Determining Factor of Income Inequality : A Case Study in Sulawesi 2009-2021

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Abstract. Problems that are often faced by developing countries are income inequality and economic inequality caused by the increase of population each year. The average rate of income inequality on the island of Sulawesi is higher when compared to other large islands. Therefore, the current research is conducted to find out what factors affect income inequality on the island of Sulawesi. The results show that the most dominant influence is Population Density, Gross Fixed Capital Formation (PMTB), Unemployment, Information Technology Development Index, Human Development Index and the least dominant influence is inflation. The results also state that population density does not significantly affect income inequality, explaining that population density has a U-like relationship to income inequality, a condition which in a certain period has a positive impact and if it continues to increase will have a negative impact.

Keywords: Income Inequality. Population Density Human Development Index.

1 Introduction

The Republic of Indonesia has 17,504 islands including large islands such as Java, Sumatra, Borneo, Sulawesi, Papua, island areas such as the Riau Island, the Thousand Island, the Maluku Island and small island such as Bali, Madura and Nusa Tenggara. However, the distribution of population is not evenly distributed on each island. Some areas have a population density of 15,978/Km^2 and other areas with a density of 5/Km^2 (databoks.katadata.co.id). The impact of high population density if it is not balanced with economic development will increase poverty, unemployment, crime and other social conditions. In general, development issues in developing countries must pay attention not only on the achievement of growth rates but also to the distribution of development results and fair equity. Development results need to be available in a fair and proportional manner at all levels of society, including balanced progress between regions.

Problems that are often faced by developing countries like Indonesia are economic inequality caused by the increase of population on each year. Wan, et al. conclude that inequality is growing significantly in the most popular countryin Asia, including China, India, Bangladesh,

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Indonesia and Pakistan (1). Deutsch, et al. have previously concluded that the ranking inequality countries in Southeast Asia are Cambodia, Indonesia and the Philippines, meanwhile the countries with low inequality rates are in Vietnam, Thailand and Malaysia. The classification is a similar country classification when calculating the multidimensional poverty index. (2)

The level of inequality affects economic instability, financial crises, debt and inflation and will have further impacts in the political, social and economic growth fields. Income inequality has an impact on the population with poverty levels and a slowing rate of economic growth (3).

Initial calculations carried out by researchers regarding the condition of the Gini ratio at the national level for 2009-2021 (Figure 1) fluctuated up and down with the lowest figure being 0.367 in 2009, the highest number is 0.414 in 2014 and the average number is 0.392 over a 13 years period of research.

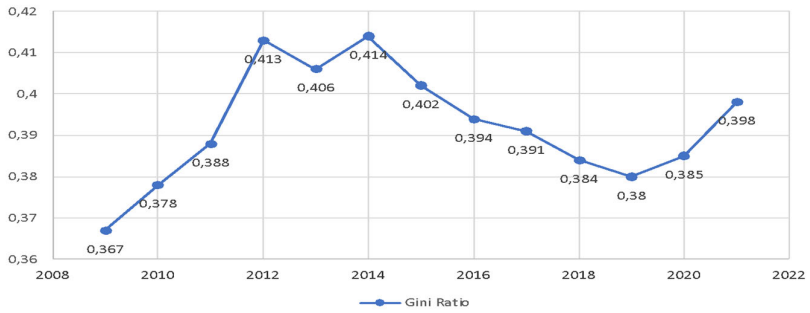
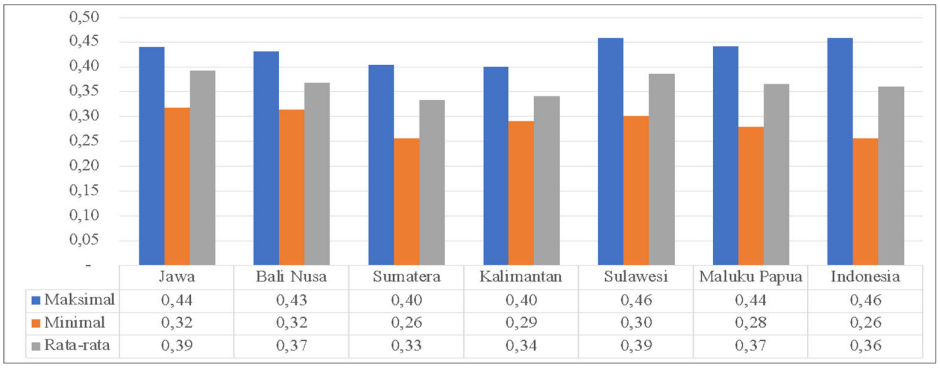


Fig 1. Gini Ratio Nationally in Indonesia year 2009-2021

Figure 2 shows the income inequality of the five large islands in Indonesia and Indonesian national level for 2009-2021. It shows the highest figure in Sulawesi Corridor at 0.46, to be precise in Gorontalo province in 2014.

