

## Measuring Spatial Disparity in East Java: A Convergence Analysis

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*Received: 23 March 2022 | Revised: 14 May 2022 | Accepted: 28 November 2022*

### Abstract

The development paradigm of development continues to evolve, not only focusing on growth, but also on equity. This study aims to analyze the spatial inequality of economic growth in the districts/cities of East Java in 2016-2020 using convergence analysis. We use GDP per capita in the t-1 period, the industrial agglomeration index, regional investment, education index, health index, and capital expenditure to determine the magnitude of their influence on the creation of convergence or divergence on growth economy in East Java. Based on the absolute and conditional convergence analysis that has been carried out, it can be seen if economic growth in 2016-2020 experiences spatial divergence or inequality. The industrial concentration index variable has a significant and negative effect on the formation of spatial inequality in East Java, this means that industrial concentration reduces the growth rate and contributes to the formation of spatial inequality in East Java. In addition, the variables of investment, education index, health index, and capital expenditure alone do not have a significant influence on the formation of spatial inequality in East Java.

**Keywords:** Spatial Disparity, Convergence, Economic Growth.

**JEL classification:** O11, R11

**How to Cite:** Sakti R. K., Maudita A. V. (2022). Measuring Spatial Disparity in East Java: A Convergence Analysis, 23(2), 229-240. doi:<https://doi.org/10.23917/jep.v23i2.15452>

**DOI:** <https://doi.org/10.23917/jep.v23i2.15452>

### 1. Introduction

Entering the decentralization era two decades ago, one of the national economic development strategies was carried out through development at the regional level, namely districts and cities. However, development does not always produce equality for every region. Inequality is a phenomenon that will always overshadow the process of regional economic development (Fauzi et al., 2019), even though the ultimate goal of decentralized economic development is equitable distribution of community welfare. One measure is the growth of Gross Regional Domestic Product (GDP) per capita.

East Java is the province with the second largest economic size after DKI Jakarta with GDP at constant prices of IDR. 1,610.4 trillion

in 2019 with a contribution to national GDP of 15.01%, while in terms of per capita GDP it reaches IDR. 40.37 million in the same year (BPS, 2020).

East Java's economic growth is almost always higher than that of average provinces in Indonesia (Figure 1). High economic growth spurred sectoral changes from business fields that depended heavily on the agricultural sector to business fields that led to the industrial sector. In the last ten years, East Java can still be categorized as an industrial area, where the role of the industrial sector reached 30.9% of the GDP in 2008. Meanwhile, in 2013, the role of the industrial sector decreased at its lowest point, which was 28.79%; and again, experienced an increase of around 30.2% in 2019.

