

DETERMINANTS OF INCOME INEQUALITY IN INDONESIAN PROVINCES: EVIDENCE FROM SYSTEM GMM

Anika Cahya Safitri ^{1*}, Dedy Yuliawan ¹

¹Department of Development Economics, Faculty of Economics and Business, Universitas Lampung

Article Info

Article history:

Received May 11, 2026

Revised June 18, 2026

Accepted June 23, 2026

Keywords:

Income Inequality, Gini Ratio, Economic Growth, Unemployment, Education, Poverty, Dynamic Panel, GMM

ABSTRACT

Income inequality remains a critical structural challenge in Indonesia, particularly across the major islands of Sumatra, Java, and Kalimantan. This study analyzes the determinants of income inequality in 21 provinces across these three islands from 2015 to 2024, using the Generalized Method of Moments (GMM) dynamic panel approach developed by Arellano and Bond (1991). The dependent variable is the Gini Ratio, while the independent variables consist of Economic Growth (GRDP per capita), Open Unemployment Rate (OUR), Mean Years of Schooling (MYS), and Poverty Rate. The study employs a dynamic panel model to address endogeneity problems and capture the persistence of income inequality over time. Results indicate that the lagged Gini Ratio, the Open Unemployment Rate, Mean Years of Schooling, and Poverty Rate have statistically significant effects on income inequality, while Economic Growth does not show a significant direct effect. The GMM model's validity is confirmed through the Arellano-Bond AR(2) test and the Hansen overidentification test. These findings underscore the importance of inclusive growth policies, expanded educational access, and poverty reduction programs to achieve more equitable income distribution across Indonesian provinces.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Anika Cahya Safitri | Faculty of Economics and Business, Universitas Lampung

Email: anikachyafitri@gmail.com

INTRODUCTION

Income inequality in the distribution of income remains one of the serious structural issues in various regions of Indonesia. The World Bank (2022) noted that unequal wealth distribution has become a primary concern at the international level, including within organizations such as the World Bank, IMF, and OECD. Julihanza and Khoirudin (2023) confirmed that this phenomenon is experienced not only by developing countries such as Indonesia but also by developed nations, making it a global challenge in achieving sustainable development and social welfare. As stated by Khoiri et al. (2023), income inequality can hinder long-term economic growth by limiting purchasing power and economic participation of low-income

populations. Such conditions also reduce social mobility and trigger political and social instability (Boushey, 2020).

Income levels vary across Indonesian regions due to differences in industrialization, infrastructure development, investment flows, and human resource quality. Java has developed more rapidly because of its concentration of industry and superior infrastructure, whereas Sumatra and Kalimantan's economies still rely heavily on plantation, mining, and natural resource sectors. Furthermore, economic growth has not fully achieved equitable income distribution because differences in education and labor skill levels between provinces affect productivity and household income. The Gini Ratio is one of the primary tools used to measure how unevenly income is distributed in a given region (Zaid Khoiri et al., 2022).

The Gini Ratio ranges from 0 to 1; a higher value indicates greater inequality. According to data collected by Statistics Indonesia (BPS), the average Gini Ratio in 21 provinces across Sumatra, Java, and Kalimantan showed fluctuating patterns from 2015–2024; several provinces recorded values above 0.40, which is considered high inequality. Provinces with high economic activity and urbanization, such as DKI Jakarta, DI Yogyakarta, and West Java, consistently registered higher Gini Ratios, while provinces such as Bangka Belitung Islands, Aceh, and North Kalimantan showed relatively lower inequality levels.

The COVID-19 pandemic in 2020 severely disrupted economic activities, production, and household incomes across all provinces, with low-income groups being more vulnerable to income declines compared to high-income groups. Economic recovery from 2021 to 2024, supported by government social protection programs, led to a decline in Gini Ratios in most provinces. Nevertheless, significant disparities in inequality levels persist between highly urbanized provinces and those focused on agriculture and natural resources.

