

Supply Chain Strategy for Convergence of Regional Economic Growth East Coast North Sumatera, Indonesia

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Abstract— Convergence as the core theory of growth in 1990, based on the hypothesis put forward by Barro and Sala-i-Martin (1995) using the neoclassical growth model. One important aspect of this model has been studied and analyzed seriously as an empirical hypothesis of convergence with the assumption that the preferences and apply the same technology. The estimation results above show the value of $(1 + \beta)$ of 0.7660. Based on these values, the value of β is known of -0.234. B value (0.2340) is between zero and -1 indicates that there is a process of convergence of economic growth among the districts / cities in North Sumatra, East Coast Region at the speed of convergence of 23.40%. And Conditional convergence models have a higher speed than the absolute convergence models. This indicates that the independent variable (GRDP/capita, working population, number of poor and length of study) has a great influence in increasing the speed of convergence of economic growth in the East Coast region of North Sumatra.

Keywords— Supply Chain Strategy, Neoclassical growth model, Convergence and Regional Economic Growth.

1. Introduction

Economic development is a process of increase in total income and per capita income by taking into account the population growth and is accompanied by a fundamental change in the economic structure of a country and the equal distribution of income for the population of the State. Economic development cannot be separated from economic growth, economic development to encourage economic growth, and otherwise facilitate the economic growth process of economic development. Indonesia's economic development has been slow due to various problems faced today. One problem that often happens is as the economic gap between the middle and upper class people

with grassroots happened because of inequities caused by the slow growth of the economy of the country today.

Regional development can be defined as a process of achieving better progress than the previous direction. In this case, the economic development a top priority because the economic development of any attempt to achieve the increase in the level of income, provide employment opportunities, to strive for revenue sharing in order to more evenly and reduce disparities in levels of development and construction, and also reduces the income gap and development among region so that the development process becomes more balanced. North Sumatra Province is divided into 3 parts, namely East Coast region, West Coast region and the Highlands (North Sumatra in Figures). Although the economic situation in North Sumatra Province tends to slow down, but the innovation and economic development in North Sumatra is likely to lead to the East Coast. When viewed in terms of structure and development economic growth averaging more rapidly in the East Coast region of North Sumatra Province.

The rate of economic growth tend to have increased in the East Coast region of North Sumatra Province. As we see in Table 1 above, Deli Serdang regency in 2003 economic growth rate of 5.06% and increased to 12.79% in 2013. Tebing Tinggi economic growth rate increased from 4.63% in 2003 to 6.91% in 2013. Labuhan Batu from 4.04% in 2003 to 6.00% in 2013. Langkat economic growth rate of 2.95% in 2003 to 5.97% in 2013. while the city of Medan rate of economic growth has decreased from 5.76% in 2003 to 4.30% in 2013. Binjai economic growth rate declined from

9.07% down to 6.48% in 2013. Similarly, the District Asahan from 7.25% in 2003 fell to 5.83% in 2013 and TanjungBalai 7.59% in 2003 leading to the 4.92% figure in 2013. And some areas there is no development data growth rate economy of time studied for area / division in the new experience are some specific time, such as SerdangBedagai (2004-2013) 6.05% in 2003 fell to 5.97% and the District of Coal (2007-2013) 4:01 % also fell to 3.35%. North LabuhanBatu in 2009 the percentage of the economic growth rate by 5.29% in 2003 rose to 6.33% in 2013, as well as South LabuhanBatu which started in 2009 amounted to 4.94% rise to 6.05% in 2013.

Sirojuzilam, related to economic growth in the East Coast region of North Sumatra province, the region has a higher contribution to the province of North Sumatra, terms of its contribution to the establishment of the Gross Regional Domestic Product (GDP), the East Coast region accounted for 67.08% in the year 2001, and by contributing 71.21% in 2003. Similarly, the GDP per capita average East Coast Region reached Rp. 2.23031 million. Judging from the industrial added value in 2001, contributing Region East Coast of 8.085 trillion rupiah (94.23% of total industrial added value of North Sumatra) and in 2003 amounted to 9,886 trillion rupiah (89.30%). Under these conditions, should Territory East Coast is also the condition of the economy is good and equitable, it is the reason why he made this study, for it was on this paper researchers wanted to examine in order to determine whether there is still a gap of economic development, especially between regions East Coast of Sumatra north and get to know and deepen the disparity of economic development in the region in terms of economic growth and per capita income of the people. Economic disparities between regions in absolute terms and relative inequality between the potential and the welfare level can cause problems in the relationship between the regions [1-8].