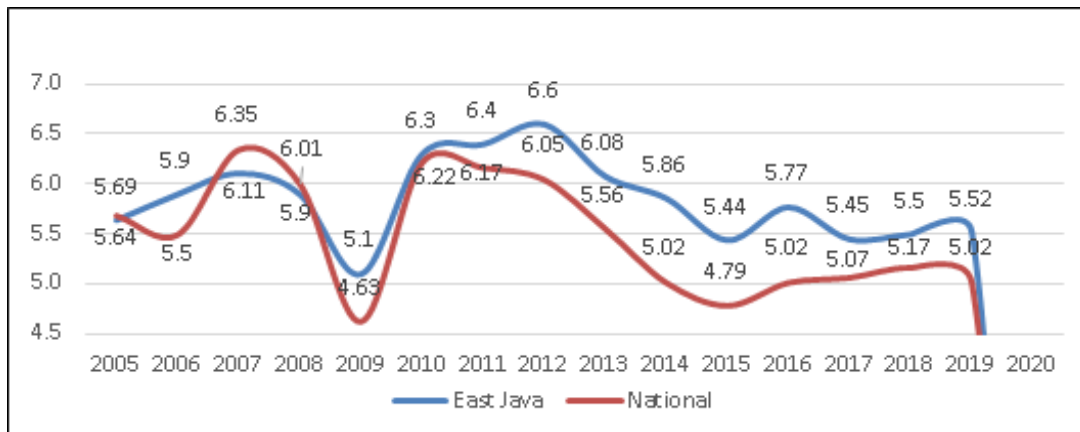


Figure 1. East Java Economic Growth Compared to National

Source: BPS East Java (2020), modified

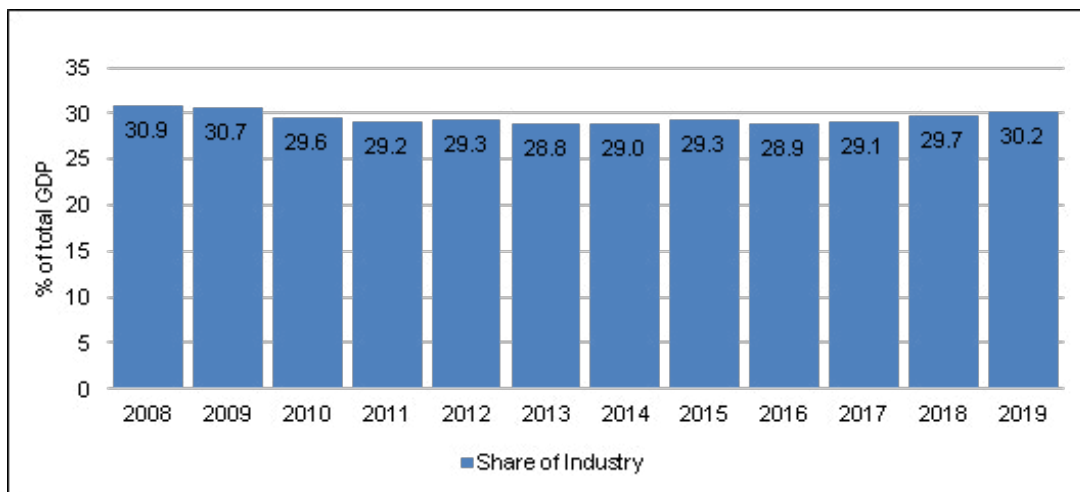


Figure 2. Contribution of the Industrial Sector to the Economic Development of East Java

Source: BPS East Java (2019), modified

The concentration of sectors that lead to industry can indeed encourage regional economic growth, but on the other hand it can also trigger inequality between regions. Since 2008, industrialization in East Java has been concentrated in only eight of the 38 districts/cities, with a relatively constant level of contribution. In East Java, agglomeration has become an industrial development strategy. The industrial agglomeration strategy implemented by East Java does not seem to reduce the level of regional development inequality. In other words, the level of convergence of East Java's economic growth is

still low, even leading to divergence. In this case, the notion of convergence refers to the theory of economic growth, where Olsson (2013) states that the convergence of economic growth occurs when regions with high per capita incomes experience lower growth than regions with low per capita incomes.

The Convergence Theory which states that economic growth naturally (without the need for government intervention) will actually improve inequality. Convergent economic growth conditions occur due to spillovers, namely the process of overflowing economic activity from one

area to another. Convergence theory can occur if the region in question has developed, then regional development inequality will be reduced (Convergence). Borrowing the terms Barro and Sala-i-Martin (2004), there are two convergences that will occur in economic development between regions: (i) absolute convergence, namely: convergence that occurs because poor regions with low per capita incomes are able to grow faster than rich regions; and (ii) conditional convergence, namely: convergence occurs because poor areas are able to grow faster by utilizing their structural characteristics (infrastructure, education, health, and so on).

Cerina & Mureddu, (2014) analyzed the impact of agglomeration on regional inequality in the European Union and the United States. This study found that inequality between regions increased as a result of the anti-growth agglomeration effect, especially in the periphery. Low economic growth in the periphery and vice versa in the core region, has led to widening inequality. World Bank (2009) in his research to find out patterns of spatial concentration in various countries. This research supports an unbalanced growth strategy. Unequal economic development between regions will create income disparities, especially in developing countries.

Flabbi & Gatti, (2018) suggest that investment in soft infrastructure provides equal opportunities for poor regions to increase their regional productivity and ultimately spur faster economic growth in poor regions. On the other hand, soft infrastructure can also exacerbate regional inequality, or in other words create divergences, as can be seen in the study of Maloney & Valencia Caicedo, (2017); Caselli, (2016); Glaeser & Gottlieb, (2009); and Pritchett, (1997). The study states that educated and highly skilled workers, such as engineers, tend to cluster in areas that have good public facilities, and at the same time, poor areas tend to be filled with highly educated and skilled workers. In line with this trend, Caselli, (2016) states that the more massive divergence occurs due to technological changes that create conditions where skilled

workers in rich regions tend to have higher productivity than poor areas.

This research contributes to the analysis of how industrialization has an impact on the economic development of a region, both in terms of creating growth, and on the other hand creating economic inequality between regions. Therefore, this fact or phenomenon that occurred in East Java is interesting to be observed more closely. The purpose of this study is to examine whether industrialization and human capital have the potential to increase economic growth and equity towards convergence or actually exacerbate inequality in economic development between regions towards divergence.

## 2. Research Method

To achieve the objectives described in the introduction, the method in this study is convergence analysis. The analysis model uses the convergence model developed by Barro and Sala-i-Martin (2004). This model basically estimates the magnitude of the level of convergence, namely the process of catching up from low-income areas to high-income areas. In convergence analysis, it is known as beta convergence. Beta convergence has two hypotheses, namely absolute convergence and conditional convergence. Absolute convergence is said to occur if low-income areas grow larger than high-income areas. At the empirical level, this can be done by estimating the econometric model in which the income at the beginning of the period is the only explanatory variable for income growth. Meanwhile, conditional convergence indicates that the model specification includes a number of variables other than the initial income of the period which are estimated to affect the level of income growth. The specifications of the absolute convergence model of this study are:

$$G_{i,t}^{cap} = \beta_0 + \beta_1 \ln y_{i,t_0} + \varepsilon_{i,t} \quad (2.1)$$

Basically, the left side of equation (2.1) reflects the per capita income growth of region  $i$  during  $t$  years. Meanwhile, the right side of equation (2.1) reflects the relationship between

regional economic growth  $i$  and its per capita income in the base year ( $\ln y_{i,t_0}$ ). If the value of  $\beta_1$  negative, then this indicates a convergence, for example regions with higher per capita incomes will have lower economic growth. On the other hand, divergence occurs when the value of  $\beta_1$  positive. The value of  $\beta_1$  referred to as absolute beta convergence, which can also be interpreted as the magnitude of inequality in economic development between regions, assuming other factors are not considered. In simple terms, the value of  $\beta_1$  indicates the magnitude of the value of development inequality between regions if the government does not carry out any development policies.

