The Third International Conference on Government Education Management and Tourism (ICoGEMT)+HEALTH
Bandung, Indonesia, January 19-20th, 2024

CONVERGENCE ANALYSIS OF ECONOMIC GROWTH IN THE LAKE TOBA REGION REGENCY USING PANEL DATA

[*1]Darwin,[2]Sirojuzilam,[3]M. Syafii,[4]Dede Ruslan

[1] Doctoral Student of Economics, Faculty of Economics and Business, University of North Sumatra
[2] Faculty of Economics and Business, University of North Sumatra
[3] Faculty of Economics and Business, University of North Sumatra
[4] Faculty of Economics, Medan State University

Author's email:
[1]darwin.damanik@gmail.com ;[2] sirojuzilam@usu.ac.id ;[3] m.syafii@gmail.com ;[4] drasruslan@unimed.ac.id
**Corresponding author: [1]darwin.damanik@gmail.com*

Abstract. *This study aims to analyze the convergence of economic growth in 8 (eight) districts in the Lake Toba Region for the period 2013-2022. The convergence analyzed includes sigma convergence, absolute beta convergence, and conditional beta convergence. Conditional beta convergence analysis uses several control variables, namely the Human Development Index, Tourism sector GRDP, and Road Infrastructure. The data used in this study is panel data. The research data comes from the Central Bureau of Statistics (BPS) North Sumatra. Data analysis uses the panel data analysis method with the Common Effect Model (CEM) approach. The results of the analysis showed that there was a sigma convergence of economic growth in the 8 (eight) districts in the Lake Toba Region during the 2013-2022 period. That is, there are indications that the dispersion of economic growth in the 8 (eight) districts of the Lake Toba Region is getting smaller. In addition, absolute beta convergence and conditional beta convergence were also found to occur, these findings indicate that the growth of per capita income of districts that are still lagging is higher than that of developed districts. The absolute beta convergence rate is 3.04 percent per year and takes 22.8 years to reach the Half-time Convergence condition. Meanwhile, the conditional beta convergence rate per year is 2.47 percent, and takes 28.01 years to reach a Half-time Convergence condition.*

Keywords: *Economic Growth; Convergence; Human Development Index; Infrastructure; Tourism Sector GDRP*

1. INTRODUCTION

Regional autonomy has been going on for almost 3 (three) decades in Indonesia, 27 years to be exact. Since the enactment of Law No.25 of 1999 which was revised into Law No.32 of 2004 concerning Regional Autonomy, development in the regions is left to each local government, the central government only as a supervisor or controller, so that each region must try as much as possible to determine its policies and development to increase its economic growth and catch up with their respective regions.

Indonesia's economic growth is supported by economic growth in each province. Economic growth in each province requires economic development that covers all aspects. However, economic growth often experiences obstacles in the form of inequality or uneven economic development disparities between regions in Indonesia. The success of regional economic development can be seen through economic growth, economic structure and the smaller income inequality among the population, between regions, and between sectors.

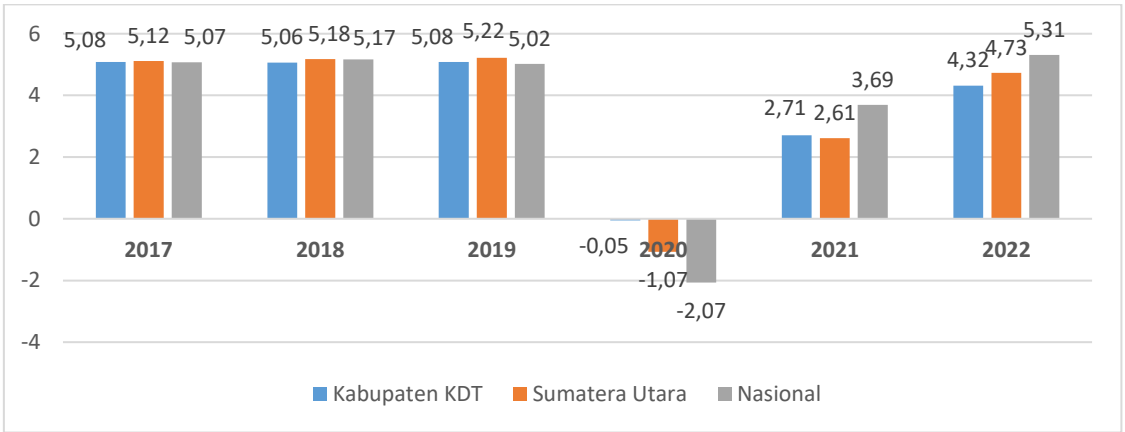
North Sumatra Province is one of the provinces in Indonesia that plays an important role in the national economy. The province has 33 districts/cities that have potential resources with diverse variants and potential to be developed, especially the potential for very diverse and beautiful tourism. The tourism industry in North Sumatra can be an opportunity for especially the very diverse and beautiful tourism potential. The tourism industry in North Sumatra can be an opportunity that can be utilized to improve the standard of living and prosperity of the community. The tourism sector can be used as a

