Exploring the Economic and Social Determinants of Income Inequality in Indonesia

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ABSTRACT

This study aims to analyze the dynamic aspects of economic and social factors that influence income inequality in Indonesia. This study applies the Autoregressive Distributed Lag (ARDL) time series model for the period 1996-2024, using the Gini Index as an indicator of inequality and including GDP per capita, literacy rate, unemployment, inflation, and population density as determinants. The result of this study show that the existence of a long rung cointegration relationship among variables as a result of Bound Cointegration Test. The short-term result indicates fluctuations of the dynamics of inequality, income, education, unemployment, inflation, and population density influence inequality in Indonesia. The Error Correction Term (ECT) is negative and statistically significant, indicating a stable adjustment from short-run disequilibrium toward long-run equilibrium. Meanwhile, long-term conditions show consistent results, but the inflation variable has no effect on inequality. The implications of this research indicate that the government needs to implement structured policies to encourage national economic growth and improve the quality of education, while simultaneously reducing unemployment and managing population density in Indonesia.

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1. Introduction

Income inequality remains a fundamental issue facing every country. This problem remains structural and affects various aspects of a country, including its economic and non-economic dimensions. Further implications of income inequality include obstacles to economic growth, which lead to declines in human capital accumulation and labor productivity, as well as increased unemployment and poverty. The problem of inequality is a global phenomenon experienced by both developing and developed countries. It is caused not only by economic growth but also by changes in economic structure, economic openness, institutional quality, and technological development.

The basic theoretical framework of income inequality is inseparable from fundamental concepts that have undergone substantial development and have implications for the various methods used to analyze inequality. Theoretically, the main concept of the relationship between economic growth and income inequality was analyzed by Kuznets (1955), who explained that inequality tends to increase at the beginning of economic growth and then decreases as economic growth increases. Theoretical developments indicate that uncertainty persists regarding the relationship between inequality and economic growth. On the other hand, measuring inequality faces conceptual and fundamental problems because, according to Atkinson (1970), a clear theoretical basis is needed to ensure that measurements are carried out consistently and meaningfully.

Fundamentally, the relationship between inequality and economic growth remains unclear. The issue of inequality between countries is crucial, as Barro (2000) notes that inequality in poor countries tends to hinder economic growth, while inequality in developed countries tends to boost it. On the other hand, (Brueckner & Lederman, 2018) note that initial income levels are a crucial factor in assessing the impact of income inequality on economic growth. Meanwhile, Bourguignon (2016) noted that global and domestic inequality move in opposite directions, where global inequality increases, while domestic inequality tends to increase.

There are more fundamental aspects with stronger implications for a country's inequality, in which the role of the state and institutions is crucial. Stiglitz (2015) argues that increasing income and wealth inequality is not a natural result of market forces but rather is caused by market failures and public policies biased toward high-income groups. The complexity and differences in conditions across countries are crucial factors contributing to the varying causes of income inequality. Inequality issues will continue to be a topic of academic and policy debate, with measurement and definition crucial for analysis (Faggian et al., 2023). A precise approach to analyzing income inequality is essential to obtain results that reflect the real world. Various studies have failed to connect appropriate methods to discussions suited to the conditions at hand, so there needs to be coherence between the methods and an appropriate explanatory justification (Anand & Segal, 2008).

Indonesia is one of the developing countries with significant economic experience and development. According to Tadjoeddin (2019), Indonesia experienced a period of relatively low and stable income inequality during the New Order era, but inequality increased sharply in the 2000s. In 2015, wealth inequality increased, indicating the

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continued strength of Indonesia's economic oligarchy. Other studies in Indonesia have shown the distributional impact of agricultural and trade liberalization (Warr, 2014), and the role of trade protectionism and tariff reform in shaping inequality (Mahadevan et al., 2017; Vadila & Resosudarmo, 2020). Inequality varies significantly across regions, reflecting the heterogeneity of local economic conditions (Tadjoeddin, 2019), and suggests that sectoral growth patterns, social conditions, and economic structure play significant roles in shaping income inequality (Afandi et al., 2017; Vadila & Resosudarmo, 2020). More recent studies highlight the importance of institutional factors, showing that institutional changes during the Reform era influenced income inequality in both the short- and long-term (Szczepaniak et al., 2022).

Given advances in research and the accuracy of previous methods, there is a gap between empirical conditions and the methods used to model them. One advantage of using time series analysis to study the issue of income inequality is that it can analyze the dynamic aspects driven by economic cycles, policy changes, and external factors. Furthermore, some previous studies emphasize economic factors as determinants of inequality, while others emphasize policy factors. Therefore, further empirical studies are needed to examine how economic and social factors can explain and influence inequality in Indonesia. This study explores several determinants of inequality in Indonesia, including economic and social conditions, using a dynamic analysis of time-series data.

2. Literature Review

Theoretically, the basic idea of Kuznets (1955) about economic growth and income distribution is that there is a non-linear relationship, with income distribution becoming more unequal of a country's economic development progresses. More broadly, according to Atkinson (1970b), conditions of inequality are determined not only by economic growth but also by aspects of policy, institutional, and social factors. Sen (1997) added that the causes of inequality are multidimensional and stem from aspects of unequal access to various non-monetary resources.