Previous research by Sumantri (2025) analyzed the effects of economic growth, poverty, mean years of schooling, and unemployment on income inequality, but was limited to Aceh Province using a static panel model (REM) without exploring alternative models or robustness checks. This study addresses these gaps by extending the analysis to 21 provinces across Sumatra, Java, and Kalimantan over the period 2015–2024, employing the Generalized Method of Moments (GMM) approach developed by Arellano and Bond (1991) to overcome endogeneity problems arising from the bidirectional relationship between economic growth and inequality, as described by the Kuznets hypothesis (1955).

LITERATURE REVIEW

Income Inequality and the Gini Ratio

Income inequality refers to disparities in the distribution of income among individuals, households, or groups within a population. According to Todaro and Smith (2015), income inequality refers to the disparity in the distribution of national or regional income among various social groups. It is an important indicator for evaluating the success of economic development because it measures not only average welfare levels but also how equitably that welfare is distributed in society.

The Gini Ratio, ranging between 0 and 1, is the most widely used quantitative measure of income inequality. Values below 0.4 indicate low inequality, values between 0.4 and 0.5 indicate moderate inequality, and values above 0.5 indicate high inequality (Todaro & Smith,

2015). It is derived from the Lorenz Curve and calculated as the ratio of the area between the line of perfect equality and the Lorenz Curve to the total area under the line of perfect equality.

Kuznets Hypothesis

Simon Kuznets (1955) proposed the inverted-U curve hypothesis, which describes the relationship between economic growth and income inequality. In the early stages of development, economic growth tends to increase inequality as labor shifts from traditional to modern sectors. However, as development progresses, inequality eventually decreases as the benefits of growth become more widely distributed. This non-linear relationship is represented by the quadratic equation: $Y = \beta_0 + \beta_1X + \beta_2X^2 + e$, where $\beta_1 > 0$ and $\beta_2 < 0$.

Human Capital Theory and Education

Human capital theory, developed by Gary Becker (1964) and Theodore Schultz (1961), posits that education is an investment that enhances individual productivity and income. Mean Years of Schooling (MYS) is expected to have a negative relationship with income inequality, as a higher average education level in a region tends to produce a more equitable income distribution by opening access to more productive employment opportunities. Ratih et al. (2018) provide empirical support for this relationship at the regional level in Sumatra, finding that differences in education and labor quality across provinces contribute significantly to diverging income distributions. Yuliawan (2022) further emphasizes that socio-economic vulnerability in rural areas is largely driven by low human capital endowments, including limited educational attainment, which constrains productive participation in the labor market and perpetuates inequality. These arguments are consistent with Emalia and Eriza (2026), who found that the Human Development Index—which incorporates educational achievement—has a positive and significant effect on economic growth in resource-rich provinces, indicating that improvements in education levels contribute to more productive and equitable economic outcomes.

Unemployment, Poverty, and Inequality

The Open Unemployment Rate (OUR) is positively associated with income inequality because unemployment worsens income distribution by increasing the proportion of the population without income. Efficiency wage theory and labor market segmentation theory explain that unemployment creates dualism between those employed in the formal sector with high wages and those marginalized in the informal sector. Poverty and inequality are closely related: high inequality makes it more difficult to reduce poverty through economic growth, while widespread poverty generally reflects and exacerbates income distribution inequality (Ravallion, 1997).

This view is reinforced by Ratih et al. (2018), who demonstrated that the open unemployment rate, along with sectoral economic factors, is among the key structural variables that shape income distribution patterns across Indonesian provinces, affirming the importance of labor market conditions as a determinant of the Gini Ratio. Additionally, Yuliawan et al. (2024) found that in a cross-provincial panel setting, higher open unemployment rates are systematically associated with a greater number of poor households, confirming that unemployment operates as a transmission channel linking labor market exclusion to broader income inequality. Emalia and Eriza (2026) further showed that economic inequality measured by the Gini Index exerts a significant negative effect on regional economic growth in resource-rich Indonesian provinces,

underscoring the bidirectional and mutually reinforcing relationship between inequality and economic development.

