



Income Inequality in Sulawesi Island: Evaluating Role of GRDP per Capita and Human Development Index

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Abstract. This study comprehensively analyzes the effect of GRDP per capita and Human Development Index (HDI) on income inequality in six provinces in Sulawesi Island during the period 2010-2023, using a panel data approach with the Random Effect Model (REM) method. The results show that GRDP per capita has a negative and significant effect on income inequality, where an increase in GRDP per capita correlates with a decrease in the gini ratio by 0.33%. In contrast, HDI has a positive and significant effect, where each increase in HDI causes an increase in income inequality by 1.204%. With a coefficient of determination (R^2) of 41.15%, this study shows that the combination of GRDP per capita and HDI contributes significantly to the variation in income inequality in the study areas. This finding underscores the importance of policy strategies that focus on economic diversification and improving access to education and equitable health services as concrete steps to reduce income inequality in Sulawesi Island.

Keywords: Income Inequality, GRDP per capita, HDI, Gini Ratio

1 Introduction

Income inequality often receives attention in world forums, especially as it relates to economic growth. This phenomenon is quite persistent in developed and developing countries, given its urgency which can not only cut national economic growth but can also cause serious development problems [1]. The benchmark of success in the development of a region can be seen from economic growth and the smaller income inequality between populations, between regions or between sectors. In the process of developing a country, it should be in line with increasing welfare, especially an increase in the economic sector which is the main driving force in increasing people's income. The success of a country's economy can also be seen from how much the results of its economy are able to realize equal distribution of welfare for all existing regions [2]. This shows a close relationship between economic growth and income inequality. That way the hope of this activity is the creation of development and welfare with good equity.

During the course of economic development there is an impression that economic theories basically focus only on the question of how to achieve prosperity through the

process of capital accumulation [3]. The dominance of this classical view of the world economy is not wrong and is still relevant today, but the expected results are not always in line in improving welfare. Simply put, if the focus is only on growth, there will be groups that are disappointed, while at the same time there will be groups that feel fortunate, this is what is called inequality. Previous research by Lyubimov [4] shows that income inequality can be a barrier to economic growth, especially if it is not matched by appropriate redistributive policies. On the other hand, research by Alvaredo et al. [5] in “The Elephant Curve of Global Inequality and Growth” shows that global inequality has increased as economic growth has been uneven across countries and regions.

In Indonesia, the success of development as seen from the high economic growth has not been enjoyed evenly in the community. This condition can be proven from the distribution of economic growth values in various provinces in Indonesia [6]. Sulawesi Island, which is one part of the Unitary State of the Republic of Indonesia, is also not immune from this complex income inequality phenomenon. Some regions may achieve rapid growth, but in reality this economic growth is not always followed by fair distribution. Furthermore, while some regions are achieving rapid growth, there are regions that are experiencing slow economic growth, which results in a widening gap of inequality within a region, using the Gini ratio as an indicator to measure income inequality. This difference is caused by several things, including differences in resources owned, the tendency of investors (investors) to only choose areas that already have adequate facilities and infrastructure, skilled labor, adequate electricity and telecommunications networks such as in urban areas [7].