2. Literature Review

Convergence as the core theory of growth in 1990 is based on the hypothesis proposed by Barro and Sala-i-Martin using the neoclassical growth model. One important aspect of this model has been seriously reviewed and analyzed as an empirical hypothesis of convergence assuming that the same preferences and technologies apply from one

economy to another and poor countries tend to grow faster than rich countries [9, 10]. Convergence generally consists of σ -convergence (sigma convergence) and β -convergence (beta convergence). The explanation of these two types of convergence is as follows: (1). Sigma convergence (σ -convergence). Sigma convergence is the most conventional measure in measuring the level of disparity between regions over a period of time and is also called a static analysis tool. Barro and Sala'i Martin measure sigma convergence through dispersion that occurs between economies. This view is called σ -convergence which is measured by the standard deviation of real income per capita between regions. If the dispersion of real income per capita between regions decreases, it means there is a slowdown in economic growth or in other words poor regions are increasingly teaching rich regions. (2). Beta convergence (β -convergence) Barro and Sala 'i Martin state that convergence occurs when the economies of poor regions tend to grow faster than rich regions. This indicates that there is a negative relationship between per capita income at the beginning of the period and per capita income growth. This opinion is called β -convergence which is also called dynamic analysis tool. Convergence speed can be known by analyzing β -convergence. One concept that is related to the speed of convergence is the half-life convergence which means the time needed to cover half of the initial gap [8-13].

Barro et al conducted a study of convergence with a neoclassical growth model framework in 73 regions in Western Europe since 1950. The results of the estimation show that there is convergence between regions, although not in accordance with the initial hypothesis that b is constant over time. In the model, the continued use of regional dummy (fixed effect model) also confirms the previous model, namely the existence of convergence in per capita income between regions. In the last model, it involves a dummy sectoral variable, indicating that b is constant with time [14, 15]. Barro and Sala-i-Martin conducted a study to see the existence of convergence in 48 states in the United States. The model used is based on the classical growth model with variable per capita personal income from 1929 to 1988 and variable per capita GRDP during the period 1963-1986. The difference between the two is that percapita personal income includes individual income from companies in the form of dividends, while per capita GRDP includes

company profits and depreciation. The estimation results show that there is convergence, where the economy with a level of income per capita relative to its steady state, tends to have a higher growth rate [16, 17].

Research conducted by Agarwal and Samantha (2014) analyzed shifts in economic power over the past five decades or more in developing countries (DC). It was found that there was a slight shift in relative rankings according to the size of GDP in the 25 largest economies in 2011. The economies

of South Korea and Brazil have become relatively much larger; changes in other countries become minor. Years of correlation between variables indicate that there has been a slight change in rank. Also, GDP and GDP per capita of other countries and regions, have increased relative to the US but this increase has been slow, especially after 1982. GDP of most DCs has increased relative to the US. GDP capita shows a slowdown in productivity growth and structural changes towards shifting economic activities from low productivity to high productivity sectors.

