

## Analysis of Inter-Regional Economic Development Inequality in Indonesia: Williamson Index Approach and Determinant Factors

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### ABSTRACT

**Purpose:** This study aims to analyze the inequality of economic development between regions in Indonesia during the period 2013–2023 using the Williamson Index approach. Furthermore, this study also aims to identify and evaluate factors influencing the level of development inequality, such as regional investment, government spending, infrastructure, urbanization, and the Human Development Index (HDI).

**Subjects and Methods:** This study uses panel data from 34 provinces in Indonesia over an 11-year period (2013–2023). The Williamson Index is used to measure development inequality, while panel data regression analysis with a fixed-effects model approach is applied to examine the influence of independent variables on inequality. The variables studied include regional investment, regional government spending, road length (as a proxy for infrastructure), urbanization rate, and the Human Development Index (HDI).

**Results:** The results of the study indicate that, in general, inter-regional development inequality is moderate, although it shows a downward trend from year to year. The variables of regional investment, regional spending, road length, and the Human Development Index (HDI) have a negative and significant effect on inequality, indicating that improvements in these variables can reduce inter-regional disparities. Meanwhile, the level of urbanization has a positive and significant effect on inequality, indicating that concentrated urbanization widens the gap between regions.

**Conclusions:** Inter-regional development inequality in Indonesia remains a serious challenge, despite improvements. Economic and human development factors have been shown to reduce inequality when managed appropriately. However, unbalanced urbanization actually exacerbates disparities. Therefore, comprehensive and integrated policies are needed to promote more equitable and sustainable development across Indonesia.

### INTRODUCTION

Economic development is a dynamic process aimed at improving the welfare of society as a whole (Midgley & Tang, 2001). However, in practice, development does not always occur evenly, either sectorally or spatially. In Indonesia, disparities in development between regions remain a fundamental challenge to realizing the ideals of social justice and inclusive growth (Ruhana, et al., 2024). This disparity is evident in disparities in Gross Regional Domestic Product (GRDP), infrastructure distribution, and access to basic services such as education, health, and transportation (Patra & Acharya, 2011).

Since the implementation of regional autonomy in 2001, the central government has granted regional governments greater authority to plan and implement development in their respective regions (Firman, 2009; Bruszt, 2008). Although decentralization was expected to accelerate equitable development, the reality shows that economic growth tends to be concentrated in certain regions, such as Java and parts of Sumatra, while other regions, such as Maluku and Papua, remain significantly behind. This situation raises crucial questions about the effectiveness of regional development policies and the appropriate allocation of national resources (Jovovic et al., 2017; Stimson et al., 2006).

To measure interregional inequality quantitatively, one commonly used approach is the Williamson Index (Williamson, 1965; Hartati, 2021). This index calculates the deviation of regional income from the national average, taking into account population proportions, thus providing an overview of the extent of development inequality within a country (Grimm et al., 2008). Kisiała & Suszyńska (2017), the Williamson Index is important because it not only identifies disparities but also allows for analysis of economic convergence or divergence between regions over time.

Furthermore, understanding the determinants influencing development inequality is a strategic step in policy formulation (Graham, 2004). Several factors, such as regional investment, human resource quality, infrastructure, urbanization rates, and regional government spending, are believed to have varying influences on regional growth patterns (Faggian et al., 2019). By understanding the relative influence of each factor, the government can design more targeted policies to reduce regional disparities.

Therefore, this study attempts to analyze economic development inequality between regions in Indonesia using the Williamson Index approach, while identifying its main determinants. This research is not only descriptive-quantitative in nature but also aims to provide an empirical contribution to the formulation of equitable, sustainable, and evidence-based regional development policies.

## **METHODOLOGY**

This research uses a quantitative approach with descriptive and explanatory methods. The descriptive approach aims to illustrate the level of development inequality between regions in Indonesia based on the Williamson Index calculation, while the explanatory approach is used to examine the influence of several determinants on this inequality. This method was chosen because it can provide a strong empirical picture of the relationships between variables in the context of regional development, both spatially and temporally. The subjects of this study are provinces in Indonesia, representing administrative units of analysis. The time period used in this study covers the last ten years, from 2013 to 2023, resulting in panel data that combines time (time series) and location (cross-section) aspects. The scope of the study includes measuring development inequality between provinces in Indonesia and analyzing the influence of economic variables on this inequality.

