Industrial Agglomeration and Economic Growth in Indonesia

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Abstract

This study aims to analyze the level of industrial agglomeration using balassa index and spatial analysis. In addition, this study also analyzes the effect of industrial agglomeration, investment, infrastructure, and inequality on economic growth. The data used in this study are secondary data. This study uses panel data regression with a fixed effect model approach, consisting of 34 provinces in Indonesia for the period 2015-2020. The results of this study indicate that industrial agglomeration occurs in 7 provinces in Indonesia (Kepulauan Riau, West Java, Central Java, DI Yogyakarta, East Java, Banten, and Bali) with an average balassa index value of 1.34 and included in low levels. Industrial agglomeration tends to occur on Java Island. The results of the regression analysis in this study indicate that industrial agglomeration, investment, and infrastructure have a positive effect on economic growth in Indonesia, while inequality has a negative effect on economic growth in Indonesia.

Keywords: *Industrial Agglomeration, Economic Growth, Investment, Infrastructure, Inequality*

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INTRODUCTION

Indicators in economic development are economic growth, equity, and the problem of poverty. Economic growth is one of the indicators used to see the success of economic development or an economy in a certain area. Economic growth can be measured using data from Gross Domestic Product (GDP) from year to year.

The average GDP growth rate in Indonesia in 2015-2020 is 3.85 percent. The highest growth occurred in 2018 which reached 5.17 percent. The lowest growth occurred in 2020 at -2.07 percent. The declining growth in 2020 reached a negative

number due to the COVID-19 pandemic that hit Indonesia and other countries, affecting economic activities worldwide. The wheels of the economy must be hampered because of the policy of restricting the movement of people. These policies have an impact on the production process, distribution, and other operational activities which in turn disrupt economic performance.
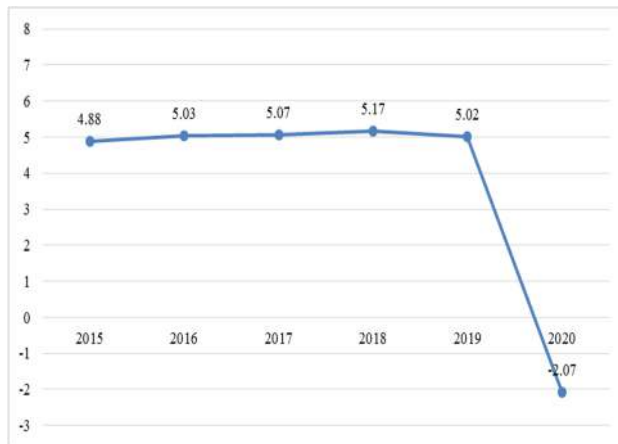

Figure 1. Indonesia's GDP Growth Rate (Percent) 2015-2020
Source: Central Bureau of Statistics, 2021

Industrialization is one of the development strategies implemented to improve the economy in developing regions (Jhingan, 2004). The industrial sector is one of the main sectors that are able to encourage other sectors such as the service sector and agriculture. The industrial sector also has a major contribution to increasing GDP. The manufacturing sector in Indonesia has a significant contribution to GDP compared to other sectors.

The contribution of the manufacturing industry to the GDP in Indonesia in 2015-2020 was 20.19 percent. The manufacturing sector has an important role in the economy of Indonesia. Industries tend to agglomerate in areas that have the resources and potential to meet their

production needs. Agglomeration causes the company's production efficiency which in turn affects the increase in economic growth. Industrial agglomeration in a region is assumed to be able to accelerate economic growth in the region because industrial agglomeration creates different consumption patterns between regions so that industrial development in that region will affect other regions (Nugroho & Wahyuni, 2019).
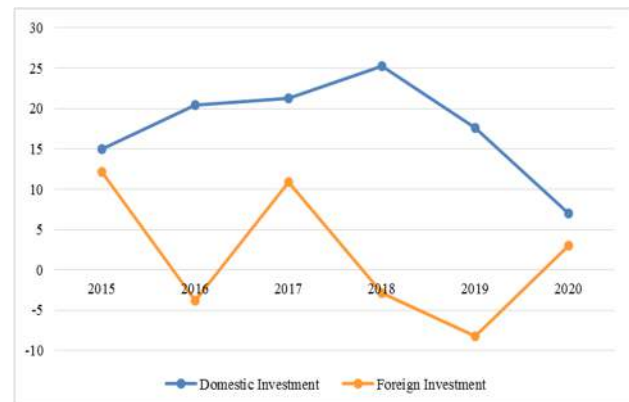

