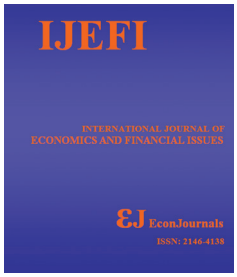

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Regional Income and its Convergence in Indonesia

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ABSTRACT

This study aims to calculate and analyze whether or not a decline occurs in regional income inequality (sigma convergence). Additionally, it attempts to examine the ability of low-income provinces to catch up the provinces with a high regional income, neither controlled nor (absolute convergence and conditional convergence). Finally, the study calculates the speed and time needed to catch up to half of the lags. The first objective of thestudy was answered by using the coefficient of variation. The second objective was answered by the First Difference GMM (FD GMM) method, and the third objective was answered by using a formula for calculating the convergence speed expressed by Feldkircher (2006), and the half convergence formula from Barro and Sala-i-Martin (1995). This research figured out that sigma convergence occurreds after divergence. The research also reported no convergence of regional income beta, in both absolute and conditional convergences. Finally, the time needed to catch up the half of the lags in non-conditional beta convergence was shorter than conditional beta convergence.

Keywords: Sigma Convergence, Absolute Convergence, Conditional Convergence, Speed of Convergence, The Life Half of Convergence
JEL Classifications: E6, H7, O1

1. INTRODUCTION

Several countries in the world have been economically and socially disadvantaged, but some others have managed to become developed countries such as Korea, Taiwan and Japan. In the period 1911-1940, Korea and Taiwan experienced a rapid economic growth, especially in the late 1930s, In the 1960s the growth of Korea's per capita income grew to 6.8% and Taiwan increased to 6.2%, surpassing the country that was originally much richer (Rodrik et al., 1995). It makes Korea's economy the eighth largest in the world. Korea's rapid development is due to good fiscal and monetary management. The government applies an important role in promoting export-oriented industries by offering performance-based incentives for exporters (Lee et al., 2001; Gregorio and Lee, 2004). Meanwhile, in the 1970s, Taiwan, which initially received assistance from the United States (US) in the form of investment, could grow faster (growth miracle) than the US (Lin, 2003).

In 1870, Japan was a poor country. Rapid economic growth caused Japan to be able to catch up with US and UK GDP per capita in 1980 (Mas and Matilde, 1998). Between the early 1950s to the late 1980s, Japan became the first major country outside Europe and the US to achieve high economic growth. In 2011, Japan ranked third in the world for the economy and ranked second in technology, defeating the US, Germany and the United Kingdom (Valli, 2012). The Japan and the US GDP ratio was 1:14 in 1950, 1:6 in 1960, 1:2.5 in 1970, 1:1.3 in 1980, and 1:0.93 in 1990. It shows that Japan's economic growth is far faster than the US (Ohno, 2006).

Differences in economic between regions require less developed regions to pursue more advanced regions so that economic inequality between regions does not widen. Continued widening inequality causes a slowing poverty reduction; a damage to the sustainability of economic growth; the severity of inequality between men and women; severe inequality in education, health and life opportunities (India Economic Summit, 2016).

Inequality in Indonesia can be seen from the inter-island Gross Regional Domestic Product (GRDP) per capita. The highest per capita GRDP was found in Kalimantan Island during 2011-2015 with an average of 60 million rupiahs, while the lowest was in Sulawesi Island with an average of 25 million Rupiahs. This difference, which has more than doubled, shows the imbalance of GDP per capita between islands within a country.

Kalimantan Island which has the highest average GDP per capita is also not free from the problem of inequality. Inequality in Kalimantan continued to occur over a period of 5 years with the lowest average GRDP per capita in West Kalimantan (24 million rupiahs), or around 1/6 of East Kalimantan's GRDP per capita (143 million rupiahs). This illustration shows economic development in Indonesia in general, and Kalimantan in particular has not been evenly distributed. Accelerating development in relatively lagging provinces is needed so that inequality does not worsen.

East Kalimantan's GRDP has increasingly left South Kalimantan, Central Kalimantan and West Kalimantan since 2009 and widened in 2010. Among the three lagging provinces there is also inequality, but not as wide as inequality with East Kalimantan. South Kalimantan's GRDP, for example is considered the highest, while West Kalimantan's GRDP is the lowest with the same developmental pattern.

