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EMPIRICAL ANALYSIS OF HDI, GDP PER CAPITA, UNEMPLOYMENT, AND INVESTMENT ON INDONESIA'S INCOME INEQUALITY 2020 - 2024

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Abstract

This study empirically examines the influence of the Human Development Index (HDI), Gross Regional Domestic Product (GDP) per capita, unemployment rate, and investment on income inequality in Indonesia covering 34 provinces during the period 2020–2024. Inequality in income distribution is still a major challenge in national development, especially in the context of post-COVID-19 pandemic recovery. Through a quantitative approach with the panel data regression method and the Fixed Effect Model, this study found that HDI plays a significant role in lowering the Gini ratio, indicating that improving people's quality of life contributes to improving income distribution. In contrast, GDP per capita, unemployment, and investment showed no significant effect on inequality. These results confirm that improving the quality of human resources evenly across regions has an important role in reducing economic disparities. Therefore, efforts to reduce inequality require strategies that emphasize equitable development, especially in the fields of education, health, and access to inclusive economic opportunities.

INDUCTION

Income inequality is one of the structural problems that continues to overshadow Indonesia's economic development, especially during and after the COVID-19 pandemic. Income inequality is still a serious challenge in Indonesia's economic development, especially during the 2020–2024 period. Although various macroeconomic indicators such as Gross Regional Domestic Product (GDP) growth per capita and declining unemployment rates show positive trends, the distribution of development results remains uneven across regions and levels of society. Income inequality not only impacts the economy, but also affects social stability, access to basic services, and the quality of human development (May 2007).

Source*:* World Bank, 2025

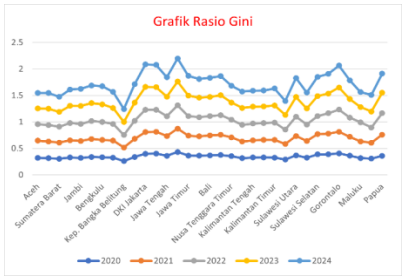
Graph 1
Indonesia's Gini Ratio for the 2020 - 2024 Period

Based on the Gini ratio chart above in 2020, Indonesia's Gini Ratio is in the range of 35.3, which is classified as moderate inequality (values between 30 - 40 are considered moderate). Although it is not extreme, this figure still reflects the income gap between the rich and poor groups. The average income distribution is still uneven, and this inequality was exacerbated by the initial impact of the COVID-19 pandemic. The informal sector and MSMEs, which are largely driven by low-income communities, have been hit hard (Narula, 2020). In contrast, the upper economic group tends to continue to earn income from investments or remote work. This condition widens the inequality gap even though nominally, the Gini Ratio value has not jumped sharply.

In 2021, the Gini Ratio rose slightly to around 35.5, which is still in the category of moderate inequality. This value is relatively stable and continues into 2022, indicating that inequality remains in the medium term. This stability needs to be watched out, as it shows that although the economy is starting to recover after the pandemic, the recovery is uneven across all levels of society. The upper middle class experienced faster economic improvement, while the lower class was left behind. A key problem during this period was the economic recovery that was not yet inclusive, where many social assistance programs were not on target and access to new economic opportunities was still limited for the poor (Tabor, 2002).

Entering 2023, the Gini Ratio has seen a more marked increase, reaching around 36.1, which is still in the category of moderate inequality, but close to the upper limit towards severe inequality. This figure is the highest peak in the last five years, reflecting a sharp widening of the economic gap. Economic growth was enjoyed more by the technology and export sectors which were dominated by the upper class, while the labor-intensive and informal sectors did not receive a comparable increase in income. The main problems this year are uneven economic growth patterns and inequality in access to education, technology, and capital, which worsen the distribution of national wealth (Avery & Perota, 2014).

In contrast, in 2024, the Gini Ratio will drop quite significantly to a level of around 34.9, which is again in the category of moderate inequality, but shows improvement because it is close to the lower limit. This is the lowest value in the last five years and gives a positive signal regarding efforts to improve income distribution. This decline is likely influenced by policy interventions such as the expansion of social security programs, direct cash assistance, and support for MSMEs and the agricultural sector *(Dela Cruz et al.,* 2023).



Source: Central Statistics Agency

Graph 2
Gini Ratio of Provinces in Indonesia for the Period 2020 - 2024

In 2020, Gini Ratio values across all Indonesian provinces showed relatively low to moderate inequality, with ranges ranging from 0.25 to 1.55 and averages around 0.5 to 0.6. This value reflects the initial conditions of the COVID-19 pandemic, where people's mobility was limited and most economic activities contracted. However, it is precisely this condition that creates a kind of "temporary equalization" effect, in which all groups of society, both rich and poor, experience fairly balanced economic pressure. The distribution of social assistance launched by the government during the pandemic also played a role in maintaining the stability of the level of inequality (Cristiano & Perugini, 2020). Areas such as Papua, NTT, and parts of Kalimantan show a fairly low Gini Ratio value due to high dependence on government assistance and low income disparity between population groups (Mudrajad Kuncoro, 2013). However, inequality is still conspicuous in metropolitan areas such as DKI Jakarta, which recorded a figure close to 1.55 being an outlier compared to other provinces. The main cause of high inequality in large urban areas is that the informal sectors in the region are hit hard, while the upper economic groups are still able to maintain or even increase their wealth through remote work, investment, and technological mastery. This shows that although in general national figures show low to moderate inequality, there are extreme differences between regions that reflect the uneven economic structure in Indonesia.