Various studies have been conducted to implement various conditions and methods that continue to evolve. Initial studies sought to test the hypothesis developed by Kuznets, in which cross-country studies by Banerjee & Duflo (2003) dynamically analyzed aspects of inequality, thereby explaining the intertemporal effects of fluctuating economic growth on inequality. Furthermore, Smeeding (2005) explained that developed countries with high incomes still experience significant inequality due to institutional factors that imply weak redistribution. Another study on cross-country cases by Roine et al., (2009) reinforced the previous analysis, showing that fiscal structure, the financial sector, and economic growth are the main factors in income distribution. Furthermore, other cross-country studies indicate a negative impact of inequality on economic growth, a condition attributed to the dependence of these countries on natural resources (Anyanwu et al., 2021).

Another factor influencing the dynamics of inequality across countries and regions is government policies, which directly and indirectly impact the development of the financial sector. Empirical results indicate that the effects of monetary policy are dynamic and vary across countries' prevailing economic regimes (Miller & Teryoshin, 2024). Fiscal institutions, which play a crucial role in shaping budgetary regulations and the fiscal framework, directly

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affect income inequality (Combes et al., 2024). Financial aspects, which also impact inequality, show mixed empirical results. Studies conducted by Mareš & Horvath (2025) and Yıldırım & Şendeniz-Yüncü (2025) show that reducing inequality within a country is determined by access to financial services and efficiency. Conversely, improving financial market conditions and the expansion of the banking sector, which directly impact high-income groups, will continue to increase inequality within a country. The importance of Foreign Direct Investment (FDI) in addressing inequality is demonstrated by its significant impact and supported by the existence of an effective tax and regulatory structure (Soto et al., 2024).

Empirical results of inequality at the regional level of a country are used to analyze the dynamics of development within a region, thereby providing implications for the diversity of outcomes resulting from the dynamics of inequality. A study conducted in the African region by Batuo et al., (2022) concluded that the determinant of income inequality is the existence of differences in macroeconomic and institutional regimes, the effect of which has led to several countries experiencing conditions of high inequality. Another study across African countries concluded that the conditions of financial liberalization have implications for increasing inequality because they are more beneficial for high-income groups, who have greater access to financial services, while they are increasingly narrowing for low-income groups (Koudalo & Wu, 2022). A study by Chancel et al., (2023) analyzed the evolution of income inequality in Africa, which generally experiences geographical disparities due to the impact of colonialism and the spread of Islam. This was done by combining survey, tax, and national accounts data. Another study in Africa was conducted by Mwakalila & Muba (2025), who analyzed the effects of financial inclusion and concluded that increasing financial inclusion, especially for women, has major implications for reducing poverty and income inequality in Africa.

Empirically, conditions in Asia show that the roles of human capital, trade, and structural transformation affect the formation of inequality. Empirically, the conditions of inequality that occur are influenced by education, health, and economic growth in both the short and long term (Islam, 2020). Another study by Nam et al., (2024) in ASEAN countries found that, in the initial stages of trade openness, inequality increased, but it decreased over the long term due to improvements in institutional quality and the strengthening of policy frameworks. Another study conducted in a single Asian country found conditions that were not significantly different from those in the cross-country analysis. A study by Mercado et al., (2024) in the Philippines, Thailand, and Vietnam found that the decline in inequality was driven by reduced income concentration within communities, due to diversification of income sources and the increasing participation of low-income households in high-value-added economic activities. Another study of Bangladesh, India, and Pakistan specifically concluded that demographic factors, financial sector development, and government spending interact in complex ways, resulting in asymmetric and specific impacts on inequality in those countries (Husain, 2022; Munir & Sultan, 2017). Empirical evidence for the case of China concludes that economic digitalization, education, and rural industrial integration play an increasingly important role in narrowing the urban-rural income gap (Jianhua et al., 2025; Zhang et al., 2025).

Empirical evidence provides mixed findings regarding these determinants of income inequality. Studies have shown that GDP per capita may either reduce or increase inequality depending on institutional quality and redistribution policies (Ayyash et al., 2025; Banerjee & Duflo, 2003; Batuo et al., 2022). Unemployment has consistently been found to widen income

inequality, particularly in countries with labor market rigidities (Aswicahyono et al., 2011; Hacibedel et al., 2024; Jäntti & Jenkins, 2010). In contrast, higher literacy and human capital development generally contribute to lower inequality by improving education, productivity, and labor market outcomes (Islam, 2020; Paweenawat & McNown, 2014; Zhang et al., 2025). The relationship between inflation and inequality remains inconclusive, with some studies reporting a positive effect, while others find insignificant or context-dependent relationships (Glawe & Wagner, 2024; Miller & Teryoshin, 2024). Likewise, empirical evidence on population density is inconclusive because its impact depends on demographic characteristics, regional development, and economic structure (Munir & Sultan, 2017; Sitthiyot & Holasut, 2016; Sylwester, 2002). These mixed findings indicate that the determinants of income inequality remain context-specific and highlight the need for further investigation using a dynamic framework capable of capturing both short-run and long-run relationships.