Figure 2. Investment Realization Growth (Percent) 2015-2020
Source: Central Bureau of Statistics (data processed), 2021

Industrial agglomeration will increase regional economic development through the transfer of knowledge and technology, increase labor productivity, increase employment opportunities, save costs, and others (Li, 2020). Hoover believes that the reason why industrial agglomeration can promote economic growth is that the external economy generated by industrial agglomeration will attract more similar companies to join the agglomeration region, which will lead to increased economic growth.

One of the government's efforts to accelerate the industrialization process is to create a conducive investment climate.

Investment is one source of economic growth. Investment is an expenditure made by investors or companies to buy capital goods or production equipment to increase economic activity. Harrod-Domar argued that in order for economic growth to occur rapidly, every economy must reserve or set aside a certain portion of its national income (GDP) to add or replace damaged capital goods. The more that can be saved and then invested, the faster the rate of economic growth will be (Todaro & Smith, 2011).
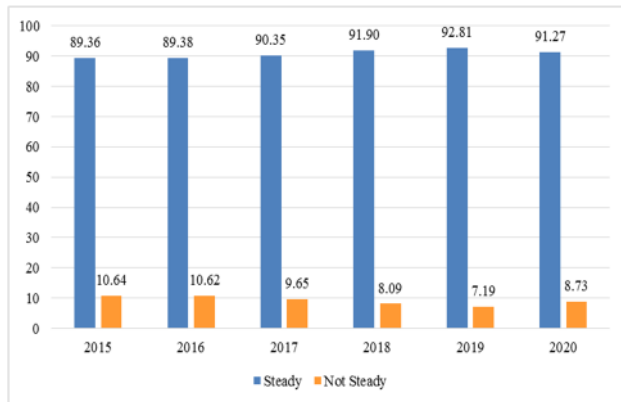

Figure 3. National Road Condition (Percent) 2015-2020
Source: Ministry of Public Works and Public Housing, 2021

For some time, investment has been an important source of finance for most of the world, especially for developing countries. Developed and developing countries have implemented several policies to attract investment in their countries, both foreign and domestic. This investment has many benefits, including job creation, increased competitiveness, technology transfer, and most importantly increased economic growth. Investment can increase productivity which will ultimately increase economic growth (Makiela & Ouattara, 2018).

In 2015-2020, Indonesia still provides an attraction for investors, especially domestic investors as indicated by the increase in domestic investment from year to year. In the graph, the highest growth occurred in 2018, where domestic investment increased by 25.25 percent from 2017. Meanwhile, foreign investment tends to experience an up-and-down trend every year. The highest growth occurred in 2015 at 12.12 percent and the lowest growth occurred in 2019, which was -8.23 percent.
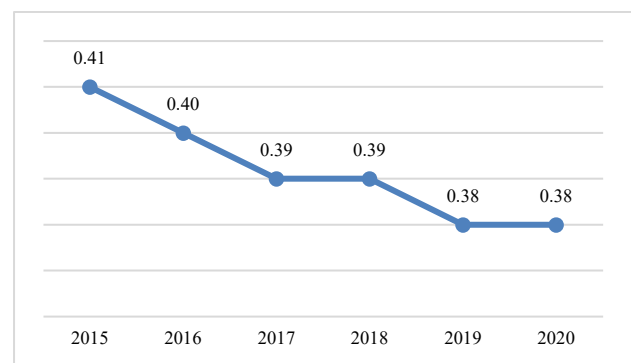

Figure 4. Indonesian Gini Ratio 2015-2020
Source: Central Bureau of Statistics, 2021

Apart from investment, industrialization cannot be separated from the availability of infrastructure. Infrastructure is an important component in the development of a country. The availability of infrastructure is a demand in running the economy of a country. Infrastructure development will have an influence on improving the economy of a country. Infrastructure has an impact on the economy, namely directly and indirectly (Yoshino & Nakahigashi, 2000).