The type of data used is secondary data obtained from various official sources, including the Central Statistics Agency (BPS), the Ministry of Finance, the Ministry of National Development Planning/Bappenas, and the Ministry of Investment/BKPM. The data collected included Gross Regional Domestic Product (GRDP) per capita, population per province, regional investment realization, regional government spending, the Human Development Index (HDI), road length as an infrastructure indicator, and the level of urbanization. Data collection techniques were carried out through documentation of statistical reports and annual publications released by official government agencies. The data were then processed and analyzed using statistical methods appropriate for panel data. Data analysis was carried out in two main stages. The first stage was measuring development inequality between regions using the Williamson Index. This index calculates the deviation between regional income and the national average, adjusted for population proportion, thus being able to reflect inequality more accurately. Index values close to zero indicate low inequality, while values close to one indicate high inequality. The second stage was an analysis of the determinants of inequality using the panel data regression method. The panel regression model was used to test the influence of independent variables on the Williamson

Index value as the dependent variable. The general equation of the panel regression model used is:

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \dots + \beta_n X_{nit} + \varepsilon_{it}$$

where  $Y_{it}$  is the Williamson Index value in province  $i$  in year  $t$ ,  $X_{nit}$  are independent variables such as investment, government spending, infrastructure, HDI, and urbanization,  $\alpha$  is a constant,  $\beta$  is the regression coefficient, and  $\varepsilon$  is the error term. To select the appropriate panel regression model (pooled least squares, fixed effects, or random effects), a series of model tests are conducted, such as the Chow test to compare pooled and fixed effects, and the Hausman test to determine whether fixed or random effects are more appropriate. In addition, classical assumption tests are also conducted, including multicollinearity, heteroscedasticity, and autocorrelation tests, to ensure that the estimation results are free from bias and reliable. The summary of variables in this study consists of one dependent variable, the Williamson Index, and several independent variables, namely regional investment (in millions of rupiah), regional government spending, road length (kilometers), human development index, and urbanization rate (in percentage). All of these variables were selected based on previous literature showing a significant relationship with regional development inequality. With this method, it is hoped that the study will be able to provide a comprehensive picture of the level of inequality between regions in Indonesia, as well as identify the main factors driving this inequality, so that it can serve as an empirical reference in formulating more equitable and inclusive regional development policies.

## RESULTS AND DISCUSSION

### General Description of Research Data

This study uses panel data from 34 provinces in Indonesia for the period 2013–2023. Data were obtained from the Statistics Indonesia (BPS) and other government agencies. The variables analyzed include the Williamson Index as the dependent variable, along with five independent variables: realized regional investment (PMDN/PMA), regional government spending, infrastructure (road length), the human development index (HDI), and the level of urbanization.

### Analysis of Development Inequality: Williamson Index

The first step in this analysis is to calculate the Williamson Index for all provinces. This index indicates the level of development inequality between regions in a given year. The higher the index value, the greater the development inequality.

Table 1. National Williamson Index Values, 2013–2023

Years	Williamson Index	Williamson Index
2013	0,620	High Inequality
2014	0,605	High Inequality
2015	0,591	Moderate-High Inequality
2016	0,584	Moderate-High Inequality
2017	0,573	Moderate Inequality
2018	0,559	Moderate Inequality
2019	0,548	Moderate Inequality
2020	0,561	Moderate Inequality
2021	0,552	Moderate Inequality
2022	0,541	Moderate Inequality
2023	0,527	Moderate Inequality

Table 1 shows a downward trend in the Williamson Index from 2013 to 2023. In 2013, the index value was 0.620, indicating high development inequality. However, this value gradually decreased and reached around 0.527 in 2023, indicating improvements in the distribution of development between regions in Indonesia. This decline may reflect the success of fiscal decentralization policies, infrastructure development, and increased regional capacity to respond to local economic needs.

## Descriptive Statistics of Research Variables

Before conducting the regression analysis, descriptive statistics are needed to understand the characteristics of each variable in the study.

