Optimum: Jurnal Ekonomi dan Pembangunan
Vol. 15, No. 2, September 2025, pp. 264-271
DOI:10.12928/optimum.v15i2.12953
ISSN 2613-9464

Regional income disparities in Indonesia: Insights from the Williamson index and panel data analysis

Linda Nur Rachmawati [a,1], Firsty Ramadhona Amalia Lubis [a,2,*], Nurul Azizah Azzakiyyah [a,3]

[a] Faculty of Economics and Business, Universitas Ahmad Dahlan, Indonesia
[1]lindarachma@gmail.com; [2]firsty.ramadhona@ep.uad.ac.id*; [3]nurul.azzakiyyah@ep.uad.ac.id

* corresponding author

ARTICLE INFO

Received : 25-03-2025
Revised : 10-08-2025
Accepted : 23-08-2025
Published : 09-09-2025

Keywords:
Human development index
Williamson index
Income disparities

JEL Classification:
R10; R11; R19

ABSTRACT

Indonesia records the highest income disparity in Southeast Asia and ranks sixth globally in terms of income inequality, as evidenced by its position in recent international analyses and inequality reports. This study aims to examine the effects of Gross Regional Domestic Product (GRDP) per capita, Human Development Index (HDI), Open Unemployment Rate (OUR), and investment on income distribution inequality, measured using the Williamson Index in Indonesia. The research utilizes panel data spanning from 2018 to 2022 across 34 provinces. A multiple linear regression analysis with panel data methodology was employed, selecting the Fixed Effect Model (FEM) as the most suitable estimator. The findings reveal that, collectively, all independent variables in the model significantly influence income distribution inequality. Individually, GRDP per capita has a positive and significant effect on income inequality, HDI exhibits a negative and significant impact, OUR shows no significant effect, while investment negatively and significantly affects income distribution inequality. This study contributes by providing input to stakeholders in formulating policies that can be implemented to address income distribution inequality, particularly in the Indonesia.

1. Introduction

Based on the report from the World Bank (2015) it was noted that income inequality in Indonesia is a long-standing economic problem and tends to increase, making it one of the highest in Asia. In the last two decades, Indonesia has faced serious problems related to this inequality, which even makes it the country with the fastest income inequality in Southeast Asia and the 6th highest in the world according to the World Bank (2024) this fact shows that income inequality has reached a critical phase that needs to be addressed immediately for Indonesia's future economic sustainability. Inequality in Indonesia is clearly reflected in the distribution of deposits within the banking sector. Of the 554 million bank accounts recorded, as many as 98.8% have balances of less than Rp 100 million, while the remaining 2.2% control 53% of the total deposits, amounting to Rp 4.6 quadrillion (Lembaga Penjamin Simpanan, 2024). This extreme concentration of wealth in a small fraction of account holders illustrates the deep gap between the majority of the population and the wealthy minority. Such an imbalance shows that access to and control over financial resources is far from evenly distributed. This reality underscores the urgency of addressing income distribution inequality, which continues to harm the welfare of the wider community.

According to Stockemer & Scruggs (2012) stated the main cause of income inequality is inappropriate political policies. At the beginning of a country's formation, income inequality can start from differences in individual asset ownership. However, wrong political policies, such as those that

favor the rich, often exacerbate inequality. This is because wealthy groups or political elites can influence policies that favor their business survival, widening the economic gap between groups (Goodin et al., 2008). In addition to political policies, decentralization and regional autonomy in Indonesia also exacerbate income inequality between regions, as wealthier provinces with stronger fiscal capacity and better infrastructure can accelerate development, while poorer regions lag further behind due to limited resources and investment opportunities.

Differences in natural resource specialization, local government governance, infrastructure, and gross regional domestic product (GRDP) contribute to inequality between regions (Alfariza et al., 2023; Pasandi & Subardin, 2025). This adds to the complexity of Indonesia's inequality problem, which requires a more in-depth and comprehensive solution. One method to measure regional income inequality is using the Williamson Index (Sukarniati et al., 2021). Considering the spatial or geographic factors, which are not taken into account by the Gini Index. This method allows for a more comprehensive analysis of inequality, especially in a country like Indonesia which consists of many islands and regions with very different economic conditions. Research using the Williamson Index provides deeper insights into income inequality between regions, which is often overlooked in previous studies (Williamson, 1965).