Economic inequality also impacts on various health and social problems, such as mental illness and violent crime (India Economic Summit, 2016). In fact, Pope Francis states that inequality is the root of evil (Christian, 2014). This condition is contrary to the statement of Todaro and Smith (2012) that the main objective of development activities is to achieve high economic growth, reduce poverty, regional income inequality and the unemployment rate. Thus, this research needs to be conducted to find solutions in addition to being able to contribute to the development of development theory.

2. THEORY AND EMPIRICAL STUDY

Convergence theory is based on the neoclassical growth model of income developed by Solow (1956) predicts that at some time the income gap between countries will decrease because low-income countries experience higher growth rates than countries with higher incomes. The process of a poor country pursuing a rich country is called the catching up effect.

Convergence is a process that makes a country or individual, company, city or other types of an entity more similar, although it requires a relatively long time (Schmitt and Starke, 2011). This convergence is a long-term growth process (Coughlin et al, 2006). The convergence begins with differences in income between poor and rich regions. These income differences reflect differences in quality of life, ranging from ownership of the number of televisions and telephone sets in the household to infant mortality rates and life expectancy rates (Mankiw, 2006).

The economic growth of a region will be influenced by capital accumulation, labor, and technological change. Solow predicts that without technological improvement, the ability of an economy to increase output per labor through capital accumulation will be severely limited by interactions between diminishing returns, the willingness of people to save, the rate of population growth, and the rate of depreciation of capital. Technology causes economic and non-economic variables to work optimally in increasing output (Abramowitz, 1956; Solow, 1956; 1957; Swan, 1956).

The role of technology in increasing output is simplified by Cobb-Douglas in a model based on empirical experience as follows:

$$Y = A_t K^{\alpha} L^{1-\alpha} \quad (1)$$

Y = output, K = capital, dan L = labor, A = technology.

Onder et al. (2007) and Barro and Sala-i-Martin (1992) state that g and n respectively indicate A and L growth rates, while the portion of the output that is s is constant and saved, then:

$$k^*_{(t)} = sy^*_{(t)} - (n + g + \delta) k_{(t)} \quad (2)$$

Using the steady state equation for the k values in equations (1) and (2), the income per capita at the steady state is:

$$Ln = \left[\frac{Y_{(t)}}{L_t} \right] = LnA(0) + gt + \frac{\alpha}{1-\alpha} Lns - \frac{\alpha}{1-\alpha} Ln(n + g + s) \quad (3)$$

If y^* indicates a steady state income level, then:

$$\frac{dlny_t}{d_t} = \lambda \left(lny^* - lny_t \right) \quad (4)$$

Thus, the convergence model that will be obtained based on the neoclassical growth theory is as follows:

$$Lny_t = e^{-\lambda\tau} lny_{t-1} + \left(1 - e^{-\lambda\tau}\right) lny^* \quad (5)$$

In equation (5), τ is the time period while λ is the degree of convergence.

The convergence theory derived from the neoclassical output growth model shows a negative relationship between current per capita income and past per capita income. This is consistent with the convergence hypothesis based on neoclassical growth theory in a closed economy. The hypothesis suggests that the growth rate per capita tends to be inversely related to past output or per capita income levels. It shows that per capita income growth in poor regions tends to be faster than rich regions (Barro and Sala-i-Martin, 1992). Countries with low productivity has great potential to have high growth even though they weaken when approaching the productivity level of the benchmark country. This shows the process of catching up (catch up) (Abramovitz, 1986; 1956).

Regional income inequality can be seen through the coefficient of variation (Takeda and Nakata, 1998; Arbia and Salvatore, 2003; Iancu, 2007; Goschin, 2015). The decreasing coefficient of variation values shows that inequality between regions tends to decrease or in other words there has been a convergence of sigma to income (Rey and Montouri, 1999). Inequality can also be measured by a standard deviation that is static because it focuses on cross-

sectional dispersion (Barro and Sala-I-Martin, 1992; Michelis and Neaime, 2004; Young et al, 2007; Simionescu, 2014; Fouquet and Broadberry, 2015). Sigma convergence is analyzed by using the Williamson Index, Gini Index and Theil Index by Terraci (1999) and Drezgic (2011).