Fig. 1. : Gini Ratio of 6 provinces in South Sulawesi

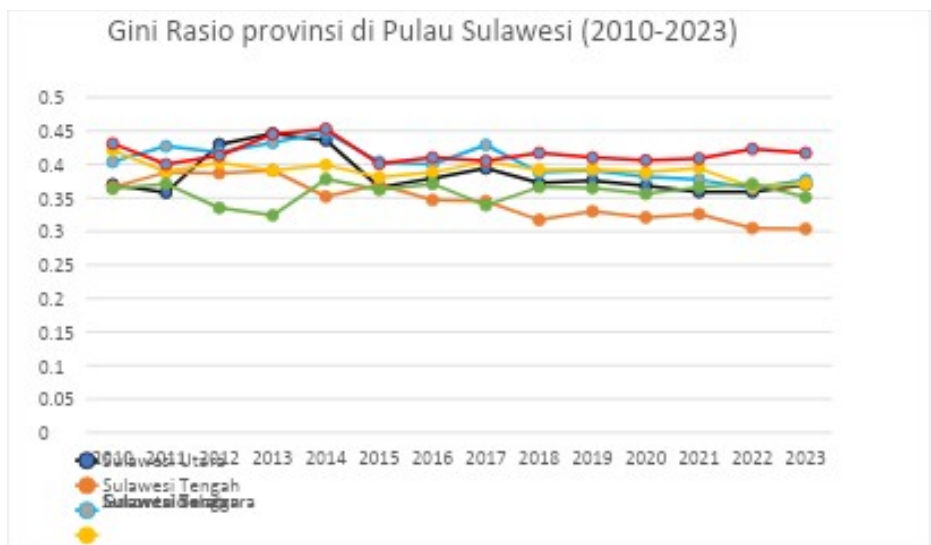


Fig. 1 shows the Gini Ratio data by the Badan Pusat Statistik (BPS), from the six provinces in Sulawesi Island between 2010 and 2023, showing fluctuations in the Gini Ratio in each province. The Gini Ratio of Gorontalo Province shows a high level

of income inequality, with values above 0.4 for 14 years. The Gini ratio in 2010 was 0.431 to 0.417 in 2023, while if we look at the economic growth rate of Gorontalo Province moving from 7.71% in 2011 and decreasing in 2023 to 4.5%, the decline in economic growth rate that occurred in Gorontalo Province was followed by a decrease in the Gini ratio. The trend of decreasing and increasing gini ratios in Central Sulawesi province is almost the same as the other five regions on the island of Sulawesi, but when compared to the rate of economic growth, Central Sulawesi province experienced a significant increase in economic growth. This means that although economic growth increased, this did not have an impact on reducing the Gini Ratio of Central Sulawesi Province. The stability of the Gini Ratio in the six provinces, which ranges from 0.3 to 0.448, indicates persistent inequality over a long period. This indicates the presence of structural factors that may be difficult to overcome.

Hasan, M. & Azis M. [8] stated that inter-regional inequality is a bad impact in economic development that only focuses on economic growth. An active role of the government is needed to establish a strategic plan to deal with this inequality problem because it involves structural aspects that are not easy to change. Ensuring the sustainability of society by creating a healthy and quality economy, it is important to pay attention to non-economic factors such as access to quality and equitable public services, especially basic services such as education and health [9].

A variety of factors may contribute to inequality between regions on Sulawesi Island, including changes in economic policy, development programs, or shifts in economic structure. Due to the clear variation in the Gini Ratio measurement in consistently determining the level of income inequality among provinces in Sulawesi Island, it is necessary to examine the economic and non-economic factors that may have a major influence on this difference. This could be the focus of research to identify the causes of fluctuations and factors that contribute to income inequality.

According to Salsabila. A [10] income inequality is a complex phenomenon and is influenced by various social, economic, and policy factors. More in-depth research can help understand the factors underlying the differences in inequality in each province and identify effective interventions to reduce income inequality between regions. Social structures that emphasize community welfare also play a role in reducing income inequality. The Human Development Index is able to explain how the level of human development is influenced by three main dimensions, namely living standards, health and education [11] [12].

Income differences between regions are increasingly evident along with the economic growth of a region, which is often triggered by uneven economic growth, which is the main cause of increasing income disparities between regions [13]. Factors such as Gross Regional Domestic Product (GRDP) per capita and Human Development Index (HDI) are known to play a role in influencing income inequality. According to previous research, GRDP per capita growth has a positive effect on income inequality, while HDI has a negative effect [14].

Research in Central Kalimantan shows that GRDP per capita and HDI have no significant effect on income inequality, while labor variables have a significant effect [15]. In addition, another study in Yogyakarta Province shows that GRDP per capita has a positive and significant effect on income inequality, while HDI has a negative and significant effect [16]. In the context of the influence of GRDP and HDI, it is

important to understand how these two variables contribute to income inequality between regions.

In the context of South Sulawesi, the influence of GRDP per capita and HDI on income inequality is interesting to study given their role in describing the level of economic development and welfare of a region. Based on theoretical understanding and empirical findings, this study aims to understand the extent to which GRDP per capita and HDI contribute to income inequality in the six provinces in the Sulawesi archipelago, as well as the policy implications that can be taken to achieve inclusive and equitable economic growth.