Entering 2021, the Gini Ratios of provinces in Indonesia began to show a more pronounced upward trend, with values ranging from 0.5 to 0.9 and averages in the range of 0.6 to 0.7 which are still included in the category of moderate inequality. This increase reflects the inequality of economic recovery after the first wave of the pandemic. Although some formal sectors have begun to recover, the informal sector and MSMEs are still experiencing difficulties, causing low-income groups to lag behind in the recovery process (Mackie et al., 2017). Many regions have experienced a significant increase in the Gini Ratio, especially provinces that rely on tourism such as Bali and NTB. Meanwhile, provinces on the island of Java such as East Java and Central Java also recorded an increase, because income inequality between regions and between villages and cities is widening (Tadjoeddin, 2019). Digitalization and access to a technology-based economy are a source of excellence for the middle and upper economic groups, but they are an obstacle for the poor who are left behind in terms of infrastructure and education. In addition, social assistance programs that were effective in 2020 began to decline in effectiveness as the government's focus shifted to macroeconomic recovery. The unequal distribution of aid and access to jobs makes it difficult for the lower group to catch up (Kaur, 2005). This structural inequality began to accumulate and was reflected in the Gini Ratio graph which more evenly rose almost in all provinces.

In 2022, the Gini Ratio jumped quite sharply with a range between 0.8 to 1.4 and an average of around 1.0 to 1.1, This figure already belongs to the category of severe inequality marking a critical point in the trend of inequality in Indonesia. Areas that are centers of development and investment such as East Kalimantan, South Sumatra, and West Java have experienced a significant increase in the Gini Ratio. This phenomenon is closely related to the imbalance of impacts of national strategic projects and large investments that have not been felt equally by local communities (Kaplan, 2024). Especially in East Kalimantan, which is the location of the construction of the new national capital (IKN), the Gini Ratio value has increased

rapidly because the economic benefits of development are only enjoyed by investors, large contractors, and workers outside the region (Syaban, Alfath Satria Negara, 2024). Local communities have not been sufficiently involved in the new economic ecosystem. Similar things happened in other provinces that experienced a surge in economic growth but were not followed by income equity. On the other hand, provinces with weak economic infrastructure remain stagnant or are pushed up in the Ginini Ratio due to exclusivity of access to education, technology, and capital (Lu & Wang, 2002). This reinforces the evidence that inequality in Indonesia is not only between groups within one region, but also between regions as a whole. Horizontal and vertical inequality go hand in hand, exacerbating the challenges of inclusive development.

The trend of inequality is increasingly worrying in 2023, with the Gini Ratio rising to a range of 1.0 to 1.7 and an average of around 1.2 to 1.3 which is still in the category of severe inequality, even more extreme than the previous year. These figures illustrate the fact that the national economic recovery that is starting to stabilize is not accompanied by an equitable distribution of benefits. Provinces such as DKI Jakarta, East Kalimantan, and Bali recorded a surge in the Gini Ratio which shows extreme inequality, indicating the concentration of wealth in the hands of a handful of community groups (Rosidin, 2021). The development of technology and economic digitalization has actually widened the gap because only educated and capital groups are able to access the benefits of the digital sector. Meanwhile, many poor households are still stuck in informal work, low wages, and limitations on basic public services such as education and health (Harriss-White, 2010). This creates an inequality trap that is difficult for the lower economic group to penetrate. These socio-economic conditions have an impact on increasing social inequality and even the potential for social conflict in urban areas. Consumption patterns, lifestyles, and access to services are increasingly marked by differences between social classes. Economic equity efforts face major challenges because existing redistribution policies have not been able to keep up with the rapidly growing rate of inequality.

By 2024, Indonesia will reach its highest point in the last five years in terms of inequality, with very high Gini Ratio values ranging from 1.2 to 2.2 and the national average close to 1.4 to 1.5. This value indicates a very severe income inequality situation, even in some regions it has been included in the category of extreme inequality. This shows that although economic growth nationally is increasing, the results are not distributed equitablely. Provinces such as Jakarta, East Kalimantan, and Bali now record Gini Ratio values above 2.0, a very rare condition and reflecting the dominance of the economy by the elite (Ssenyonga, 2011). The lower classes in these areas are increasingly marginalized, while rising living prices in growth centers have led to relative poverty. Inequality between groups and between regions is no longer only economic, but has begun to have social and political implications. Factors such as ininclusive development policies, weak tax systems, and low social protection exacerbate the situation (Doctoral *et al.*, 2019). If this trend is not addressed, high inequality could become a serious threat to social stability and the sustainability of the national economy. Governments need to design systemic and structural interventions to ensure that economic growth is truly inclusive and equitable.

One of the factors that plays an important role in reducing inequality is human resource development which is reflected in the Human Development Index. HDI measures aspects of health, education, and a decent standard of living, which theoretically contribute to improved quality of life and reduced inequality (Windhani *et al*., 2022). However, empirical studies show that an increase in HDI is not always followed by a decrease in inequality if human development progress is uneven between regions (Wicesa *et al.,* 2024). Inequality in access to education, health services, and economic opportunities in various Indonesian provinces is still a significant obstacle. The Human Development Index (HDI), which has been a benchmark for achieving quality of life,

has not been able to become an effective instrument in suppressing inequality. Research by Maichal *et al.* (2024) showed that in a number of metropolitan cities in Indonesia, the increase in HDI was negatively and significantly correlated with income distribution inequality, while economic growth and government capital expenditure did not contribute significantly to the reduction of inequality. Meanwhile, the increase in GDP per capita is another indicator that is often used as a benchmark for regional economic progress. (Muthmaina, 2024) highlighted that high GDP per capita growth has the potential to magnify income inequality if not balanced with effective and inclusive redistribution policies. This condition can occur due to economic growth that is concentrated in certain sectors and established community groups, while other community groups still experience limited access to economic resources. Some studies indicate that GDP growth per capita tends to be concentrated in developed regions such as Java, creating a significant disparity with the eastern region of Indonesia. Research OECD, (2021) and (Amalia *et al.* (2023) emphasized that economic growth is not inclusive and still leaves development gaps, especially in the eastern Indonesia region. The relationship between inequality and human development is reciprocal. Stuart (2024) emphasizing that a high HDI can reduce poverty and inequality, but only if the development is geographically and sectorally equal. Otherwise, then development will create "islands of prosperity" in the midst of a sea of poverty. Income inequality is also closely related to foreign and domestic investment flows.