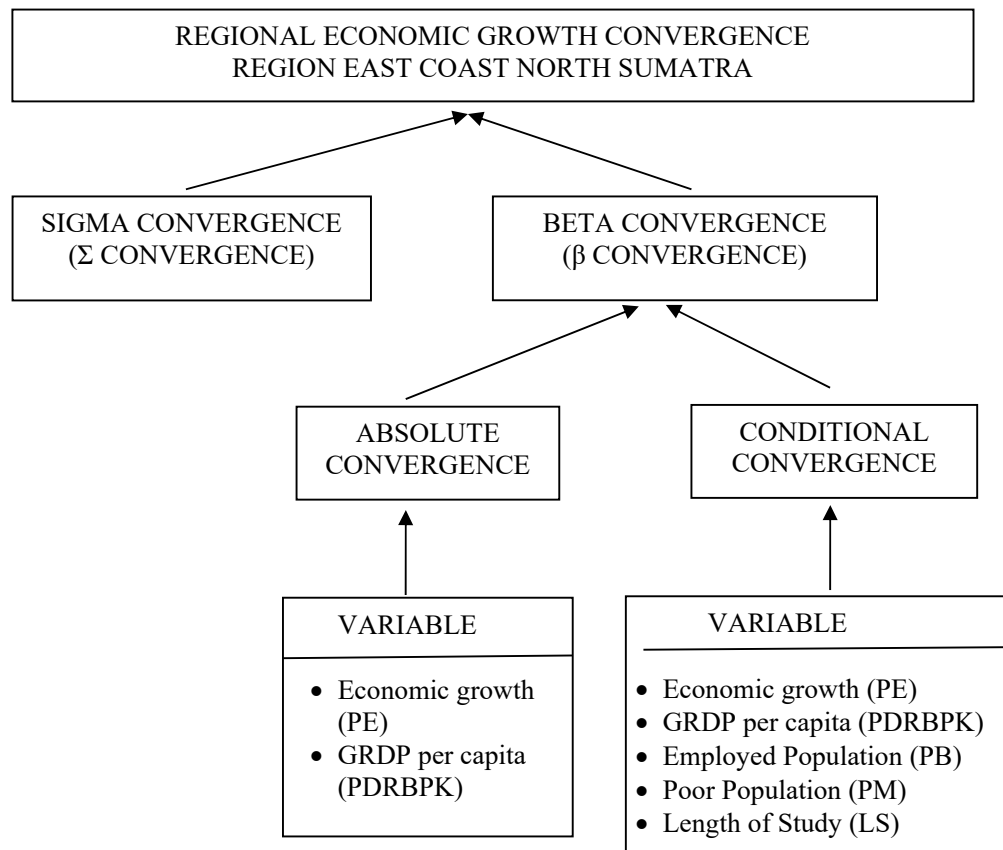


Figure 1. Conceptual Framework

3. Research Methods

3.1 Study Area

This study examines the convergence of regional economic growth in the East Coast of North Sumatra. The term of this analysis is from 2009 -

2013. As the district / city that will be examined is the East Coast region consisting of: LabuhanBatu regency, North LabuhanBatu regency, South LabuhanBatu district in Asahan, TanjungBalai, District Deli Serdang, Langkat, SerdangBedagai, Batu Bara District, TebingTinggi, Medan and Binjai.

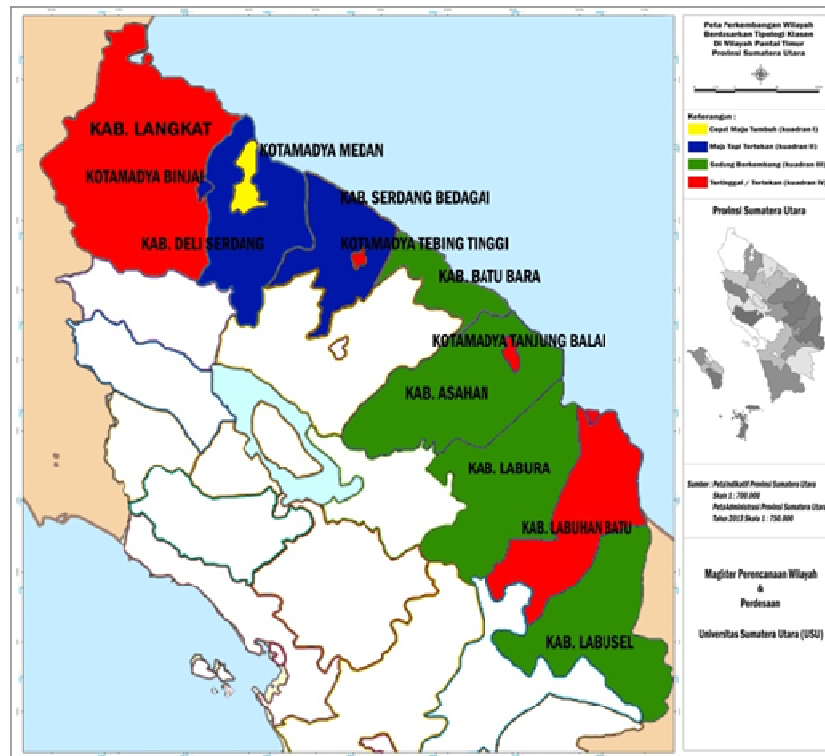


Figure 2. Map of the District / Town Region East Coast of North Sumatra Province.