According to the World Bank (2023) there are several other economic factors also play a role in the unequal distribution of income in Indonesia, including educational disparities, unequal access to infrastructure, and differences in regional economic potential. Research shows that investment has a significant influence on inequality, although there are differences in findings across studies. Different finding states that investment has a significant negative effect on inequality (Samiha et al., 2021). Investment can boost economic growth and create jobs, but the distribution of benefits is often uneven, depending on the sector and region (Halvarsson et al., 2018). In addition, the Human Development Index (HDI) is also found to have a negative influence on inequality, although there are studies that show that HDI is not always directly related to reducing income inequality (Ningtiyas & Dwiputri, 2021). Although there are differences in study findings, the Human Development Index has no significant effect on inequality in Indonesia. Other factors that affect income inequality in Indonesia are the Open Unemployment Rate and GRDP per capita. A high unemployment rate can worsen inequality as it leads to greater income disparities between groups of people (Razia et al., 2023; Hayat et al., 2023).

In addition, although GRDP per capita reflects the economic capacity of a country, an increase in GRDP often worsens income inequality, due to unequal distribution of wealth across regions or groups of people (Walujadi et al., 2022). These factors suggest that despite Indonesia's economic growth, income distribution inequality remains a serious problem. Addressing income inequality in Indonesia therefore requires a more holistic and evidence-based approach, including the use of more appropriate measurement tools such as the Williamson Index (Fitri & Rindiani, 2024). In addition, more inclusive policies and equitable development across regions are needed to ensure that the benefits of economic growth are felt by all levels of society. This study is conducted with the purpose of examining the determinants of income distribution inequality in Indonesia by integrating economic growth, human development, unemployment, and investment within one analytical framework. The novelty of this research lies in its combined use of the Williamson Index as a measure of regional inequality and a panel data approach covering multiple provinces over time, enabling a more nuanced understanding of disparities. Compared to previous studies, which often focused on single variables or used the Gini coefficient as the sole indicator, this study offers a broader perspective by incorporating multiple determinants simultaneously. The lack of significance in certain variables, such as the open unemployment rate, also provides new insights into the complexity of inequality and suggests that non-labor market factors may play a more prominent role in shaping income distribution in Indonesia.

2. Literature Review

Income distribution inequality is the inefficient sharing of national income between households or populations (Todaro & Smith, 2020). The problem of income inequality can be viewed from the transmission in a particular population or household (Sosodoro et al., 2023). Differences in income receipts between households differ significantly from each other which is influenced by several factors such as ethnic heterogeneity, and the failure of the Government to provide a sound economic system. Focuses on calculating income distribution by comparing the percentage of national income received by a population as labor with the percentage of national income derived from returns on capital

ownership (such as land or other forms of capital) (Todaro & Smith, 2020). If a larger percentage of total national income is controlled by capital owners than the percentage received by workers or labor, then there is an indication of inequality.

Reviewing the previous studies that have been observed, most of them use panel data dimensions and the majority use fixed effect models even though there are other models such as CEM, SEM, REM and Sys-GMM. Then only one previous study was found that used the independent variable of regional inequality (Williamson index) and it was confirmed to have a significant effect on the Gini ratio. Means that this study complements the existing literature gap. The results of the studies show diversity. HDI has a positive and significant influence on income distribution inequality (gini ratio), but some others find different study results, namely a negative and significant influence. This raises new arguments that develop a negative correlation with the Gini ratio. Increasing the quality of human resources (HDI) can equalize income between individuals (Dasic et al., 2020)**.** The unemployment rate (UNEM) can show overall uniform, positive and significant results. Theoretically, the unemployment rate can trigger income disparities between individuals (Farhan & Sugianto, 2022). Because the unemployed do not have the minimum income to use for consumption.