The unemployment rate is also an important indicator in looking at income inequality. Although BPS data shows a decline in unemployment from 7.1% in 2020 to 4.9% in 2024, this does not reflect an improvement in the quality of the job market. The informal sector still dominates, and inequality of access to formal employment remains high. Sari & Setyowati, (2022) emphasized that educated unemployment is also a contributor to economic inequality due to the mismatch between the competence of graduates and industrial needs. Another factor that is no less important is investment. Investment, both domestic and foreign, has the potential to accelerate economic growth and create jobs. However, the uneven distribution of investment leads to unequal economic growth between regions. Conclusion *et al.* (2024) revealed that more investment flows to the island of Java, while Sumatra, Sulawesi, and Papua are still lagging behind in terms of investment absorption and added value creation. High levels of unemployment, especially in the predominantly labor-dominated informal sector without adequate social protection, exacerbate income disparities between social groups (Rozi & Atmanti, 2024). Unemployment not only reduces household income but also limits access to resources and opportunities to improve well-being. Therefore, unemployed unemployment that is not effectively handled is the main trigger for inequality in various regions.

Investment, especially Foreign Direct Investment (FDI), has the potential to be a major driver of economic growth and job creation (Hornok & Raeskyesa, 2024). However, without proper policies in the management and distribution of investment benefits, FDI can contribute to increased inequality if it only benefits a handful of people and does not touch the bottom layer of the economy Lestari Agusalim, (2024). Therefore, optimizing the role of investment in economic development must be based on the principles of inclusivity and equity. (2024) (Gahari & Hasmarini, 2024) Identify that increased investment that is not accompanied by strengthening the capacity of the local workforce will only widen the gap between rapidly developing and disadvantaged regions. This condition is exacerbated by gaps in infrastructure, access to technology, and basic services such as education and health. Karlina & Ahmad Hafidh Siaful Fikri, (2023) It shows that the education index has a significant influence on income inequality, where areas with low quality education tend to have higher levels of inequality. Digital inequality and lack of connectivity between regions also exacerbate this situation, as revealed by Gondauri, (2024) that links socio-economic challenges and access to

technological innovation to income disparities. In addition, the governance aspect also plays a crucial role. Corruption and inefficient bureaucracy reduce the effectiveness of equity policies and worsen income distribution. Singh & Cheemalapati, (2025) In their study, they mentioned that institutional weaknesses can hinder the achievement of equitable human development, even though from a statistical point of view macro indicators look positive. Study by Thye *et al.* (2022) analyze the relationship between human capital development and income inequality using the NARDL (Nonlinear Autoregressive Distributed Lag) approach. The study concludes that an increase in human development (in the form of HDI) has a decreasing effect on income inequality in the long term, while a decrease in HDI actually worsens it. GDP per capita and inflation actually increase inequality.

These findings reinforce the importance of inclusive human development policies. Research conducted by Pradana & Sumarsono, (2018) analyze the influence of the Human Development Index (HDI), capital expenditure, and fiscal decentralization on economic growth and income inequality in East Java Province with a quantitative approach using time series and cross-section data. The results show that HDI and capital expenditure have a positive and significant effect on economic growth, while fiscal decentralization has no significant effect. In addition, economic growth has a positive and significant influence on income inequality, which shows that uneven economic growth can actually widen income gaps. Therefore, this study emphasizes the importance of policies that not only focus on growth, but also on the equitable distribution of development outcomes. The fiscal decentralization policy implemented by the Indonesian government is also expected to be an important instrument in reducing the gap between regions by providing greater financial autonomy to local governments. However, evaluations in provinces such as East Java indicate that fiscal decentralization has not shown a significant effect in reducing income inequality, and even economic growth in these areas sometimes widens the gap (Siburian, 2020). This shows the need to evaluate and adjust fiscal policies to be more responsive to local needs and able to reach vulnerable community groups. Another factor that is no less important is the inequality of access to education and health services. The low quality and availability of services, especially in disadvantaged areas such as Eastern Indonesia, hinder the increase in HDI and deepen socio-economic inequality. Limited access to education reduces individuals' opportunities to improve skills and income, while limited healthcare impacts labor productivity and overall quality of life.

According to *Dependency Theory*, the inequality that occurs in Indonesia reflects an unequal economic structure between the center (developed regions) and the periphery (disadvantaged regions). Regions such as Java, which are centers of economic and political power, tend to absorb resources and investment from other regions, strengthen their dominance, and cause the periphery to be economically dependent. Meanwhile, according to the *Inclusive Growth Theory*, sustainable economic growth will only provide real benefits if it is accompanied by equal opportunities in education, employment, and basic services. Without inclusivity, growth will actually create deeper gaps because it only benefits certain groups of people. Therefore, to answer the challenge of income inequality in Indonesia, human development and investment policies oriented towards spatial and social justice are needed.

Limitations in research methodology are also a concern. Many studies still use conventional panel regression models with assumptions that do not always correspond to heterogeneous conditions between regions. Gondauri, (2024) suggests the use of spatial approaches and non-linear models to capture the complexity of the relationship between economic variables and inequality.

This study aims to empirically analyze the influence of the Human Development Index (HDI), Gross Regional Domestic Product (GDP) per capita, unemployment rate, and investment on income inequality

in Indonesia during the period 2020 to 2024. This study aims to partially and simultaneously examine the contribution of these four variables to the Gini Ratio as an indicator of income distribution inequality between provincial regions. Through a panel data approach covering 34 provinces in Indonesia, this study aims to uncover the causal relationship and statistical significance of each variable to the inequality that occurs. In more depth, this study also aims to find out the extent to which human development through HDI really has an impact on reducing income gaps, or even worsening it if there is no equitable distribution of development between regions.

In addition, GDP per capita as an indicator of economic growth is also analyzed whether it has an inclusive effect or even magnifies economic disparities if growth is only concentrated in certain regions. Unemployment and investment rates are analyzed not only in the context of job creation and resource distribution, but also in the context of encouraging more spatially and sectorally equitable economic development. Through statistical analysis using the panel regression method with the Fixed Effect Model (FEM) approach, this study aims to produce empirical findings that can be used as a reference in policy formulation.

