

Convergence of Economic Growth in The Bandung Metropolitan Area

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Abstract - This study aims to determine the convergence and acceleration of growth to achieve steady-state conditions in the Bandung Metropolitan Area in 2010-2022. This research uses a quantitative descriptive approach by measuring variables and analyzing data statistically. Secondary data is used in this study to analyze convergence through panel data regression analysis and coefficient of variation. The results show that sigma convergence for the Bandung Metropolitan Area does not show convergence. The gap in the Bandung Metropolitan Area will decrease in less than 13 years. The absolute and conditional beta convergence results in the Bandung Metropolitan Area show convergence. Labor productivity is expected to accelerate economic growth due to the previous year's economic growth; the absolute beta convergence results do not significantly affect economic growth in the study year. Therefore, local governments are expected to focus on resource redistribution and infrastructure investment to increase the growth potential of lagging regions. In addition, investment in basic infrastructure such as roads, electricity, water, and health facilities should be increased in lagging regions to create conditions conducive to economic growth. Finally, encouraging inter-regional cooperation to share resources and knowledge can help lagging regions to catch up.

Keywords: sigma convergence, beta convergence, gap, productivity

INTRODUCTION

The potential diversity that exists in each region will encourage regional economic growth. However, potential resources in the area may cause obstacles due to differences in resource potential between regions.

Differences in economic potential create gaps in economic growth between regions. Poor regions will find it difficult to catch up with the economic growth of developed regions. Currently, many regions are combined within a regional scope, such as mergers between regions, usually called metropolitan areas.

The metropolitan area is the core urban area with the closest cities in the regional infrastructure system integrated with the population. In general, metropolitan areas tend to have an increasing population. The characteristic of areas, including metropolitan areas, is that they have over 1 million people. Metropolitan areas are usually called functional areas and are used as the center of the regional transportation system, government activities and the location of main activities.

Bandung City is the center of economic growth and government in West Java and is integrated into a regional system. The Bandung Metropolitan Area is an area surrounding Bandung which is interconnected to form a region.

The WMB core areas integrated with Bandung City are Cimahi City, Bandung Regency, West

Bandung Regency, and Sumedang Regency. The Bandung Metropolitan Area is one of the metropolitan areas which is a national activity in West Java Province. The Bandung Metropolitan Area does not necessarily mean all regions have equal development. This can be seen from the fact that per capita income in the Bandung Metropolitan Area is still experiencing inequality.

Table 1 shows large differences in GDP per capita values in Bandung Metropolitan Regency/City. Even though it is a metropolitan area, there are still areas far behind the per capita income of other regions, such as Sumedang Regency, Bandung Regency, and West Regency, which are far behind Bandung City as the center of West Java's economic growth. Regional income in Metropolitan Bandung tends to come from the processing industry and wholesale and retail trade sectors.

These two sectors contribute positively to the economic growth of Metropolitan Bandung. The industrial and trade sectors provide added production value for areas in Metropolitan Bandung. However, the level of GDP per capita in this metropolitan area is relatively high, and there is a high inequality.

Table 1 GRDP Per Capita Regency/City Bandung Metropolitan Region 2018-2022
(thousand rupiah)

Bandung Metropolitan	2018	2019	2020	2021	2022
Bandung Regency	20.879	22.321	22.433	22.898	23.782
Sumedang Regency	19.574	20.490	20.552	21.059	21.972
West Bandung Regency	17.752	18.773	17.198	17.474	18.080
Bandung City	73.924	77.545	79.032	81.704	85.820
Cimahi City	34.867	38.002	39.336	40.718	42.857

Source: Central Statistics Agency (calculated), 2018-2022

Every region tries to improve the quality of development through economic growth. The Bandung Metropolitan Region prioritizes economic growth as a form of regional government success, which sometimes becomes a dilemma because economic growth tends to widen the economic gap between regions. According to (Bai et al., 2012; and Wahyuningsih et al., 2020), increasing economic growth for each region tends to increase income inequality, especially in underdeveloped regions that cannot catch up with the economic growth of developed regions. The contribution of the processing industry and trade sectors in the Bandung Metropolitan Area increases the gap between underdeveloped and developed areas. The results of regional economic development, both internally and externally, can hinder convergence. Convergence is the condition of regions needing to catch up with regions with high incomes. Convergence can occur if underdeveloped regions tend to grow faster than developed regions. Muzani & Benardin, 2020; Wahyunadi, (2019), convergence is due to the condition of underdeveloped regions growing faster than developed regions so that it can reduce the per capita income gap in developed regions. According to (Todaro & Smith, 2006), regional economies will converge on the same income level as seen in savings, depreciation, productivity and labor growth.