Investment has yielded mixed results, with research confirming positive and significant impacts, but a nearly equal proportion of researchers confirming negative and significant impacts. In theory, investment is a supporting element and driver of GDP or GRDP in addition to consumption, government spending and net exports (Case et al., 2019). So it can be assumed that when investment increases, it can reduce income disparity, because investment can increase national income. GRDP per capita is still debated regarding its correlation with income distribution. Some argue that an increase in GRDP per capita is only contributed by the top group of people, which does not guarantee income equality (Azim et al., 2022).

3. Method

This type of research is descriptive quantitative. The data in this study has been previously provided by official institutions, so the data in this study is secondary data. Observations were made in 2018-2022 with the observed objects being 34 provinces throughout Indonesia. Thus, the data dimension in this study is panel data. This study uses data up to 2022 to serve as a significant reference point in capturing the post-pandemic economic recovery phase, allowing this study to reflect the impact of the COVID-19 disruption and the initial effects of subsequent response policies on regional income disparities. Panel data is when time-series data is combined with cross-sectional. The analytical tool applied in this research is panel data multiple linear regression. In the process, panel data multiple linear regression will produce three regression outputs, namely CEM (common effect model), FEM (fixed effect model), and REM (Random Effect Model). The model will be selected based on the effect characteristics through a testing process called the model specification test (Baltagi, 2005). After the regression selection process is carried out, the next step is to ascertain whether the regression model is free from classical assumptions or not. Classical assumptions include normality, multicollinearity, and heteroscedasticity. The modeling of this study based on the analytical tools used is as follows:

$$IW_{it} = \alpha_0 + \beta_1 lnGDRP_{it} + \beta_2 HDI_{it} + \beta_3 UNEM_{it} + \beta_4 INV_{it} + \varepsilon_{it} \quad (1)$$

Where IW is the Williamson index; $lnGDRP$ is the gross domestic regional product per-capita; HDI is the human development index; $UNEM$ is the unemployment rate; INV is the investment; α_0 is the constanta; $\beta_1 - \beta_4$ is the coefficient of independent variable; ε_{it} is the error term. The simultaneous test or F test is used to determine whether all independent variables in the model have a simultaneous and significant effect or no. This test has a basic decision if the probability value is below 0.05, the decision states that there is simultaneous significance in the model. Then the partial test or T test also has the same decision basis where the tested variable has a significant effect when the probability value shows less than 0.05.

4. Results and Discussion

Understanding the characteristics of the data used in this study, it is essential to first examine the descriptive statistics of each variable. Descriptive statistics provide an overview of the range, distribution, and central tendency of the data, allowing researchers to identify general patterns before

conducting further analysis. Table 1 shows the result of descriptive statistics or a quantitative overview of the variables. The Williamson index, which is an indicator to assess income distribution inequality, has the highest value of 1.45 and the lowest value of 0.143. This means that the most severe income distribution inequality in Indonesia recorded an index of 1.45 or severe inequality category. The lowest inequality in Indonesia (equal income distribution) recorded a value of 0.143. The other variables that are independent variables can be observed directly in Table 1. For example, the best HDI in Indonesia scored 81.65 and the lowest was 60.06. The significant difference between the highest and lowest scores represents that human development between provinces is still very unequal. Some provinces have managed to advance, but others have fallen behind. Similar to Investment, GRDP per capita, and TPT, the comparison of the highest and lowest values can be said to be significant, which means that development in Indonesia has not been evenly distributed.