The results of the research are expected to be able to make a scientific contribution in supporting the government's efforts to reduce inequality in a sustainable manner, by providing policy recommendations that integrate aspects of human development, regional economic equity, quality job creation, and inclusive investment strategies in all provinces in Indonesia. This research is expected to make a relevant scientific contribution as the basis for the formulation of more just, inclusive, and sustainable development policies.

Problem Formulation

1. Do the human development, unemployment, investment, and GDP per capita indices affect the Gini ratio (income inequality) of the 34 provinces in Indonesia?

LITERATURE REVIEW

Income Inequality

Income inequality is a central issue in development economics and is often measured through indicators such as the Human Development Index (HDI), Gini ratio, and national income distribution (Aprelia & Arif, 2024). Income inequality refers to differences in the distribution of income between individuals or households in a community. This indicator is used to assess the extent to which wealth and economic resources are distributed fairly within the population. Income Inequality Measurement Method One of the most commonly used methods for measuring inequality is the Gini coefficient, which indicates a range of values from 0 (completely even distribution) to 1 (absolute inequality) (Camilo & Muskus, 2022). In addition to Gini, there are also other measures such as the Palma ratio and the Atkinson index that provide additional perspective in understanding the level of income inequality more thoroughly (Judijanto *et al*., 2023).

Theories of income inequality seek to explain the causes, mechanisms, and impacts on human and social development Income inequality is the difference in income distribution among individuals or groups in a society (Prawoto & Cahyani, 2020). This inequality is often measured using the Gini Ratio, where a value of 0 indicates perfect equality and a value of 1 indicates perfect inequality (Hornok & Raeskyesa, 2024). According to the Dependency Theory (*Dependency Theory*), inequality in developing countries such as Indonesia is created due to an unequal economic structure between the central and peripheral regions, where the central region absorbs more resources than the disadvantaged regions. Inequality has an impact on social stability, labor productivity, and people's quality of life (Singh *et al*., 2025).

- Classical Theory: Classical economists such as Adam Smith

and David Ricardo highlighted the role of capital accumulation, productivity, and the distribution of wealth in creating inequality. They argue that economic growth can improve inequality, but without intervention, income distribution tends to be uneven.

- Modernization Theory: This theory states that inequality is a temporary phenomenon in the development process. In the early stages of industrialization, inequality increased due to differences in the productivity of the traditional and modern sectors, but it would decrease along with equal access to education and economic opportunities.
- Kuznets Curve Theory: This theory, proposed by Simon Kuznets, states that the relationship between economic growth and income inequality resembles an inverted U-curve. In the early stages of economic development, inequality tends to increase as the modern industrial sector expands and attracts labor from the traditional agricultural sector with higher wages, leaving most of the population in the traditional sector with low incomes. However, as development continues and education and access to social services continue, inequality will decline(Pratomo *et al*., 2024)**.**

Human Development Index (HDI)

HDI is a composite indicator that reflects the quality of human development based on three main dimensions: education, health, and decent living standards. Human Capital theory states that investment in education and health can increase people's productivity and income, which can ultimately reduce income inequality (Peric & Filipovic, 2021). However, empirical studies show mixed results. High HDI does not automatically reduce inequality if it is spatially unevenly distributed. Some metropolitan areas even show a negative correlation between HDI and income inequality, suggesting that exclusive human development can exacerbate inequality (Wicesa *et al*., 2024). An increase in HDI is assumed to reduce inequality as it reflects improved quality of human resources and access to basic services. Research shows that HDI has a complex influence on income inequality. Although the increase in HDI may contribute to economic growth (Maichal *et al*., 2024). The impact on inequality is not always immediate and positive (Wibowo, 2024)**.** Human capital development, as measured by HDI, has a non-linear relationship with income inequality in Indonesia, suggesting that improving the quality of human resources can reduce inequality but with a pattern that is not always linear (Thye *et al*., 2022)

Gross Regional Domestic Product (GDP) per Capita

Gross Regional Domestic Product (GDP) per capita is a measure of gross value added generated by all business units in a region (e.g., a state or province) in a given period, divided by the total population of that region. This indicator is used to measure the average level of prosperity of the population in a region and is one of the main tools for comparing economic performance between regions (Mendoza-González *et al*., 2024). Gross Regional Domestic Product (GDP) per capita in the available documents is defined as the average income of all inhabitants in an area, which is calculated by dividing the total value of GDP by the total population of that region (Azizah, 2022). GDP per capita is used as the main indicator to measure the level of economic growth and prosperity of a region, and is often used as a benchmark in the analysis of income inequality (Hidayanti, 2023). However, its uneven distribution can exacerbate inequality. Research shows that Gross Regional Domestic Product (GRDP) per capita has a significant influence on income inequality in Indonesia, although the direction of its influence can vary depending on the context and time period This is in line with studies that examined the impact of GDP per capita on the number of poor people, where GDP per capita was found to have a

negative and significant effect on the number of poor people, suggests that an increase in GDP per capita can contribute to poverty reduction (Growth, 2024). On the other hand, some studies have also found that GDP per capita has a positive and significant effect on economic growth (Sari & Setyowati, 2022), although this does not directly show an effect on inequality.

Unemployment

The unemployment rate or jobless rate is a measure that shows the percentage of the population in the labor force who are looking for a job but have not managed to get it. This indicator is widely used to describe the state of the economy and social welfare of a country or region. The higher the unemployment rate, the greater the economic pressure felt, both by individuals and by the government (Kumaran *et al*., 2024). Crisis as a result The COVID-19 pandemic has worsened employment conditions in the Asian region, characterized by an increase in unemployment due to limited economic activity and a decrease in demand for labor(Safitri *et al*., 2024). Countries such as Indonesia, Malaysia, and Vietnam have experienced spikes in unemployment, especially in the informal sector and among vulnerable groups such as women and workers with low levels of education. However, various government interventions such as wage subsidies, support for micro, small, and medium enterprises (MSMEs), and economic stimulus programs have succeeded in reducing the increase in unemployment in a number of countries (Saad *et al.*, 2025). Unemployment reduces household income and widens the gap between those who have stable jobs and those who don't. Studies show that unemployment has a positive and significant impact on economic growth. According to (Sari & Setyowati, 2022) Unemployment is also one of the factors that affect poverty (Umara *et al*., 2024). This relationship indicates that a reduction in the unemployment rate can contribute to the reduction of income inequality indirectly through increased household income and poverty reduction.