Furthermore, equation (2.1) is developed into the following conditional convergence equation:

$$G_{i,t}^{cap} = \beta_0 + \beta_1 \ln y_{i,t_0} + \beta_2 Ind_{i,t} + \beta_4 Edu_{i,t} + \beta_5 Health_{i,t} + \beta_6 BM_{i,t} + \varepsilon_{i,t} \quad (2.2)$$

Where  $Ind$  is the level of industrial concentration which is the industrial intensity relative to the geographic area of an area (Gardiner et al., 2011);  $Inv$  is a regional investment;  $Edu$  is the Education Index;  $Health$  is the Health Index; and  $BM$  is capital expenditure. The operational definition of the measurement of each research variable is as follows:

**Table 1. Definition of Operational Variable**

Variable	Measurement	Scale	Reference
Growth of Per capita GDP ( $G_{i,t}^{cap}$ )	$G_{i,t}^{cap} = \ln \left( \frac{y_{i,t_0+1}}{y_{i,t_0}} \right)$ where, $y_{i,t_0+1}$ is per capita GDP in region $i$ in year $t_0+1$ , $y_{i,t_0}$ is per capita GDP in region $i$ in year $t_0$	Ratio	(Barro & Sala-i-Martin, 2004)
Initial Per capita GDP ( $y_{i,t_0}$ )	$y_{i,t_0}$ is per capita GDP in area $i$ in the previous year	Ratio	
Industry Agglomeration Index ( $Ind_{i,t}$ )	$Ind_{i,t} = \frac{\left( \frac{Ind_i}{Ind_j} \right)}{\left( \frac{A_i}{A_j} \right)}$ where $Ind_i$ is GDP of industry in region $i$ ; $Ind_j$ is GDP of industry in East Java; $A_i$ is the width of area in region $i$ ; $A_j$ is the width of East Java area	Ratio	(Gardiner et al., 2011)
Investment ( $Inv_{i,t}^s$ )	$Edu_{i,t} = IP$ $= \frac{\left( \frac{EYS - EYS_{min}}{EYS_{max} - EYS_{min}} \right) + \left( \frac{AYS - AYS_{min}}{AYS_{max} - AYS_{min}} \right)}{2}$ Log of Domestic Investment in the region.	Ratio	(Rahmani & Motamedi, 2018)
Education Index ( $Edu_{i,t}$ )	where, EYS is the expected year of schooling and AYS is the average year of schooling.	Ratio	
Health Index ( $Health_{i,t}$ )	$Health_{i,t} = IK = \frac{LFE - LFE_{min}}{LFE_{max} - LFE_{min}}$ where, LFE is life expectancy	Ratio	(Barro & Sala-i-Martin, 2004)
Capital Expenditure ( $BM_{i,t}$ )	Log of capital expenditure in regency- $i$ in year- $t$	Ratio	(Kouassi, 2018)

### 3. Results and Discussion

Economic growth is a process of increasing production which is manifested by an increase in regional/state income. One indicator of an efficient macro allocation is the value of Gross Regional Domestic Product (GDP) which increases from time to time Rahardja, (2008); Juliana et al., 2018. Based on data from the Central Statistics Agency, East Java Province's GRDP is mostly driven by three main sectors, namely the manufacturing sector with a contribution of 28.91 percent, the wholesale and retail trade sector with a contribution of 17.90 percent, and the agriculture,

forestry, and fishery sectors with a contribution of 17.90 percent. contribution of 13.44 percent in 2016. In 2020, the general economic structure is still the same, where the manufacturing sector contributes the most at 30.68 percent, the wholesale and retail trade sector contributes 17.95 percent, and the agriculture, forestry sector, and fisheries contributed 11.94 percent. Economic growth that describes an increase in production should be accompanied by an increase in people's income. One of the economic measures that more specifically describes people's income is GRDP per capita.