Regional income sigma convergence occurred in 28 European Union (EU) countries in 2012 after divergences had previously occurred (Simionescu, 2014) and in provinces in Vietnam (Vu and Nghiem, 2016). The convergence of income sigma did not occur in the US in the period 1970-1998 reflected by the standard deviation values and the Gini coefficient which tends to be close to 1 (Young et al., 2007). Romania is one of the countries in Europe which is considered the most converging. However, Goschin (2015) and Iancu (2007) find a long-term divergence in this country. This indicates that there is an imbalance of development between regions in Romania which tends to widen. Romania needs a systematic regional development strategy to reverse this unfavorable trend.

Convergence and divergence can occur in a period of observation and in various regions in a country. Arbia and Salvatore (2003) found a trend of convergence of regional income in 92 provinces in Italy in the period 1951-1970. However, in the 1971-2000 period the tendency changed to become divergent as evidenced by the increased coefficient of variation. In contrast, Madariaga et al. (2005) have found divergences between provinces in Italy in the 1980-1988 period, which then converged in the 1990-2002 period. Regional income divergences were also found in Italy during the period 1953-1993. In 1975 there was a break-point with a divergent tendency after a period of convergence (Terraci, 1999).

Michelis and Neaime (2004) analyzed three groups of countries in 1960-1999, namely the Asia-Pacific Economic Cooperation (APEC), the Association of South East Asian Nations (ASEAN) and countries in the East Asian region at 5-year intervals. The research concluded that the gross Gross Domestic Product (GDP) standard deviation for APEC decreased in the 1965-1990 period and began to increase in the early 1990s with a greater tendency during the 1995-1999 period. In the period 1997-1998 there was a financial crisis in most countries in East Asia. For ASEAN and East Asian countries, the divergence continued in 1960-1999. Meanwhile, sigma convergence only occurred in APEC countries in the period 1965-1990.

Studies in six European countries, namely Britain in the period 1300-1700 and after 1700; Netherlands since 1348; Italy, especially Central Italy and Northern Italy since 1310; Spain since 1300; Sweden since 1560; and Portugal since 1500 shows that economic growth is converging, although initially there was a divergent tendency (Fouquet and Broadberry, 2015).

Although studies in East Asian and European countries have been widely documented, research on the convergence of income sigma in Indonesia is still limited. Some researchers are interested in convergence because Indonesia has experienced complex regional disparities since the centralistic era. Indonesia is an archipelago that has differences in resources, population, economic concentration and other matters so that it emphasizes growth rather than income distribution. However, income between regions in Indonesia is still unequal as shown by findings of previous studies.

Using the coefficient of variation indicators, it has been found that regional income sigma convergence, including oil and gas, has been found in 27 provinces in Indonesia during the period 1976-1995. Without oil and gas, regional income gaps are widening, so that sigma convergence does not occur (Takeda and Nakata, 1998).

North Sumatra has decreased inequality which means regional income convergence has occurred. This is indicated by the regression coefficient that is negative and significant at the 5% error rate. The income of the cities in North Sumatra also experienced convergence. Conversely, economic development between districts is still undergoing a process of divergence with a positive value of the regression coefficient. Since the implementation of the regional autonomy policy, each district has tried to encourage the economic growth of the region by using its resources. Districts that are rich in economic resources will grow faster leaving those which are lacking in ownership of economic resources (Wau, 2015).

Beta convergence tends to contribute to sigma convergence. Meanwhile, sigma convergence is a sufficient requirement to measure beta convergence (Barro and Sala-i-Martin, 1995). Beta convergence is used to test whether or not there is convergence by looking at the lag coefficient of the convergence variable. There are two types of beta convergence namely non-conditional convergence and conditional convergence. Nonconditional convergence assumes that there are similarities in demographic conditions, financial conditions, and other economic conditions between regions. Conversely, conditional convergence assumes that these variables are not the same so that they can control the occurrence of convergence (Lall and Yilmaz, 2000; Islam, 2003; Paas et al., 2007; Onder et al., 2007; Schmitt and Starke, 2011).

Absolute convergence of per capita income occurred in 47 and 48 US states respectively in the period 1880-1988 and 1963-1986 (Barro and Sala-i-Martin, 1992). Still in the US, absolute convergence of productivity levels had occurred in 16 industrialized countries from 1870 to 1979 (Baumol, 1986). Absolute convergence on GDP per capita occurred in Italy significantly in 1951-1970, but not significantly in 1971-2000 (Arbia and Salvatore, 2003). There has been a non-conditional convergence of regional income in APEC and East Asian countries but not in ASEAN (Michelis and Neaime, 2004). Nonconditional income convergence is also found in 28 countries of the Organization for Economic Cooperation and Development (OECD), 123 oil-producing countries and 23 developing countries (Hu, 2012).