3.2 Data Analysis

This research model starts with the neoclassical Solow growth model extended by Mankiw, Romer and Weil as follows:

$$Y_{it} = A_{it} K_{it}^{\alpha} H_{it}^{\beta} L_{it}^{1-\alpha-\beta} \quad (1)$$

Where Y_{it} is the economic growth of the country i at time t ; A_{it} is the technological level of the country i at time t ; K_{it} is capital accumulation the country i at time t ; H_{it} is the Human Capital accumulation the country i at time t ; and L_{it} is the amount of labor the country i at time t . The above model is assumed constant returns to scale.

The data used is the nature of data panel or pool of data that is combined time series and cross section during the period 2009-2015. Data were examined among others categorized as economic variable is economic growth that is the growth of Gross Domestic Regional Product (GRDP), the GRDP per capita, while those categorized as social variables are Working Population, number of Poor, and Average Length of school.

Analysis model used in this research is descriptive analysis, inference models, and models of

convergence with panel data regression analysis approach is accompanied by testing analysis tools used. Then to determine whether convergence occurs regional economic growth and convergence velocity (speed of convergence) as well as the time required to close half of initial gap (half-life of convergence), then were estimated with a model of convergence.

Model convergence was first introduced by Baumol later developed by Barro and Sala-i-Martin, the next most widely applied by other researchers of Chi, Agarwalla and Pangotra [17-24]. To measure the absolute convergence, use panel data regression equation:

$$\frac{\ln(y_{it,T}) - \ln(y_{i,t-1})}{T} = \alpha + \beta \ln(y_{i,t-1}) + u_{i,t} \quad (2)$$

where y is income per capita, i indicates the region, T indicates the number of years of the initial period of the study ($t-1$) until the end of the T , α is a constant, and β is the coefficient of the initial per capita income. If the value of the coefficient β is negative or less than zero means the convergence and divergence occurs when a significant positive economic growth. This model once used to prove

the first hypothesis in this study. For operations research, the model equation is :

$$\log PE_{it} = \alpha + \beta \log PDRBK_{i, t-1} + e_{it} \quad (3)$$

where PE is economic growth, PDRBK is the Gross Domestic Regional Product per Capita.

To determine the convergence conditional use panel data regression also with some additional control variables (variables other than the variables of economic growth and the GRDP per capita) is also known as an exogenous variable. Exogenous variables in this study dikategorikan as social variables that the number of the working population, the number of poor and length of study.

Economic variables is Regional Income (PAD). Estimates used to measure convergence is conditional regression equation data panel of Baro and Sala-I-Martin and several applications of other researchers with the following equation [25-29]:

$$\frac{\ln(y_{i,T}) - \ln(y_{i,t-1})}{T} = \alpha + \beta \ln(y_{i,t-1}) + \sum_{j=1}^k \theta_j \ln(x_{i,t-1}^j) + u_{i,t} \quad (4)$$

where $x_{i,t-1}^j$ is the estimated exogenous variables contribute to economic growth in addition to income per capita. For operations research, equation (17) is changed to:

$$\log EG_{it} = \alpha + \beta_1 \log GRDP_{i,t-1} + \beta_2 \log WP_{it} + \beta_3 \log PP_{it} + \beta_4 \log LS_{it} + e_{it} \quad (5)$$

Of that models above, will be determined the most appropriate model for estimating panel data regression models which include common effects, fixed effects models and random effects models. If the panel data regression estimation model has been chosen to do the testing to choose estimators

with the structure of the residual variance-covarians better. If selected, the test random effects models to choose estimators with variance-covarians residual structures are better not done.

4. Result and Discussion

North Sumatra Province is located in the western part of Indonesia. North side bordering the province of Aceh, the east with the State of Malaysia in the Straits of Malacca, the South bordering the province of Riau and West Sumatra, and in the west bordering the Indian Ocean. The surface area of the Province North Sumatra is 71680.68 km², mostly located on the mainland of Sumatra Island and a small portion is located on the island of Nias. Under the conditions of the location and natural conditions, North Sumatra were divided into 3 groups of county / region that is the West Coast, the Highlands, and the East Coast.