Infrastructure is basically the basis on which economic growth is built. Infrastructure has a two-way relationship with economic growth: 1) infrastructure promotes economic growth; 2) economic growth brings infrastructure changes (Palei, 2015). The output

of the infrastructure sector is used as an input for production in the direct sector. Infrastructure development such as roads and transportation significantly increases productivity. Infrastructure development is important to do because the impact is not only for economic growth but can reduce the level of inequality as well. Roads are part of the infrastructure component that can drive economic growth. Good road conditions will facilitate the distribution of goods and services which in turn will encourage economic growth in an area.

The condition of national roads during the 2015-2020 period continues to improve, this can be seen from the condition of national roads in the steady category which continues to increase every year. During 2015-2020 the condition of national roads in the steady category had an average of 90.78 percent. In addition to paying attention to economic growth, other things that must be considered in economic development are issues of equity and inequality.

Some of the things that cause inequality between regions are the concentration of regional economic activities, investment allocation, low level of mobility of production factors between regions, differences in natural resources between regions, differences in geographical conditions between regions, and the lack of smooth trade between regions (Tambunan, 2003).

In general, inequality and economic growth have a negative relationship. A relatively general pattern can be observed depending on the level of development of a country. When the economy is in the early stages of its development, inequality will be higher because returns on physical capital tend to be higher than returns on human capital. However, when the economy has reached a more advanced stage of development, the level of inequality tends to decrease because the return on physical capital is lower than the return on human capital (Naguib, 2017).

Inequality in Indonesia in 2015-2020 tends to experience a downward trend. Inequality in Indonesia is usually measured using the Gini ratio. The average Gini ratio from 2015-2020 is 0.39. Based on the graph, the highest inequality in Indonesia occurred in 2015, when the Gini ratio reached 0.41 and there was a decline until 2020 the Gini ratio reached 0.38. During 2015-2020 inequality in Indonesia was in the moderate category.

The theory of growth centers can be interpreted with two approaches, namely the functional approach and the geographical approach. Functionally, the growth center is a location for the concentration of business or industrial groups which due to the nature of their relationship have dynamic elements so that they are able to stimulate economic activity both internally and externally (the surrounding area).

Geographically, the growth center is a location that has many facilities and conveniences so that it becomes a center of attraction (pole of attraction) which causes various kinds of businesses or industries to be interested in being located in the area, even though there is no interaction between these businesses or industries (Tarigan, 2005).

Perroux stated that leading industries are the main drivers in regional development. The existence of a leading industrial sector allows the centralization of industry which will accelerate economic growth, because industrial concentration will create different consumption patterns between regions so that industrial development in one region will affect other

regions. The economy is a combination of a relatively active industrial system (leading industry) with relatively passive industries or industries that depend on leading industries (Kuncoro, 2002).

Central economic growth (growth pole) has several effects on a region and the surrounding area (Pratiwi & Kuncoro, 2016), among others: (1) Spread Effect by providing a positive influence on the development of the surrounding area, such as the opening of job opportunities so as to encourage urbanization, the amount of investment coming in, higher labor wages, and the population being able to market raw goods; (2) Backwash Effect is a negative influence caused by the widening regional disparity.

Unequal growth in an area leads to regional inequality, crime, and increasing environmental damage. Harrod-Domar theory states that investment is the key to economic growth. Investment affects aggregate demand through increased production capacity (Nikolaos & Tsaliki, 2021). Capital accumulation occurs when part of the income is saved and reinvested with the aim of increasing output and income in the future.

This income can be invested through the procurement of factories, machinery, equipment, and raw materials that can support product marketing so that investment can help increase capital stock and the level of output to be achieved. (Suswita & Damanik, 2020). In the case of capital accumulation, it is necessary to set aside savings and reinvest them for some time.

The accumulation of capital here is not only in the form of investment in the procurement of factories, machinery, equipment, and so on but also includes infrastructure which is one of the supporting factors for industrialization and the development and marketing of other economic sector products. Capital accumulation is seen as an important element in economic growth (Mankiw, 2003).

Kuznets defines economic growth as a long-term increase in the supply of various types of increasing economic goods to society. This capability grows on the basis of necessary technological, institutional, and ideological advances (Jhingan, 2004). The definition has three components: 1) the economic growth of a nation is seen from the supply of goods that increases continuously; 2) advanced technology is a factor in economic growth that determines the degree of capacity growth in providing various kinds of goods for the community; 3) the widespread and efficient use of technology requires adjustments in the institutional and ideological fields so that the innovations produced by science can be used appropriately and well (Suryana, 2000).