Several studies related to convergence, such as research by Zainuri et al., (2022), show that income inequality between regions in East Java is very dynamic. The research results found that districts/cities in East Java showed no convergence, so growth did not become faster (catch-up effect) in more developed areas. Research by (Atmasari et al., 2020), shows that the research results do not accelerate economic growth for underdeveloped regions in pursuit of growth in developed regions. The research result from Muhammad et al., (2023), shows that absolute convergence is getting slower in Sulawesi Province, and the Williamson Index is decreasing.

This research will analyze whether economic growth inequality decreases every year. It will also analyze whether convergence is occurring in the Bandung Metropolitan Area and the extent of regional

acceleration to reach steady state conditions. Previous studies have never carried out convergence research in the Bandung Metropolitan Area.

RESEARCH METHODS

This research uses a quantitative descriptive approach by measuring variables in the form and analyzing data statistically. The data in the research is panel data for the 2010-2022 year; the data source is obtained from the Central Statistics Agency. Convergence analysis in this research is divided into sigma convergence and beta convergence. Sigma convergence is carried out by calculating the standard deviation of GDP per capita growth (logarithmic value) in the Bandung Metropolitan Area. Suppose the coefficient of variation value for each research period (t) is lower than the value of the previous coefficient. In that case, it can be said that there is a sigma convergence in the Bandung Metropolitan Area. The formula for the coefficient of variation.

$$CV = \frac{\sum \sqrt{Y_i^2 - Y'^2}}{n/Y'}$$

(1)

CV (Coefficient Variance) is the coefficient value for year t, while Y_i is the value of regional economic growth at constant prices, Y' is the economic growth value of Metropolitan Bandung at constant prices and n is the total of the Regencies/Cities in the Bandung Metropolitan Area. Then, the absolute beta convergence measurement is estimated in an econometric model on per capita (log) income in the Bandung Metropolitan Area. The estimated coefficient value is positive, so the area in the Bandung Metropolitan Area does not experience beta convergence. The formula for beta convergence:

$$\log Y_{it} = \alpha + \beta_1 \log Y_{it-1} + e_{it} \quad (2)$$

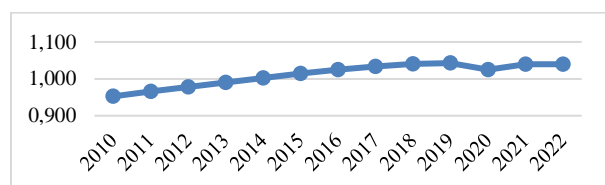
Y_{it} is economic growth (real GDP) in year t, Y_{it-1} : economic growth in year t-1, α , β are coefficients, e_{it} is error term. Furthermore, the conditional convergence model in this research refers to (Solihin et al., 2021) with modifications to several variables as follows:

$$\text{LnYit} = \alpha + \beta_1 \text{LnYit-1} + \beta_2 \text{Lninvit} + \beta_3 \text{LnProdit} + \beta_4 \text{LnPopit} + \text{eit} \quad (3)$$

where Y is economic growth in the year, Lninv: capital investment gross, LnProd: labor productivity, Pop: population, Ln: natural logarithm, t: year, i: district/city and e: error term.

RESULT AND DISCUSSIONS

Based on the trend of the coefficient of variation of economic growth (real GDP), it reflects an increase in income inequality in the Bandung Metropolitan Area. Figure 1 shows that the value of the coefficient of variation for the Bandung Metropolitan Area continues to increase, only decreasing in 2020 and increasing again in 2021-2022. In general, the Bandung Metropolitan Area has a larger coefficient of variation value, which can increase income inequality between



Source: BPS

Figure 1. Coefficient of Regional Variation in the Bandung Metropolitan Area

Furthermore, the results of absolute beta convergence (unconditional convergence) are carried out to measure the acceleration of economic growth in a region towards regions with high economic growth. Regions with high income will experience a steady state, so regions that have reached maximum conditions

regions. Regions that are part of Metropolitan Bandung have a real GDP level below Bandung City, which has the potential to increase economic growth inequality during the research year.