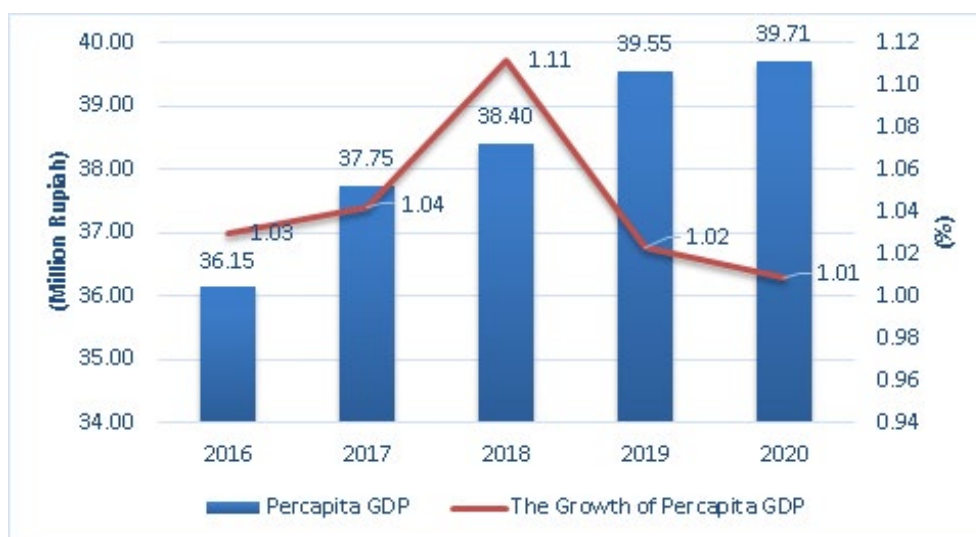


Figure 3. GDP Per Capita and Its Growth in East Java, 2016-2020

Source: BPS East Java (2020), modified

Based on per capita income, nominally there was an increase in people's income during 2016-2020. In 2016, the average income of the people in East Java was Rp. 36.15 million per year and increased to Rp. 39.71 million per year although per capita income growth decreased in 2019 and 2020. This was driven by East Java's economic growth. in the fourth quarter of 2019 which reached 5.54 percent, higher than the third quarter of 2019 which was 5.32 percent and higher than the national (4.97 percent year-on-year). The main drivers of this growth are estimated to come from government consumption, Gross Fixed Capital Formation (PMTB) or investment and net exports between

regions. Private consumption is also still growing positively and relatively stable. The increase in government consumption and investment also occurred in line with infrastructure development in East Java

#### 3.1 Absolute Convergence of East Java Economic Growth

The absolute convergence test was carried out to test the existence of an increasingly even or more unequal trend in the economic growth of districts/cities in East Java during 2016-2020. Prior to the convergence test, a model selection test was conducted to determine the appropriate model to be used in the convergence test. Hausman

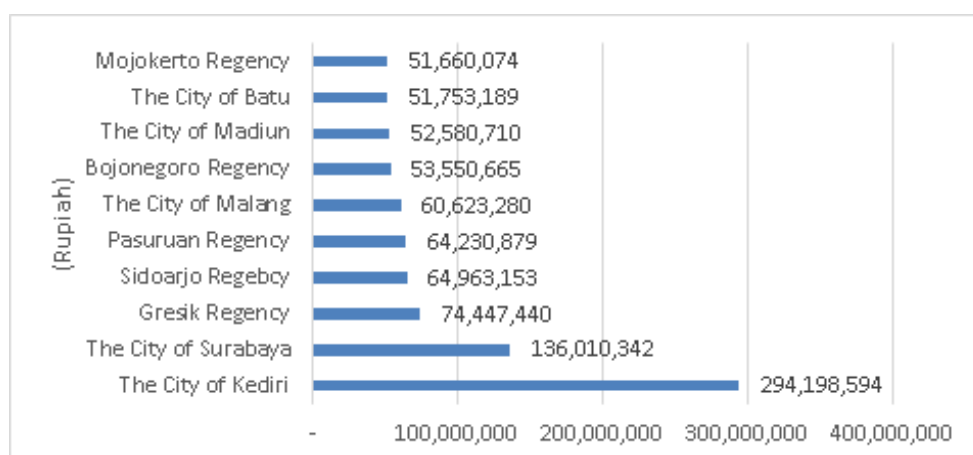
test was conducted to select the more appropriate fixed effect or random effect model. Hausman test results show a value of  $0.3306 > 0.05$  so that

the selected analysis model is a random effect. Furthermore, absolute convergence estimation is carried out with the following results:

**Table 2. Absolute Convergence Estimation Results**

Variable	Coefficient	z	Probability	Conclusion
GDP t-1	0,015*	2,22	0,026	Divergent
Constant	-1,131	-2,20	0,028	

Source: Results of data processing (2021)



**Figure 4. Cities and Regencies with the Highest GDP Per Capita in East Java, 2020**

Source: BPS East Java (2020), modified

Table 2 describes the results of the absolute convergence test of the GDP of the previous period (t-1) on the formation of the convergence or divergence of economic growth in East Java. The results of the analysis show a significant and positive influence on the t-1 GDP coefficient, so it can be interpreted that there has been a spatial divergence or inequality in the economic growth of districts/cities in East Java. In the 2016-2020 period, the development of district/city economic growth in East Java has not shown a direction towards equity (convergence).