Investment

Investment, both in the form of Domestic Investment (PMDN) and Foreign Investment (PMA), is generally understood as an important factor that can increase economic output and create jobs. However, according to Regional Economic Theory, investment tends to flow to regions with better infrastructure and human resource readiness (Patricia *et al*., 2024). As a result, investment flows can actually widen inequality between regions, where developed areas will be increasingly developed, while disadvantaged areas are increasingly marginalized. In this context, investment plays the role of an independent variable (X) that affects regional economic inequality or growth as a bound variable (Y). Therefore, investment equity policies based on local potential and strengthening regional capacity are very important to ensure that investment benefits can be distributed more evenly (Gahari & Hasmarini, 2024).

On the other hand, at the company level, the decision to invest cannot be separated from the consideration of the company's market value, one of which can be measured through the Tobin's q indicator. Tobin's q is the ratio between a company's market value (share price multiplied by the number of outstanding shares) and the cost of replacing its physical assets. When Tobin's value q is greater than one ($q > 1$), this indicates that the market values the company's assets higher than its cost of reproduction, so the new investment is considered profitable. Conversely, if $q < 1$, then the company's market value is below the cost of asset replacement, which makes the company tend to refrain from making investments because it is considered risky (Eklund, n.d.). In this framework, Tobin's q acts as an independent variable (X) that influences a company's investment decisions as a bound variable (Y). Thus, both on a macro (regional) and micro (corporate) scale, investment can be positioned as a variable that is influenced by various factors and at the same time a factor that influences broader economic development.

Theoretical and Conceptual Approaches

HDI is seen as able to reduce inequality through improving the quality of human resources, but only if the increase is evenly distributed between regions. High GDP per capita does not guarantee equitable distribution of development outcomes without redistributive policy interventions (Allen & Prabowo, 2024). Unemployment increases inequality because it limits people's access to income and economic opportunities. Investment is a driving factor for economic development, but inclusive management is needed so as not to exacerbate the gap (Thye *et al*., 2022).

METHODOLOGY

Data types and research approaches

This study uses a quantitative approach that aims to measure and analyze the influence of macroeconomic variables on income inequality in Indonesia objectively and systematically. The method used in this study is panel data regression. In this study, regression was carried out on four independent variables, namely Human Development Index (HDI), Gross Regional Domestic Product (GDP) per capita, open unemployment rate, and investment, to dependent variables, namely the Gini Ratio as an indicator of income inequality.

Location and time of the study

The study covers 34 provinces in Indonesia this year. The location of the research does not refer to the collection of direct field data, but rather the processing of secondary data at the provincial level obtained from official sources of government and related institutions. With this wide geographical coverage, the study can identify patterns of income inequality between regions and examine the influence of the economic and social factors that are the focus of the study. The research span covers a five-year period, namely from 2020 to 2024. This period is important to analyze because it reflects the transition period from crisis to national economic recovery, which is characterized by significant fluctuations in variables such as HDI, GDP, unemployment, and investment. Using this time span, the research is expected to be able to capture short-term changes and long-term trends that are relevant to the issue of inequality.

Data types and sources

The type of data used in this study is secondary data in the form of panel data, which is a combination of *time series* data and *cross-section data*. The data covers 34 provinces in Indonesia during the period 2020 to 2024. The data used consisted of several main variables, namely the Human Development Index (HDI) as an indicator of the quality of human resources, Gross Regional Domestic Product (GDP) per capita as a measure of regional prosperity, open unemployment rate as an indicator of labor market pressure, and investment value (in the form of Gross Fixed Capital Formation) as a measure of economic expansion. These variables were selected based on the literature and theories of development economics as well as previous empirical studies that emphasize their role in influencing income inequality. Data sources are obtained from various official and credible institutions, such as the Central Statistics Agency (BPS), and various international institutions that publish Indonesian macroeconomic data.

Variable operational definition

This research involves 4 main variables, namely:

- GINI RATIO (Y): Income inequality is measured using the Gini Ratio, which is a statistical index that shows the extent to which the distribution of income of the population in a region is uneven. Gini Ratio values range from 0 (perfect equity) to 1 (perfect inequality). This data was obtained from the Central Statistics Agency (BPS) and used as a dependent variable (Y) in the study to measure the influence of HDI, GDP per capita, unemployment, and investment.
- HDI (X1): HDI is a composite indicator that reflects the quality of life of the population through three

main dimensions, namely health, education, and decent living standards. HDI was used as an independent variable (X1) in this study and was assumed to reduce income inequality. HDI data is obtained from BPS and measured in the form of an index with a value range of 0–100.

- Gross Regional Domestic Product per Capita – GDP per Capita (X2): GDP per capita measures the average income of the population of an area and is used to assess the level of economic prosperity. As an independent variable (X2), GDP per capita functions to see whether economic growth affects income distribution. Data is obtained from BPS and measured in rupiah units per person.
- Unemployment Rate (X3): The open unemployment rate is the percentage of the labor force that is actively looking for work but has not yet found one. This variable is used as X3 in the model and serves to find out whether unemployment also affects the level of income inequality. The data source is from BPS and is measured in percentage units (%).
- Investment – Gross Fixed Capital Formation/PMTB (X4): Investment is measured through PMTB, which includes expenditure on capital goods such as machinery and infrastructure. As a variable X4, investment is assumed to have an effect on reducing inequality because it has the potential to create jobs and increase income. Data is obtained from BPS and measured in billions of rupiah.