2 Literature Review

Theoretically, income inequality has a complex relationship with economic growth. The Kuznets curve illustrates that in the early stages of economic development, income inequality tends to increase with economic growth, but will decline after reaching a threshold level based on the Kuznet hypothesis, in Lyubmov I [17]. Still in the same study, Lyubmov [17] argued that this view is challenged by modern research such as Piketty, which shows that income inequality tends to increase in the long run, mainly due to unequal capital accumulation.

GRDP per capita is one of the indicators often used to describe the economic welfare of a region. Research conducted by Hartini [16] shows that GRDP per capita has a positive and significant influence on income inequality in Yogyakarta Special Region Province. In other words, the higher the GRDP per capita in a region, the greater the income inequality. This finding supports Kuznets' theory which explains that in the early stages of economic growth, income inequality tends to increase before declining as the level of development increases.

Several other studies have shown that an increase in GRDP per capita tends to reduce income inequality. For example, research conducted in Indonesia from 2019 to 2021 found that higher GRDP per capita is associated with a decrease in the Gini ratio, a common measure of income inequality [18] [19] [20] [21]. Similarly, Wiza's study [22], which focused on the period from 2017 to 2021 confirmed that GRDP per capita had a negative impact on income disparity across Indonesian provinces, suggesting that economic growth can help reduce income inequality.

In contrast to the research conducted by Aryani et al. [13], where per capita growth shows a significant positive effect on income inequality between regions in Yogyakarta. However, research in Central Kalimantan by Astuti & Hukom [15] shows that GRDP has no significant influence on income inequality. This difference in results may be due to differences in economic structure, development policies, and the level of economic equality in these regions.

As for the relationship between the Human Development Index (HDI) and income inequality, it is complex and multifaceted, with various factors influencing these dynamics. The HDI is a composite index that measures average achievement in key dimensions of human development, which can affect and be affected by income inequality. HDI reflects the quality of human development that includes aspects of education, health, and decent standard of living [23] [24].

The Human Development Index (HDI) has a significant effect on income inequality in Indonesia. In the context of development economics theory, this finding supports the hypothesis that better human development can help reduce income inequality between regions. In addition, higher HDI values, reflecting better education, health and living standards, are associated with reduced income inequality. It thus suggests that improving human development factors can help bridge the income gap between different segments of the population [25].

Salsabila et al, [10] in their research on Banten Province from 2019-2023, showed that the Human Development Index (HDI) actually has a significant influence on income inequality, with an increase in HDI correlating with higher income inequality. This suggests that while improvements in education and health infrastructure which are components of HDI are generally positive for growth and negative for inequality, they may inadvertently contribute to widening income inequality.

Research conducted by Hartini [16] shows that HDI has a negative and significant effect on income inequality, which means that an increase in HDI can reduce income inequality. This indicates that improving people's quality of life through education, health, and income can help reduce income inequality.

In contrast to the previous findings, research by Astuti D [15] shows that in Central Kalimantan, GRDP and HDI have no effect on income inequality. The increase in output in Central Kalimantan has not been able to improve people's welfare ideally because the impact of GRDP on income inequality does not show significant results. Income disparity in this region is dominantly influenced by labor. This is in line with the findings put forward by Firmansyah &mad [26] on the island of Sumatra.

In a study conducted by Wijayanti & Putri [27], found that both GRDP and HDI have a significant influence on income inequality in Java during the period 2017-2022. This suggests that variations in economic output and human development levels do not directly affect the gap in income distribution in the region.

3 Research Method

This research focuses on the Sulawesi Islands region with an observation period of 14 years. The data used in this study includes cross-sectional variations and time series or better known as panel data. The data source used comes from the Badan Pusat Statistik (BPS). The data includes information related to the Gini Ratio which represents the level of income inequality, Gross Regional Domestic Product per capita (GRDP per capita) and the Human Development Index (HDI). This study uses panel data analysis method which involves combining cross-section data and time series data. Cross-section data includes 6 provinces in the Sulawesi Islands, and longitudinal data consists of 84 observations, which cover the same time period between 2010 and 2023.

Data analysis uses panel data analysis with the software used in this study using Eviews 12, where before conducting panel data analysis, first conduct a model selection test through the Chow Test, Housman Test, and Lagrange Multiplier Test.