leading sector that can increase the economic scale of North Sumatra and make it a better source of economic growth.

The Lake Toba region is a central economic source, of development management in 8 (eight) districts that are directly adjacent spatially, namely Toba, Samosir, Simalungun, North Tapanuli, Humbang Hasundutan, Karo, Pakpak Bharat and Dairi Regencies, of course, requires integrated governance. If development is carried out based on the district economy, there will likely be economic divergence in the Lake Toba Region which ultimately reduces the level of achievement of Lake Toba as a super-priority tourist destination that will produce prosperity for the people in the Lake Toba Region in particular.

Figure 1. 8 (eight) Districts in the Lake Toba Region

The average economic growth rate in 8 (eight) districts in the Lake Toba Region (KDT), North Sumatra Province, and National from 2017 to 2022 always fluctuates. In 2020, economic growth experienced negative or no growth as a result of the COVID-19 pandemic that hit the world at the end of 2020. On average, the rate of economic growth over the past 6 years, the economic growth rate in 8 (eight) districts in the Lake Toba Region is better or higher than that of North Sumatra Province. Where the average economic growth in the Lake Toba Region Regency was 3.70%, the Province was 3.63%, and the National was 3.70%.



Source: BPS Sumatera Utara, 2023

Figure 2. Average Economic Growth Rate of 8 Regencies of Lake Toba Region, North Sumatra Province and National, Period 2017-2022.

Over the past 6 (six) years, the average economic growth in 8 (eight) districts in the Lake Toba Region has been above the average economic growth of North Sumatra Province and the nation at 3.71%, only a few districts such as Simalungun, Pakpak Bharat, Samosir, and North Tapanuli whose economic growth is above the average of North Sumatra Province. This is a necessary condition in development, economic growth in the Lake Toba Region does not yet have the power to produce welfare in the form of reducing income inequality and poverty levels in the Lake Toba Region. The low level of economic growth in the Lake Toba Region is in line with the high level of poverty in the Lake Toba Region.

Over the past almost 2 (two) decades, the dominant economic sectors contributing to the formation of GRDP in the Lake Toba Region districts are the agriculture, forestry and fisheries sectors, the construction sector, the wholesale and retail trade sector, and the non-oil and gas processed industry sector. The tourism sector only contributes less than 5 percent in the formation of GRDP in 8 (eight) districts of the Lake Toba Region. The contribution of the tourism sector to the largest GRDP in the Lake Toba Region was achieved by Samosir Regency, which reached 4.91 percent in 2022. Meanwhile, Simalungun Regency has the lowest contribution of the tourism sector to GRDP in the Lake Toba Region, which only amounted to 0.76 percent.

