	97.480	3,7905
3	Singapura	79,03	4.498	7.715	709	4,2040
4	Brunei Darussalam	68,77	63	79	5.270	2,7477
5	Malaysia	63,67	2.647	91	328.550	3,4476
6	Vietnam	48,31	1.076	293	310.070	2,6952
7	China	47,90	9.602	145	9.388.211	3,7524
8	Philipine	39,69	1.084	332	298.170	2,5501
9	Thailand	34,89	1.581	133	510.890	3,1237
10	Indonesia	17,14	1.586	140	1.811.570	2,6452
11	Laos	14,26	14	29	230.800	1,7618
12	Cambodia	14,00	46	87	176.520	2,3629
13	Myanmar	11,52	26	82	653.080	2,3296

Source: *The World Bank* (2016)

By using the information that is shown in Table 3, there is three countries with highest internet users, which is Japan, Korea, and Singapura. With the highest score is 5 for infrastructure index, so these countries has the good infrastructure in giving the internet users with high amount of servers. With the increasing number of internet servers, it will provide convenience for residents to be able to access the internet. Students and academics can easily access information resources, and businessman can quickly conduct e-commerce transactions, thus making this percentage of internet users variable positively related to the growth of real GDP per capita.

CONCLUSION

In conclusion, there has been a sigma convergence in the APT region for the real GDP per capita. This is known by the decrease in real GDP per capita dispersion. However, only three countries are capable of catching up effects in convergence of per capita income, namely Singapura, China, and Myanmar.

The Estimation result on the absolute convergence model of fixed effect cross-section of SUR is in line with the given result by sigma convergence, that is, there is an absolute convergence for real GDP per capita variable. This can be known by the negative relationship between the initial GDP per capita variable with the growth of real GDP per capita. The gap between actual GDP growth per capita and steady state GDP per capita GDP will be reduced by 2% per year. It takes 33 years to remove the 50% initial gap, or it takes 110 years to cover 99% of the initial gap, ceteris paribus.

The estimation result on conditional convergence model of fixed effect cross-section of SUR is in line with the result given by absolute convergence, that is conditional convergence for real GDP per capita variable. This can be known by the negative relationship between the initial GDP per capita variable with the growth of real GDP per capita. The gap between actual GDP growth per capita and GDP growth per capita steady state will be reduced by 2.2% per year. It takes 31 years to remove the 50% initial gap, or it takes 104 years to cover 99% of the initial gap, ceteris paribus.

At the level of the APT area as whole, the ratio of the labor force significantly affects the growth of real GDP per capita and that is negative. At the overall APT area level, agricultural value added significantly affects the growth of real GDP per capita and that is positive. At the level of the APT area as whole, the value added of industrial sector significantly affects the growth of real GDP per capita with positive value. This is due to the enormous value added that the industrial sector can afford to increase the growth of real GDP per capita. Therefore, the effect given by the industrial sector is greater than the agricultural sector.

At the overall APT area level, TOT significantly affects the growth of real GDP per capita and that is negative. This is due to the large dependence of the APT area's state production sector on international trade, especially imports. At the overall APT area level, FDI significantly affects the growth of real GDP per capita and that is positive. This is because most of the foreign investment is invested in the production sector of APT area, so it can help increase the capacity of output which ultimately positively affect the growth of real GDP per capita.

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