The highest figure on Sulawesi Island is one of the rationales to conduct research on the condition of income inequality and the factors that cause it.



	Jawa	Bali Nusa	Sumatera	Kalimantan	Sulawesi	Maluku Papua	Indonesia
Maksimal	0,44	0,43	0,40	0,40	0,46	0,44	0,46
Minimal	0,32	0,32	0,26	0,29	0,30	0,28	0,26
Rata-rata	0,39	0,37	0,33	0,34	0,39	0,37	0,36

Fig 2. Gini ratio in 5 major islands in Indonesia year 2009-2021

2. Literature Review

The Gini Ratio is an indicator to measure the level of income inequality in a country. The increase of economic growth will increase income inequality and vice versa if the economic growth decreases, it will cause income inequality. (4)

The theory of distributional inequality is an "inverted-U" hypothesis put forward by Simon Kuznets in 1955 who states that at first when development begins, income distribution will be more unequal, but after reaching a certain level of development, income distribution will be more equal.

There are two models of inequality, namely the theory according to Harrod Domar and the Neo-classical. Both of these theories give a special role of capital which can be represented by investment activities invested in an area to attract capital into the area. This will clearly affect the ability of each region to grow as well as create differences in the ability to generate income. Investments are considered more profitable if they are allocated to areas that are able to generate large returns in a relatively short period of time. The market mechanism will actually cause inequality, where relatively developed regions will grow faster, while less developed regions will have a relatively slow growth rate. This has led to income inequality between regions. Therefore, a plan and policy is needed to direct investment allocation towards a more balanced economic progress in all regions within the country. [5]

Eight factors influencing income inequality in an area are as follows: 1. If a population growth increases significantly, per capita income will decrease, , 2. Inflation where a monetary income increases which is not proportional to the increase of production of goods, 3. Tidak, 4. high capital-intensive project investment, 5. minimum social movement, 6. Implementation of import policy which has an impact on increasing the price of industrial goods to protect capitalist companies, 7. low exchange rate, 8. Damage to the home industry ladder. [6]

3. Methods

Panel data in 6 provinces in Indonesia were used in the current research with variables: population density, (X_1) unemployment (X_2), human development index (IPM) (X_3), inflation (X_4), Gross Fixed Capital Formation (PMTB) (X_5), Information Technology Development Index (IP_TIK) (X_6) and income inequality (Y).

The research data were data for 13 (thirteen) years starting from 2009 to 2021, so the total research sample is 78 data for each research variable.. The research data were obtained from various agencies, namely Bank Indonesia, the Population Service, the Central Statistics Agency (BPS) and the Regions.

The definitions of variables and research data sources are :

- Population density (X_1) is the population per unit of land area, for example, the number of persons per square kilometre and the data source comes from Statistics Indonesia (bps.go.id)

- Unemployment (X_2) *is percentage of unemployment to the number of labor force (bps.go.id) and the data source comes from Statistics Indonesia (bps.go.id)*
- Human Development Index (X_3) is an explanation of how residents can access development results in obtaining income, health, education, and so on. The data source comes from Statistics Indonesia (bps.go.id)
- Inflation (X_4) is a tendency to rise in the price of goods and services in general that takes place continuously. The data source comes from Statistics Indonesia (bps.go.id)
- Gross Fixed Capital Formation (X_5) is expenditure for capital goods which have an effective life of more than one year and which do not represent commodities for consumption. The data source comes from Statistics Indonesia (bps.go.id)
- Information Technology Development Index (IP_TIK) (X_6) is a standard measure level of ICT development in an area that can be compared over time and between regions. The data source comes from Statistics Indonesia (bps.go.id)