Generalized Method of Moments (GMM)

The Generalized Method of Moments (GMM) is an estimation method developed by Hansen (1982) and subsequently adapted for dynamic panel data by Arellano and Bond (1991). GMM is designed to address endogeneity problems that frequently arise in panel data estimation, where independent variables are correlated with the error term. This study employs Difference GMM, which uses first differences to eliminate unobserved fixed individual effects and uses lagged level variables as instruments.

Previous Studies

Table 1. Summary of Previous Studies

No.	Author & Title	Method/Variable	Results
1	Khoiri A.Z. et al. (2023) – Income Inequality in Indonesia: Panel Data Approach 2016–2020	Variables: income inequality, poverty population, GRDP, minimum wage, HDI. Method: Panel Data (Fixed/Random Effect)	Poverty and GRDP have significantly positive effects; minimum wage has negative effect; HDI has significantly negative effect on income inequality.
2	Putri, Eka Yosi et al. (2018) – Education, Provincial Minimum Wage, and Capital Expenditure on Income Inequality	Variables: income inequality; independents: education, provincial minimum wage, capital expenditure. Method: Panel Data Regression	Education has non-significant negative effect; minimum wage has significantly negative effect; capital expenditure has significantly positive effect.
3	Nesha Rizky Ashari (2024) – Effects of Education, Unemployment, and Poverty on Income Inequality in Indonesia	Variables: income inequality; independents: education, unemployment, poverty. Method: Random Effect Model	Education has significantly negative effect; unemployment is not significant; poverty has significantly positive effect.
4	Darmuji, Alawiyah & Hasanah (2024) – Education Quality and Poverty on Economic Income Inequality	Variables: income inequality; independents: education, unemployment, poverty. Method: Random Effect Model	Education and poverty significantly affect income inequality; together they explain 23% of variation in inequality.
5	Meidiyan, Asrini & Irmanelly (2025) – Minimum Wage, Economic Growth, and HDI on Income Inequality in Jambi	Variables: income inequality; independents: minimum wage, economic growth, HDI. Method: Multiple	Minimum wage and HDI have significantly negative effects; economic growth has positive but non-significant effect.

		Linear Regression (2015–2024)	
6	Al Aqilah et al. (2024) – Determinants of Income Inequality in Sumatra Island	Variables: income inequality; independents: GRDP, poverty, population, minimum wage, IDG. Method: Random Effect Panel Data	GRDP and poverty significantly positive; population and minimum wage significantly negative; IDG not significant.

Source: Compiled from various studies

RESEARCH METHODOLOGY

Data and Variables

This study uses secondary panel data comprising both time series (2015–2024) and cross-sectional dimensions (21 provinces: 10 in Sumatra, 6 in Java, and 5 in Kalimantan), yielding a total of 210 observations. All data are obtained from official publications of Statistics Indonesia (BPS). Data were compiled and processed using EViews 12.

Table 2. Research Variables

Variable	Symbol	Unit	Source
Gini Ratio	GR	Index (0–1)	BPS, Welfare Statistics (Susenas)
Economic Growth	GRDP	Percent (%)	BPS, Provincial GRDP
Open Unemployment Rate	OUR	Percent (%)	BPS, National Labor Force Survey (Sakernas)
Mean Years of Schooling	MYS	Years	BPS, Human Development Index
Poverty Rate	POV	Percent (%)	BPS, Provincial Poverty Data

Source: BPS (various years)

Static Panel Model Specification

As a preliminary step, this study estimates a static panel data model to obtain an initial understanding of the relationships between variables. Three approaches are considered: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). Model selection is conducted through the Chow Test (to select between CEM and FEM) and the Hausman Test (to select between FEM and REM). The static panel model is specified as:

$$GINI_{it} = \beta_0 + \beta_1 PDR_{Bit} + \beta_2 TPT_{it} + \beta_3 RLS_{it} + \beta_4 KMS_{it} + \epsilon_{it}$$