Government intervention through fiscal variables (expenditure and revenue) causes an interesting convergence study to be studied. Government intervention can have a positive effect on regional income as stated in Keynes's Theory. Fiscal variables can control the occurrence of regional income convergence as has been found by previous studies. The performance of government expenditure and revenue in controlling the occurrence of regional income

convergence is important to discuss given its relevance in policy making, especially related to budget deficits (Liliana et al., 2011).

Analysis of income convergence that is controlled by fiscal variables is also conducted by Michelis and Neaime (2004). They use government spending, population growth and economic openness as control variables in the conditional convergence of economic growth. The results showed that there was a conditional convergence of regional income but government spending had a negative impact on economic growth and was not significant. This might be due to the limited data used on government consumption expenditure which did not cover all expenditures.

Government intervention does not always have a positive influence. Drezgic (2011) shows that there is no positive relationship between government spending on infrastructure and regional income in Croatia despite the convergence of regional revenues. In fact, regions that have high levels of public spending usually automatically have high rates of economic growth. Government spending does not encourage regional income convergence in the US (Lall and Yilmaz, 2000). In Ecuador, public spending also cannot control the convergence of regional income (Chamba et al., 2019).

Battaglini and Coate (2008) examined the convergence of regional income with tax revenue and government debt as a control variable. The government is considered to be able to increase its income by raising proportional taxes on labor income and borrowing on the bond market. According to Barro (1974) excess government revenue can be used to prevent an increase in tax rates that are too large so that economic stability can be maintained. The excess government revenue can also be used to finance the provision of public goods and fund a lower government.

An increased income tax tends to cause consumption to be substituted by savings. This means an increase in income tax will actually reduce public consumption so that regional income derived from public consumption tends to decrease. It can be concluded that income tax cannot drive the regional income convergence process in the US and will continue to have a negative relationship (Russo, 2002).

3. FORMULATION AND EMPIRICAL TESTING OF THE MODELS

Sigma convergence is a concept formulated by Barro and Sala-i-Martin in 1995. It is capable of capturinge the trend of regional inequality with the following formulation (Goschin, 2015):

$$CV_i = \frac{\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}{\bar{y}} \quad (6)$$

CV_i = coefficient of variation for regional income
y_i = regional income
$\bar{y}$ = the average value of regional income
n = number of provinces in Kalimantan

If the coefficient of variation in a particular year is smaller than the convergence of the sigma of the previous year ($CV_t < CV_{t-1}$), it can be said that a reduction in inequality has occurred. But if $CV_t > CV_{t-1}$, the decrease in inequality does not occur or in other words the gap continues to widen (Table 1).

The results show that regional income experienced divergence at the beginning of the period. This is indicated by the increasing coefficient of variation, indicating widening inequality. In 2012, the coefficient value began to shrink, indicating that regional income convergence had occurred.

Beta convergence includes nonconditional and conditional convergence, where beta convergence is said to occur if the lag coefficient of the variable to be analyzed for convergence is smaller than 0, $\alpha_1, \gamma_1, \beta_1 < 0$. Dynamic adjustment is needed in panel data where dynamic relationship is indicated by the lag of the dependent variable which is one of the independent variables in the same regression model.

The general form of dynamic panel data model according to Verbeek (2008) is as follows:

$$y_{it} = \delta y_{i,t-1} + x_{it}'\beta + u_{it}; i = 1,\ldots,N; t = 1,\ldots,T \quad (7)$$

The development of equation (7) can be applied for the second purpose in this study. In detail, the equation to test whether non-conditional convergence (equation 8) and conditional convergence occur (equation 9) can be written as follows:

$$lnPDRB_{it} = \alpha_0 + \alpha_1 lnPDRB_{i,t-1} + \varepsilon_{1,it} \quad (8)$$

$$lnPDRB_{it} = \theta_0 + \theta_1 lnPDRB_{i,t-1} + \theta_2 lnGEXP_{it} + \theta_3 lnGREV_{it} + \varepsilon_{4,it} \quad (9)$$

$PDRB$ = regional income
$GEXP$ = government expenditure
$GREV$ = government revenue
α_0 $dan\theta_0$ = constanta
θ_1, θ_2, θ_3 = coefficient of explanatory variables
ε_1, $dan\varepsilon_4$ = error