Table 1. Research data structure

Year	Population Density (X_1)	Unemployment (X_2)	Human Development Index (X_3)	Inflation (X_4)	Gross Fixed Capital Formation (X_5)	Information and Communication Technology Development Index (X_6)	Income inequality (Y)
2009 (1)	Log $(X_1)_{i,2009}$	Log $(X_2)_{i,2009}$	Log $(X_3)_{i,2009}$	Log $(X_4)_{i,2009}$	Log $(X_5)_{i,2009}$	Log $(X_6)_{i,2009}$	Log $(Y)_{i,2009}$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
2021 (13)	Log $(X_1)_{i,2021}$	Log $(X_2)_{i,2021}$	Log $(X_3)_{i,2021}$	Log $(X_4)_{i,2021}$	Log $(X_5)_{i,2021}$	Log $(X_6)_{i,2021}$	Log $(Y)_{i,2021}$

The relationship between variables of the research in the formulation is as follows:

$$log\ income\ inequaty_{it} = \alpha_{it} + \beta_1 log\ population\ density_{it} + \beta_2 logUnemployment_{it} + \beta_3 logHDI_{it} + \beta_4 logInflation_{it} + \beta_5 logGross\ Fixed\ Capital\ formation_{it} + \beta_6 logIP\_TIK_{it}$$

Three approaches are used to determine the estimation model using panel data, namely: PLS (Pooled Least Square) or CEM (Commond Effect Model), FEM (Fix Effect Model), REM (Random Effect Model). There are three tests that can be used, namely by using: Chow Test, Hausman test , Lagrange Multiplier Test. (7)(8)

4. Results and Discussions

The following are the results of descriptive analysis of each variable on the island of Sulawesi.

4.1. Population_Density (X_1) on the island of Sulawesi has the highest number in the province of South Sulawesi in 2021 with a density of 196/km2 and has the lowest density of 35/km2 in the province of Central Sulawesi in 2009, and the average population density on the island of Sulawesi is 106.37/km2 for 13 years.

4.2. Unemployment (X_2) on the island of Sulawesi has the highest open unemployment rate in 2009-2021 in the province of North Sulawesi in 2009 with a figure of 10.63 and the lowest in the province of West Sulawesi in 2019 with a rate of 1.29, as well as an average unemployment rate in below Indonesia, namely at 4.59 in the past 13 years.

4.3. The Human Development Index (HDI)(X_3) on the island of Sulawesi had the highest Human development Index in the province of North Sulawesi in 2009 of 75.68% and the lowest in 2010 in the province of West Sulawesi with a figure of 59.74% and the average Development Index Humans on the island of Sulawesi 67.85% where this figure is lower than the national rate during the study period.

4.4. Inflation (X_4) on the island of Sulawesi has the highest inflation rate in 2014 of 9.67 in the province of North Sulawesi and the lowest rate of 0.10 in 2020 in the province of North Sulawesi and the average inflation rate on the island of Sulawesi is 3.93 where this figure is lower than the national figure of 4.15 in 13 years

4.5. Gross Fixed Capital Formation (X_5) on the island of Sulawesi has the highest figure in the province of South Sulawesi in 2021 with PMTB of 134,156,535.23 and in 2009 all provinces had the lowest PMTB at 2,366,615. The average PMTB on the island of Sulawesi is 32,277,862.80 for 13 years.

4.6. The Information and Communication Technology Development Index (IP-TIK) (X_6) on the island of Sulawesi has the highest score in the province of North Sulawesi in 2021 of 5.93 and the province of West Sulawesi in 2009 has the lowest score of 2.30 and has an average IP_TIK score of 4.15 for 13 years

Table 2. Results of data analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.529960	0.142546	-3.717817	0.0004
SULAWESI_LOG_ POPULATION_DENSITY	0.037443	0.028768	1.301557	0.1981
SULAWESI_LOG_UNEMPLOYMENT	0.026660	0.053916	0.494469	0.6228
SULAWESI_LOG_HDI	0.015604	0.046250	0.337390	0.7370
SULAWESI_LOG_INFLATION	0.005010	0.018861	0.265631	0.7914
SULAWESI_LOG_ GROSS_FIXED CAPITAL_FORMATION	-0.007942	0.012736	-0.623613	0.5353
SULAWESI_LOG_IP_TIK	0.084906	0.183161	0.463561	0.6447

