# Convergence Analysis of Economic Growth on Sumatra Island

**Darwin Damanik**
Mahasiswa Doktoral Ilmu Ekonomi Universitas Sumatera Utara

*Korespondensi penulis: darwin.damanik@gmail.com*

*Abstract. This study aims to determine the level of convergence of economic growth in Sumatra Island from 2015 to 2021. The data used are secondary data sourced from the Central Agency. Statistics. The analysis used in this research is Regression Test Analysis, Partial Test (t-test), and Simultaneous Test (F test). The third model is used to see the level of convergent beta on the island of Sumatra. The results of data analysis show that both per capita PDRB and PDRB growth show the level of convergence that occurs is greater than zero (> 0). This means that the growth of PDRB per capita and PDRB between provinces on the island of Sumatra tends to diverge. Economic growth in poor areas is still relatively slow compared to rich areas. The results of research conducted in 10 provinces on the island of Sumatra for the period 2015-2021 have an absolute convergence speed (economic growth) of 0.587670 which means that there has been a convergence speed of economic growth at absolute convergence on the island of Sumatra.*

*Keywords: Convergence, Growth Economy, GDRP, Regional Economy.*

## INTRODUCTION

Economic growth is one dimension of development. Economic growth describes the expansion of potential GDP or *output* national In the sense of economic development, there is a context of social welfare which must be achieved through increasing the standard of living. Almost all of this variation in living standards can be attributed to differences in productivity between countries.

The higher the productivity of society, the higher the standard of living obtained. In other words, economic growth occurs when the country's production-possibility frontiers *shift* outward. This is why the issue of regional inequality is still a hot topic that is often discussed so that in the last few decades the government has focused on growth and equity in Indonesia's economic development.

The form of government's focus on growth and equity in Indonesia's economic development can be seen in the economic growth in each province, one of which is the island of Sumatra. Sumatra is the second-largest island in Indonesia and the sixth largest

island in the world. This island has abundant natural wealth that can support the economic growth of society in general. Economic growth will occur through the development process of an area as measured by the Gross Regional Domestic Product (GRDP) where the GRDP is a measure that shows the *added value* of the production of goods and services for citizens, that people can enjoy with the availability of sources of production inputs such as labor, capital and, other natural resources.

The island of Sumatra itself has three potential areas that are rich in natural resources, such as the provinces of Aceh, Riau, and South Sumatra, this is evidenced by the amount of Gross Regional Domestic Product (GRDP) and economic growth. The following shows the economic growth between provinces on Sumatra Island in the 2015-2021 period:

**Table 1**

**Growth Economy in Sumatra Island, 2015-2021**

| PROVINCE | Growth Economy (%) | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | |
| Aceh | 3,01 | 3,29 | 4,18 | 4,61 | 4,14 | -0,37 | 2,79 | 2,70 |
| North Sumatra | 4,72 | 5,18 | 5,12 | 5,18 | 5,22 | -1,07 | 2,61 | 3,64 |
| West Sumatra | 4,26 | 5,27 | 5,30 | 5,14 | 5,01 | -1,62 | 3,29 | 3,33 |
| Riau | 5,96 | 2,18 | 2,66 | 2,35 | 2,81 | -1,13 | 3,36 | 2,27 |
| Jambi | 4,18 | 4,37 | 4,60 | 4,69 | 4,35 | -0,44 | 3,66 | 3,28 |
| South Sumatra | 4,39 | 5,04 | 5,51 | 6,01 | 5,69 | -0,11 | 3,58 | 3,76 |
| Bengkulu | 5,32 | 5,28 | 4,98 | 4,97 | 4,94 | -0,02 | 3,24 | 3,57 |
| Lampung | 5,59 | 5,14 | 5,16 | 5,23 | 5,26 | -1,67 | 2,79 | 3,44 |
| Bangka Belitung Island | 5,50 | 4,10 | 4,47 | 4,45 | 3,32 | -2,30 | 5,05 | 3,07 |
| Riau Island | 3,01 | 4,98 | 1,98 | 4,47 | 4 | -3,80 | 3,43 | 2,30 |

Source : Central Bureau of Statistics

Based on the data above, it shows that provinces with low income levels grow faster than provinces that actually have a higher per capita income value, which grows very slowly. Where the Provinces of Lampung, West Sumatra and South Sumatra were able to grow faster than provinces with high per-capita income such as Riau and Riau Islands Provinces which actually experienced weakening growth in per capita income. This proves that there is an imbalance in economic growth and equitable distribution of development in various provinces on the island of Sumatra.