Empirical research on Indonesia demonstrates diverse findings, with differences in determinants, inequality measures, and analytical methods. Early studies using Computable General Equilibrium (CGE) models suggest that free trade and the agricultural sector generate greater welfare gains and provide relatively larger benefits to low-income groups, particularly those living in urban areas (Warr, 2014). Using the same CGE approach, (Mahadevan et al., 2017) show that protectionist policies, such as mineral export taxes, increase poverty without significantly affecting income inequality. Using micro-survey data and decomposition analysis, Bou Dib et al., (2018) find that shifts from farmland to non-farmland use contribute to income inequality. Meanwhile, using a panel fixed-effects model, Gordón & Resosudarmo (2019) found that a higher share of the agricultural sector in GDP reduces income inequality. Using a first-difference panel data model, Vadila & Resosudarmo (2020) found that tariff reforms and institutional improvements reduce income inequality. Using provincial panel data analysis, Afandi et al., (2017) concluded that income inequality in Indonesia is determined by sectoral growth patterns, socioeconomic disparities, and economic structure; Pertiwi et al., (2021) found that income inequality and poverty are associated with regional environmental quality; Badriah & Istiqomah (2022) reported that gender inequality contributes to regional income inequality; and Nuraini et al., (2024) found that persistent income inequality reduces people's happiness.

The development of the literature and empirical studies on income inequality has broadened the scope of analysis from multiple perspectives, addressing increasingly complex economic and social challenges. This growing body of research has primarily focused on identifying the key determinants of income inequality. However, studies conducted across countries, particularly in developing economies such as Indonesia, have produced inconclusive findings due to diverse empirical results and conflicting mechanisms, suggesting that income inequality is highly context-dependent and shaped by economic, institutional, and social factors. Moreover, previous studies have largely overlooked the dynamic nature of income inequality. This study addresses this gap by employing a dynamic ARDL framework to estimate the short-run and long-run effects of the determinants of income inequality and to capture the adjustment toward long-run equilibrium.

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3. Research Method

This study focuses on time-series analysis of inequality conditions in Indonesia, with the aim of determining the dynamic aspects of the model and its responses to changes over time driven by policies or shocks. This study analyses the conditions of inequality in Indonesia using time-series data for the period 1996–2024, examining the influence of factors that shape inequality, including GDP per capita, literacy rate, unemployment, inflation, and population density. An explanation of each of these variables is shown in Table 1. The detailed definition of each variable used in this study is as follows:

Table 1. Definition of Variable

Variable	Symbol	Definition	Hypothesis Sign
Dependent			
Gini Index	GINI	The Gini Ratio is a coefficient used to measure the degree of inequality in population distribution, as shown by the Lorenz curve. The Gini Ratio ranges from 0 to 1.	-
Independent			
GDP per Capita	GDPCAP	A measure of the value of all final goods and services produced in a country (GDP) divided by its population.	Negative (-)
Literacy Rate	LITRATE	Adult literacy rate is the percentage of people ages 15 and above who can both read and write with understanding a short, simple statement about their everyday life.	Negative(-)
Unemployment	UNMPL	Percentage of the working age population (15 years and over) who are unemployed, actively seeking work, but are included in the workforce, divided by the total workforce.	Positive(+)
Inflation	INF	A general and continuous increase in the prices of goods and services over a certain period of time, as measured by changes in the Consumer Price Index (CPI) over time	Positive(+)
Population Density	PDENS	The ratio between the number of inhabitants and the geographical area, calculated by dividing the total population by the area (usually per square kilometer).	Positive(+)

The analysis of inequality in this study was conducted based on a basic model that formulates the relationship between the influence of GDP per Capita, Literacy Rate, Unemployment, and Population Density, which is specifically shown in equation 1.

$$Gini_t = f(GDPCAP_t, LITRATE_t, UNMPL_t, INF_t, PDENS_t) \quad \text{.....(1)}$$

Based on the basic model in equation 1, a regression equation can be derived using equation 2 to perform regression analysis. Equation 2 shows that there is an influence between variables represented through β_0 , which is a constant, $\beta_1 - \beta_5$ is the coefficient value of the magnitude of the influence value of the variable, and ε_t is the disturbance error.

$$Gini_t = \beta_0 + \beta_1 GDPCAP_t + \beta_2 LITRATE_t + \beta_3 UNMPL_t + \beta_4 INF_t + \beta_5 PDENS_t + \varepsilon_t \text{.....(2)}$$

The advanced model of the basic model above is obtained by considering the conditions of the existence of autoregressive (AR) and distributed lag (DL) terms; the advanced model is then compiled as shown in equation 3. In equation 3, the General ARDL (Levels) model shows

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that the value of β_0 is a constant/intercept term, ϕ_i is an autoregressive term for the Gini variable, $\beta_{1j} - \beta_{5j}$ is the short-run effect of the independent variable, and ε_t is the error term.

$$Gini_t = \beta_0 + \sum_{i=1}^{p} \phi_i Gini_{t-i} + \sum_{j=0}^{q_1} \beta_{1j} GDPCAP_{t-j} + \sum_{j=0}^{q_2} \beta_{2j} LITRATE_{t-j} + \sum_{j=0}^{q_3} \beta_{3j} UNMPL_{t-j} + \sum_{j=0}^{q_4} \beta_{4j} INF_{t-j} + \sum_{j=0}^{q_5} \beta_{5j} PDENS_{t-j} + \varepsilon_t \quad \text{.....(3)}$$