Dynamic Panel GMM Model

The detection of autocorrelation in the FEM residuals indicates the presence of temporal persistence in income inequality. This necessitates the use of a dynamic panel model that explicitly incorporates a lagged dependent variable. The Difference GMM model (Arellano & Bond, 1991) is employed, specified as:

$$GINI_{it} = \alpha_0 + \delta \cdot GINI_{i,t-1} + \beta_1 PDR_{Bit} + \beta_2 TPT_{it} + \beta_3 RLS_{it} + \beta_4 KMS_{it} + \mu_i + \epsilon_{it}$$

The first-difference transformation eliminates unobserved individual fixed effects (μ_i), and lagged levels of the endogenous variables are used as instruments. The validity of instruments is tested through the Arellano-Bond test for second-order autocorrelation (AR(2)) and the Hansen overidentification test. Model validity requires: (1) non-significant AR(2), confirming instrument validity; and (2) non-significant Hansen J-statistic, confirming that instruments are uncorrelated with the error term.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 3. Descriptive Statistics

Variable	Mean	Median	Max.	Min.	Std. Dev.
Gini Ratio (Y)	0.3842	0.3790	0.4420	0.2650	0.0391
GRDP per Capita (X1, %)	52.74	38.61	215.83	18.23	38.52
OUR (X2, %)	5.41	4.97	11.47	2.18	1.96
MYS (X3, Years)	8.73	8.56	11.22	6.48	1.17
Poverty Rate (X4, %)	9.34	7.81	26.43	3.27	5.18

Source: EViews 12 Output, processed (2026)

The Gini Ratio has a mean of 0.3842, indicating a moderate level of income inequality across the sample provinces. The GRDP per capita shows substantial variation between provinces (ranging from 18.23% to 215.83%), reflecting significant differences in economic capacity between provinces in Sumatra, Java, and Kalimantan. The Open Unemployment Rate (OUR) and Poverty Rate show declining trends during the observation period, while Mean Years of Schooling (MYS) shows a consistent increase, reflecting improvements in educational quality.

Panel Model Selection

The Chow Test yielded a Cross-section F probability and Cross-section Chi-square probability of 0.0000, both below the 5% significance level, indicating that the Fixed Effect Model (FEM) is preferred over the Common Effect Model (CEM). Subsequently, the Hausman Test yielded a Chi-square probability of 0.0011, also below 0.05, confirming that FEM is preferred over the Random Effect Model (REM). The FEM was therefore selected as the appropriate static panel model, as it controls for unobserved individual heterogeneity.

Classical Assumption Tests

Normality: The Jarque-Bera statistic was 1.339 with a probability of 0.512, indicating that residuals are normally distributed. Multicollinearity: All correlations between independent variables were below 0.80 (the highest being 0.3875 between OUR and MYS), confirming the absence of multicollinearity. Heteroscedasticity: All independent variables had probabilities above 0.05 in the Glejser test (X1: 0.065; X2: 0.084; X3: 0.956; X4: 0.287), confirming homoscedasticity. Autocorrelation: The Durbin-Watson statistic was 0.905, below the lower bound ($dL = 1.634$), indicating the presence of autocorrelation in the FEM residuals. This finding necessitates the use of the dynamic GMM model.

GMM Estimation Results

Following the detection of autocorrelation in the FEM, the study proceeded with Difference GMM estimation. The validity of the model was confirmed by the Arellano-Bond AR(2) test (p-value = 0.6204 > 0.05) and the Hansen test (J-statistic p-value = 0.2087 > 0.05), ensuring instrument validity and model consistency.

Table 4. GMM Difference Estimation Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Gini Ratio(-1)	0.163566	0.072814	2.246734	0.0248*
GRDP per Capita (X1)	0.000137	0.000100	1.373220	0.1697
Open Unemployment Rate (X2)	0.001859	0.000427	4.354498	0.0000***
Mean Years of Schooling (X3)	-0.017386	0.003297	-5.273340	0.0000***
Poverty Rate (X4)	0.001630	0.000792	2.057681	0.0396*
AR(1) p-value: 0.0294 AR(2) p-value: 0.6204 Hansen J-stat p-value: 0.2087				
Note: * significant at 5%; ** significant at 1%; *** significant at 0.1%. Source: EViews 12 Output, processed (2026)				

The lagged Gini Ratio (Y(-1)) has a significant positive coefficient of 0.164 (p = 0.025), confirming the persistence of income inequality. Income inequality in the previous period significantly influences current inequality levels, consistent with the dynamic nature of distributional outcomes.