The following is the operational definition in this study:

- Income inequality (Y) is a condition that describes the unequal distribution of income between individuals or households within a region. To measure income inequality, BPS has several indicators, one of which is the Gini Ratio or Gini Coefficient. The Gini ratio is a number that shows the level of income inequality, with values ranging from 0 to 1. "0" means that income distribution is very equal (no inequality) and "1" means that income distribution is very unequal (very high inequality).
- GRDP per capita (X1), is the value of Gross Regional Domestic Product (GRDP) per capita calculated based on constant 2010 prices. This value reflects the added value generated by all business units in a provincial area which is then divided by the total population in the area. The unit of data is expressed in thousands of rupiah and describes the average income per capita adjusted for inflation with 2010 as the base year, thus providing an overview of economic growth without the influence of price changes.
- The Human Development Index (HDI) is a composite indicator that measures the quality of human development through three main dimensions: longevity and healthy living (measured by life expectancy at birth), knowledge (measured by average years of schooling and expected years of schooling), and a decent standard of living (measured by adjusted real expenditure per capita). Calculating HDI using a geometric approach, each dimension is converted into an index on a scale of 0 to 100. An index value closer to 100 indicates a better quality of human life in a region.

4 Result

The procedure for determining the regression model using panel data is to determine the most appropriate model from several models such as the common effect model (CEM), fixed effect model (FEM) and random effect model (REM).

4.1 Model Selection Test

Chow Test.

Table 1. Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	12.449503	(5,76)	0.0000
Cross-section Chi-square	50.258234	5	0.0000

Sumber : Eviews Data Processing 12, 2023

Based on the results of the Chow Test in table 1 above, the Chi Square crossection probability value is $0.000 < \alpha (0.05)$, this shows that the temporary approach, namely

the Fixed Effect Model (FEM), is considered more appropriate than the Common Effect Model (CEM) approach.

Housman Test.

Table 2. Housman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob
Cross-section random	2.998648	2	0.2233

Source : Eviews Data Processing 12, 2023

Hasil Uji Housman pada tabel 2 diatas, menunjukkan nilai probabilitas Cross section Chi Square yaitu $0,2233 > \alpha (0.05)$, maka pendekatan sementara yaitu Random Effect Model (REM) lebih sesuai daripada pendekatan Fix Effect Model (FEM).

Lagrange Multiplier test.

Table 3. Housman Test

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	58.13410 (0.0000)	0.181464 (0.6701)	58.31556 (0.0000)

Source : Eviews Data Processing 12, 2023

Based on the results of the Lagrange Multiplier Test in the table above, which compares REM and CEM, the Breusch_pagan cross section value is $0.0000 > \alpha (0.05)$, it can be concluded that the Random Effect Model (REM) is more suitable than the Common Effect Model (CEM).

4.2 Classical Assumption Test

After choosing the Random Effects Model (REM) as the regression model for panel data, the classical assumption test is no longer required. According to Herlambang baskoro [28], the Random Effect Model (REM) uses the Generalized Least Square (GLS) estimation method. This method is considered effective for handling problems such as sequential linkages in time series data and linkages between observations. With GLS, REM can perform more effective and consistent estimation for panel data. The Generalized Least Squares (GLS) method can meet the Best Linear Unbiased Estimation (BLUE) properties, which is an appropriate approach to overcome violations of heteroscedasticity and autocorrelation assumptions. By using the GLS

method, the estimates obtained are linear, unbiased, and have maximum efficiency, so this method can handle these problems successfully.

4.3 Goodness of Fit

Based on the regression analysis results (see Table 4), the following equation is obtained:

$$Y_{it} = -0,45 - 3.33X_1 + 1.2X_2$$

Where :

Y : Income Inequality

X₁ : GRDP per capita

X₂ : HDI

Table 4. Regression Results.

Variable	Coefficie nt	Std. Error	t- Statistic	Prob.
C	-0.455553	0.76061 6	- 0.598926	0.5509
GRDP percapita	-0.326532	0.05668 4	- 5.760517 3.29805	0.0000
HDI	1.204415	0	1	0.0014
R-squared				0.4115 95
Adjusted R-squared				0.3970 66
S.E. of regression				0.0472 64
F-statistic				28.330 12
Prob(F-statistic)				0.0000 00

Source : Eviews Data Processing 12, 2023

Based on the results of data analysis, the constant value is (α) -0.455553. This shows that if X1 and X2 increase by 1%, then Y decreases by 45.5%. In addition, in this study, the model feasibility test involves the coefficient of determination (R^2) test, statistical F test, and statistical t test. The Random Effect Model (REM) approach used in panel data regression produces a regression coefficient value on each variable in the observation with the equation presented in table 4.