In general, the rate of economic growth of districts/cities in East Java Province has increased every year. In 2019, most districts/cities in the northern region of East Java had economic growth above the economic growth rate of East Java Province (5.52), but high economic growth has not been followed by equity. The year 2020 is a special note, because with the pandemic, most districts/cities actually grew negatively lower than the

economic growth of East Java Province (-2.39).

In accordance with data from the Central Statistics Agency for East Java Province, the average GDP per capita of East Java Province in 2020 is IDR 39.71 million. Regencies/cities that have an average GDP per capita above East Java Province include the City of Kediri (IDR 294.19 million), Surabaya City (IDR 136.01 million), Gresik Regency (IDR 74.44 million), Sidoarjo Regency (IDR 64.96 million), Pasuruan Regency (IDR 64.23 million), Malang City (IDR 60.62 million), Bojonegoro Regency (IDR 53.55 million), Madiun City (IDR 52.58 million), Batu City (IDR 51.75 million), and Mojokerto Regency (IDR 51.66 million). Meanwhile regencies/cities that have a relatively low average GDP per capita in 2020 below IDR 20 million include Probolinggo, Lumajang, Magetan, Situbondo, Pacitan, Kediri, Madiun, Bondowoso, Trenggalek, Bangkalan, Nganjuk, Ngawi, Ponorogo, Sampang, and Pamekasan. This very striking difference in

the level of per capita income is one indication of development inequality caused by the high concentration of economic activity in several growth centers.

### 3.2 Conditional Convergence of East Java Economic Growth

Similar to absolute convergence analysis, conditional convergence analysis also begins with the Hausman model selection test to determine the best model in the convergence test. The results of the Hausman test show a value of  $0.6385 > 0.05$ , which means that the right model to be used in

the conditional convergence analysis is the random effect. Next, the estimation results of conditional convergence are shown in table 2.

Based on the estimation results of conditional convergence, there is a divergence of economic growth in East Java, which is indicated by a significant probability value and a positive direction of influence from the t-1 GDP variable. Together with other conditional/explanatory variables, such as the industry concentration index, investment, education index, health index, and capital expenditure, there are still spatial disparities in economic growth in East Java.

Table 3. Conditional Convergence Estimation Results

Variable	Coefficient	z	Probability	Conclusion
GDP t-1	0,238*	2,65	0,008	Divergent
Industry Agglomeration Index	-0,002**	-1,95	0,052	
Investment	-0,011	-0,80	0,425	
Education Index	0,005	0,05	0,958	
Health Index	0,008	0,11	0,913	
Capital Expenditure	0,065	0,98	0,325	
Constant	-2,078	-3,19	0,001	

Source: Results of data processing (2021)

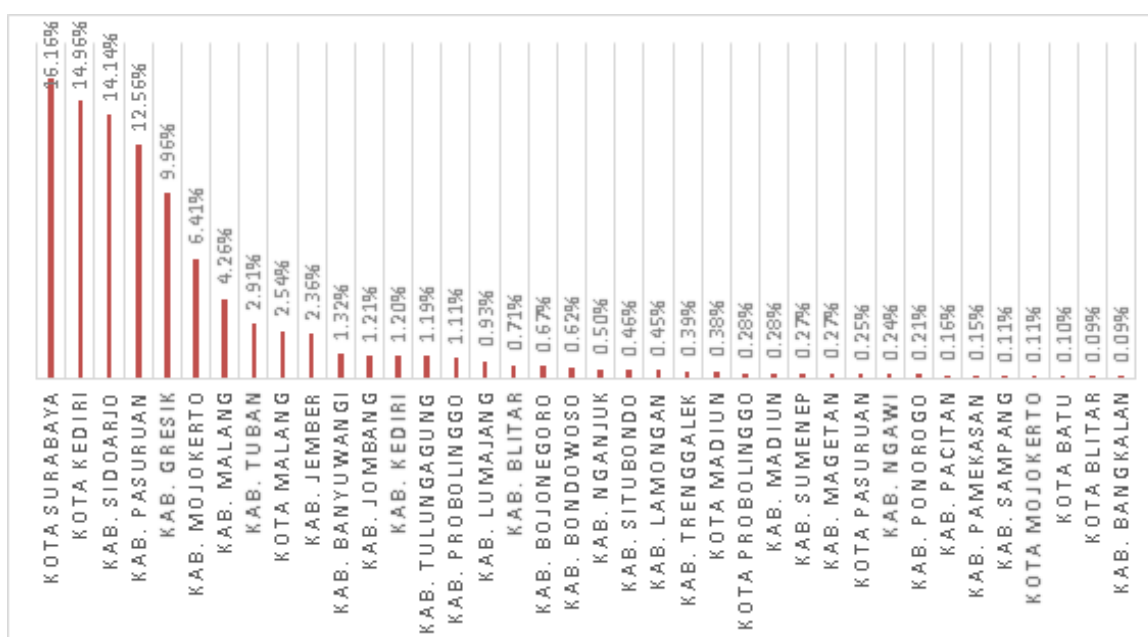


Figure 5a. Contribution of Regency/City Industrial GDP in East Java in 2016 (Percent)