The process of estimating the ARDL model is calculated by first differencing the Unrestricted Error Correction Model (UECM), as shown in equation 4. In the ARDL framework Pesaran et al., (2001), the UECM is the main estimating equation used to perform the Bounds Test for cointegration. The UECM includes both lagged levels of the dependent and independent variables (to capture the long-run relationship) and first differences (to capture the short-run dynamics). Prior to estimating the ARDL model, the optimal lag length was selected based on the Akaike Information Criterion (AIC), following the procedure proposed by (Pesaran et al., 2001). The AIC-based lag selection ensures that the estimated model achieves an appropriate balance between goodness of fit and model parsimony, thereby improving the reliability of both the short-run and long-run parameter estimates. Equation 4 shows that the value of α_0 is a constant/intercept term, $\delta_1 - \delta_6$ are long-run coefficients, $\phi_i, \theta_j, \rho_k, \sigma_l, \varphi_m$, and ϑ_n are short-run dynamics.

$$\Delta Gini_t = \alpha_0 + \delta_1 Gini_{t-i} + \delta_2 GDPCAP_{t-1} + \delta_3 LITRATE_{t-1} + \delta_4 UNMPL_{t-1} + \delta_5 INF_{t-1} + \delta_6 PDENS_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta Gini_{t-i} + \sum_{j=0}^{q_1-1} \theta_j \Delta GDPCAP_{t-j} + \sum_{k=0}^{q_2-1} \rho_k \Delta LITRATE_{t-k} + \sum_{l=0}^{q_3-1} \sigma_l \Delta UNMPL_{t-l} + \sum_{m=0}^{q_4-1} \varphi_m \Delta INF_{t-m} + \sum_{n=0}^{q_5-1} \vartheta_n \Delta PDENS_{t-n} + \mu_t \quad \text{.....(4)}$$

The Bounds Cointegration Test, also sometimes called the Pesaran, Shin, and Smith (PSS) Bounds Test (Pesaran et al., 2001), is a statistical procedure used in the ARDL (Autoregressive Distributed Lag) framework to check whether there is a long-run equilibrium relationship between variables, even when the variables are a mix of I(0) and I(1). In the bounds test, we check whether the coefficients of the lagged level terms are jointly significant using an F-test. If the computed F-statistic is higher than the upper bound critical value, it implies that cointegration exists. The hypothesis of the Bound Cointegration Test is shown in Equations 5 and 6. The null hypothesis with no long-run relationship can be written as:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0 \quad \text{.....(5)}$$

The alternative hypotheses of cointegration can be stated as:

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0 \quad \text{.....(6)}$$

The next step after the Bound Cointegration Test is to determine the best model to estimate. The next model for the estimation process is the Estimated Equilibrium (Error Correction Term, ECT) model, which satisfies the Restricted ECM conditions. This model is

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presented in equation 7, which shows the conditions under which ECT exists, or the state of moving towards equilibrium. This equation shows that the ECT value, indicated by the coefficient γ, represents the speed of adjustment. If $-1 < \gamma < 0$, the system converges to equilibrium. The coefficient values $\theta_1 - \theta_2$ represent the long-run multipliers from the cointegration equation.

$$\Delta Gini_t = \alpha_0 + \sum_{i=1}^{p-1} \phi_i \Delta Gini_{t-i} + \sum_{j=0}^{q_1-1} \theta_j \Delta GDPCAP_{t-j} + \sum_{k=0}^{q_2-1} \rho_k \Delta LITRATE_{t-k} + \sum_{l=0}^{q_3-1} \sigma_l \Delta UNMPL_{t-l} + \sum_{m=0}^{q_4-1} \varphi_m \Delta INF_{t-m} + \sum_{n=0}^{q_5-1} \vartheta_n \Delta PDENS_{t-n} + \gamma ECT_{t-1} + \mu_t \quad \text{.....(7)}$$

Where:

$$ECT_{t-1} = Gini_{t-i} - \theta_1 GDPCAP_{t-1} + \theta_2 LITRATE_{t-1} + \theta_3 UNMPL_{t-1} + \theta_4 INF_{t-1} + \theta_5 PDENS_{t-1} \text{ ..(8)}$$

4. Results and Discussion

Procedurally, the analysis in this study was conducted by analyzing the condition of the data through descriptive statistics, followed by testing the time series data through the data stationarity test, after which a cointegration test was conducted on the model. The results of the time-series tests will inform the choice of an appropriate method; in this study, the ARDL model was selected as the best. Further testing was conducted using the model stability test using the CUSUM and CUSUM Square tests.