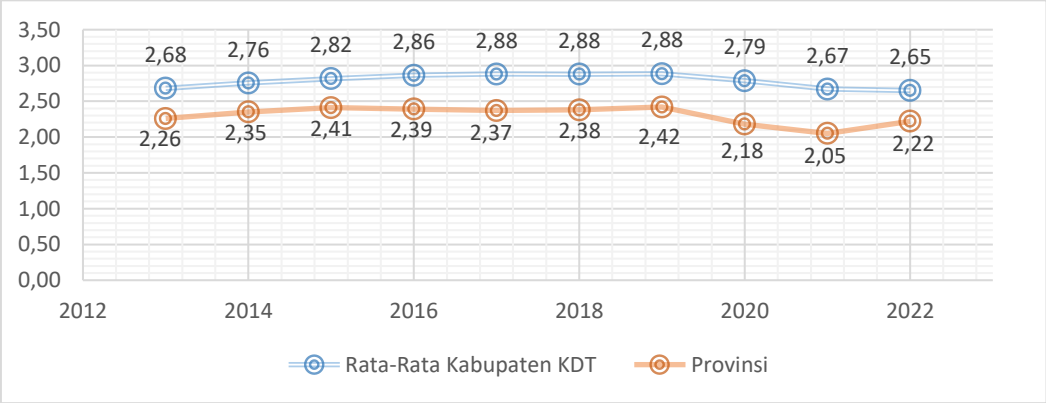


Figure 3. Contribution of Tourism Sector in 8 Regencies of Lake Toba Region (KDT) and North Sumatra Province, Period 2013-2022 (%)

Thus, it can be said that the utilization of natural resource wealth in the form of the panoramic beauty of Lake Toba has not been able to become a driving force for economic development in the Lake Toba Region (KDT). The determination of Lake Toba as a Super Priority Tourism Area (DPSP), is expected to be a trigger for improving the economy of the Lake Toba Region. Sectoral economic development by each district in the Lake Toba Region is expected to make the tourism sector the ultimate goal of regional development which has a direct impact on improving the welfare of the people in the Lake Toba Region.

Likewise, the GRDP Per Capita in the 8 (eight) districts in the Lake Toba Region, which is an indicator of the level of prosperity of the population in the area, shows that the GRDP per capita of the 8 (eight) districts in the Lake Toba Region has increased every year but is still below the GRDP per capita of North Sumatra and the National, where the average GRDP per capita of the 8 (eight) districts in 2022 was Rp.24,707,645.70 while North Sumatra Province and the National were

Rp.37,943,827.31 and Rp.42,463,780.00. Pakpak Bharat and North Tapanuli Districts are the 2 (two) districts that have the lowest GRDP per capita of the 8 (eight) districts in the Lake Toba Region.

In addition, the poverty rate in the 8 (eight) districts of the Lake Toba Region also looks still alarming where most of the percentage of poor people in the Lake Toba Region District is above the average poverty percentage of North Sumatra Province. Based on BPS data in 2022, there are 5 (five) districts in the Lake Toba Region (KDT) whose percentage of poor people is above the average percentage of North Sumatra Province, which is 8.42 percent. Samosir Regency has the highest percentage of poor people in the Lake Toba Region at 11.77 percent, followed by North Tapanuli, Toba, Humbang Hasundutan, and Pakpak Bharat Regencies.

With higher regional inequality, there is a need for a mechanism that can reduce this gap commonly called convergence, where convergence is defined as the process of economic growth of countries or regions with such growth that reduces differences or disparities in income, productivity, wage levels, and various other indicators. Convergence itself is a concern of experts with the central issue being whether there is a tendency for less developed regions to grow faster than those that have developed first or whether there is a tendency for the rich to get richer and the poor to get poorer and more left behind (Kuncoro, 2008).

Convergence is a phenomenon that leads to a meeting point (Barro, 2004). The process of convergence is closely related to the development of a region or area. There are two types of convergence, namely sigma convergence and beta convergence (Barro and Martin, 1992; Arsyanti and Nugrahadi, 2020). Sigma convergence (α) indicates the smaller gap or inequality in the development of a region within a certain period. Meanwhile, beta convergence (β) indicates that the growth of per capita income of poor regions is faster than that of rich regions. There are two types of beta convergence, absolute convergence, and conditional convergence. In the concept of absolute convergence, measurement is done only on the per capita income variable, while other variables that can determine the achievement of economic stability are ignored. In contrast, conditional convergence accommodates economic heterogeneity by adding several control variables. The added control variables are variables that have a significant influence on economic growth.