Table 1. Descriptive Statistics

Variable	Max	Min	Mean
IW	1.45	0.143	0.55
lnGDRP	5.28	4.08	4.56
HDI	81.65	60.06	71.18
UNEM	10.95	1.4	5.19
INV	92967	259	13.477

Source: data processed

In the model specification test or best model test section, it shows that the FEM is the best model or the relevant model used according to the characteristics of the data. With the selection of FEM as the best model, it shows a fixed effect in each observation. The equation for FEM model as follows:

$$IW_{it} = -3.4 + 0.94lnGDRP_{it} - 0.004HDI_{it} + 0.004UNEM_{it} - 0.000000854INV_{it}$$

Table 2 shows GRDP per capita has a positive and significant effect on income distribution inequality, HDI has a negative and significant effect on income distribution inequality, UNEM has no significant effect on income distribution inequality, investment has a negative and significant effect on income distribution inequality. From a theoretical perspective, the findings of this study align with the theory developed by Simon Kuznets. According to Kuznets (1955) in the early stages of development, an increase in per capita income will actually increase income distribution inequality. This argument is represented through the Kuznets curve, which depicts an inverted U-shape relationship between economic development and income inequality. In his curve, Kuznets (1955) state that during the initial phase of development, there is a group of individuals who possess capital to develop businesses and reap significant profits from their investments. Whereas there is a population lacking capital, causing them to fall further behind compared to those with capital. This disparity in capital ownership leads to income distribution inequality (Carchedi & Roberts, 2023).

Based on the findings of this study regarding the influence of per capita GRDP on income distribution inequality in Indonesia, Kuznets' theory remains relevant to the current economic situation in the country. Indonesia, as a developing nation with industrialization still in progress, reflects the early development stage described by Kuznets. In this stage, individuals with capital can more easily accumulate wealth compared to those with limited capital, thereby creating a gap or inequality in income distribution. GRDP per capita has a positive and significant effect on income distribution inequality. The coefficient of 0.94 implies that, when GRDP per capita increases by one unit in the measurement scale used in this study (million rupiah if using raw values, or log units if using transformed data), the Williamson Index is predicted to increase by 0.94, indicating a strong association between regional income levels and inequality. This finding aligns with previous research. Found that GRDP per capita has a positive and significant effect on income distribution inequality in Indonesia. Similarly to Ilyasa et al (2025) confirmed that GRDP per capita positively and significantly influences income distribution inequality.

Human Development Index (HDI) has a negative and significant effect on income distribution inequality in Indonesia during the 2018–2022 period. This finding aligns with research by Suhendra et al (2020) which states that an increase in HDI is associated with higher education levels, thereby enhancing individual productivity through improved skills. Higher productivity enables individuals to earn better incomes, thus reducing the income gap with high-income groups. Walujadi et al (2022) found that HDI negatively and significantly affects income distribution inequality in Indonesia. HDI represents the quality of human life in terms of education and health, which are directly associated

with individual productivity. Individuals with a good quality of life, supported by adequate health and education, can access resources to increase income through gainful employment. Conversely, individuals with a lower quality of life face limitations in accessing resources, reducing their opportunities to earn a decent income. Therefore, improving HDI can reduce income disparities among groups, leading to a more equitable income distribution as the quality of human life improves. Human capital theory, states that differences in income levels among individuals are due to variations in education and skills (Ramos & Uitermark, 2025).

This findings supports the research finding that improving human quality (HDI) is directly proportional to increases in income or wages received. Thus, income disparities among groups can be minimized through efforts to improve the educational quality of each individual. Improving the Human Development Index (HDI) can raise wages in the selected group because higher human quality—reflected in better education, health, and living standards—enhances individual productivity and competitiveness in the labor market (Ajide & Alimi, 2021). This supports the research finding that improvements in HDI are directly proportional to increases in income or wages received. Consequently, income disparities among groups can be reduced through targeted efforts to enhance the educational quality and skill levels of individuals, ensuring that economic growth benefits are distributed more equitably.