Bandung City has the highest GDP per capita, which encourages people in the Bandung Metropolitan area to work in the Bandung City area. The gap between regions is caused by people working outside their region. The value of the coefficient of variation, which continues to increase throughout the research period, indicates that the area in Metropolitan Bandung is not experiencing sigma convergence. These results are in line with research by (Atmasari et al., 2020), showing an increasing trend in the coefficient of variation so that the East Java Metropolitan does not converge. The continuously increasing coefficient of variation will increase inequality in the East Java Metropolitan cluster.

when experiencing population growth will experience reduced economic growth. Declining economic growth in developed regions will affect the acceleration of economic growth in low regions. The calculation of absolute beta convergence in this study uses panel data regression. The Fixed Effect Model (FEM) is a suitable model to use to calculate absolute beta convergence because the Chi-Square probability value of 0.001 is greater than alpha 5%.

Table 2 shows that economic growth (real GRDP) in the previous year had a significant negative influence on economic growth in the Bandung Metropolitan Area. The previous year's growth coefficient value was 0.626009 with a confidence level of $\alpha = 1\%$. The estimated value of absolute beta convergence shows the direction of unconditional convergence in the Bandung Metropolitan Area.

Table 2. Absolute Beta Estimation Results for the Bandung Metropolitan Area

Variable	Coefficient	t-stat	Prob
C	2.847.426	1.556.579	0.0000
LnY(-1)	-0.626009	-5.995.525	0.0000
Adjusted R-squared	0.399159		
F-statistic	8.839.135		
Prob(F-statistic)	0.000004		

Source: Data Calculated (Eview's)

Then, to determine the speed of absolute convergence, it is shown from the results of the estimation of real GDP growth in the previous year against economic growth in the research year. The estimated coefficient value for absolute convergence is 0.626009, this result is entered into the formula below to get the beta convergence value:

$$\beta = \frac{\log(0.626009+1)}{10}$$

The divider of 10 is the number of research periods, then:

$$\beta = \frac{0.531609469}{10} = 0.053161$$

The results of absolute beta convergence, namely 0.053161, indicate that 5.3% of the gap can be reduced through the previous year's GRDP growth conditions compared to steady state economic growth

conditions within 1 year. The time needed to reduce the initial gap can be through half life convergence as follows:

$$T = \frac{\ln(2)}{\beta}$$

$$T = \frac{0.6931}{0.053161}$$

$$T = 13.039$$

High economic growth will result in a catch-up effect, while the time to reduce the initial gap is used to pursue output (real GRDP) in the Bandung Metropolitan Area. Based on half life convergence calculations, the time needed to reduce the initial gap is 13.04 years. So, the gap in the Bandung Metropolitan Area can be reduced in approximately 13 years. The calculation result of the convergence speed is 5.3% to reduce the gap between regions.

The negative value of unconditional convergence indicates that a convergence process has occurred in the Bandung Metropolitan Area. This is based on the convergence hypothesis of (Barro & Sala-I-Martin, 1992; i Martin, 1990; Mankiw Gregory et al.,

1992) explains that the partial relationship between growth and initial income begins with a negative correlation (Pratama et al., 2022). Several regions in Metropolitan Bandung can rely on superior sectors to reduce disparities between regions and pursue more advanced regional economic growth.

The results of the conditional beta convergence estimation have structural characteristics between different regions so that convergence will be influenced by the structure of the region (Atmasari et al., 2020). Therefore, conditional beta convergence can occur by adding several independent variables to influence economic growth in the Bandung Metropolitan Area. The independent variables in this research include investment proxied by gross fixed capital investment, labor productivity, and population. The conditional beta convergence equation model uses a fixed effect model because the Chi-Square probability of 0.000 is smaller than the 5% confidence level. The estimated conditional convergence calculation can be seen in table 3.