East Coast Regional population growth from year to year marginally increased, meaning that the number of birth rate more than the number of deaths resulting population growth rate increases, although in 2011 slightly decreased the total population of the East Coast region of North Sumatra province. The total population of North Sumatra Province with an area of 13,326,307 inhabitants of North Sumatra Province area 71680.69 and the population density is of 186 inhabitants / km.

The Condition quadrant location of each regency / city in North Sumatra, East Coast Region by Klassen Typology Analysis 2003-2009 (at the initial momentum) can be described by the following matrix.

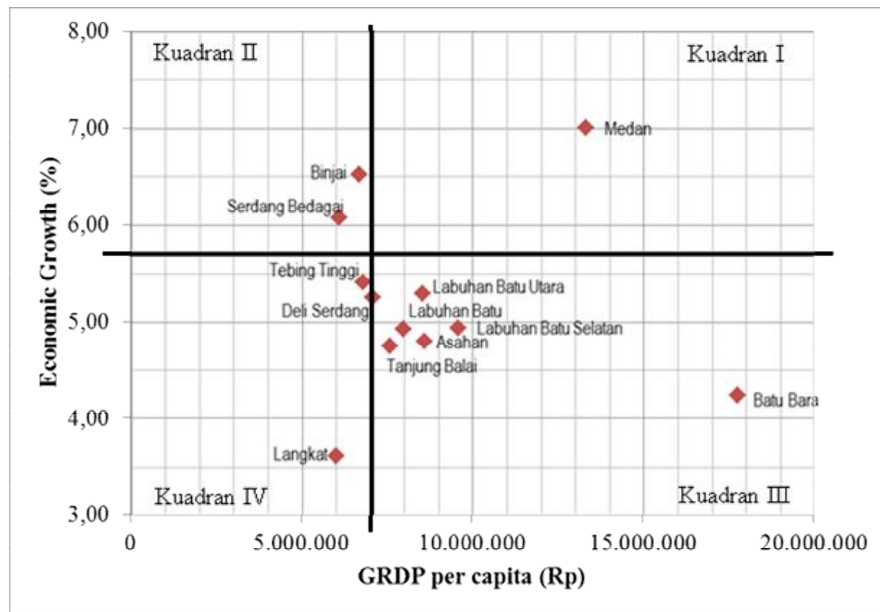


Figure 3. Klassen Typology of Region East Coast North Sumatera Province 2005-2010

The Condition quadrant layout respective regencies / cities in North Sumatra, East Coast Region by

Klassen Typology analysis 2008-2015 can be described by the following matrix

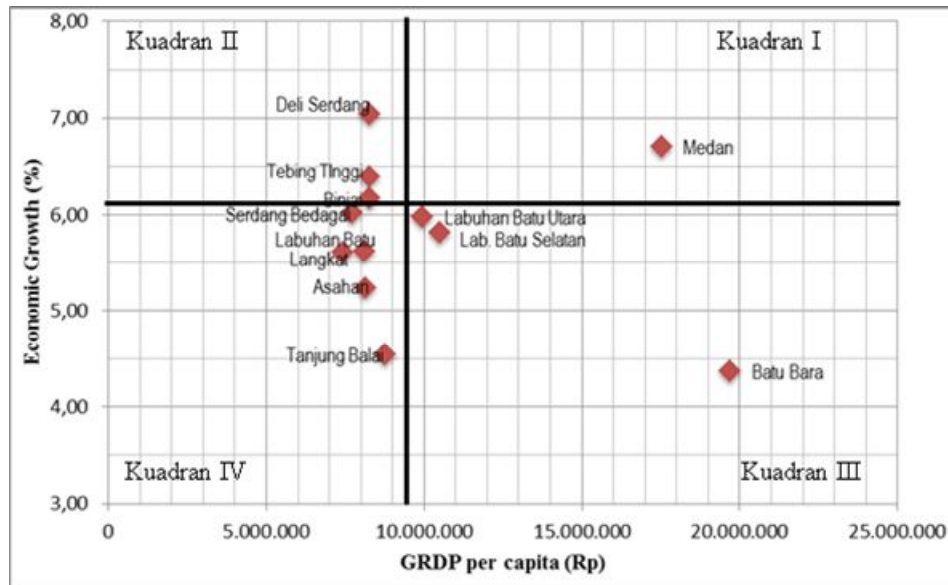


Figure 4. KlassenTypology of Region East Coast North Sumatera Province 2010-2015

1.SigmaConvergence.