Source: BPS (2021), modified

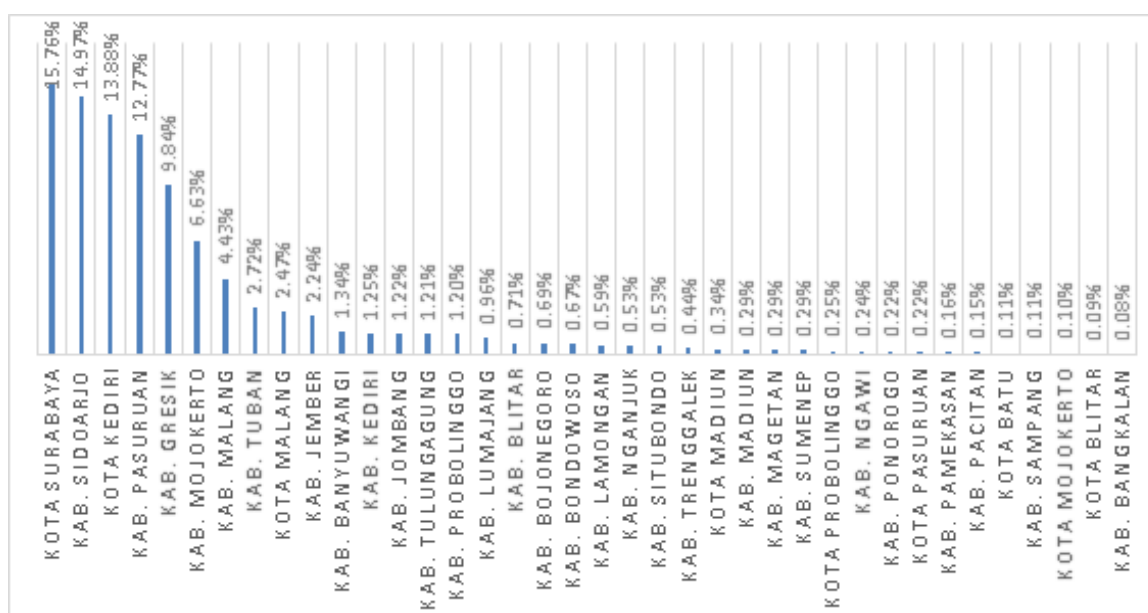


Figure 5b. Contribution of Regency/City Industrial GDP in East Java in 2020 (Percent)

Source: BPS (2021), modified

Furthermore, the industrial concentration index variable was found to have a significant effect with a negative direction, which means that industrial concentration tends to decrease per capita income growth and contribute to the formation of spatial inequality in East Java. The industrial concentration index shows the comparison of the GDP of the industrial sector of the district/city to the GDP of the industrial sector of East Java Province divided by the ratio of the area of the district/city compared to the area of East Java Province, then the industrial concentration index basically shows the contribution of industrial activity in the district/city to the province. Regions with the industrial sector as the main economic activity have a high industrial GDP contribution to the provincial industrial GDP. These areas can have a higher index of industrial concentration compared to areas with the main economic activity in the non-industrial sector, but can also have a relatively low index if they have a large administrative area.

When it's compared between 2016 and 2020, the GDP contribution of district and city industries in East Java in general did not change much, especially in the list of regions with the highest contribution. Based on the GDP

contribution of the Industrial sector, the City of Surabaya and several surrounding areas are the areas with the highest percentage contribution compared to other regencies/cities. The industrial sector of Surabaya City contributed 15.76 percent to East Java's industrial GDP, followed by Sidoarjo Regency with a contribution of almost 15 percent. Furthermore, Kediri City, Pasuruan Regency, and Gresik Regency are also included in the regions with the highest GDP contribution from the industrial sector, respectively at 13.88 percent, 12.77 percent, and 9.84 percent.

Economic activities in East Java Province are concentrated in the central part and in the northern coastal areas, especially in the Gresik-Bangkalan-Mojokerto-Surabaya-Sidoarjo-Lamongan (Gerbangkertosusila/GKS) area with the center in the city of Surabaya. The formation of Gerbangkertosusila has a function as the development of industrial activities and resources. The establishment of the Gerbangkertosusila area also aims to become a competitive national economic center. Four of the six regions with the highest industrial contribution in Figure 5 are part of the Gerbangkertosusila area.

These areas with high industrial concentration also tend to have high per capita



GDP. The City of Kediri has the highest GDP per capita among other regencies/cities, which is IDR 294.19 million, because the City of Kediri has a GDP based on high constant prices and a relatively small population. Furthermore, the city of Surabaya also has the second highest GDP per

capita, amounting to IDR 136.01 million per year. Gresik Regency, Sidoarjo Regency, and Pasuruan Regency are also included in the regencies/cities with high GDP per capita, respectively IDR 74.44 million, IDR 64.96 million, and IDR 64.23 million per year.