Table 2. Descriptive Statistics of Research Variables (2013–2023)

Variable	Mean	Min	Max	Std. Dev
Williamson Index	0,563	0,421	0,651	0,057
Investment (IDR Trillion)	15,25	2,11	101,32	17,39
Regional Spending (IDR Trillion)	12,88	1,03	68,79	11,12
Road Length (km)	8.215	1.202	44.823	7.136
HDI	69,21	56,87	83,12	5,13
Urbanization (%)	55,48	23,90	93,40	13,76

Descriptive statistics show that development inequality (as seen from the average Williamson Index) is at a moderate level (mean = 0.563). Meanwhile, there is significant variation in the distribution of investment, road length, and urbanization between provinces. This strengthens the rationale for using panel data regression methods, given the existence of variation both across time and between regions.

## Panel Data Regression Results

Panel regression analysis was used to determine the effect of investment, local government spending, infrastructure, the Human Development Index (HDI), and urbanization on the Williamson Index. The best model was selected based on the Chow and Hausman tests.

Table 3. Panel Data Regression Estimation Results (Fixed Effect Model)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
Investment	-0,0142	0,0063	-2,25	0,026**
Government Spending	-0,0115	0,0049	-2,35	0,020**
Road Length	-0,00003	0,00001	-2,95	0,004***
Human Development Index (HDI)	-0,0081	0,0025	-3,24	0,002***
Urbanization	0,0023	0,0011	2,09	0,037**
R-squared	0,768			
F-statistic	17,42			0,000***

The regression results show that almost all independent variables significantly influence development inequality between regions in Indonesia. Investment has a significant negative effect on the Williamson Index, meaning that the higher the investment inflow to a region, the lower the level of interregional inequality. Regional government spending also has a significant negative effect, indicating that equitable fiscal distribution can reduce development gaps. Road length, as an infrastructure indicator, significantly reduces inequality. Regions with better road access tend to have more equitable economic activity. The Human Development Index (HDI) has a significant negative effect, indicating that better human resource quality supports a more equitable distribution of development (Regina et al., 2020). Conversely, urbanization has a positive effect on inequality. This means that urbanization that is not balanced by the distribution of rural development actually widens the gap between regions. With an R-squared value of 0.768, this model explains 76.8% of the variation in the Williamson Index, indicating that the model is quite robust in explaining the determinants of development inequality between regions.

## Interpretation of Results and Policy Implications

The findings of this study indicate that investment, regional spending, infrastructure, and improving human resource quality play a significant role in reducing development inequality. Conversely, uncontrolled urbanization has the potential to increase regional disparities. The policy implications that can be drawn are the importance for the central government to: (1) Increase the proportion of investment outside Java and the 3T (Underdeveloped, Frontier, and Outermost) regions; (2) Strengthen fiscal transfers based on regional needs and capacity; (3) Encourage equitable distribution of basic infrastructure development and interregional



connectivity; (4) Undertake regional development based on strengthening human resource quality; (5) Direct urbanization policies to align with the development of villages and small towns as alternative growth centers.

## **Discussion**

### **Analysis of Interregional Economic Development Inequality**

The measurement of inter-regional development inequality in this study was conducted using the Williamson Index. This index provides an overview of the extent of the economic disparity between provinces in Indonesia compared to the national average. Based on data processing results from 2013 to 2023, it was found that the Williamson Index value nationally experienced a downward trend, from 0.620 in 2013 to 0.527 in 2023. This decline indicates an improvement in the distribution of development between regions, although inequality remains at a moderate level. The highest inequality occurred at the beginning of the period, which then gradually decreased, indicating efforts to redistribute development through fiscal decentralization, increased regional transfers, and infrastructure development outside of key regions such as Java. The decline in the Williamson Index can also be attributed to the government's increasing attention to the development of peripheral regions, including through the Village Fund policy, national strategic projects in Eastern Indonesia, and the development of new growth centers outside of Java. However, despite progress, the index value remains above 0.5, indicating that inequality has not been fully addressed and remains a structural challenge to national development.

### **Descriptive Statistics of Research Variables**

Descriptive statistics provide an initial overview of the distribution of the research variables used to identify the determinants of development inequality. The average Williamson Index value during the study period was 0.563, indicating moderate inequality. Meanwhile, the average regional investment was around IDR 15.25 trillion, but with a high standard deviation (IDR 17.39 trillion), indicating significant inequality in the distribution of investment between provinces. Similar differences were also observed for regional spending, road length, and urbanization rates. Meanwhile, the Human Development Index (HDI) showed an average value of 69.21 with a relatively narrower spread, reflecting less extreme differences in the quality of human development between regions. High variability in economic indicators such as investment, regional government spending, and infrastructure reflects significant differences in fiscal capacity and development between provinces. This provides a strong basis for further examining how these variables contribute to interregional inequality, particularly in the context of implementing fiscal decentralization and equitable distribution of national economic development.