Based on the results of data processing, standard deviation value indicates the fluctuation dispersion of economic growth in the East Coast region of North Sumatra Province. Dispersion of economic growth declined sharply from 2004 to the year 2005. This decrease was identified through a reduction in standard deviation value in 2004

amounted to 2.08 into 1,165 in 2005. The decline in the dispersion of economic growth in 2005 followed by an increase in the dispersion of economic growth in 2006 until further declined in 2007 to 2012. At the end of the study period, an increase of extreme dispersion that occurs due to an increase in economic growth is very rapid in some regions. These regions include Deli Serdang which increased from 4.99% in 2012 to 9.22% in 2013,

and Central Tapanuli which increased from 9.09% in 2012 to 17.43% in 2013 ,

Table 1. Standard Deviation North Sumatera Economic Growth Year 2004-2014

Year	Standart of Deviation
2004	2,082639176
2005	1,165819798
2006	1,329260446
2007	1,129594618
2008	0,815698474
2009	0,673409649
2010	0,675205216
2011	0,722889169
2012	0,800435645
2013	2,215226976

Economic growth is identified sigma convergence event of a downward trend in economic growth dispersion. The table shows the fluctuation standard deviation is quite sharp, especially at the beginning and end of the study period. But the sharp rise in the value of dispersion in the year 2013 can not be used as an indicator that the sigma convergence did not occur, otherwise the increase is a temporary rise that does not represent the entire study period. The other side shows the declining trend of the dispersion of economic growth during

the study period, therefore it can be concluded that sigma convergence occurred in North Sumatera, East Coast Region in the period 2004-2013.

2. BetaConvergence (β -Convergence)

Absolute convergence is estimated using the GRDP per capita as the dependent variable, and the GRDP per capita before as an independent variable. Here are the results of estimation using Chow Test as a method for selecting the best model to be used.

Table 2. Chow Test

<i>Effect Test</i>	<i>Statistic</i>	<i>d.f</i>	<i>Prob.</i>
Cross-section F	0.327594	(11,107)	0.9781
Cross-section Chi-square	3.974785	11	0.9706

Source: Data processed.

The table above shows the probability values F cross-section of $0.9781 > \alpha 5\%$, meaning that the best model that will be used for the estimation of panel data regression is Common Effect Model. When the Chow test has shown Common Effect Model as the best model, the Hausman test is not required. Here are the results of analysis by using a common convergence Effect Model.

Table 3. Convergence Analysis using Common Effect Model

Dependent Variable: LNGRDPcap?				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.776068	0.627957	6.013259	0.0000
LNGRDPcap?	0.766019	0.042427	18.05514	0.0000
R-squared	0.734227	Mean dependent var		14.27811
Adjusted R-squared	0.731975	S.D. dependent var		5.007056
S.E. of regression	2.592210	Akaike info criterion		4.759425
Sum squared resid	792.9073	Schwarz criterion		4.805883
Log likelihood	-283.5655	Hannan-Quinn criter.		4.778292
F-statistic	325.9882	Durbin-Watson stat		1.942109
Prob(F-statistic)	0.000000			

Through substitution intercept and coefficient values of independent variables, the model is used. The independent variable in the table above has a value of Prob 0.0000 α 5%, meaning that statistically significant independent variable. GRDP percapita variable coefficient, t-1 at 0.7660 showing an increase of 0.766% in the GRDP percapita, t caused by the increase in the GDP Perkapita, t-1 of 1%. The coefficient of determination (R²) of 0.7342 means that 73.42% of the GRDP change percapita variation, caused by the GRDP percapita t, t-1. Absolute convergence occurs when the value of β is between zero and -1, where the speed of convergence would be higher if β close to -1. The estimation results above show the value of $(1 + \beta)$ of 0.7660. Based on these values, the value of β is known of -0.234. B value (0.2340) is between zero and -1 indicates that there is a process of

convergence of economic growth among the districts / cities in North Sumatra, East Coast Region at the speed of convergence of 23.40%.