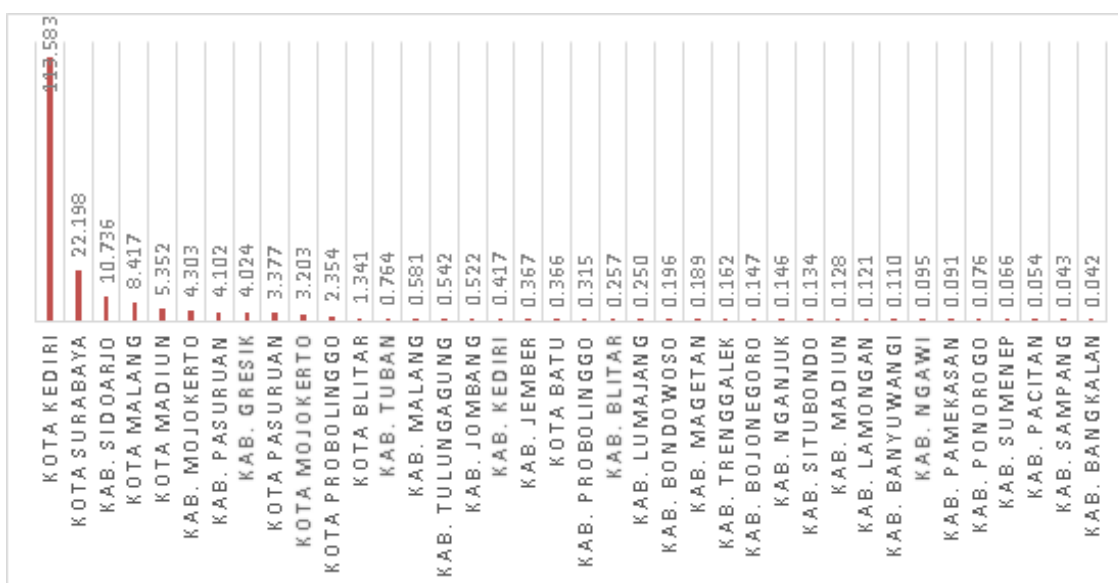


Figure 6a. Regency/City Industrial Concentration Index in East Java in 2016

Source: BPS (2021), processed

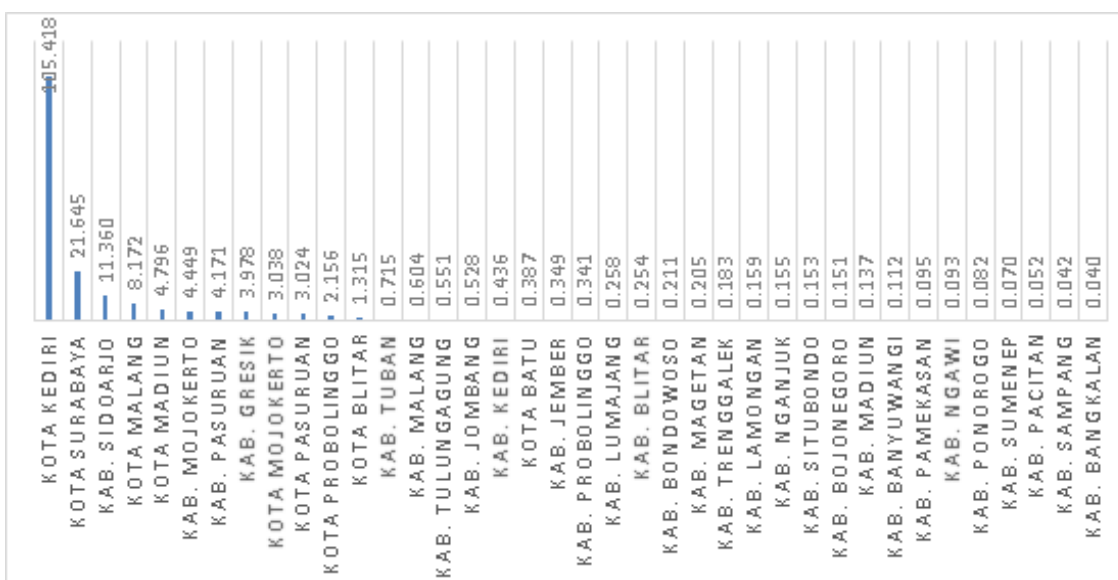


Figure 6b. Regency/City Industrial Concentration Index in East Java in 2020

Source: BPS (2021), processed

Figure 6a and 6b shows the district/city industrial concentration index in East Java and it can be seen that the areas with a high GDP contribution from the industrial sector (Figure 5a and 5b) also tend to have a high concentration index as well, such as Kediri City, Surabaya City, Sidoarjo Regency, Mojokerto Regency, and Pasuruan Regency. In terms of the industrial concentration index, the list of regions with the highest indexes in 2016 and 2020 also did not experience much change, although there was a decrease or increase in the index value. The figures explain that industrial activities concentrated in several districts/cities in East Java tend to create higher per capita incomes in these and surrounding areas, compared to other areas. This actually reduces the growth of per capita income and also forms a spatial divergence or inequality in East Java as estimated in table 3.