There have been many previous studies related to development convergence in Indonesia. Arsyanti and Nugrahadi (2020) analyzed economic convergence between regions in Western Indonesia (KBI) and Eastern Indonesia (KTI) and found that there was still economic inequality between KBI and KTI. However, during the 2011-2018 period there was an improvement in per capita income dispersion at the KTI and national levels, while the KBI did not. Furthermore, absolute and conditional beta convergence occurred at the KBI, KTI and national levels. The same thing was also found by Yuniasih et. al. (2013) regarding the existence of regional disparities between KTI and KBI during the period 1987-2011. The regional disparity of aggregate labor productivity in KTI is more unequal than in KBI. They predicted that it would take about 11 years to close the gap.

Several regions in Indonesia experienced convergence, indicating an increase in the rate at which poor regions catch up with rich regions. Java Island experienced spatial conditional beta convergence and needed 5.206 years to close half the gap (Yudistira and Sohibien, 2019). This means that underdeveloped regions in Java have the opportunity to catch up with economically developed regions. To achieve this, the control and intervention of each local government is needed. Purwandari and Wahyuni (2016) argued that the Special Region of Yogyakarta (DIY) as a region with the lowest level of development success on the island of Java requires the role of the government to control various variables such as Regional Original Revenue (PAD), the length of good category roads, the number of working population, and the average length of schooling so that per capita income convergences. Convergence is difficult to achieve if these variables

are not controlled, because each region in DIY has not yet reached a steady state condition.

Convergence between regions is one indicator of success in regional development. However, the successful development of a region cannot be claimed as the success of the region itself. The interrelationship of spatial interaction between regions cannot be ignored in influencing the success of development. This study examines the convergence of economic growth among 8 (eight) districts in the Lake Toba Region of North Sumatra Province, which after being designated as a national tourism strategic area as an indicator of the success of regional development.

2. LITERATURE REVIEW

2.1 Convergence Theory

Convergence is a condition that shows the similarity of economic activities that occur between rich and poor countries. Convergence is defined as a condition in which the economies of poor countries can equal or catch up with developed economies. Convergence conditions can be interpreted as conditions when meetings between regions have an impact on low disparities (Schmitt and Peter, 2011; Dekiawan, 2014; Maryaningsih et al, 2014).

Convergence measurement is carried out in two ways, namely sigma convergent and beta convergent. Sigma convergent is defined as an approach to directly see the distribution of income between regions (Dekiawan, 2014; Maryaningsih et al, 2014; Dana, 2018). The occurrence of real per capita income disparities between regions that have decreased over time indicates the presence of sigma convergence. The condition of convergence in the convergent sigma approach is seen through the Unweighted Coefficient of Variation, Weighted Coefficient of Variation, and Theil Index. Determination of the existence of convergent sigma can be calculated through the spread of economic growth measured as the coefficient of variation or standard deviation of the logarithm of economic growth.

The concept of beta convergence aims to measure the speed at which lagging regions catch up with richer regions (Maryaningsih et al, 2014; Gömleksiz et al, 2017). The convergent beta approach focuses on the economic growth literature. So that it will be known that differences in economic growth between regions or countries can have convergent conditions take how long.

2.2 Economic Growth

Economic growth is an illustration of the impact of government policies implemented, especially in the economic field. Economic growth is the rate of growth formed from various economic sectors which indirectly describes the level of economic growth that occurs. For the region, this indicator is important to determine the success of future development (Sirojuzilam, 2011).

Endogenous growth theory, also called new growth theory, is a modification of the Solow growth model, this model tries to improve the failure of the Solow model in terms of explaining the causes of technological development, according to this theory, technological change is endogenous (from within the economic system) and affects long-term growth.

Mankiw, Romer, Weil / MRW (1992) proposed using human capital accumulation variables in modifying the Solow model. The source of economic growth is thus the growth of capital, labor, and human capital. It turns out that the MRW estimation results are better than the Solow model.

3. RESEARCH METHODS

This research uses a quantitative descriptive approach that emphasizes the form of mathematical calculations that emphasize hypothesis testing that examines the influence of the determinants of regional economic growth.

The scope of this research is 8 (eight) districts located in the Lake Toba Region as

the unit of analysis and the period selected in this study during the period 2013 - 2022. The Lake Toba Region referred to in this study consists of 8 districts spread across North Sumatra Province, namely: Toba Samosir, Samosir, Simalungun, North Tapanuli, Humbang Hasundutan, Karo, Pakpak Bharat, and Dairi regencies.