Table 3 Estimated Conditional Beta Convergence for the Bandung Metropolitan Area

Variable	Coefficient	t- stac	Prob
C	1.624602	2218497	0.0310
LnY(-1)	-0.014836	-1607790	0.1141
LnINV	0.287725	6397392	0.0000
LnPROD	0.986312	1068112	0.0000
LnPOP	0.544026	2542918	0.0141
Adjusted R-squared	0.995763		
F-statistic	1734196		
Prob (F-statistic)	0.000000		

Source: Data Calculated (Eview's)

Table 3 explains the results of the conditional beta convergence estimation as follows : The coefficient value of LnY(-1) is -0.014836, that a 1% increase in economic growth in the previous year will reduce economic growth for the research period by 0.014836% ceteris paribus. The economic growth coefficient value of the previous year does not have a significant influence on economic growth in the research year because the probability value exceeds the α value of 0.05, which is contrary to the results of the absolute beta convergence estimation, which shows a significant influence on economic growth in the research year. The investment coefficient value (gross fixed capital investment) is 0.287725, so a 1% increase in investment will increase economic growth by 0.287725% ceteris paribus. The labor productivity coefficient value is 0.986312, so a 1% increase in labor

productivity will increase economic growth by 0.986312% ceteris paribus. The population coefficient value is 0.544026, so a 1% increase in population will increase economic growth by 0.544026% ceteris paribus. The coefficient of economic growth (real GRDP) t-1 is 0.014836, so the regional acceleration to approach a steady state is 1.4%.

The results of investment estimates (PMTB) positively influence on the economic growth of the Bandung Metropolitan Area. Positive results from the investment variable indicate the ability of regional investment to produce goods and services demanded by consumers and impact on increasing real GDP growth in the Bandung Metropolitan area. Government spending for physical and capital investment needs can increase economic growth in the Bandung Metropolitan Area. (Zulfa Emalia, 2012) research shows that

increasing investment will increase capital goods and technology so that metropolitan areas can increase economic growth.

The labor productivity variable has a positive effect on economic growth. This reflects that the higher the quality of the workforce will produce higher quality output so that economic growth increases. When the quality of the workforce is higher, it will maximize the ability to produce goods and services, which will impact on increasing economic growth in the Bandung Metropolitan Area. An increasingly productive workforce is caused by work experience and increased workforce skills, which can spur accelerated economic growth (Zulfa Emalia, 2012). The positive coefficient value of the population reflects that an increase in population can increase the working age population. Residents who have skills are obtained from government efforts to improve the quality of human resources.

The result of government programs can be seen in the population's ability to master technology. Education and health programs are government priority programs in improving workforce quality. The success of government programs in the fields of education and health has the opportunity to obtain quality residents. Otherwise it will reduce economic growth and increase the dependency ratio in the Bandung Metropolitan Area.

The previous year's economic growth coefficient ($\ln Y_{t-1}$) in conditional beta convergence does not have a significant influence and has a negative sign on economic growth in the Bandung Metropolitan Area. Other independent variables can accelerate convergence. The labor productivity variable is the independent variable that has the most influence on economic growth, as shown in the highest coefficient value in the conditional beta convergence equation compared to other independent variables. Therefore, labor productivity can be relied on to accelerate economic growth in the Bandung Metropolitan Area.

CONCLUSION

Based on the sigma convergence results, it is concluded that the Bandung Metropolitan Area is not experiencing convergence. This can be seen from the coefficient of variation of economic growth, which is increasing in the Bandung Metropolitan Area, thereby increasing income inequality. The estimation results of conditional absolute beta convergence show that there is the convergence of economic growth in the Bandung Metropolitan Area, as seen from the negative relationship between economic growth in the previous year and economic growth in the research year. The time required to reduce the initial gap in the Bandung Metropolitan Area is approximately 13 years.

The variables investment, labor productivity, and population have a significant positive influence on economic growth in the Bandung Metropolitan Area. Labor productivity has the largest estimated value, so labor productivity can be relied on to accelerate economic growth in the Bandung Metropolitan Area. Equal distribution of education and health is a government priority in the Bandung Metropolitan Area to obtain quality workers. Labor productivity must be accompanied by increasing employment opportunities in the Bandung Metropolitan Area. More effective government spending on education and health can influence economic growth.

Policy implications include that areas in the Bandung Metropolitan City that do not converge will continue to experience greater economic inequality than faster-growing areas. Policies should focus on resource redistribution and infrastructure investment to increase the growth potential of lagging regions. In addition, investments in basic infrastructure such as roads, electricity, water, and health facilities must be increased in lagging regions to create favorable conditions for economic growth. Finally, encouraging inter-regional cooperation to share resources and knowledge can help

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