This result is also supported by the findings of Fauzi et al., 2019 that there is inequality in the Grebangkertosusila area (Gresik, Bangkalan, Mojokerto, Surabaya, Sidoarjo, and Lamongan) which is a metropolitan area and a unit area of development with other areas. The presence of the Suramadu Bridge has not provided more opportunities for Bangkalan to improve development performance. In addition, this condition also occurs in the pattern of the center-periphery relationship between the City of Blitar (central) with Blitar Regency (periphery) and Madiun City (center) Ponorogo, Magetan, and Ngawi (periphery) Regencies. The central region has a tendency to perform higher than its peripheral regions.

Geographically, regencies/cities in East Java Province can basically be classified into the *Pantura* (North Coast), Central, *Pansela* (South Coast), Horseshoe Region and Madura Island. The *Pantura* region consists of 7 regencies/cities located on the north coast, from Tuban Regency to Pasuruan Regency. The *Pansela* region consists of 5 regencies/cities located on the south coast, from Pacitan Regency to Malang Regency. The Central Region consists of 15 regencies/cities, located in the middle of the mainland and does not have a beach, the Horseshoe Region consists of 6 Regencies and 1 City starting from Probolinggo and Lumajang

Regencies to Banyuwangi Regency; while the Madura Island Region consists of 4 regencies, namely Bangkalan, Sampang, Pamekasan and Sumenep regency.

Compared to the northern part of East Java, in the southern part and the islands around East Java, the level of regional development as well as the income and welfare of the community is relatively lagging behind. The pace of economic growth in this region is slower than other regions, resulting in increasing disparities between regions. Thus, the challenge is to increase the development of these underdeveloped regions by harmonizing their growth rate to reduce the gap in the level of welfare and prosperity between regions in this province. In the growth pole theory, it is stated that in order to achieve a higher level of income, there is a need to build one or several centers of economic power within the territory of a country, or what are known as growth centers (growth points). or growth poles). There is a very important element for economic growth, namely the driving industry.

The spatial concentration of economic activity shows that industrialization is a selective process and only occurs in certain cases when viewed from a geographical point of view. For example: in the United States, the majority of the manufacturing industry has long been concentrated in a location called the manufacturing belt. According to Porter in Landiyanto et al., 2011, a cluster is a group of companies that are spatially concentrated and interrelated in an industry. Companies in these spatially concentrated industries are also linked to institutions that can practically support the industry, such as consumers and marketing networks, as well as raw materials and complementary products. In addition to being in the form of clusters, industrial concentrations can also form an agglomeration where there is not only one type of industry. There can be different types of industries that are not related to each other.

The main difference between the analysis of national economic growth and the analysis of regional growth is that the emphasis in the analysis is on factor movement. Possible entry and exit rates of regional economic growth.

Regional economic development and growth will be faster if it has an absolute advantage of being rich in natural resources and has a comparative advantage if the area is more efficient than other regions in carrying out production and trade activities (Sirojuzilam, 2008). Yu & Wei, 2008 added that the level of regional development also has a positive spatial correlation with the tendency of clustered patterns. This reinforces the statement that linkage is an important factor in regional development, so it was found in the East Java region that districts/cities with high growth tend to be close together, clustered, or clustered.

Furthermore, investment variables, education and health indices, and capital expenditures were also found to have a negative direction on per capita income growth, although they were found to have an insignificant effect. The investment variable has the same direction as the industrial concentration index variable, because if it is observed the regions with the highest investment are mostly the same as the regions with the high industrial concentration. However, both the index and capital expenditure have a positive influence on the growth of per capita income. Education and health together will form human capital as the basic capital for regional development. Meanwhile, capital expenditure reflects government investment, of which is used for the construction of fixed assets. This development aims to provide adequate public services so as to increase economic productivity.

#### 4. Conclusions

Based on absolute and conditional convergence analysis, it was found that economic growth as reflected in per capita income growth experienced spatial divergence or inequality in 2016-2020. The increase in growth has not been followed by equity in districts/cities in East Java Province. Furthermore, it was also found that the industrial concentration index has a significant effect with a negative direction, which means that industrial concentration reduces the growth rate and contributes to the formation of spatial inequality in East Java. Industrial activities that gather in several areas in East Java, such as in the Gerbangkertosusila area tend to only create

growth in the central region while other regions are still lagging behind. In addition, investment, education index, health index, and capital expenditure were found to have no significant effect on the formation of spatial inequality in East Java.

Seeing the concentration of economic activity, especially industry, in several parts of East Java, development policies need to be carried out for an orientation towards equity. The development of new economic growth centers is needed to balance development between regions in East Java Province. Regions that already have a high per capita income are approaching a steady state, so development can be focused on other areas that are still lagging behind. Access to adequate and equitable basic infrastructure in the long term will have a spillover effect to non-industrial areas, because basically they support the activities of the industry itself. Regarding population, the government needs to take advantage of the demographic bonus as a development opportunity, so that it focuses on equitable development between regions from all aspects of the economy, infrastructure, and education, which in turn is able to improve the quality of human resources, productivity, and regional competitiveness.

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