Data collection techniques

The data collection technique in this study is carried out through the documentation method, namely by accessing, identifying, and collecting secondary data from various reliable sources. The documentation method allows researchers to obtain data that has been verified and has gone through a validation process by official agencies, such as BPS and related ministries. The collection process begins with tracing historical data from 2020 to 2024 for each variable in each province, then continues with the selection and preparation stages of data so that it is ready to be processed in the form of panels. All data was compiled and recapitulated using a statistical table format and further analyzed using *Stata 14 software*, which was chosen for its ability to process panel data efficiently and accurately. This documentation technique also includes the process of checking data so that there are no *missing values* or inconsistencies between years and provinces, as well as ensuring that the data used is up-to-date and reflects the actual conditions in each region. Through this technique, the data collected is expected to provide a solid basis for empirical testing of the formulated regression model.

Data analysis techniques

Data analysis is carried out through several stages:

1. Chow test: determines the best model between Pooled OLS or Fixed Effect Model
2. Hausman test: choosing between Fixed Effect and Random Effect
3. Classic Assumption Test:
    - Multicollinearity: tested with VIF (Variance Inflation Factor).
    - Heteroscedasticity: tested through the Modified Wald Test.
    - Autocorrelation: tested using the Wooldridge Test.
4. The final analysis was carried out using a Fixed Effect Model equipped with a Robust Standard Error.

Panel Regression Model

The best model used in this study is the Fixed Effect Model (FEM). The model selection was based on the results of the Chow Test ($p = 0.012$) and the Hausman

Test (p = 0.000), which showed that FEM was more appropriate than the Pooled OLS and Random Effect Model. In addition, this model is analyzed using robust standard error to overcome heteroscedasticity and autocorrelation.

The panel regression model used in this study can be summarized as follows:

RGit = α + β1IPMit + β2PDRBit + β3TPTit + β4Invit + μi + εit..... (1)

Information:

- *RGit* : Gini ratio (income inequality)
- *IPMit* : Human Development Index
- *GDPBit*: Gross Regional Domestic Product per capita
- *TPTit* : Open Unemployment Rate
- *Invitation* : Investment (Gross Fixed Capital Formation)
- *μi* : Fixed effect of each province
- β_0 : The constant (intercept)
- $\beta_1 \, dan \, \beta_2 \; \beta_3 \, \beta_4$: The regression coefficient represents the influence of each variable on the Gini Ratio
- *Eit* : Error term

RESULT AND DISCUSSION

RESULTS

This study uses panel data from 34 provinces in Indonesia from 2020 to 2024 to analyze income inequality between regions more comprehensively. The variables used include the Gini ratio as an indicator of inequality (dependent variable), as well as GDP per capita, the Human Development Index (HDI), the open unemployment rate, and net investment as independent variables. All data is obtained from official sources such as the Central Statistics Agency (BPS) and has been processed using the panel data regression method in order to capture economic dynamics both across time and between provinces.

Panel Data Regression Model Selection

a. Chow Test (F-test)

The Chow test was performed to determine whether the Fixed Effect model was more accurate than the Pooled OLS model

Table 1.1

Chow Test Results (F-Test)

Tested Models	F-statistical value	Probability (p-value)	Decision
Pooled OLS vs Fixed Effect Model	3.33	0.012	Decline Use Fixed Effect H_0

Source: Results of data processing Stata14, 2025

Based on the results of data processing using Stata software, an F-statistical value of 3.33 with a probability value (p-value) of 0.0120 was obtained. This value is smaller than the significance level of 5% (0.05), so the null (H_0) hypothesis that the Pooled OLS model is more appropriate is rejected. Thus, it can be concluded that the Fixed Effect Model (FEM) is more suitable for use in this study because it is able to capture the differences in fixed characteristics between provinces that affect income inequality.

b. Hausman Test

The Hausman test is used to choose between a Fixed Effect Model (FEM) and a Random Effect Model (REM).

Table 1. 2

Hausman Test

Tested Models	Chi-Square Value	Probability (p-value)	Decision
Fixed Effect vs Random Effect Model	113.17	0	Reject : Use Fixed Effect Model (FEM) H_0

Source: Results of data processing Stata14, 2025

Based on the results of data processing, a Chi-square statistical value of 113.17 with a probability value of 0.0000 was obtained. Since the p-value is less than 0.05, the null (H_0) hypothesis is rejected. This means that there is a correlation between individual effects and independent variables, so the right model used in this study is the Fixed Effect Model (FEM).

Conclusion of Best Model Selection

Table 1.3

Summary of Panel Data Regression Model Selection Test

Types of Testing	Statistical Value	p-value	Test Results	Selected Models
Chow Test	F = 3.33	0.012	Reject → Use FEMH_0	Fixed Effect Model (FEM)
Hausman Test	χ^2 = 113.17	0	Reject → Use FEM H_0	Fixed Effect Model (FEM)

Source: Results of data processing Stata14, 2025

The results of the Chow test show that the Fixed Effect model is more accurate than the Pooled OLS model (p-value = 0.0120). Furthermore, the results of the Hausman Test show that the Fixed Effect Model is more accurate than the Random Effect Model (p-value = 0.0000). Therefore, the best model used in this study is the Fixed Effect Model (FEM), because it is able to capture the difference in fixed characteristics between provinces that affect income inequality**.**

Classic Assumption Test

a. Mulicolinierity Test

Multicollinearity is a condition in which two or more independent variables in a regression model are highly correlated with each other, or almost perfectly linear. This means that information from one independent variable can actually be predicted from another independent variable.

Table 1.4

Mulicolinierity Test

Variable	VIVID	1/VIF
IPM	1.69	0.5904
GDP per capita	1.54	0.6502
Open Unemployment	1.27	0.7885
Net Investment	1.12	0.8945
BRIGHT RED	1.4	

Source: Results of data processing Stata14, 2025

Based on the test results, all variables in the model showed very low VIF values, ranging from 1.12 to 1.69, with a mean VIF of 1.40. This shows that there is no problem of multicollinearity among independent variables, so the regression model can be said to be stable and reliable for further analysis.

b. Heteroscedasticity Test (Modified Wald Test)

Heteroscedasticity is a condition in a regression model in which the variant of the residual or the error is not constant for each observation. This means that the model's prediction errors tend to increase or decrease systematically with respect to the value of independent variables.