The causes of inequality and unequal economic growth are usually caused by several problems, such as the concentration of regional economic activity, which is usually supported by investment activities. Investment itself is a driving factor for reducing inequality between regions so that disparities are created in each province. Observing this phenomenon, Domestic Investment (PMDN) is needed to try to increase more trade sectors, in order to create jobs so as to reduce inequality in a region and increase investment. capital in development in a region can accelerate the development of a region.

Convergence is a condition where there is a decrease in the difference in per-capita income from poor countries or regions to rich countries or regions based on their very fast economic growth. It explains that convergence will occur if poor countries or regions with low incomes will grow faster than rich countries or regions with high incomes so that in the long run all countries will achieve the same level of convergence. Therefore, convergence is needed by lagging regions to equalize their economic growth with developed regions so that development disparities do not occur between regions within a region.

In relation to inequality, the actual human condition is the most dominant factor in the economic growth of a region. Determine the increase in equity in an area that is determined by the quality of its people. (Budiman, et al. 2018) in his research stated that innovative human capacity and the qualifications of an educated workforce are important factors that are expected to improve the economic sector. Where with good human capacity will be able to use and create the latest technology to increase productivity. The his means that the human development index (IPM) is one of the main problem factors in development and economic growth and the most difficult to overcome. Often this distribution of economic growth is ignored because the government tends to concentrate on increasing growth but does not pay attention to the human development index so that there are disparities between regions.

Economic convergence on the island of Sumatra will be achieved if there is a process of economic convergence in the provinces on the island of Sumatra, namely through increased per capita income growth. To encourage the creation of this

convergence, it is necessary to invest in the right sectors and possibly other factors such as the human development index that need to be identified to speed up the process.

Based on the background above, the authors feel that it is necessary to conduct research whether there is a decrease in the economic growth gap every year (*sigma convergence*) and there is an acceleration of low economic growth to high economic growth (*beta convergence*) in every province on the island of Sumatra.

## THEORETICAL STUDY

## Convergence Theory

Convergence is a condition where in a country or region economically has the same utility and production function, then a poor country or region can relatively have a faster rate of economic growth than a richer country or region, or in a simple sense it is called convergence (Putra & Jamal, 2017).

Convergence is a conditional phenomenon that describes the linkages of lagging regions that have not been able to catch up with the low allocation of government spending so that it can affect the rate of accelerated growth in the region (Kurniati, 2022).

Convergence is a condition where the growth rate between countries or regions tends to decrease over time. Convergence will occur if areas with low income grow faster than areas with high income (Budiman et al, 2018).

According to Muzani and Benardin (2019) Convergence is a condition that describes the smaller the gap or disparity of a variable between regions in a certain period.

According to Aulia (2019), in general, the intended convergence is the process of reducing the income gap between regions so that it can also be understood as a process of catching up with low-income areas towards high-income areas. The income gap that attempts to reduce through the convergence process is calculated based on real per-capita income.

According to Salvatore (2011), convergence is an imbalance or deviation that occurs due to lifestyle. The researchers found that the similarities in the lifestyles of middle-class people around the world were greater than expected and continued to grow

as income or education increased. With an increase in culture and convergence, it can be predicted that it will accelerate in the future.

According to Dinata (2016) Convergence itself has two perspectives, namely *σ convergence* and *β- convergence*. *σ-convergence* is constrained by the discussion of the size of the dispersion between economies. Through this approach, convergence will occur if the measure of dispersion between economies decreases according to a certain size of time. That is, convergence occurs when the inequality of income distribution gets smaller over time. This dispersion (a measure of spread) can be measured through the standard deviation of the real GRDP log. The second approach is through *β-convergence*. This analysis is based on the notion that the economic prosperity experienced by developing countries and developed countries will meet at the same point at a certain time frame. Developed countries will move towards a steady state condition, that is, their economic growth will stop at a certain point. This is caused by the addition of investment no longer generate additional income.analysis *β-convergence* is a long-term analysis, and can be used as a projection of the economy in the future.

This analysis can also describe the convergence speed accurately. This means about when the period when the economy of poor countries and the country's economy can be known.

**Economic Growth Theory**

According to Sukirno (2018) Economic growth as a quantitative measure that describes the development of an economy in a given year when compared to the previous year. These developments are always expressed in the form of a percentage change in national income in a given year compared to the previous year.

According to Dinata (2016) Economic growth is considered to have a single dimension through the measurement of increased production only. Meanwhile, economic development has broader donors, namely not only in terms of increasing production quantitatively, but also includes changes in the composition of production, changes in the pattern of allocation of production *resources (productive resources)* among sectors of economic activity, changes in the distribution of wealth. and income among various classes of economic behavior, changes in the institutional*framework* in society as a whole.