Kuznets stated that in the early stages of economic growth, equity tends to deteriorate, but in the later stages, equity will gradually improve. The relationship between inequality and economic growth can be described by an inverted U-curve. The curve represents that in the short term, the relationship between inequality and growth is positive, which is indicated by an increasing graph.

Then when it reaches the climax or maximum point, in the long term the relationship between inequality and economic growth is negative, which is indicated by a downward graph. The cause of the increase in the initial phase of economic growth is the occurrence of urbanization and industrialization (Jovanovic, 2018). This study aims to analyze the

level of industrial agglomeration using the balassa index and spatial analysis.

RESEARCH METHODS

The type of study used is quantitative and spatial analysis. The data used is secondary data, in the form of panel data with time series data for 6 years, namely the 2015-2020 period and cross section data of 34 provinces in Indonesia, so the number of observations obtained is 204 observations. Balassa index is used to analyze the point of industrial agglomeration that occurs in the research area. This index can also be used to distinguish the specialization factor represented by the workforce.

$$\text{Balassa Index} = \frac{\frac{E_{ik}}{\sum E_{ik}}}{\frac{E_{ip}}{\sum E_{ip}}}$$

Where E_{ik} is the industrial sector workers in the province, $\sum E_{ik}$ is total workforce in the province, E_{ip} is industrial sector workers in Indonesia and $\sum E_{ip}$ is total workforce in Indonesia. The level of agglomeration is said to be high if the ballast index number is above 4, if the value between 2 and 4 can be categorized as average or moderate, and low if the value is between 1 and 1.99, if the ballast index value is between 0 and 0.99 it can be said that agglomeration does not occur in the region or that the region does not have a comparative advantage for agglomeration to occur (Sbergami, 2002).

Spatial analysis can reveal the spatial location trends of industry-centred locations and the preferred location behavior of companies. GIS can see trends in the spatial location of industrial agglomerations which are illustrated through maps, besides that GIS data can also be used to carry out spatial planning by

practitioners and policymakers (Gumbo, Geyer, Moyo, & Moyo, 2018). The purpose of spatial analysis in this study is to create a mapping that will provide an overview of the results of the calculation of industrial agglomeration in the provinces located in Indonesia. This spatial analysis is useful for identifying industries that tend to cluster in areas that will cause agglomeration.

In this study, the dependent variable used is Indonesia's economic growth as measured by the GDP (billion IDR) of 34 provinces in Indonesia. While the independent variables used are 4 variables, including: 1) industrial agglomeration as measured by ballast index; 2) investment which is measured using the realization of domestic investment and foreign investment (billion IDR); 3) infrastructure as measured by the length of the national road in steady condition (km); and 4) inequality as measured by the Gini Ratio. The data is sourced from the Central Bureau of Statistics and the Ministry of Public Works and Public Housing.

In analyzing the data, this study uses a fixed effect model approach with panel data regression analysis. The econometric model equation in this study has been transformed into a logarithmic form. The goal is to equalize the variable units and reduce the scale of the variables used, so that the possibility of heteroscedasticity problems can be minimized. The form of the linear equation is as follows:

$$\text{Log}Y = \alpha + \beta_1 \text{Log}X_1 + \beta_2 \text{Log}X_2 + \beta_3 \text{Log}X_3 + \beta_4 \text{Log}X_4 + e$$

Where Y is GRDP (billion IDR), α is constant, β is coefficient, X_1 is balassa index, X_2 is domestic investment + foreign investment (billion IDR), X_3 is the length of national road in

steady condition (km), X4 is gini ratio, e is error and Log is the logarithm.

RESULTS AND DISCUSSION

The first objective of this study is to analyze how the level and condition of industrial agglomeration in provinces in Indonesia is measured using the Hoover Balassa Index.

Table 1. Provinces in Indonesia with Low Industrial Agglomeration Averages (2015-2020)

Province	Average
Kepulauan Riau	1.58
West Java	1.45
Central Java	1.49
DI Yogyakarta	1.13
East Java	1.07
Banten	1.65
Bali	1.06

Source: Central Bureau of Statistics (data processed), 2021

The results of the analysis of the balassa index of 34 provinces in Indonesia in 2015-2020 have two categories, the level of industrial agglomeration is low and there is no agglomeration. This result explains that industrial agglomeration will occur when the proportion of workers in the industrial sector in the province is greater than the Indonesian level. In Indonesia, industrial agglomerations are specialized in several provinces, namely the Kepulauan Riau, West Java, Central Java, DI Yogyakarta, East Java, Banten, and Bali.