Table 1: Coefficient of variation for regional income

Year	PDRB
2002	0.378
2003	0.382
2004	0.392
2005	0.403
2006	0.433
2007	0.457
2008	0.458
2009	0.469
2010	0.921
2011	0.921
2012	0.917
2013	0.849
2014	0.830
2015	0.796
2016	0.765

PDRB: Reginal income

i = Provinces in Kalimantan
t = years, 2002-2016
ln = natural logarithm

The convergence analysis in this study experiences an endogeneity problem that is the independent variable in a particular equation becomes the dependent variable in another equation so that the variable is correlated with a large enough error. Equations that contain endogeneity, if estimated by OLS method will cause three problems, namely: estimators become biased and inconsistent, hypothesis testing becomes invalid, and forecasting becomes biased and inconsistent (Andren, 2007). The concept of convergence that uses lag as an independent variable causes the possibility of correlation between observations or called spatial dependence. Estimation using the OLS method will cause parameter estimates to be unbiased and consistent, but the variance is greater (Table 2).

One alternative to overcome this problem is to use Generalized Method of Moments (GMM) (Greene, 2012). GMM estimators are more efficient because they produce smaller standard errors (Liu and Saraiva, 2015). Another advantage of using GMM is that GMM does not require normality assumptions. It can handle heteroscedasticity problems, and makes it easy to determine the appropriate instrument variables to deal with endogeneity (Verbeek, 2008).

Dynamic panel procedure estimation by GMM method is generally divided into First Difference GMM (FD GMM) and System GMM (SYS GMM). FD GMM uses the first difference equation at the level as an instrument. Meanwhile, SYS GMM was developed by combining level equations at first difference and first difference equations at the level as instruments (Baltagi, 2005). If all of the data is leveler, then the SYS GMM is used. If it is stationary at the first difference level, then what is used is FD GMM.

Based on the results of the stationary test and the test mode. It is revealed that stationary variables are at the first difference, so it can be concluded that the right method is FD GMM. J-Hansen's test results show that all models in this study cannot be rejected. Thus, the model built is appropriate to illustrate the effect of independent variables on the dependent variable by using the appropriate instrument variable (IV).

Table 3 shows that neither absolute convergence nor conditional convergence has been proven to occur. What is happening is regional income divergence. This is evidenced by the value of the lag coefficient is positive and significant.

The equation obtained is:

$$PDRB_{it} = 1,6005 + 0,9538 PDRB_{i,t-1} \quad (10)$$

$$PDRB_{it} = 0,4129 + 0,6725 PDRB_{t-1} + 0,6054 GREV - 0,2526 GEXP \quad (11)$$

After the β value in nonconditional convergence and conditional convergence is found, the convergence speed of the two can be compared using the following formula (Feldkircher, 2006):

$$\beta = \frac{\left[ln(b+1)\right]}{T} \quad (12)$$

β = annual speed of convergence
b = lag regional income coefficient,
T = years

Furthermore, this study will calculate and analyze the half of life, i.e. the time needed to catch up to half of the backward regions of the reference area as stated by Barro and Sala-i-Martin (1995) as follows:

$$Half\ of\ Life = \frac{-ln(0.5)}{\beta}\ \ atau\ \ \frac{ln(2)}{\beta} \quad (13)$$

Table 4 shows that the annual speed of absolute convergence of regional income is 4.47%. This indicates that underdeveloped areas must be able to grow at a minimum speed of 4.47% per year for 15.52 years to be able to catch up to half the lagging of developed regions if not controlled by other variables. If controlled by current government revenues and expenditures, regions with low income must grow at a minimum speed of 3.43% per year for 20.22 years in order to catch up to half the lagging of higher income regions.

4. DISCUSSION

Convergence theory states that low-income regions will grow faster than high-income regions. It indicates that there has been a decrease in inequality and the catch-up process (Solow, 1956). However, Mankiw (2000) criticized that in two different countries if the analysis is only based on initial income it would never converge. This is consistent with the results of this study which shows that there is no convergence of regional income, either absolute or conditional convergence.