Coefficient of Determination (R Square).

Each dependent variable and independent variable in this estimation model obtained a coefficient of determination (R^2) between 0 and 1. The results of the

Random Effect Model (REM) regression in the R-squared column found a coefficient of determination (R squared) of 0.411595. This means that it can be concluded that the contribution of GRDP per capita and HDI simultaneously affects the changes in the rise and fall of income inequality by 41.15% over a period of 14 years, while the remaining 58.85% is caused by factors not analyzed in this study.

f test.

To find out how the effect of the independent variables as a whole is significant on the dependent variable, it can be seen in the f test. And based on the results of the random effects model (REM) regression in the column f statistical value (f count) of 28.33. The f statistical table is used to find the f table value. Based on the α (0.05) criterion, the value of f count is $28.33 > 3.11$ (f table value), it can be concluded that GRDP and HDI have a significant effect on the level of income inequality (gini ratio) simultaneously.

t test.

The partial effect of the independent variable on the dependent variable based on the table above shows that the coefficient value of GRDP per capita is -0.033, then the t-count is $5.76 > 1.99$ (t table value), with prob. $0.0000 < \alpha$ (0.05). Thus, there is a negative and significant relationship between the GRDP per capita variable and the level of income inequality in the 6 provinces on the island of Sulawesi during the study period between 2014-2023. This shows that when GRDP per capita increases, the level of income inequality tends to decrease. Every 1% increase in GRDP per capita causes the level of income inequality (gini ratio) to decrease by 3.3%.

Meanwhile, the HDI based on the table above shows that the coefficient value is 1.204415, with t count of $3.29 > 1.99$, the prob. value obtained is $0.0014 < \alpha$ (0.05). Therefore, statistically there is a positive and significant influence between HDI variable and the level of income inequality in 6 provinces on the island of Sulawesi during the study period between 2014-2023. In this case, there is an indication of a relationship between an increase in HDI and an increase in the level of poverty inequality. This indicates that as HDI increases, the level of income inequality also increases. Every 1 percent increase in HDI causes the level of income inequality (gini ratio) to increase by 12.04%.

5 Discussion

The results of the analysis and hypothesis testing show that about 41.15% of the variation in income inequality can be explained by changes in GRDP per capita and HDI simultaneously. This means that the two independent variables have a strong influence on the level of income inequality in the region. This contribution indicates that economic growth and quality of life as measured by GRDP per capita and HDI play a role in influencing income inequality (gini ratio). Meanwhile, 58.85% is influenced by other factors not included in the research model. These factors may include differences in infrastructure, investment, unemployment rates, access to financial services, and differences in employment sectors in each province. For

example, reliance on agriculture and fisheries sectors in Southeast Sulawesi and West Sulawesi may be a contributing factor to inequality as these sectors tend to generate lower and less stable incomes than industry and services sectors.

The coefficient of GRDP per capita based on the results of data analysis and hypothesis testing in Table 4, shows a significant negative relationship with income inequality. This indicates that an increase in GRDP per capita at the provincial level tends to reduce income inequality between the regions. The difference in economic growth rates between provinces in Sulawesi Island could be one of the factors that affect the level of income inequality between provinces. High GRDP per capita growth in a province tends to increase people's income and reduce inequality. The high value of GRDP per capita reflects the success of a region in optimising its available resources, which will reduce income inequality in the community.

This result is in line with research conducted by Janah M [18], and Wiza [22] who found that GRDP per capita when associated with income inequality, has an impact on reducing income disparity across Indonesian provinces, suggesting that economic growth can help reduce income inequality. Sunanda [19] and Sari [20] in their research in Yogyakarta Province also showed the same thing, that GRDP has a negative and significant effect on income inequality in the region, which means that GRDP per capita has the opposite direction to income inequality, if the level of GRDP per capita increases, there will be a decrease in income inequality, and vice versa. This result is also in line with economic growth theory, which states that an increase in economic output per capita can reduce income inequality, especially if the growth is evenly distributed throughout society. This supports the hypothesis that inclusive economic growth can reduce income disparity in the region.