Table 1.5

Heteroscedasticity Test

Statistical Test	Value
Chi-Square (chi2)	3498.45
Degree of Freedom (df)	33
Probabilities (Prob > chi2)	0
Hypothesis Zero (H_0)	There is homokedasticity (constant variance)
Decision	Minus H_0

Source: Results of data processing Stata14, 2025

Based on the test results, a chi-square value of 3498.45 was obtained with a Prob > chi2 = 0.0000. Since the probability value is much smaller than the significance level of 5% (0.05), the null (H_0) hypothesis is

rejected, which means that there is a heteroscedasticity problem in the model.

This heteroscedasticity problem can cause standard errors to be biased, so parameter estimation can be misleading. To overcome this, it is recommended to use robust estimates of heteroscedasticity, such as Fixed Effect Robust Standard Error (FE-Robust) or use clustered standard errors.

c. Autocorrelation Test (Wooldridge Test)

The autocorrelation test is one of the classic assumption tests that aims to detect whether there is a correlation between the residual value (error) of a period and the previous period

Table 1.6

Autocorrelation Test

Test Statistics	Value
Method	Wooldridge test for autocorrelation in panel data
Hypothesis Zero (H_0)	No first-order autocorrelation
F (1, 32)	11.670
Prob > F	0.0017

Source: Results of data processing Stata14, 2025

The autocorrelation test was performed using the Wooldridge Test for Autocorrelation in Panel Data to find out if there is a first-order autocorrelation in the panel data model. Based on the test results, a statistical value of F of 11,670 was obtained with a probability value (Prob > F) of 0.0017. Since the probability value is smaller than the significance level of 5% (0.05), it can be concluded that it is Minus H_0, which means that there is a first-order autocorrelation in the panel data regression model.

d. Fixed Effect Regression with Robust Standard Error

The following is the interpretation of the results of the Fixed Effects regression with the robust standard error displayed on the Stata output, after adjusting for heteroscedasticity and autocorrelation:

Table 1.7

Robust Standart Error

Variable	Coefficient	Std. Error	t-Statistics	P-Value	95% Confidence Interval
pdrb_perkapita	3.35 E-07	5.34 E-07	0.63	0.535	7.53e-07 – 1.42e-06
ipm	-0.0042169	0.0014	-3.01	0.005	-0.0070676 – -0.0013662
pengangguran_terbuka	-0.0015294	0.001529	-1	0.326	-0.0049488 – 0.0018900
investasi_bersih	-3.69 E-14	1.24 E-13	-0.3	0.769	-2.90e-13 – 2.16e-13

Source: Results of data processing Stata14, 2025

This regression used Fixed Effects (FE) with robust standard error adjusted for 33 clusters (provinces), to address the heteroscedasticity and autocorrelation previously detected in the model.

Key results:

1. GDP per capita was not statistically significant (p = 0.535), which suggests that the increase in GDP per capita had no significant effect on income inequality at the provincial level during the observation period.
2. HDI (Human Development Index) has a significant negative effect on income inequality (coefficient = -0.0042, p = 0.005). This means that every 1-point increase in HDI is estimated to lower the Gini ratio by 0.0042 points, assuming the other variables are constant. This means that an increase in HDI tends to lower income inequality.
3. Open unemployment was not significant (p = 0.820), indicating that there was no strong enough influence between unemployment rates and income inequality in this model.
4. Net investment was also insignificant (p = 0.769), indicating that investment flows have not played a significant role in influencing income distribution

between communities in the observed areas.

DISCUSSION

Human Development Index (HDI)

The results of the FEM regression show that HDI has a negative and significant influence on the Gini Ratio, which means that an increase in HDI will reduce the Gini Ratio. These results are in line with human capital theory, which states that investments in education, health, and living standards improve human capabilities, thereby encouraging a more equitable distribution of income. Improving HDI, which includes education and health indicators, allows for wider access to economic opportunities, especially for low-income groups. Becker, (2009) Alesina and Rodrik (1994). affirms that high inequality, as seen in Indonesia, can hinder the positive effects of economic growth on income distribution in the absence of effective redistribution policies.

However, the results of the panel's data regression showed contradictory results, where HDI had a positive coefficient indicating that an increase in HDI actually increased inequality. This phenomenon can be explained by the uneven distribution of HDI, for example, being more focused on urban areas or specific groups of people, thus widening the gap. Studies by highlight that the benefits of human development are often concentrated in elite groups if policies are not designed for inclusivity. (Barro, 2000) (Anand & Sen, 2000)

Investment (Gross Fixed Capital Formation)

Investment did not show a significant effect on income inequality in this study. This indicates that investment flows do not directly affect the equitable distribution of income between regions. According to Zhang, Zhang, Xu, Wang, & Shi, (2021), investments tend to be concentrated in specific sectors, such as large industries, or in areas with established infrastructure, so the benefits are not evenly distributed. In Indonesia, investment flows are more directed to provinces such as DKI Jakarta and East Java, which have better supporting facilities, so they have less significant impact on income equity in disadvantaged areas.

The impact of investment on reducing income inequality may take longer to be detected. Investment in new infrastructure or industries may generate future job opportunities, but its effect on income distribution is not immediately apparent in the short term (Bivens, 2014). During the 2020–2024 observation period, existing investments are likely to not have fully generated equitable economic opportunities, especially if they are not supported by relevant policies, such as workforce training programs to enhance the capacity of local communities.

The imbalance in the distribution of investment between provinces in Indonesia is also a relevant factor in these findings. Trips, (2015) asserts that investment concentration in certain regions can exacerbate regional inequality. Provinces with limited infrastructure, such as those in eastern Indonesia, often face difficulties in attracting investment, which ultimately perpetuates the gap between regions. Policies that direct investment to less developed areas can be a solution to overcome this problem.