Economic Growth (GRDP per capita) has a positive but statistically insignificant coefficient of 0.000137 (p = 0.170). This suggests that economic growth, while directionally associated with slightly higher inequality in the short term, does not significantly explain changes in the Gini Ratio. This may reflect the non-inclusive nature of growth in some provinces, where benefits are concentrated among upper-income groups, consistent with early stages of the Kuznets hypothesis.

Open Unemployment Rate (OUR) has a significantly positive coefficient of 0.001859 (p < 0.001), indicating that higher unemployment rates significantly worsen income inequality. This finding is consistent with labor market segmentation theory, where unemployed individuals are excluded from formal income-generating activities, thereby widening the income gap between employed and unemployed populations. Mean Years of Schooling (MYS) has a significantly negative coefficient of -0.017386 (p < 0.001), indicating that improvements in educational attainment significantly reduce income inequality. This result supports human capital theory: higher education levels expand access to productive employment opportunities and reduce the skills-based wage premium, contributing to more equitable income distribution.

Poverty Rate has a significantly positive coefficient of 0.001630 (p = 0.040), confirming that provinces with higher poverty rates tend to exhibit greater income inequality. This finding reflects the poverty-inequality trap: widespread poverty reinforces and exacerbates unequal distribution of income, consistent with the findings of Ravallion (1997). At the provincial level, Ratih et al. (2018) documented that inequality among districts/cities in Lampung Province is closely intertwined with poverty patterns, with economically lagging sub-regions exhibiting both higher poverty rates and greater income disparities. Yuliawan (2022) similarly established that rural areas in Lampung characterized by high socio-economic vulnerability tend to have

elevated poverty rates alongside widening income gaps, confirming that poverty and inequality are mutually reinforcing in a regional context. These findings are further corroborated by Pratama and Yuliawan (2026), who showed through an ARDL analysis spanning 1995–2024 that education and employment conditions jointly mediate the pathway from economic development to poverty reduction, highlighting the importance of addressing distributional factors beyond aggregate growth.

CONCLUSIONS

This study analyzed the determinants of income inequality in 21 provinces across Sumatra, Java, and Kalimantan from 2015 to 2024, using the Difference GMM dynamic panel approach. The lagged Gini Ratio has a positive and significant effect, confirming the persistence of income inequality across periods. 2. Economic Growth (GRDP per capita) does not have a statistically significant effect on the Gini Ratio in this study, suggesting growth has not yet been sufficiently inclusive to reduce disparities. 3. The Open Unemployment Rate has a positive and significant effect on income inequality, as unemployment excludes populations from formal income channels and widens income gaps. 4. Mean Years of Schooling has a negative and significant effect on income inequality, supporting human capital theory that education broadens access to productive employment. 5. The Poverty Rate has a positive and significant effect, reflecting the reinforcing relationship between poverty and inequality.

Collectively, these variables jointly and significantly influence the Gini Ratio, as confirmed by the Wald test. The model's validity is supported by non-significant AR(2) and Hansen test results. Based on these findings, the following policy recommendations are proposed: (1) Promote inclusive economic growth through labor-intensive sectors, SME development, and downstream industry creation; (2) Expand formal employment opportunities through vocational training aligned with labor market needs; (3) Increase education investment, particularly in provinces with low MYS, through scholarship programs, school infrastructure development, and teacher quality improvement; (4) Integrate poverty alleviation programs with income distribution policies to break the poverty-inequality cycle; and (5) Future research should extend coverage to all 34 Indonesian provinces, compare Difference and System GMM approaches, and incorporate variables such as fiscal decentralization and infrastructure accessibility.