The region with the highest specialized index of industrial agglomeration occurs in Banten with an average return index of 1.65, meaning that the Indonesian industrial sector workforce is specialized in Banten with low criteria. The lowest index or not having specialization occurs in Papua, which is 0.14 which means that the region does not have a comparative advantage for agglomeration to occur. Spatial analysis is an analysis that provides geographic (spatial) information.

Table 2. Provinces in Indonesia with Average No Industrial Agglomeration (2015-2020)

Province	Average
Aceh	0.51
North Sumatra	0.65
West Sumatra	0.63
Riau	0.52
Jambi	0.34
South Sumatra	0.44
Bengkulu	0.37
Lampung	0.66
Kepulauan Bangka Belitung	0.51
West Nusa Tenggara	0.80
East Nusa Tenggara	0.60
West Kalimantan	0.40
Central Kalimantan	0.36
South Kalimantan	0.59
East Kalimantan	0.47
North Kalimantan	0.55
North Sulawesi	0.56
Central Sulawesi	0.46
South Sulawesi	0.58
Southeast Sulawesi	0.57
Gorontalo	0.61
West Sulawesi	0.54
Maluku	0.58
North Maluku	0.44
West Papua	0.32
Papua	0.14

Source: Central Bureau of Statistics (data processed), 2021

Each section analyzed provides an overview of a phenomenon followed by

information about the occurrence and location and distribution of the phenomenon between spaces (regions). If it is associated with the presentation of data, then the map is an appropriate form of presentation in spatial analysis. Figure 5 shows that the average industrial agglomeration in 2015-2020 in Indonesia has a tendency to be closely spaced. The industry is centered on Java Island, precisely in the provinces of West Java, Central Java, DI Yogyakarta, East Java, and Banten. Apart from Java, industrial agglomeration also occurs in the Kepulauan Riau and Bali.
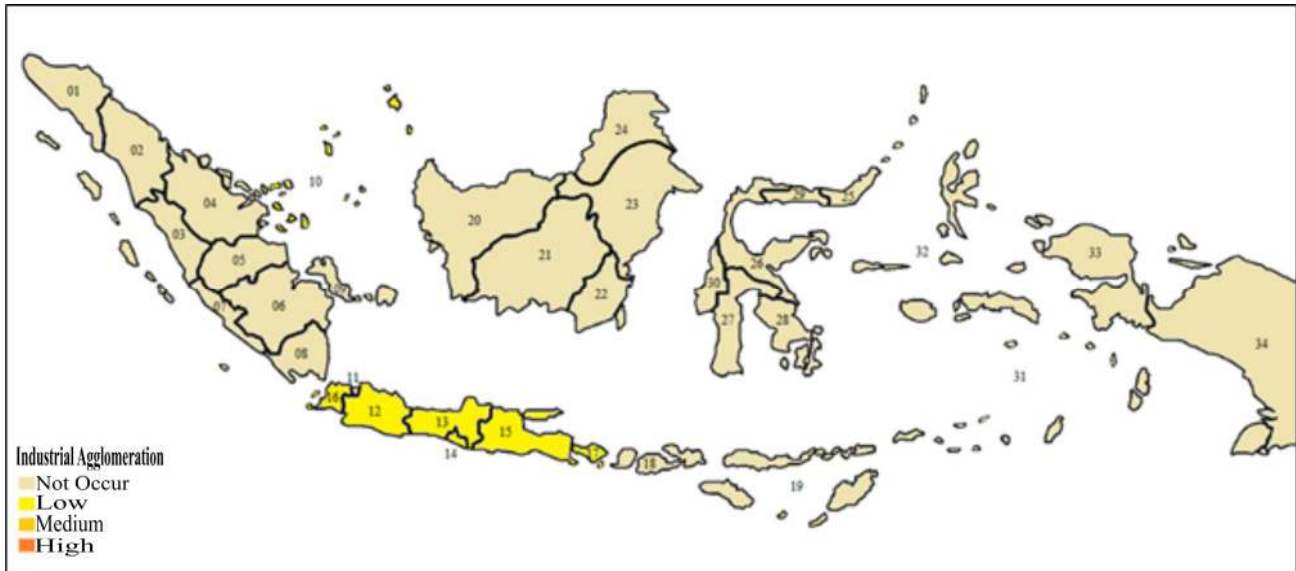