Table 2: Result of model testing for regional income convergence

Model (1)	J_{stat} (2)	Obs (3)	J_T=(2 × 3) (4)	χ^2 (5)	Decision (6)
Absolute convergence	0.00	56	0	3.84	(4) < (5) model cannot be rejected
Conditional convergence	0.00	56	0	7.81	(4) < (5) model cannot be rejected

J_T: J-Hansen test

Table 3: Result of GMM for absolute and conditional convergence

Regional income convergence	lag coefficient (β)	Prob	Condition for convergence (β<0)	Decision
Absolute convergence	0.95	0.00	Not eligible	Divergence
Conditional convergence	0.67	0.00	Not eligible	Divergence

Table 4: Result of speed of convergence and the half of life convergence

Dependent variable	Beta coefficient		Speed of convergence		Half of life convergence	
	Absolute	Conditional	Absolute	Conditional	Absolute	Conditional
Reginal income	0.95	0.67	4.47	3.43	15.52	20.22

Cobb-Douglas in his theory, pinted out the importance of technology to increase output (Abramowitz, 1956; Solow, 1956; 1957; Swan, 1956). Kerr et al. (1960) also underlined that industrial countries with technological support would be more similar in some respects, but with basic social, economic and social differences, it would be difficult for them to meet. This shows that even in industrialized countries, divergence tendencies can occur.

They also revealed that if capital was not optimally invested in areas with relatively low socioeconomic conditions, lack of natural resources, poor quality of education and human resources, then what happened was divergence. This is the case in Kalimantan, where different socioeconomic aspects from the beginning, have caused the incomes of the West Kalimantan, Central Kalimantan and South Kalimantan regions to not be able to meet with East Kalimantan within 15 years.

This study gives different results from the convergence theory proposed by Solow (1956). The sigma convergence in this study is shown by regional income inequality, which is getting smaller between provinces. Before this period, the coefficient of variation in regional income fluctuated with a tendency to increase. This shows that regional income in Kalimantan diverged before converging. The sigma convergence expresses more reality (Monfort, 2008), especially if it uses a longer time dimension (Malešević et al., 2016).

During the divergence period, the smallest regional income inequality occurred in 2002 (0.38) and continued to increase until 2011 (0.92). Nevertheless, the coefficient of variation in regional income at the end of the period is still higher than the coefficient of variation at the beginning of the period, indicating that there are still quite high differences between regions. Regional income inequality which is getting smaller can be caused by optimal government spending, especially public investment to improve people's welfare (Takeda and Nakata, 1998; Vu and Nghiem, 2016).

Regression test results indicate that beta convergence, both nonconditional and conditional, did not occur. It means that whether influenced by other variables or not, regional income did not converge during 2002 to 2016. West Kalimantan, Central Kalimantan and South Kalimantan, which have lower regional income, have not been able to catch up with East Kalimantan. However, mobility of capital and labor in underdeveloped provinces can encourage an increase in output although it does not cause convergence (Michelis and Neaime, 2004).

Beta convergence was not proven to occur in this study, probably because of the relatively short observation time of 15 years. In addition it was caused by the low convergence speed per year. This study found that the time needed by the three provinces to cover half of the lagging income of the East Kalimantan region was faster if it was not controlled than when controlled by other variables. With a higher speed, the three provinces needed shorter time to catch up to East Kalimantan. West Kalimantan, Central Kalimantan and South Kalimantan were able to cover half of the lagging of regional income within 15.52 years with a convergence speed of at least 4.47% per year, without being controlled by other variables. Meanwhile, if controlled by other variables, then West Kalimantan, Central Kalimantan, and South Kalimantan were able to cover half a lag of regional income within 20.22 years with a minimum convergence speed of 3.43% per year.

5. CONCLUSION

Inequality of regional income in Kalimantan was decreased since 2012. Thus, regional income converges (2012-2016) after experiencing a divergence (2002-2011). Because of the divergence phase was longer, it was concluded that regional income in Kalimantan experienced divergence throughout the observation period. This condition requires a policy that seeks to reduce inequality and shorten the time to convergence. This can be achieved by improving the quality of human resources. Quality of human resources has high productivity and ability to pay taxes so as to increase government revenue. Productive government spending also needs to be optimized in order to drive the economy.

Whether controlled or not, West Kalimantan; Central Kalimantan; and South Kalimantan was unable to catch up with East Kalimantan, which had higher regional income during the observation period. Therefore, macro policies in Kalimantan should be based on inequality analysis because they show the real conditions.