Table 2. Descriptive Statistic

Variable	Mean	Std.Dev.	Maximum	Minimum
Gini Index	34.05	2.95	38.90	29.30
GDP per Capita	29399.89	8665.40	45576.13	18443
Literacy Rate	94.14	4.49	99.83	87.35
Unemployment	5.34	1.42	8.06	3.31
Inflation	8.21	10.49	58.45	1.56
Population Density	131.11	12.07	147.82	112.17

Source: Author's calculation

The results of the initial data processing are shown in Table 2, which shows the results of descriptive statistics. The Gini Index averages 34.05, with a range of 29.30 to 38.90, indicating a moderate level of income inequality during the study period. GDP per capita averages USD 29,399.89, with values ranging from USD 18,443.00 to USD 45,576.13 and a standard deviation of 8,665.40, suggesting considerable variation in economic performance across the observations. The literacy rate is relatively high, with an average of 94.14%, ranging from 87.35% to 99.83%. The unemployment rate averages 5.34%, with values ranging from 3.31% to 8.06%, indicating relatively moderate fluctuations over the study period. Inflation has an average value of 8.21%, ranging from 1.56% to 58.45%, and exhibits the highest standard deviation (10.49) among the explanatory variables, reflecting substantial price volatility during certain periods. Meanwhile, population density averages 131.11 people per km^2, with values ranging from 112.17 to 147.82 people per km^2 and a relatively low standard deviation of 12.07, indicating limited variation across the observations.

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Table 3. Stationarity Test Results

Augmented Dickey-Fuller (ADF)					
Variable	Level		First Difference		Result
	t-stat	prob.	t-stat	prob.	
Gini Index	-1.4851	0.8106	-6.0271	0.0002	I(1)
GDP per Capita	-3.3790	0.0747	-4.7231	0.0042	I(0)
Literacy Rate	-1.7488	0.7020	-4.8062	0.0034	I(1)
Unemployment	-2.0140	0.5687	-4.1121	0.0166	I(1)
Inflation	-5.2340	0.0012	-5.8890	0.0006	I(0)
Population Density	-0.9716	0.9322	-2.3470	0.3958	I(1)
Phillips-Perron (PP)					
Variable	Level		First Difference		Result
	Adj. t-stat	prob.	Adj. t-stat	prob.	
Gini Index	-1.5339	0.7930	-5.9235	0.0002	I(1)
GDP per Capita	-10.409	0.0000	-4.7231	0.0042	I(0)
Literacy Rate	-1.9356	0.6095	-4.8062	0.0034	I(1)
Unemployment	-2.0336	0.5585	-4.1329	0.0158	I(1)
Inflation	-5.3022	0.0010	-17.950	0.0000	I(0)
Population Density	-1.1972	0.8917	-4.6362	0.0051	I(1)

Source: Author's calculation

The analysis of time series data requires stationarity to produce valid results that represent the data's actual conditions. Data stationarity in this study was assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests; the results of these tests are shown in Table 3. The stationarity results show that the GDP per Capita and Inflation variables are stationary at the level (I(0)). Meanwhile, the results for the Gini Index, Literacy Rate, Unemployment, and Population Density variables indicate that the data are stationary in first differences (I(1)). These test results suggest that the data-stationarity conditions differ across variables, so further testing is needed to ensure the analysis tools can be used in this study.

Table 4. ARDL Estimation Result Selected Model: ARDL (2, 3, 1, 3, 2, 3)

Variable	Coefficient	Std. Error	t-Stat	Probability
Gini Index(-1)	-0.3851	0.3205	-1.2015	0.2748
Gini Index(-2)	0.4244	0.2697	1.5737	0.1666
GDP per Capita	-0.0003	0.0004	-0.8640	0.4208
GDP per Capita (-1)	-0.0007	0.0006	-1.1707	0.2861
GDP per Capita (-2)	-0.0012	0.0006	-1.8125	0.1199
GDP per Capita (-3)	-0.0011	0.0005	-2.2995	0.0611
Literacy Rate	-0.4763	0.2650	-1.7975	0.1224
Literacy Rate (-1)	-0.4808	0.3306	-1.4543	0.1961
Unemployment	0.8680	0.4816	1.8021	0.1216
Unemployment (-1)	-0.5824	0.5940	-0.9806	0.3647
Unemployment (-2)	-1.9366	0.9460	-2.0472	0.0866
Unemployment (-3)	0.4759	0.5207	0.9139	0.3960
Inflation	-0.1368	0.1337	-1.0238	0.3454
Inflation (-1)	0.2122	0.0716	2.9621	0.0252
Inflation (-2)	0.0933	0.0964	0.9671	0.3708
Population Density	0.8819	1.1319	0.7792	0.4655
Population Density (-1)	-0.5638	1.0812	-0.5214	0.6207
Population Density (-2)	1.4496	0.4686	3.0937	0.0213
Population Density (-3)	1.1241	0.5534	2.0312	0.0885
R-Squared	0.987514	F-Test		24.97627
Adj. R-Squared	0.947976	Prob. F-Test		0.000344

Source: Author's calculation

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The initial results of the ARDL model estimation are shown in Table 4, which indicates that the selected ARDL model is (2, 3, 1, 3, 2, 3), determined by the Schwarz Criterion (SIC). These results demonstrate lag variations for each selected variable, as indicated by the independent lag variables, namely the Gini Index (-1) and (-2), which do not affect the Gini Index. Other variables that have an influence on the Gini Index are GDP per Capita (-3), Unemployment (-2), Inflation (-1), Population Density (-2), and Population Density (-3), which are indicated by probability values less than alpha (10%). This condition suggests variation in the model's determinants, as reflected in the value of the lag variable relative to the current value. The results of this selected model are preliminary and intended to demonstrate the implications of all variables in the basic ARDL model. In general, these initial results indicate that the dynamic conditions of inequality, as reflected in the Gini lag index, warrant considering the dynamic pattern of inequality in government policymaking.