Table 2. Result of FEM Model

Variable	Coefficient
lnGDRP	0.94 (4.86)***
HDI	-0.004 (-3.45)***
UNEM	0.004 (0.76)
INV	-0.000000854 (-2.88)**
C	-3.441 (-4.24)***

Source: data processed

The unemployment rate (UNEM) did not have a significant effect on income distribution inequality in Indonesia from 2018 to 2022. This finding aligns with the study conducted by Schütz et al (2025) which also indicated that the UNEM does not significantly influence income inequality. Unemployment rate (UNEM) does not have a significant impact on income inequality. These social protection initiatives help reduce the burden on the unemployed, thereby preventing fluctuations in the open unemployment rate from affecting income inequality in Indonesia. Based on the 2024 Central Statistics Agency report, the open unemployment rate in Indonesia is around 4.9%. When compared to the total population, this figure is relatively small. Meanwhile, measurements of income inequality encompass the entire population. Therefore, this could be a reason why the UNEM does not have a significant effect on income inequality in Indonesia.

Investment has a negative and significant effect on income distribution inequality in Indonesia. Muryani et al (2021) stated that domestic investment (PMDN) can reduce the level of income distribution inequality in Indonesia. Lee et al (2021) found that the combination of foreign investment (FDI) and domestic investment (PMDN) is significant in reducing income disparity between groups. Investment realization can have a spillover effect on other sectors; for example, the opening of a new factory (investment) can absorb new workers (effect). Investment is a component of gross domestic product, so an increase in investment can increase people's per capita income. According to Halvarsson et al (2018) increased investment, especially at the micro level, will support the business climate so that income equality can be realized.

The positive and significant relationship between GRDP per capita and inequality (coefficient 0.94) indicates that for every Rp1 million increase in GRDP per capita, the Williamson Index is predicted to rise by 0.94 points. This finding reflects the dynamics described by Simon Kuznets' inverted U-shaped hypothesis, which posits that in the early stages of economic growth, inequality tends to increase before eventually declining. In Indonesia's context, economic expansion is often concentrated in urban and industrial hubs such as Jakarta, Surabaya, and Batam, where productivity and wages grow faster than in rural or less-developed regions. This concentration benefits those with

capital, advanced skills, and better market access, leaving behind populations in lagging provinces. The significant disparity in GRDP per capita seen in Table 1 (ranging from 4.08 to 5.28 in log form) illustrates the uneven pace of growth across regions. These structural imbalances in development perpetuate income gaps, thereby validating the Kuznets framework in Indonesia's case.

5. Conclusion

Indonesia records the highest income disparity in Southeast Asia and ranks sixth globally in terms of income inequality, as evidenced by its position in recent international analyses and inequality reports. This fact shows that income inequality has reached a critical phase that needs to be addressed immediately for Indonesia's future economic sustainability. Inequality in Indonesia is clearly reflected in the distribution of deposits within the banking sector. Of the 554 million bank accounts recorded, as many as 98.8% have balances of less than Rp 100 million, while the remaining 2.2% control 53% of the total deposits, amounting to Rp 4.6 quadrillion. This study is conducted with the purpose of examining the determinants of income distribution inequality in Indonesia by integrating economic growth, human development, unemployment, and investment within one analytical framework. The novelty of this research lies in its combined use of the Williamson Index as a measure of regional inequality and a panel data approach covering multiple provinces over time, enabling a more nuanced understanding of disparities.

Based on the finding of the study can be concluded that the variables examined in this study collectively influence the level of income distribution inequality in Indonesia. The findings highlight that economic growth alone, as reflected in rising GRDP per capita, does not automatically lead to a fairer distribution of income and can even widen the welfare gap if not supported by equitable policies. On the other hand, improvements in human development and increased investment have the potential to reduce inequality by enhancing productivity, expanding job opportunities, and fostering more inclusive economic participation. These results emphasize the need for policies that promote balanced regional development, strengthen education and health services to boost human capital, and create an investment climate that benefits all levels of society, including small and medium enterprises. A development strategy that is both inclusive and equitable is essential to achieving sustainable reductions in income inequality.

Acknowledgment

The authors would like to express their sincere appreciation to all individuals and institutions that contributed to the realization of this research.

Declarations

Author contribution	:	All authors contributed equally to the main contributor to this paper. All authors read and approved the final paper.
Funding statement	:	This research did not receive funding from any other party or funding agency
Conflict of interest	:	The authors declare no conflict of interest.
Additional information	:	No additional information is available for this paper.

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