Acknowledgements

The author expresses gratitude to the Faculty of Economics and Business, Universitas Lampung, for institutional support. Thanks are also extended to Statistics Indonesia (BPS) for providing the data used in this research.

REFERENCES

- Acemoglu, D., Laibson, D., & List, J. A. (2015). *Macroeconomics*. Pearson.
- Aimon, H. (2015). *Analisis dan Kebijakan Ekonomi Makro*. Padang: Andalas University Press.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277–297.
- Ashari, N. R., Gunawan, S., Irwan, W., & Nilawati. (2024). Pengaruh Pendidikan, Pengangguran, dan Kemiskinan terhadap Ketimpangan Pendapatan di Indonesia. *Jurnal Intelektualita: Keislaman, Sosial Dan Sains*, 13(2).

- Badan Pusat Statistik. (2024). *Statistik Indonesia 2024*. Jakarta: BPS.
- Becker, G. S. (1994). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education* (3rd ed.). University of Chicago Press.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- Boushey, H. (2020). *Unbound: How Inequality Constricts Our Economy and What We Can Do About It*. Harvard University Press.
- Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica*, 50(4), 1029–1054.
- Julihanza, & Khoirudin. (2023). Pengaruh pertumbuhan ekonomi dan kemiskinan terhadap ketimpangan pendapatan. *Jurnal Ekonomi Pembangunan*, 12(1), 45–58.
- Khoiri, A. Z., Pahlawan, E. R., & Samara, F. H. (2022). Ketimpangan Pendapatan di Indonesia: Pendekatan Data Panel 2016-2020. ResearchGate. <https://www.researchgate.net/publication/367157631>
- Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review*, 45(1), 1–28.
- Oksamulya, & Anis. (2020). Analisis determinan ketimpangan pendapatan di Provinsi Lampung. *Jurnal Ekonomi dan Pembangunan*, 9(2), 112–125.
- Ravallion, M. (1997). Can high-inequality developing countries escape absolute poverty? *Economics Letters*, 56(1), 51–57.
- Todaro, M. P., & Smith, S. C. (2020). *Economic Development* (13th ed.). Pearson.
- World Bank. (2022). *Poverty and Inequality Platform*. Washington, DC: World Bank.
- Ratih, A., Prasetya, H., & Gunarto, T. (2018). Pengaruh Sektor Primer Terhadap Pertumbuhan Ekonomi Dan Ketimpangan Pembangunan Antar Provinsi Di Pulau Sumatera. *Jurnal Ekonomi Pembangunan*, 7(1). Fakultas Ekonomi dan Bisnis, Universitas Lampung.
- Emalia, Z., & Eriza, A. P. (2026). Paradoks Sumber Daya Alam: Pengaruh Dana Bagi Hasil Sumber Daya Alam, Ketimpangan Ekonomi, dan Indeks Pembangunan Manusia Terhadap Pertumbuhan Ekonomi di Provinsi Kaya Sumber Daya Alam di Indonesia. *Nusantara Hasana Journal*, 5(10), 136–148. <https://doi.org/10.59003/nhj.v5i10.2010>
- Yuliawan, D., Hakim, D. B., Juanda, B., & Fauzi, A. (2022). Integrated Rural Socio-Economic Vulnerability Analysis in Lampung Province. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah*, 10(3), 175–188. <https://doi.org/10.22437/ppd.v10i3.17591>
- Umara, G., Gunarto, T., & Yuliawan, D. (2024). Influence Human Development Index, Open Unemployment Rate, and Product Gross Regional Domesticity Per Capita on Poverty in Indonesia. *Revenue Journal: Management and Entrepreneurship*, 2(1), 34–52. <https://doi.org/10.61650/rjme.v2i1.561>
- Pratama, R. F., & Yuliawan, D. (2026). The Relationship Between Economic Development to Poverty in Indonesia. *Jurnal Ekonomi Manajemen dan Bisnis (JEMB)*. <https://doi.org/10.61650/jemb.v4i1.4563>