According to Suparmoko (2019) Economic growth is the most prioritized thing, adhered to by growth theory saying that by prioritizing economic growth, the Indonesian economy since the birth of the New Order until now, we need to pay attention to the main ideas underlying the pattern of economic development in each country. each of these eras, including the policies they pursued. Basically every government in this world (including the government in Indonesia) always aims to develop its economy in such a way that the standard of living of the nation concerned increases. A better or higher standard of living is reflected by the existence of two important words, namely a just (*equity*) and prosperous (*growth*) society. So every society certainly wants to achieve the universal goal of every development, namely "*growth and equity*".

## RESEARCH METHOD

This study used panel data regression analysis. The data used in this study is secondary data obtained from related institutions, namely the Central Bureau of Statistics for the Island of Sumatra. The data used is panel data in the form of a combination of *cross sections* and *time series* from 2015 to 2021 which covers 10 provinces on the island of Sumatra. The analysis used in this study is panel analysis and convergence analysis using *Dynamic Panel Data / Least Squares analysis.* Estimation results with the *Random Effect Model*.

**Panel Data Analysis Panel**

Data regression model is as follows:

$$\ln y_{it} = \beta_{0it} + \beta_1 \ln y_{it-1} + u$$

dimana:

where:

$\beta_0$ : Constant/intercept

$\beta_1$ : Convergence

coefficient $y_{it}$ : real GRDP of province i year t

$y_{it-1}$ : real GRDP of province i year t-1

u : *error term*

i : *cross section*

t : *time series*

## Sigma Convergence

Analysis This analysis is a time series analysis to observe the convergence of the observed variables by calculating the coefficient of variation. According to Shanker, et al., in Achmad (2017) the formula for calculating the coefficient of variation each year is as follows:

$$CV = \frac{\sqrt{\sum(Yi - Y)2/n}}{Y}$$

Where:

*CV* is the coefficient of variation in a given year

*Yi* represents the real GRDP for each district/city year *i*

*Y* represents the mean real GRDP for 2015- 2021

and *n* represent the number of provinces in the study

## Beta Convergence Analysis

The regression model with conditional beta convergence is as follows:

$$\ln yit = \beta 0it + \beta 1 \ln yit-1 + \beta 2 \ln X 1it + \beta 3 \ln X 2it + uit$$

dimana:

β0 : Constant/intercept

β1 : Convergence

Coefficient yit : real GRDP of province i year t

yit−1 : real GRDP of province i year t- 1

X1,X2 : Independent variables in the study

The next test, namely the hypothesis test used in this study, is the t test to find out whether in the panel regression model, the independent variable partially influences the

dependent variable significantly by comparing t-counts and t-tables. Then the F test to find out whether the independent variables jointly affect the dependent variable.

In testing the convergence hypothesis, the authors use conditional convergence which has been analyzed using the *dynamic panel data/generalized method of moment regression model.* The parameter used as the convergence hypothesis is the value of β, which is the amount of convergence during the study period to determine whether convergence occurs.

## RESULTS AND DISCUSSION

Calculation of sigma convergence is used to see the trend of decreasing per capita income dispersion which is used as a measure of convergence during the study period. The following is from the Convergence of all provinces on Sumatra Island:

**Table 2.**

**Sigma Convergence**

| Year | Dispersion Value |
|------|------------------|
| 2015 | 0.196884 |
| 2016 | 0.193378 |
| 2017 | 0.187493 |
| 2018 | 0.166790 |
| 2019 | 0.189567 |
| 2020 | 0.119099 |
| 2021 | 0.187899 |

*Sources: Research Result Output*

Based on the table above, it is shown the results of sigma convergence that occurred on Sumatra Island in the 2015-2021 period where the dispersion value of per capita income in 2015 was 0.196884 and in 2021 it decreased to 0.187899. This decrease in the dispersion of per capita income can be interpreted as the condition of the provinces on the island of Sumatra together approaching the condition of equity.

Beta convergence is used to see the measure of convergence that you want to know during the research period by knowing the conditional convergence model. Conditional convergence can be identified by dynamic panel data analysis or the *generalized method of moment* with the proposed conditional convergence model as follows.

$$\text{lnPDRBit} = \alpha + \gamma 1 \ln(\text{PMDN})\text{it} + \gamma 2\ln(\text{IPM})\text{it} + +u_i$$

The level of beta convergence on economic growth that occurs in provinces on the island of Sumatra. The following are the results of the regression for Beta Convergence:

**Table 3**

**Output for Beta Convergence**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 20.63898 | 5.589718 | 3.692312 | 0.0077 |
| PMDN | 0.033630 | 0.180428 | 0.186387 | 0.8574 |
| IPM | 0.246303 | 0.078329 | 3.144489 | 0.0163 |
| R-squared | 0.587670 | Mean dependent var | | 3.133000 |
| Adjusted R-squared | 0.469861 | S.D. dependent var | | 0.540639 |
| S.E. of regression | 0.393642 | Akaike info criterion | | 1.216577 |
| Sum squared resid | 1.084680 | Schwarz criterion | | 1.307353 |
| Log likelihood | -3.082885 | Hannan-Quinn criter. | | 1.116996 |
| F-statistic | 4.988342 | Durbin-Watson stat | | 2.202432 |
| Prob(F-statistic) | 0.045015 | | | |

**Discussion**

Based on the results of the sigma convergence analysis, it can be concluded that there has been sigma convergence between provinces on Sumatra Island during the period 2015-2021, meaning that poor provinces on Sumatra Island have the possibility to catch up with the economic growth of rich provinces . Therefore, to achieve convergence between provinces, the role of the government in each province on the island of Sumatra is needed to increase *its leading sector again.*

From the results of the beta convergence analysis using panel data regression, the results of *β-convergence were*. With the estimated coefficient value of the first lag variable, GRDP is positive, which is equal to 20,638, meaning that if the PMDN and IPM

values are equal to zero, then the GRDP level is 20,638 and positive, it can be concluded that very strong empirical evidence has been found that there is a divergence in economic growth on the island of Sumatra.

Based on the Partial Test (t test) The results of this study show that the partial results of the regression coefficient on PMDN are 0.186 with a prob value. 0.85 (greater than 0.05), which means that the PMDN log variable has no significant effect on the log variable (GDP). The regression coefficient of 0.186 explains that if the PMDN variable cannot affect the GRDP value.

While partially the regression coefficient on HDI is 3.144 with a prob value of 0.01 (smaller than 0.05) which means that the HDI log variable has an effect and is significant on the log variable (GRDP). The regression coefficient is 0.01, explaining that if the HDI variable increases by one unit, it can definitely increase the log variable (PDRBit) by 3.144.

The coefficient of determination ($R^2$) basically measures how far the model's ability to explain the variation in the dependent variable is, while the rest is explained by other variables outside the model. It can be seen that the R Square value is 0.587 or 58.7%. This means that the log variable (PDRBit) is explained by 58.7% of the independent variables, namely PMBN and HDI. While the remaining 41.3% is explained by other variables or independent variables outside of this regression equation.

Speed *absolute convergence* (economic growth) is 0.587670 which means that there has been an absolute convergence speed of economic growth. This means that the convergence speed is explained as 58.7% per year with the Convergence rate being influenced by PMBN and HDI in the 2015-2021 period.

Based on research results and supported by previous research, it proves that GRDP, PMBN, and IPM can affect economic growth and conditional convergence calculations as a measure of speed and ability to achieve equal conditions. The island of Sumatra is moving increasingly convergent and achieving equal conditions with the condition of increasing investment and human development to manage technology as a condition for economic development so that the results of the sigma convergence calculation state that the island of Sumatra is experiencing a process of convergence and

moving towards equal conditions and a steady state. With the dispersion value getting smaller from year to year and moving toward zero, it indicates that equal distribution conditions can be achieved.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research conducted by the author on the convergence analysis of economic growth between provinces on the island of Sumatra, the conclusions are obtained, namely: The sigma convergence states that Sumatra Island is experiencing a convergence process and is moving towards a condition of equalization and *steady state*. With the dispersion value getting smaller from year to year and moving toward zero, it indicates that equal distribution conditions can be achieved. Beta convergence using panel regression calculations shows that per capita income is an indicator for measuring sigma convergence and beta convergence. There is that direct PMBN does not have a significant effect on income per capita on the island of Sumatra. And HDI has a positive and significant influence on income per capita on the island of Sumatra. And the human development variable has a positive and significant effect on income per capita on the island of Sumatra; and Speed of *absolute convergence* (economic growth) is 0.587670 which means that there has been an absolute convergence speed of economic growth. This means that the convergence speed is explained as 58.7% per year with the Convergence rate being influenced by PMBN and HDI in the 2015-2021 period.

From the conclusions that have been put forward, several suggestions can be presented, namely as follows: (1). It is hoped that the central and regional governments will be able to increase convergent values by carrying out a number of policies to further promote the economic potential of provinces experiencing weak growth to domestic and foreign investors in order to reduce disparities so that disparities can be more evenly distributed. And also the central government is expected to pay more attention to underdeveloped regions, namely by allocating development budgets as instruments to reduce economic inequality. It seems that more attention is needed in the future by building infrastructure that can increase the rate of economic growth in underdeveloped areas

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