The type of data used in this study is quantitative data and the data source used is secondary data. The secondary data used is panel data, which is data that combines time series data and cross-section data. The panel data used is time series data from 2013-2022 and a cross-section of 8 districts in the Lake Toba Region of North Sumatra Province obtained from official publications of the Central Statistics Agency (BPS), Bappeda of North Sumatra Province, and other related agencies.

This study uses quantitative research methods using panel data. The econometric model used in this study is the panel data model. Data analysis that will be carried out in this study is as follows: Sigma Convergence, Absolute Beta, and Conditional Beta. Where sigma convergence can be measured by dispersed measures such as standard deviation and or the coefficient of variation (CV) which refers to Barro et al (1992), Sodik (2006), and Gama (2009). Convergence occurs if the dispersion between economies decreases over time. To determine and analyze the existence of sigma convergence, it is measured using the coefficient of variation of per capita income between regions. The formulation used to calculate the coefficient of variation is as follows:

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

Where CV is the coefficient of variation in a particular year, Yi represents the real GRDP per capita of each district in the Lake Toba Region in 2013-2022, and Y represents the mean of the real GRDP per capita of each district in the Lake Toba Region in 2013-2022, while n is the number of districts.

Absolute beta convergence (β-convergence) is the negative correlation between the initial per capita income level and the growth rate. To examine the concept of absolute beta, the equation of Barro & Sala-i-Martin is used, as follows:

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

where:
β0 : Constant/Intercept
β1 : Convergence Coefficient
y_{it} : economy growth
y_{it-1}: economy growth of the previous year
μ_{it}: error term
i: cross-section
t : time series

Conditional Beta Convergence, The equation to test for conditional beta convergence in this study is as follows:

$$\ln y_{it} = \beta_{0it} + \beta_1 \ln y_{i,t-1} + \beta_2 \ln HDI_{i,t} + \beta_3 \ln PDRB_{i,t} + \beta_4 \ln Roads_{i,t} + \mu_{it}$$

Where:

β0	: Constant/Intercept
β1	: Convergence Coefficient
β_2, β_3, β_4	: Coeficient
y_{it}	: Economic growth
y_{it-1}	: Economic growth in the previous year
HDI	: Human Development Index
PDRB	: GRDP of the tourism sector
Roads	: Road length in good condition
μ_{it}	: error term
I	: 8 regencies/cities in the Lake Toba region

t : period 2013-2022

4. RESULTS AND DISCUSSION

a. Sigma Convergence Analysis

Sigma convergence indicates a shrinking development gap between the eight districts in the Lake Toba Region, which is reflected by a decrease in economic growth disparities. The tendency of sigma convergence is indicated by the decreasing coefficient of variation of economic growth.

Table 1. Coefficient of Variation Results

Year	Coefficient of Variation
2013	0.1008
2014	0.1023
2015	0.0890
2016	0.1041
2017	0.0986
2018	0.0969
2019	0.0939
2020	-17.3106
2021	0.2363
2022	0.0394

The results of the calculation of the coefficient of variation show a tendency towards sigma convergence. This can be seen from the value of the coefficient of variation of economic growth in the eight districts of the Lake Toba Region which decreased during the period 2013 to 2018. In 2013, the coefficient of variation of economic growth was 0.1008. Furthermore, it decreased to the lowest point in 2015, which amounted to 0.0890. In 2016, the coefficient of variation rose to 0.1041. From 2017 to 2020, it fell successively to -17.3106 due to the COVID-19 pandemic. Although it had increased, the coefficient of variation in 202, but in 2022 it was much lower when compared to 2013. This means that during the 2013-2022 period, there was a convergence of economic growth sigma in the eight districts in the Lake Toba Region. This shows that the dispersion of economic growth in the eight districts is getting smaller, with the lowest dispersion occurring in 2020.

b. Beta Convergence Analysis

Beta convergence analysis, both absolute beta convergence and conditional beta convergence are conducted using the Common Effect Model (CEM) approach. Model selection is based on the results of the Chow test, LM test, and Hausman test that have been conducted. The results of the Chow test and Hausman test are presented in Table 2 below:

Table 2.Results of Chow Test, LM Test, and Hausman Test

	Prob.			Kriteria
	Uji Chow	**Uji Hausman**	**LM - Test**	
Cross-section F	0.9948	-		

Cross-section random	-	0.3248		Model yang paling sesuai adalah CEM
Breusch-Pagan			0.0669	

Source: Data processed (2024)

Absolute beta convergence analysis

The absolute beta convergence analysis aims to see the tendency of economic growth convergence in the eight districts in the Lake Toba Region. The independent variable tested is the economic growth of the previous year (t-1). Absolute beta convergence occurs if the value of the regression coefficient (β1) of economic growth in the previous year t-1 < 1. The results of the analysis are presented in Table 3 below:

Table 3.Results of Absolute Beta Convergence Analysis

Variable	Coefficient	Prob.
C	2.737142	0.0000
(Y_1)	0.355489	0.0009

Source: Data processed (2024)

From Table 3, it is known that absolute beta convergence occurred in eight districts in the Lake Toba region for the period 2013 to 2022. This can be seen from the regression coefficient value of economic growth in the previous year (t-1) < 1. Furthermore, economic growth in the previous year (t-1) is known to have a significant effect on current economic growth. This means that the economic growth of the eight districts of the Lake Toba region that are still lagging is faster than the districts whose development has advanced. The rate of convergence is 3.04 percent per year and requires 22.8 years to reach semi-converged conditions.

Conditional beta convergence analysis

Conditional beta convergence shows the tendency of economic growth in underdeveloped regions to grow faster than in developed regions by controlling for certain dimensions and characteristics that can affect the success of a region's economic development. Some of the control variables in this study are the Human Development Index, Tourism Sector GRDP, and Road Infrastructure. Conditional beta convergence is analyzed using a fixed effect model. Conditional beta convergence occurs if the value of the regression coefficient (β1) of economic growth in the previous year (t-1) < 1. The results of the analysis are presented in Table 4 below:

Table 4. Conditional Absolute Convergence Analysis Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.52456	6.791994	2.138483	0.0358
Y_1	0.280736	0.113800	2.466936	0.0160
X2	-0.156147	0.098043	-1.592640	0.1156
X3	0.001909	0.003204	0.595846	0.5531
X4	-0.001715	0.001273	-1.347052	0.1821

Root MSE	1.550850	R-squared	0.200359
Mean dependent var	4.313205	Adjusted R-squared	0.156543
S.D. dependent var	1.745517	S.E. of regression	1.603082

Akaike info criterion	3.843688	Sum squared resid	187.6005
Schwarz criterion	3.994759	Log likelihood	-144.9038
Hannan-Quinn criter.	3.904165	F-statistic	4.572737
Durbin-Watson stat	2.133096	Prob(F-statistic)	0.002374

Source: Data processed (2024)

Based on Table 4, it is known that the regression coefficient of economic growth in the previous year (t-1) is 0.280736 < 1. Economic growth in the previous year (t-1) also has a significant effect on current economic growth. This shows that there is conditional absolute convergence in the eight districts of the Lake Toba region in 2013-2023. This means that districts that are still lagging can catch up with districts that are already developed, resulting in convergence. The rate of convergence per year is 2.47 percent. It takes 28.01 years to reach a semi-converged state. Several factors are known to determine the acceleration of convergence between districts in the Lake Toba Region, namely human capital, tourism sector revenue, and infrastructure.

Based on the results of the analysis, the human capital variable proxied by the Human Development Index has a regression coefficient of -0.156147 with a significance probability value greater than the alpha value (0.1156 <0.05). This shows that the Human Development Index has a negative effect on economic growth. This means that an increase in HDI has a negative impact on economic growth, potentially hindering the acceleration of convergence. To accelerate convergence, HDI needs to be controlled.

The regression coefficient value of the tourism sector GRDP variable is 0.001909 with a significance probability value greater than the alpha value (0.5531> 0.05). This shows that GRDP in the tourism sector has a positive and insignificant effect on economic growth. This means that income from the tourism sector in the eight districts of the Lake Toba region does not have a significant impact on increasing economic growth, so it cannot be used as one of the variables determining the acceleration of convergence.