The coefficient of Human Development Index (HDI) as a non-economic factor shows a different result. The results of data analysis and hypothesis testing in Table 4 show that there is a positive and significant effect on income inequality. This means that although quality of life and access to education, health, and income have increased, income inequality is still a problem. Theoretically, this result can be explained by the phenomenon that an increase in HDI is often associated with improvements in the quality of education, health, and living standards, but is not always directly reflected in a more equitable income distribution [29]. Provinces that have a higher HDI may have certain groups that are better able to utilise economic opportunities, while other groups are left behind, thus increasing income inequality.

This is in line with research conducted by Salsabila, A [10] on Banten Province in 2019-2023, showing that the Human Development Index (HDI) actually has a positive and significant influence on income inequality, with an increase in HDI correlating with higher income inequality. This suggests that while improvements in education and health infrastructure which are components of HDI are generally positive for growth and negative for inequality, they may inadvertently contribute to widening income inequality.

Further examination of the 6 (six) provinces in the Sulawesi Islands shows that there are variations in the influence of GRDP per capita and HDI on income inequality within each province in the Sulawesi Islands based on the Gini ratio. Based on regression tests conducted in each province, it is found that GRDP per capita and HDI do not have a partial effect, but can have a simultaneous effect. The provinces of Central Sulawesi and South Sulawesi show a strong relationship between the

contribution of GRDP per capita and HDI simultaneously to the significant changes in the rise and fall of inequality over a period of 14 years. Meanwhile, the provinces of Gorontalo and West Sulawesi have small contributions of GRDP per capita and HDI below 10%, with West Sulawesi contributing only 3.37%.

Central Sulawesi Province has more varied economic sectors, ranging from agriculture, mining, processing industry, to services. This sector diversity means that changes in one economic sector can have a direct impact on the overall income of the community. In addition, the development of infrastructure and investment projects in recent years has helped boost Central Sulawesi's economic growth, but the effect on income distribution may not be evenly distributed. Similarly, South Sulawesi Province shows that HDI has a greater influence on income inequality, perhaps due to more equitable levels of education and access to health services in the South Sulawesi area. On the other hand, provinces such as Gorontalo and West Sulawesi do not experience the same, other factors beyond GRDP per capita and HDI are likely to be the main drivers of income inequality, such as the distribution of employment or the dominant informal economic sector, and so on.

The Human Development Index (HDI), which includes aspects of education, health and living standards, also shows a correlation with income inequality. Areas with higher HDIs usually have better access to education and health services, which can reduce income inequality. Conversely, regions with low HDI tend to have limited access to these facilities, thus exacerbating income inequality.

6 Conclusion

The conclusion of the analysis shows that GRDP per capita and HDI simultaneously contribute 41.15% to the variation of income inequality in the Sulawesi Islands region, while 58.85% is influenced by other factors such as infrastructure, investment, and employment sector. GRDP per capita has a significant negative effect on income inequality, which means that an increase in GRDP per capita in the Sulawesi Islands region tends to reduce income inequality, in line with economic growth theory and previous research. In contrast, HDI shows a positive and significant effect, signalling that improvements in quality of life and access to education between provinces have not succeeded in effectively reducing income inequality, and may even widen inequality if economic opportunities are unequal. In addition, the results show that differences in economic structure and level of development between provinces also affect income inequality. Provinces with more varied economic sectors and more developed infrastructure, such as Central Sulawesi and South Sulawesi, have greater potential to reduce income inequality through increasing GRDP per capita. However, in provinces such as Gorontalo and West Sulawesi, where the economy is dominated by the informal sector and access to education and health services is limited, the effect of GRDP per capita and HDI on income inequality is less significant. Therefore, policy interventions focused on infrastructure development, economic diversification, and improved access to education and health services are needed to effectively reduce income inequality across the Sulawesi Islands region.

Province-by-province analysis reveals that GRDP per capita and HDI have a stronger simultaneous influence in Central Sulawesi and South Sulawesi, while

Gorontalo and West Sulawesi show smaller contributions to income inequality. These findings emphasise the need for a more holistic approach and inclusive policies to reduce income inequality in the region.

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