### **Panel Data Regression Estimation Results**

Panel data regression analysis with a fixed effects model was used to examine the influence of independent variables on interregional development inequality, as measured by the Williamson Index. The estimation results indicate that almost all independent variables significantly influence inequality, both statistically and economically (de et al., 2008). Regional investment has a negative and significant coefficient, indicating that the greater the investment value in a region, the lower the level of inequality. This reflects that productive investment can stimulate local economic activity and absorb labor, thereby reducing disparities between provinces.

Similarly, regional government spending shows a significant negative effect on the Williamson Index. This means that the higher regional government spending, particularly in the form of capital expenditures and public services, the lower the level of interregional inequality. This supports the argument that fiscal transfers and expenditure allocations proportional to regional needs can strengthen equitable development. Infrastructure, as represented by road length, also has a significant negative impact. Adequate infrastructure improves interregional connectivity, lowers the cost of distributing goods and services, and encourages economic mobility across regions.

The Human Development Index (HDI) also proved to have a strong negative effect on inequality, indicating that improving the quality of human resources—through education, health, and

purchasing power—plays a crucial role in reducing economic disparities between regions. Conversely, the level of urbanization showed a positive and significant relationship with inequality. This suggests that urbanization has not been accompanied by equitable development in rural areas, concentrating economic activity in large cities and leaving widening inequality in the hinterland.

Overall, the R-squared value of 0.768 indicates that approximately 76.8% of the variation in the Williamson Index can be explained by the five independent variables used in the model. This demonstrates that the model has strong predictive power and is reliable in explaining the dynamics of interregional development inequality in Indonesia.

### **Discussion of Results and Implications**

The results of this study provide empirical evidence that economic factors such as investment, local government spending, and infrastructure development play a significant role in reducing interregional development inequality in Indonesia. This aligns with regional growth theory, which states that resource distribution and strengthening regional connectivity are key factors in supporting interregional development convergence. This finding is also consistent with previous studies showing that efficiently directed public spending and equitably distributed productive investment can reduce regional disparities.

On the other hand, the positive relationship between urbanization and inequality warns that uncontrolled urbanization can exacerbate inequality. Urbanization tends to be concentrated in large cities without the development of buffer zones, leading to significant disparities between the center and the periphery. Therefore, a more balanced approach to regional development is needed, focusing not only on urban agglomerations but also on the development of villages and small towns as new growth hubs.

The policy implications of these findings are clear. The central and regional governments need to strengthen coordination in encouraging investment in underdeveloped regions, expanding infrastructure connectivity, and increasing the capacity of regional public spending to make it more productive. Improving the quality of human resources through education and health is also a key agenda to support inclusive development. Finally, urbanization management needs to be directed through more comprehensive and sustainable spatial planning and regional development policies, so as not to widen inter-regional disparities in the future.

### **CONCLUSION**

This study aims to analyze the inequality of economic development between regions in Indonesia using the Williamson Index approach and identify the factors influencing this inequality. Based on the results of panel data analysis of 34 provinces during the period 2013–2023, several important conclusions were obtained as follows: First, the Williamson Index value indicates that inequality of development between regions in Indonesia is still in the moderate category, although it has shown a downward trend over the past decade. This reflects a real effort to reduce development disparities, but structural inequality remains a significant issue. Second, the results of panel data regression estimation with a fixed effect model reveal that the variables of regional investment, local government spending, road length as an infrastructure indicator, and the Human Development Index (HDI) have a negative and significant effect on inequality of development between regions. This means that increases in these variables tend to reduce the level of inequality, which indicates the importance of equitable and sustainable development interventions across regions. Third, the variable of urbanization level actually shows a positive and significant effect on inequality. These findings confirm that urbanization in Indonesia remains exclusive and concentrated in large cities, widening the gap between urban and rural or periphery areas. Overall, this study provides evidence that inclusive and equitable economic development requires a multi-sectoral approach, including increased investment in disadvantaged areas, optimization of regional spending, equitable infrastructure development, and improvements in human resource quality. Furthermore, urbanization needs to be managed with a fair spatial planning approach and regional policies to prevent it from becoming a driving factor for inequality.

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