The regression coefficient value of the road infrastructure variable is -0.001715 with a significance probability value greater than the alpha value (0.1821 <0.05). This shows that road infrastructure has a negative and insignificant effect on economic growth. This means that an increase in road infrastructure in good condition has a negative impact on economic growth, potentially hindering the acceleration of economic growth convergence. To accelerate convergence, good-condition road infrastructure needs to be controlled.

CONCLUSION

The results of the analysis showed that there was a sigma convergence of economic growth in the eight districts in the Lake Toba Region during the 2013-2022 period. That is, there are indications that the dispersion of economic growth in the eight districts of the Lake Toba Region is getting smaller. In addition, absolute beta convergence and conditional beta convergence were also found to occur, these findings indicate that the growth of per capita income of districts that are still lagging is higher than that of developed districts. The absolute beta convergence rate is 3.04 percent per year and takes 22.8 years to reach the Half-time Convergence condition. Meanwhile, the conditional beta convergence rate per year is 2.47 percent, and takes 28.01 years to reach a Half-time Convergence condition.

The control variables in this study are The Human Development Index has a negative effect on economic growth, GRDP in the tourism sector has a positive and insignificant effect on economic growth, and the road infrastructure has a negative and insignificant effect on economic growth.

REFERENCES

Arsyanti, R. A., & Nugrahadi, T. (2021). Analisis Konvergensi Ekonomi Pada Level Kawasan Dan Nasional Serta Faktor-Faktor Yang Memengaruhinya. Seminar Nasional Official Statistics, 2020(1), 717–727. https://doi.org/10.34123/semnasoffstat.v2020i1.481

Barro, Robert J. and Xavier Sala-i-Martin. 1992. Convergence. Journal of Political Economy,100: 223-251.

Barro, R. J., & Sala-I-Martin, X. X. (1992). 1992 Barro and Martin _Convergence. Journal of Political Economy, 100(2), 223–251.

Dekiawan, H. 2014. Konvergensi Penerimaan dan Pengeluaran Pemerintah Provinsi di Indonesia: Pendekatan Data Panel Dinamis Spasial Tahun 2000-2012. Buletin Ekonomi Moneter dan Perbankan, 17(1), 100-128. https://doi.org/10.21098/bemp.v17i1.4.

Gömleksiz, M., Şahbaz, A., & Mercan, B. (2017). Regional Economic Convergence in Turkey: Does the Government Really Matter for? Economies, 5(3), 27. doi:10.3390/economies5030027

Maryaningsih, N., Hermansyah, O., Savitri, M. 2014. Pengaruh Infrastruktur Terhadap Pertumbuhan Ekonomi Indonesia. Buletin Ekonomi Moneter dan Perbankan, 17(1), 62-98. https://doi.org/10.21098/bemp.v17i1.44

Mankiw, N.G., Romer, D & Weil, D.N. 1992. A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics Vol 107, hlm 407-437

Sirojuzilam. 2011. Regional: Pembangunan, Perencanaan, dan Ekonomi. Medan: USU Press

Sodik, J. 2006. Pertumbuhan Ekonomi Regional: Studi Kasus Analisis Konvergensi Antar Provinsi di Indonesia. Jurnal Ekonomi Pembangunan: Kajian Ekonomi Negara Berkembang, 11(1), https://doi.org/10.20885/ejem.v11i1.570.

Yudistira, M. R., & Sohibien, G. P. D. (2020). Analisis Konvergensi Ekonomi Di Pulau Jawa Menggunakan Data Panel Dinamis Spasial Tahun 2013-2017. Seminar Nasional Official Statistics, 2019(1), 438–448. https://doi.org/10.34123/semnasoffstat.v2019i1.66

Yunianto, D. (2021). Analisis pertumbuhan dan kepadatan penduduk terhadap pertumbuhan ekonomi. FORUM EKONOMI, 23(4), 687–698. http://journal.feb.unmul.ac.id/index.php/FORUMEKONOMI

Yuniasih, A. F., Firdaus, M., & Fahmi, I. (2013). Disparitas, Konvergensi, dan Determinan Produktivitas Tenaga Kerja Regional di Indonesia. Jurnal Ekonomi Dan Pembangunan Indonesia, 14(1), 63–81. https://doi.org/10.21002/jepi.v14i1.447