Figure 5. Map of Average Industrial Agglomeration in Indonesia (2015-2020)
Source : Output using ArcGIS 9

Industry which tends to be concentrated in Java Island and the high level of development progress in Java is due to the fact that until now Java Island is still an area where the center of government is located, which means that political activities and state administration are centered on Java Island. In addition, human resources are also concentrated in Java, where the highest proportion of the population reaches 57.5 percent.

On Java Island, the educational facilities are the most extensive and diverse and become a center for research and development of various applied and applied sciences. Java Island is also known as the entry point and exit point, namely the entrance and exit of economic activity, especially in terms of trade, both international and domestic. The availability of facilities on Java Island, especially in terms of the availability of transportation facilities such as the number of ports and airports, is an important factor in the selection of industrial locations and industrial activity centers.

This is explained in the Weberian Location concept, namely in the selection of industrial locations it is necessary to pay attention to strategic locations where the industrial location has an affordable distance from raw materials and markets and is able to reduce transportation costs and increase maximum profits (Murray, 2020). The purpose of this test is to determine the choice of approach, namely between the

common effect model and the fixed effect model. The results of the Chow test show the chi-square cross-section probability value of 0.0000 which means less than 0.05 and it can be concluded that the fixed effect is the right model.

Table 3. Chow Test Results

Effect Test	Statistic	d.f.	Prob.
Cross-section Chi-square	956.804002	33	0.0000

Source: Output using Eviews 9

The purpose of the test is to determine whether the fixed effect model approach or the random effects model is the chosen approach.

Table 4. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	105.431248	4	0.0000

Source: Output using Eviews 9

The results of the Hausman test show a random cross-section probability value of 0.0000 which means less than 0.05 where the fixed effect is the chosen model. Based on the two tests that have been carried out, the chosen approach model is the fixed effect. Then the next step is to test the classical assumptions. Based on the results of the normality test, obtained a probability value of 0.134644 where the value is more than 0.05 so it can be concluded that the data in this study is normally distributed.

According to the test results of the correlation coefficient between the independent variables, there is no independent variable that has a correlation value of more than 0.8 so that the model passes the multicollinearity test.

According to the results of the glejser test, there is no t-statistic probability of the independent variable having a value of less than 0.05, meaning that there is no independent variable that has a significant effect on the absolute residual. So that the model passes the heteroscedasticity test.

Table 5. Estimation Results of Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.553311	0.853848	8.846203	0.0000
Log Ag	0.155373	0.031394	4.949199	0.0000
Log Inv	0.048236	0.009756	4.944302	0.0000
Log Inf	0.427303	0.125294	3.410414	0.0008
Log Ig	-0.975300	0.151281	-6.44695	0.0000

Source: Output using Eviews 9

If written in an equation, the estimation results of the fixed effect model based on table 5 are as follows:

$$LogPDRB = 7{,}553311 + 0{,}155373\ LogAg + 0{,}048236\ LogInv + 0{,}427303\ LogInf - 0{,}975300\ LogIg + e$$

The constant value of 7.553311 shows that if the variables of industrial agglomeration, investment, infrastructure, and inequality are considered constant, the average economic growth rate is 7.55 percent. The probability value of F-statistics in the model in this study is 0.000000 where less than 0.05 means that the independent variables in the model as a whole are able to influence the dependent variable.

While the Adjusted R-square value is 0.996879, meaning that all independent variables in the model are able to explain the dependent variable by 99.68 percent while the remaining 0.32 percent is an explanation of other variables besides the variables in the model being tested. All independent variables in

this study have a t-statistic value below 0.05 which indicates that all independent variables have a significant influence on the dependent variable.

The industrial agglomeration coefficient value of 0.155373 means that if industrial agglomeration increases by 1 percent, Indonesia's economic growth will increase by 0.15 percent with the assumption of ceteris paribus. In theory, agglomeration arises because of differences in resources, both natural and human. Regions that have been able to determine their regional potential can experience agglomeration with positive impacts.