The results shown by the GDP per Capita variable show a negative and significant condition in GDP per Capita t-3, which indicates that the periodic effect in the previous period affects the inequality that occurs in Indonesia, which is in line with research from Ayyash et al., (2025), which explains that this condition is due to the persistence of the previous period. The results for the Unemployment variable are the lag value in period t-2, which affects the current inequality conditions. The adverse effect of unemployment is consistent with the results of a study conducted by Jäntti & Jenkins (2010) in the UK, which found an influence of unemployment on inequality. The results for the Inflation variable show that inflation in period t-1 has a positive effect on inequality, meaning that higher inflation increases inequality in Indonesia, in accordance with the literature (Glawe & Wagner, 2024). The final results for the population density variable indicate effects at t-2 and t-3, with a positive and significant impact, consistent with research by Munir & Sultan (2017) in Sri Lanka.

Table 5. The Bound Test for Cointegration

Test Statistics	Value	Critical Value		
		Alpha	I(0)	I(1)
F-Statistic	4.80093	10%	2.08	3
k	5	5%	2.39	3.38
		2.50%	2.7	3.73
		1%	3.06	4.15

Source: Author's calculation

The initial results of the ARDL model estimation are shown in Table 4, which indicates that the selected ARDL model is (2, 3, 1, 3, 2, 3), determined by the Schwarz Criterion (SIC). These results demonstrate lag variations for each selected variable, as indicated by the independent lag variables, namely the Gini Index (-1) and (-2), which do not affect the Gini Index. Other variables that have an influence on the Gini Index are GDP per Capita (-3), Unemployment (-2), Inflation (-1), Population Density (-2), and Population Density (-3), which are indicated by probability values less than alpha (10%). This condition suggests variation in the model's determinants, as reflected in the value of the lag variable relative to the current value. The results of this selected model are preliminary and intended to demonstrate the implications of all variables in the basic ARDL model. The advanced model specification process involves conducting a cointegration test using the Bound Test, as shown in Table 5. The null hypothesis for the bound test based on equation 5 is that there is no cointegration relationship in the model. Based on the bound test results, it is shown that the F-statistic value at k = 5 is 4.80093 when compared to the critical value at I (1) with an alpha of 1 percent of 4.15. The null hypothesis is rejected, indicating cointegration in the model. The results of the data stationarity

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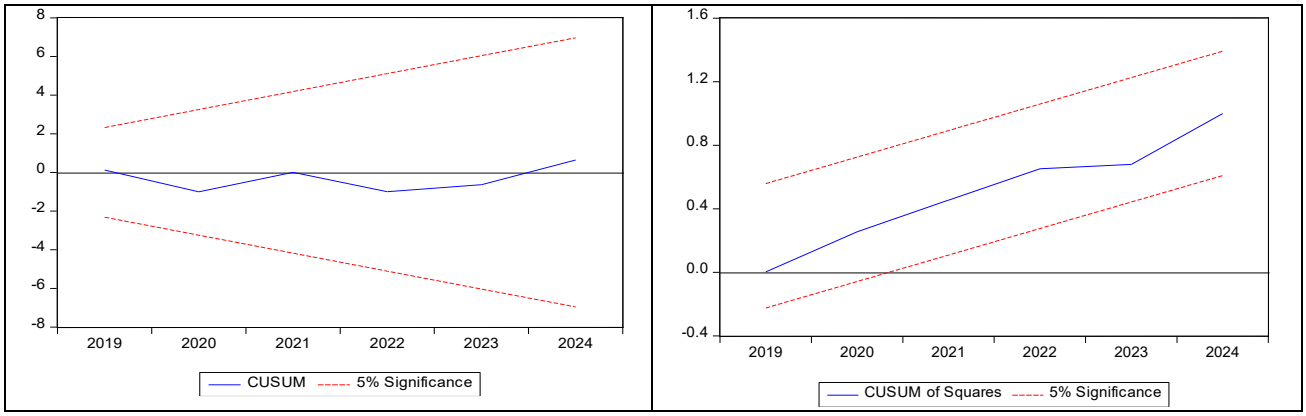
test suggest that the data in this study exhibit varying stationarity, namely at the level and in first differences. In addition, the results of the Bound Test indicate cointegration, so the best model for this study is the Autoregressive Distributed Lag (ARDL) model.



Source: Author's calculation

Figure 1. Stability Test

Before analyzing the estimation results from the ARDL model, it is necessary to conduct a model stability test to ensure the stability of the model's fluctuations. The results of the ARDL model stability test are shown in Figure 1, which presents the Cusum and Cusum of Squares values. Based on the Cusum results shown by the blue line, the Cusum value fluctuated from the initial to the final period but remained within the significance line limits. A similar situation is also shown in the Cusum of Squares results from the initial period to the end of the period, where the value indicated by the blue line is between the red line/significance line, so that based on the two conditions of Cusum and Cusum of Squares, this ARDL model has a stable condition.