Without being controlled by other variables, the time needed to cover half of the backwardness of West Kalimantan; Central Kalimantan; and South Kalimantan from East Kalimantan was shorter, which was 15.52 years. Meanwhile, if controlled by government revenue and government expenditure variables, it took more time, which ranged up to 20.22 years.

The results of the study have an impact on policy making especially on inequality in each province in Kalimantan. The research findings indicate that fiscal policy in Kalimantan has not been effective in reducing inequality and catching up with more developed regions.

REFERENCES

Abramovitz, M. (1956), Resource and output trends in the US since 1870. American Economic Review, 46, 5-23.
Abramovitz, M. (1986), Catching up, forging ahead, and falling behind. Journal of Economic History, 46(2), 385-406.
Andren, T. (2007), Econometrics. United Kingdom: Thomas Andren and Ventus Publishing ApS.
Arbia, G., Basile, R., Salvatore, M. (2003), Measuring Spatial Effects

in Parametric Modelling of Regional Growth and Convergence. Helsinki: World Institute for Development Economics Research.
Baltagi, B.H. (2005), Econometrics Analysis of Panel Data. 3rd ed. Chichester: John Wiley and Sons Ltd.
Barro, R.J. (1974), Are government bonds net wealth? Journal of Political Economy, 82, 1095-1118.
Barro, R.J., Sala-i-Martin, X. (1992), Convergence. Journal of Political Economy, 100(2), 223-251.
Barro, R.J., Sala-i-Martin, X. (1995), Economic Growth. New York: McGraw-Hill.
Battaglini, M., Coate, S. (2008), A dynamic theory of public spending, taxation, and debt. American Economic Review, 98(1), 201-236.
Baumol, W.J. (1986), Productivity growth, convergence, and welfare: What the long-run data. The American Economic Review, 76(5), 1072-1085.
Chamba, J.G., Quezada, R.C., Garcia, J.A., de la Cruz, R.M. (2019), Spatial economic convergence and public expenditure in Ecuador. Symmetry, 11(130), 2-18.
Christian, R. (2014), Pope Francis Tweet about Equality is the Wake-up Call we All Need' Time May 2. Available from: http://www.time.com/85864/pope-francis-tweet-about-inequality-is-thewake-up-call-we-all-need. [Last accessed on 2019 May 24].
Coughlin, C.C., Thomas, A.G., Henandez, M.R. (2006), Spatial Dependences in Model of State Fiscal Policy Convergence. St. Louis: Federal Reserve Bank of St. Louis. Research Division.
Drezgic, S. (2011), Public investment and regional income convergence: Empirical analysis of Croatian regions. Socialiniai Tyrimai/Social Reserch, 3(24), 43-55.
Feldkircher, M. (2006), Regional Convergence within the EU-25 a Spatial Econometric Analysis. Proceedings of OeNB Workshop. New Regional Economics in Central European Economies: The Future CENTROPE.
Fouquet, R., Broadberry, S. (2015), Seven centuries of European growth and decline. Journal of Economic Perspectives, 29(4), 227-244.
Goschin, Z. (2015), Regional divergence in Romania based on a new index of economic and social development. Procedia Economics and Finance, 32, 103-110.
Greene, W.H. (2012), Econometric Analysis. 7th ed. London: Pearson Education.
Gregorio, D.J., Lee, J.W. (2004), Growth and adjustment in East Asia and Latin America. Economía Journal, 5, 69-134.
Hu, J. (2012), New empirical evidence on economic convergence. Journal of Cambridge Studies, 6(4), 103-116.
Iancu, A. (2007), Economic convergence applications. Romanian Journal of Economic Forecasting, 53, 24-48.
India Economic Summit. (2016), World Economis Forum. 6 – 7 October. New Delhi, India: India Economic Summit.
Islam, N. (2003), What have we learnt from the convergence debate? Journal of Economic Surveys, 17(3), 309-362.
Kerr, C., Dunlop, J.T., Harbison, F., Myers, C.A. (1960), Industrialism and industrial man. American Political Science Review, 55(1), 147-158.
Lall, S.V., Yilmaz, S.W. (2001), Regional economic convergence: Do policy instrumenst make a difference? The Annals of Regional Science, 35, 153-166.