To increase the contribution of investment in reducing income inequality, government efforts are needed to ensure that investment generates inclusive economic opportunities. Alecke, Mitze, Alecke, & Mitze, (2023), suggesting that policies that support micro, small, and medium enterprises (MSMEs) or infrastructure development in disadvantaged areas can strengthen the positive impact of investment. Without this strategy, investment will not make a significant contribution to income equity.

These findings are also supported by Ostry, Berg, & Tsangarides (2014), which concludes that global investment will not be effective in reducing inequality in the absence of supportive redistribution policies. In the Indonesian context, directing investment to sectors that are able to absorb large numbers of labor, such

as agribusiness or tourism in disadvantaged provinces, can ensure that the benefits of investment are felt by the wider community, thereby supporting income equity efforts.

Open Unemployment Rate

The open unemployment variable shows a negative but not always significant influence. In the *fixed effect model* and *random effect model*, it is shown that unemployment does not have a significant impact on the Gini Ratio. This result seems counterintuitive because, in theory, unemployment tends to increase inequality. However, these findings can be explained by the existence of the informal sector or social policies such as cash assistance that reduce the impact of unemployment on income distribution (Galbraith, 1998) (Fields, 2001).

Studies by show that high unemployment can have an ambiguous effect on inequality, depending on the structure of the labor market. In Indonesia, predominant informal employment may mask the effects of unemployment on the Gini Ratio, as found by in the Indonesian context. Eicher and Turnovsky , (2000) (Alisjahbana & Yusuf, 2003)

GDP Per Capita

GDP per capita showed insignificant influence in the *fixed effect model* and was only close to significant in the random effect model. This suggests that economic growth, measured through GDP per capita, does not automatically reduce inequality. These results support the hypothesis, which states that in the early stages of economic development, inequality tends to increase before decreasing as development outcomes are equalized. Indonesia, as a developing country, may still be at a stage where economic growth is more favorable to certain groups of people, as found by . (Kuznetz, 1955) (Milanovic, 2005)

Studies by show that economic growth that is not accompanied by redistribution policies often fails to reduce inequality. In the Indonesian context, these findings confirm the need for policies that ensure equitable distribution of development outcomes, as suggested by . (Deininger & Squire, 1996) (LAMBERTE†, 2008)

The regression results showed significant variation between provinces on the Gini Ratio. Provinces such as Banten, West Java, and Bangka Belitung have higher levels of inequality than the reference provinces, while provinces such as West Sulawesi and South Sumatra show lower inequality. This variation is consistent with findings by those who show that regional inequality in Indonesia is influenced by geographical factors, natural resources, and urbanization levels. (Akita & Lukman, 1995) Ravallion and Chen (2004) asserts that uneven economic growth, as seen in some Indonesian provinces, tends to widen inequality if it is not accompanied by a fair distribution of resources.

The study highlights that provinces with high levels of urbanization, such as West Java and Banten, tend to have greater inequality due to economic concentration in urban areas. (Leigh & van der Eng, 2009) Suryahadi, Suryadarma, and Sumarto (2009) asserts that the dominant geographical location and economic sectors in Indonesia's provinces affect income distribution, with urban areas having higher inequality than rural areas. In contrast, provinces with natural resource-based economies, such as West Sulawesi, may have a more even distribution of income due to social transfers or local policies (Tadjoeddin, 2013).

Other factors such as fiscal policy, labor market structure, or socio-political factors, may have a major influence on inequality, as found by and . In the REM test it was shown that most of the variability of the Gini Ratio came from differences between provinces, which confirms the importance of regional characteristics in the analysis of inequality. (Piketty, 2014) (Stiglitz, 2012)

The results of the study confirm the importance of increasing HDI and investment to reduce income inequality.

Policies that ensure equitable access to education and health, as well as equitable investment in different regions, can foster inclusive growth. In addition, the insignificance of GDP per capita indicates the need for redistribution policies, such as progressive taxes or social transfers, to ensure that economic growth benefits all groups of people (Ostry & Tsangarides, 2014) .

The results show that HDI and investment have a negative and significant influence on the Gini Ratio, supporting the theory of human capital and inclusive growth. However, GDP per capita and open unemployment do not show significant impacts, reflecting the challenges in achieving equitable growth. Variation between provinces emphasizes the importance of policies tailored to regional characteristics. To reduce inequality, the government needs to focus on equitable HDI distribution, inclusive investment, and effective redistribution policies.

CONCLUSION

This study found that the Human Development Index (HDI) has a significant influence in reducing income inequality between provinces in Indonesia. In contrast, the variables of GDP per capita, open unemployment rate, and investment did not show a significant influence on inequality. This shows that the equitable quality of human development is a major factor in creating a fairer distribution of income. Meanwhile, economic growth and investment flows are not effective enough in reducing inequality if they are not accompanied by policies of economic equity and inclusion.

RECOMMENDATIONS

1. Equitable Human Development: Improve access to quality education and health services in disadvantaged areas through scholarship programs, educational infrastructure development, and health facilities to ensure equitable distribution of HDI to reduce income inequality.
2. Revenue Redistribution: Implementing progressive tax policies and fiscal transfer allocation to less developed regions to overcome the limitations of the influence of GDP per capita, so that economic growth can be enjoyed in real terms
3. Inclusivity-Based Investment: Encourage investment in labor-intensive sectors such as agriculture, tourism, and MSMEs, as well as in disadvantaged areas, by supporting them through fiscal incentives and local infrastructure development.
4. Improving the Quality of the Workforce: Implementing skills training relevant to the needs of the labour market and encouraging the formalisation of the informal sector to improve access to decent work, to reduce income gaps.
5. Regional-Based Policies: Adapting policy strategies to provincial characteristics, such as controlling the cost of living in urban areas and strengthening the primary sector in rural areas, to address variations in inequality between regions.

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