Table 6. Short-run estimation of the ECM model

Variable	Coefficient	Std. Error	t-Stat	Probability
D(Gini Index(-1))	-0.4244	0.1098	-3.8655	0.0083
D(GDP per Capita)	-0.0003	0.0002	-1.7885	0.1239
D(GDP per Capita (-1))	0.0023	0.0004	5.8759	0.0011
D(GDP per Capita (-2))	0.0011	0.0003	4.0705	0.0066
D(Literacy Rate)	-0.4763	0.1257	-3.7905	0.0091
D(Unemployment)	0.8680	0.2084	4.1654	0.0059
D(Unemployment (-1))	1.4607	0.3935	3.7120	0.0099
D(Unemployment (-2))	-0.4759	0.2692	-1.7676	0.1276
D(Inflation)	-0.1368	0.0395	-3.4605	0.0135
D(Inflation (-1))	-0.0933	0.0227	-4.1112	0.0063
D Population Density)	0.8819	0.2037	4.3295	0.0049
D(Population Density (-1))	-2.5736	0.3994	-6.4446	0.0007
D(Population Density (-2))	-1.1241	0.2385	-4.7136	0.0033
Error Correction Term (-1)	-0.9607	0.1172	-8.1984	0.0002
R-Squared	0.9091			
Adj. R-Squared	0.8107			

Source: Author's calculation

The results of the model specification process indicate that the ARDL model is appropriate and that the condition is stable. The ARDL output results for equation 7 of the short-term model are shown in Table 6. The short-term ARDL estimation results indicate that the Gini Index t-1 has a negative and significant effect on the current Gini Index, suggesting that current inequality tends to decrease relative to the previous period. This indicates that the inequality condition in the last period has an opposite impact on the current inequality condition. The government's

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role in reducing the level of inequality in Indonesia is carried out through various structured programs that can affect current changes of inequality. In line with the study by Ayyash et al., (2025), the persistence of inequality from one period to the next indicates a structural gap in the Indonesian economy. The short-term estimation results for the GDP per capita variable suggest that it is not significant in the current period and therefore has no influence on existing inequality conditions. Meanwhile, GDP per capita at time t-1 and t-2 has a positive and significant impact on current inequality. This indicates that increases in public income tend to increase inequality in Indonesia, underscoring the importance of redistribution policies, such as wage increases and cash transfers, to reduce inequality and stimulate economic growth (Batuo et al., 2022).

The short-term education variable, represented by the literacy rate, shows a negative and significant effect on income inequality in Indonesia. The role of human capital through education is demonstrated by the accumulation of education within a community, whereby increased education reduces national inequality. In line with the study conducted by Mwakalila & Muba (2025) across countries, which concluded that the structured process of increasing financial access has implications for human capital development by encouraging individual investment in education, health, and productive economic activities, thereby reducing poverty and inequality. Another implication is that, as Islam (2020) shows, improving education and health through human capital formation plays an important role in promoting sustainable economic growth in the South Asian region, thereby reducing the income gap between countries. Meanwhile, Wang et al., (2024) highlighted income inequality as a significant driver of health disparities in the US, underscoring the importance of health analysis and the need for effective policies to address this growing inequality.

Other results for the short-term unemployment variables show that in periods t and t-1, unemployment is positive and significant, whereas in period t-2 it is negative and significant. This condition shows that the increase in inequality is influenced by unemployment conditions that occur because the dynamics of labor market development in Indonesia have dynamic and fluctuating conditions with various problems that have implications for increasing unemployment, which is in line with Aswicahyono et al., (2011), who state that rising jobs have been a significant challenge in Indonesia since the Asian financial crisis. According to (Tadjoeddin, 2016) real income, productivity, and income inequality in Indonesia and across economic sectors show that, after the crisis, democratic Indonesia experienced a global trend of decoupling between labor productivity and real income, which has impacted income inequality.

Inflation in a country indicates that economic stability tends to fluctuate, which can affect people's incomes and change inequality in Indonesia. In the short term, inflation tends to reduce inequality within a country, as evidenced by the significant negative coefficient. This finding suggests that the relationship between inflation and income inequality may vary depending on economic conditions and the transmission of monetary policy. In line with these results, it is explained by Miller & Teryoshin (2024), that monetary policy has an impact on income inequality because structural changes in this regard will change over time.

One important aspect of a country's demographic conditions is the differences across income groups by age, gender, and residential area, which can affect regional equality and have an impact on the conditions of inequality. The results of the analysis show that, in the short term, the Population density variable at t-1 and t-2 has negative and significant values,

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indicating the effect of population on inequality in Indonesia. According to (Sylwester, 2002), cross-country data show that past population density is negatively related to current income inequality, meaning that areas with higher population density in the past tend to have lower income inequality today. Religiousness and community mobility also affect income distribution in the long term. Another study by Warr (2014) in Indonesia and Thailand shows that comprehensive liberalization increases welfare more than agricultural liberalization, and is more beneficial to the poor, especially in urban areas. Furthermore, according to Md Jamil et al., (2024), financial inclusion and an aging population reduce inequality in the lower quantiles. Other findings from Mercado et al., (2024) indicate that in Thailand and Vietnam, regional disparities and income differences between urban and rural areas have narrowed.