Agglomerated areas generally develop faster due to the interaction between adjacent areas so that economic activities also develop (Christiari, 2021). The presence of a concentration of activity in an area usually causes a diffuse impact on the surrounding areas. In this case, the agglomeration area in Indonesia occurs in the province located on Java Island, where several economic activities that support Indonesia's economic growth are located on Java Island.

The presence of industrial concentration can increase productivity stemming from increased profits, lower transportation costs, and migration which ultimately has a positive impact on economic growth in the region. Agglomeration produces spatial differences in income levels. If the economy is more spatially agglomerated, it will increase its growth (Artaningtyas, Winarti, & Sodik, 2019).

Areas with concentrated areas in the manufacturing industry will grow faster than areas without concentration in the manufacturing industry, this is because areas with many industries have accumulated capital. In addition, based on research (Mukhlis, Hidayah, & Sariyani, 2018) industrial agglomeration has a positive effect on economic growth. Facilities and infrastructure, as well as access to grouped information due to agglomeration can support the potential for economic growth.

The investment coefficient value of 0.048236 means that if investment increases by 1 percent, Indonesia's economic growth will increase by 0.04 percent with the assumption of ceteris paribus. Harrod Domar's theory states that economic growth depends on factors of production and technology. One of the factors of production is capital. The increase in capital stock can be done by investing.

Investment can have a positive impact on economic growth, which in addition to helping to increase the capital stock, investment can also create jobs and improve the quality of the workforce in the areas that are given the investment (Damanik, Zulgani, & Rosmeli, 2018). The government still has a role in the entry of investment in Indonesia, it is necessary to be firm in the provisions and policies to protect the areas that are given investment.

Provisions and policies on environmental protection are required in investment licensing so that sustainable economic activities can still be considered (Christiari, 2021). The economic situation in an area is also a factor in investors' decision-making to invest. Economic stability in a region in ensuring the economy in the future is an important reason for investors. The greater the income of an area, it indicates the size of the market in the area is large and this will be a benchmark for investors to invest in the area (Yuliadi, 2020).

The infrastructure coefficient value of 0.427303 means that if the infrastructure

increases by 1 percent, Indonesia's economic growth will increase by 0.42 percent with the assumption of ceteris paribus. When infrastructure development with road length indicators increases, it will be followed by an increase in economic growth in Indonesia. This research is in line with Harrod Domar's theory which states that economic growth or GRDP growth depends on the accumulation of capital which is then invested.

The form of investment can be in the form of infrastructure which is one of the factors to increase economic growth (Lestari & Suhadak, 2019). The inequality coefficient value of -0.975300 means that if inequality increases by 1 percent, Indonesia's economic growth will decrease by 0.97 percent with the assumption of ceteris paribus. Inequality causes a decline in economic growth in Indonesia.

Inequality and economic growth have a considerable influence. Simon Kuznets has examined the relationship between economic growth and inequality, where the results show the pattern of the relationship between economic growth and inequality. The early stages of economic growth will be followed by worsening equity between regions which will lead to inequality (Pradana & Sumarsono, 2018).

CONCLUSION

Research conducted in 34 provinces in Indonesia during 2015-2020 focused on the analysis of industrial agglomeration and analysis of the influence of industrial agglomeration, investment, infrastructure, and inequality on economic growth in Indonesia. Based on the results of the discussion in the previous chapter, this study produces several conclusions, such as Industrial agglomeration occurs in 7 provinces in Indonesia, namely Kepulauan Riau, West Java, Central Java, DI Yogyakarta, East Java, Banten, and Bali.

Based on the calculation of the ballast index, industrial agglomeration in Indonesia is still in the low category. Industrial agglomeration has a positive and significant effect on economic growth, it shows that if the level of agglomeration increases, Indonesia's economic growth will also increase.

However, the level of industrial agglomeration in Indonesia is still relatively low because there are other sectors that are more dominant than the industrial sector in Indonesia. Investment has a positive and significant effect on economic growth in Indonesia, this shows that the increase in investment is able to encourage economic growth in Indonesia.

Infrastructure has a positive and significant impact on economic growth in Indonesia, this shows that the increase in the quality of infrastructure is able to encourage economic growth in Indonesia. 5) Inequality has a negative and significant effect on economic growth in Indonesia, this shows that when inequality decreases, economic growth in Indonesia will increase.

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