Lee, J.W. (2016), The Republic of Korea's Economic Growth and Catch-up: Implications for the People's Repulic of China. ADBI Working Paper. Tokyo: Asian Development Bank Institute. Available from: http//www.adb.org/publication/republic-korea-economic-growthcatchup-implication-prc.
Liliana, B., Diana, M., Carmen, C. (2011), Is there a correlation between government expenditures, population, money supply and government revenue. International Journal of Arts and Sciences, 4(12), 241-254.
Lin, T.C. (2003), Education, technical progress, and economic growth: The case of Taiwan. Economic of Education Review, 22, 213-220.
Liu, X., Saraiva, P. (2015), GMM estimation of SAR models with endogenous regressors. Regional Science and Urban Economics, 55, 68-79.
Madariaga, N., Montout, S., Ollivaud, P. (2005), Regional Convergence and Agglomeration in Argentina: A Spatial Panel Data Approach. Centre National De La Recherce Scientifiqne. Available from: http://www.mse.univ_paris1.fr/Publicat-htm. [Last accessed on 2019 Apr 16].
Malešević, P.L., Golem, S., Mihaljević, K.M. (2016), Convergence in government spending components in EU15: A spatial econometric perspective. Amfiteatru Economic, 18(42), 240-254.
Mankiw, N.G. (2006), Macroeconomics. 6th ed. Cambridge, MA: Harvard University.
Mas, F.J., Matilde, G. (1998), Japan/USA: The (apparent) Miracle of Convergence. Instituto Valenciano de Investigaciones Economicas (IVIE) Working Papers, First Edition, October.
Michelis, L., Neaime, S. (2004), Income convergence in the Asia-Pasific region. Journal of Economic Integration, 19(3), 470-498.
Ohno, K. (2006), The Economic Development of Japan: The Path Traveled by Japan as a Developing Country. Japan: GRIPS Development Forum.
Onder, A.O., Metin, K., Ertugrul, D. (2007), The Effect of Public Capital on Regional Convergence in Turkey. Working Paper in Economics, 7(1). Turkey: Ege University.
Paas, T., Kuusk, A., Schlittle, F., Vork, A. (2007), Econometric Analysis of Income in Selected EU Countries and their NUT 3 Level Regions. Tartu, Turkey: Tartu University Press.
Rey, S.J., Montouri, B.D. (1999), US Regional income convergence: A spatial econometrics perspective. Regional Studies, 33, 143-156.
Rodrik, D., Grossman, G., Norman, V. (1995), Getting intervention right: How South Korea and Taiwan grew rich. Economic Policy, 10(20), 55-107.
Russo, B. (2002), Taxes, the speed of convergence, and implications for welfare effect of fiscal policy. Southern Economic Journal, 69(2), 444-456.
Schmitt, C., Starke, P. (2011), Explaining convergence of OECD welfare states: A conditional approach. Journal of European Social Policy, 21(2), 120-135.
Simionescu, M. (2014), Testing sigma convergence across EU-28. Economic and Sociology, 7(1), 48-60.
Solow, R. (1956), A contribution to the theory of economic growth. Quarterly Journal of Economics, 70, 65-94.
Solow, R. (1957), Technical change and the aggregate production function. Review of Economics and Statistic, 39, 312-320.
Swan, T.W. (1956), Economic growth and capital accumulation. Economic Record, 32, 334-361.
Takeda, T., Nakata, R. (1998), Regional disparities in Indonesia. Journal of Development Assistance, 4(1), 192-215.
Terraci, M. (1999), Convergence and divergence across Italian regions. The Annals of Regional Science, 33, 491-510.
Todaro, M.P., Smith, S.C. (2012), Economic Development. 11th ed. Boston: Pearson.
Valli, V. (2012), Growth and Crisis in the Japanese Economy. Working Paper Series. Department of Economics. Universita di Torino. S. Cognetti de M artiis.
Verbeek, M. (2008), A Guide to Modern Econometrics. 3rd ed. Rotterdam: RSM Erasmus University, Wiley.
Vu, X.B., Nghiem, S. (2016), Analysis of GDP trends and inequalities in Vietnam's provinces. Asian Journal of Empirical Research, 6(7), 167-186.
Wau, T. (2015), Konvergensi Pembangunan Ekonomi Antar Daerah Kabupaten Dan Kota di Sumatera Utara. Book of Proceedings Published by SNEMA.
Young, A.T., Matthew, J.H., Levy, D. (2007), Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-level Data. Munich Personal RePEc Archicive (MPRA) Paper No 2714.