The Error Correction Term (ECT) is negative and significant, indicating an error-correction process toward long-term equilibrium. When inequality deviates from long-term equilibrium, the system will readjust toward equilibrium. Based on this, income inequality is stable, with a rapid adjustment from short-term dynamics to long-term equilibrium. This means that factors such as GDP per capita, literacy rates, inflation, and unemployment ultimately influence long-run inequality, despite short-term fluctuations.

Table 7. Long-run Estimation

Variable	Coefficient	Std. Error	t-Stat	Probability
GDP per Capita	-0.0035	0.0008	-4.1494	0.0060
Literacy Rate	-0.9963	0.4234	-2.3531	0.0568
Unemployment	-1.2233	0.3445	-3.5509	0.0121
Inflation	0.1755	0.1051	1.67098	0.1458
Population Density	3.0101	0.7100	4.23979	0.0054
Constant	-159.855	45.4710	-3.5156	0.0126

Source: Author's calculation

Based on the long-term estimation results shown in Table 7, some variables show consistent results, while others yield different results. The results for long-term GDP per capita indicate a negative relationship: higher income is associated with lower inequality in Indonesia. This negative relationship between GRDP per capita and inequality aligns with Banerjee & Duflo (2003), who stated that of increase or decrease in inequality is associated with a slowdown in economic growth in the subsequent period. Meanwhile, Anyanwu et al., (2021) argue that in resource-rich countries, high inequality can be reduced by the effect of natural resource wealth on economic growth. This suggests that the government's role in driving economic growth should be carried out through the establishment of structured policies that significantly reduce inequality in Indonesia.

The long-term human capital estimation results yield a negative and significant coefficient, consistent with the short-term results. This indicates that investing of and developing human capital is crucial for reducing inequality in a country. Indonesia has policies aligned with this, with various programs providing access to education for all. These results align with those of Paweenawat & McNown (2014), who found that variations in household education levels are a significant determinant of inequality in Thailand. Meanwhile, similar results were demonstrated by Zhang et al., (2025), who found that human capital, through education, can moderate the development of the digital economy, thereby narrowing income inequality.

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The long-term effect of unemployment on inequality is negative and significant, due of decreased productivity and limited individual capabilities, thereby affecting the government's ability to redistribute income through taxes and subsidies. According to Hacibedel et al., (2024), unemployment, particularly among young people, is a significant channel through which fluctuations in economic growth influence inequality dynamics. The quality of jobs created, and labour market policies are crucial to ensuring that economic growth outcomes can contribute to inequality reduction. The long-run results are positive and insignificant. This condition suggests that fluctuations in the effects of inflation on income adjustment occur, but that they depend on the country's stability. In this case, in the long run, there is no effect of inflation on income inequality in Indonesia, in line with research Jäntti & Jenkins (2010) in the UK, which shows that inflation has no significant effect on income distribution, and there is no clear relationship between macroeconomic factors and inequality during that period. According to Marson & Saccone (2025), the impact of food price shocks on income inequality is ambiguous because it creates both advantaged and disadvantaged groups. Hence, the net effect depends on the relative strength of these effects.

Long-term results indicate that population density has a positive, significant effect, meaning that higher population density is associated with greater inequality. This can be analyzed from several perspectives, including the social group perspective. According to Roine et al., (2009), economic growth and financial sector development are pro-rich, increasing the income share of the wealthiest groups, whereas banking crises reduce it. Therefore, fiscal structure, financial development, and economic growth dynamics play a significant role in shaping income inequality between social groups. According to Sitthiyot & Holasut (2016), the relationship between the Gini coefficient and the natural logarithm of population size is nonlinear and approximated of a second-degree (quadratic) polynomial. This suggests that increases in inequality can occur cumulatively and outweigh increases in population density.

5. Conclusion

The analysis of dynamic inequality conditions in Indonesia using the Autoregressive Distributed Lag (ARDL) time series model concluded that the short-term estimation results indicate that the dynamic aspect in the model occurs with the influence of the Lag value of Inequality, which indicates that the inequality value in the previous period has an influence on the current inequality condition. In addition, the lag values of GDP per Capita, Unemployment, Inflation, and Population Density also influence current inequality. On the other hand, current values of Education, Unemployment, Inflation, and Population Density also affect the inequality condition. Other results from the model indicate that GDP per Capita, Education, Unemployment, and Population Density are determinants of long-term inequality in Indonesia. Based on these findings, the implications of the research can serve as a basis for government policymaking and be implemented through several appropriate mechanisms. Policy implications of the lagged effect of inequality on short-term income inequality and the role of redistributive policies in achieving income equality. In the GDP per capita variable, both short-term and long-term improvements can be made by improving the quality of economic growth, thereby achieving sustainable and inclusive economic growth. Results for the education variable: in the short term, focus on market-oriented education, such as skills training and vocational schools; in the long term, focus more on improving the quality of education and

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equalizing access to education. Based on the unemployment results, the government needs to implement short-term, labor-intensive programs and industry incentives to boost labor absorption. Meanwhile, in the long term, this can be done by changing the economic structure towards industrialization and international cooperation based on industrial output. Regarding inflation, short-term price-stabilization policies are necessary to prevent prevailing price dynamics from eroding people's real incomes. Regarding population density, it is necessary to implement structured policies such as the development of new areas to ensure equitable distribution of economic development, which will have implications for reducing inequality.

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