Half life of convergence is obtained through the

equation $t = \frac{-\ln(0.5)}{0.2340}$ or $t = \frac{\ln(2)}{0.2340}$ is 2.962. Half life value of 2.962 indicates the time it takes the economy to cover half of total inequality, which is about 3 years, and to cover the entire inequality takes 6 years. To determine the influence of the factors that affect the speed of convergence, conditional convergence analysis is required. The calculation of conditional convergence is done by adding certain variables that are detrimental to economic growth. In this study, these variables are the number of the working population, the number of poor, and old school. Here are the results of the Chow test to determine the best regression model.

Table 4. Chow Test

Effect Test	Statistic	df	Prob.
Cross-section F	1.309530	(11,104)	0.2296
Cross-section Chi-square	12.566233	11	0.1580

Probability value. Cross-section F of 0.2296 is smaller than the alpha 5%, meaning that the best model is used to estimate the conditional convergence is Common Effect Model.

Table 5. Convergence Analysis using Common Effect Model

Dependent Variable: LNGRDPcap?				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.160626	0.892582	0.179956	0.8575
LNGRDPcap2?	0.295835	0.144127	2.052599	0.0424
LNPB?	0.671187	0.161191	4.163912	0.0001
LNPM?	-0.204211	0.176066	-1.159855	0.2485
LNLS?	2.358056	0.537579	4.386434	0.0000
R-squared	0.806176	Mean dependent var		14.27811
Adjusted R-squared	0.799434	S.D. dependent var		5.007056
S.E. of regression	2.242389	Akaike info criterion		4.493734
Sum squared resid	578.2553	Schwarz criterion		4.609880
Log likelihood	-264.6241	Hannan-Quinn criter.		4.540901
F-statistic	119.5804	Durbin-Watson stat		1.857419
Prob(F-statistic)	0.000000			

According to the table above, the value of F-statistics $< \alpha$ 5%, meaning that simultaneously independent variables used in the model have a significant effect on economic growth. R square value of 0.8061 means that for 80.61% of the variation fluctuation in the GRDP. To determine the occurrence of conditional convergence, the value of β should be between zero and -1. Through the above table values obtained $(1 + \beta)$ of 0.2958. Based on these values, the value of β obtained is -0.7042. Thus, through the value of β can be determined that the conditional convergence process occurs in economic growth in the East Coast region of North Sumatra with the speed of convergence of 70.42%.

Conditional convergence have a higher speed than the absolute convergence. This indicates that the independent variable has a great influence in increasing the speed of convergence of economic growth in the East Coast region of North Sumatra. Through the above table, the variables working population has a value of Prob. by 0.0001 $< \alpha$ 5% showed that the variables significantly influence the independent variable. Variable coefficient value of 0.6712 (positive effect) means

that if the number of people working increased by 1%, then the GRDP per capita will increase by 0.6712%. Variable old school has a value of Prob. by 0.0000 $< \alpha$ 5% showed that the variables significantly influence the independent variable. Variable coefficient value indicates the number 2,358 (positive effect) means that if the old school increased by 1%, then the GRDP per capita will increase by 2.358%. The last variable used is the number of poor people. Value Prob. a sum of 0.2485 $> 5\%$ α indicates that the variable number of poor people do not have a significant effect in the model.

5. Conclusion

Based on the description of the results and discussion that has been done before, so this research derive some conclusions as follows:

1. The regional gap between districts / cities in the East Coast region of North Sumatra Province-year period from 2003 to 2015, showed some areas are likely to increase and another region tends to decrease

2. The independent variable (working population, number of poor, and average length of school) has a great influence in increasing the speed of convergence of economic growth in the East Coast region of North Sumatra

Classification of the area between districts / cities in the East Coast region of North Sumatra province by Klassen Typology analysis shows that there is one area that includes areas of fast forward and fast-growing (quadrant I) include Medan City. There are three regions including category forward but suppressed (quadrant II) is Deli Serdang, SerdangBedagai and Binjai City. Furthermore, there are four areas that are growing (expanding) (quadrant III), namely Asahan District, LabuhanBatu reGENCY of North and South LabuhanBatu reGENCY. And there are three regions including the category of disadvantaged areas (quadrant IV) is Langkat, TebingTinggi, TanjungBalai city.

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