The equation formulated from the test results (Table 2) is:

$$log\ income\ inequaty_{it} = -0.529960 + 0.037443\ population\ density + 0.026660\ Unemployment + 0.015604\ HDI + 0{,}005010\ Inflation - 0.007942\ Gross\ Fixed\ Capital\ formation + 0.084906\ IP\_TIK$$

the direction of the relationship between variables on income inequality on the island of Sulawesi is as follows:

a. The relationship between population density (X_1) and income inequality (Y) on the island of Sulawesi is 0.037443 or the direction of a positive relationship and inelastic influence. When there is an increase in population density on the island of Sulawesi, it will cause an inelastic increase in income inequality of 0.037443 units.
b. The relationship between unemployment (X_2) and (Y) income inequality in Sulawesi is 0.026660 or the direction of the positive relationship and the influence of inelasticity. When there is an increase in unemployment on the island of Sulawesi, it will cause an inelastic increase in income inequality of 0.026660 units.
c. The relationship of the Human Development Index (IPM) (X_3) to income inequality (Y) on the island of Sulawesi is 0.015604 or the direction of a positive relationship and inelastic influence. When there is an increase in the Human Development Index on the island of Sulawesi, it will cause an inelastic increase in income inequality of 0.015604 units.
d. The relationship of inflation (X_4) to income inequality (Y) is 0.005010 or the direction of a positive relationship and inelastic influence. When there is an increase in inflation on the island of Sulawesi it will cause an inelastic increase in income inequality of 0.005010 units.
e. The relationship between Gross Fixed Investment (PMTB) (X_5) and (Y) income inequality is -0.007942 or the direction of the negative relationship and the influence of inelasticity. When there is an increase in PMTB on the island of Sulawesi, it will cause an inelastic decrease in income inequality by 0.007942 units.
f. The direction of the IP_TIK (X_6) relationship to (Y) income inequality is 0.084906 or the direction of a positive relationship and inelastic influence. When there is an increase in IP_TIK on the island of Sulawesi, it will cause an inelastic increase in income inequality of 0.084906 units.

The test results on the island of Sulawesi with income inequality (Y) are the dependent variable and population density (X_1), unemployment (X_2), human development index (IPM) (X_3), inflation (X_4), Gross Fixed Capital Formation (PMTB) (X_5), Information Technology Development Index (IP_TIK) (X_6) as the independent variable show the Prob number (F-statistic) of 0.01505 <0.05 which means there is a significant influence.

The influence of population density, (X_1) unemployment (X_2), human development index (IPM) (X_3), inflation (X_4), Gross Fixed Capital Formation (PMTB) (X_5), Information Technology Development Index (IP_TIK) (X_6) on income inequality (Y) on the island of Sulawesi which has been proven to have a significant influence you can know the value by looking at the R^2 figure, which is 0.394709 and the Adj R^2 is 0.210044. This means that the influence of all variables simultaneously on income inequality (Y) in Sulawesi is 21.0044%, and the remaining number is 78.9956% influenced by other factors outside the research model. In line with the

small number of influences collectively, if one looks at the magnitude of the influence partially within the scope of the island of Sulawesi, the order of influence from the largest to the smallest effect is 1) Population Density (X_1) of 1.30155, 2) PMTB (X_5) of 0 .62361, 3) Unemployment (X_2) of 0.49446, 4) Information Technology Development Index IP_TIK (X_6) of 0.46356, 5) human development index (X_3) of 0.33739 and the smallest effect is inflation (X_4) of 0.26563.

However, the results in table 2 show that all variables as population density (X_1), unemployment (X_2), HDI (X_3), inflation (X_4), PMTB (X_5) and IP_TIK (X_6) have a prob value of > 0.05, which means the influence of the variable independent is not significant to income inequality partially within the scope of the island of Sulawesi.

5. Conclusion

Population density has a positive relationship direction, when population density continues to increase, the density will affect the income ratio which is getting bigger. One of the factors that causes income inequality in an area is when population growth increases significantly which will result in a decrease in per capita income and a disproportionate increase in production of goods resulting in inflation. Comparison of the total income received by individuals or groups with all the incomes of people in the area also reflects the level of population density. The results which state that population density does not significantly affect income inequality partially are also seen in the low ability to explain and the inaccurate results of parameter calculations. As previously explained that population density has a U-like relationship to income inequality, a condition that in a certain period has a positive impact and if it continues to increase will have a negative impact.

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