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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 extent of inter-regional economic development inequality in Indonesia and identify its determinant factors using a quantitative approach. The study focuses on understanding spatial disparities in regional development outcomes across provinces and regions, examining whether fiscal, infrastructural, demographic, and economic variables contribute to the widening or narrowing of inequality levels.*

***Subjects and Methods:** This study employed a descriptive-inferential quantitative method using secondary data from national statistical databases, covering all 34 provinces in Indonesia over a five-year period. The Williamson Index was used to measure the magnitude of regional inequality, while multiple linear regression was applied to identify the significance of factors such as investment allocation, labor productivity, infrastructure development, and human capital indicators on the inequality index.*

***Results:** The analysis revealed a persistent pattern of inequality, with the highest disparities recorded between the western and eastern regions. Regression analysis confirmed that infrastructure access, educational attainment, and industrial diversification had statistically significant effects in reducing inter-regional inequality, while centralized investment distribution and limited fiscal autonomy were linked to the persistence of regional gaps.*

***Conclusions:** The findings highlight that economic development in Indonesia remains unevenly distributed due to structural and policy-related constraints. A reformulation of regional development strategies that emphasizes equitable investment, capacity building, and infrastructure expansion is necessary to address spatial inequality and promote balanced national growth.*

INTRODUCTION

Economic inequality across regions remains a critical development challenge for Indonesia, a country characterized by vast geographical diversity, uneven resource endowments, and historically centralized economic growth. The disparity in regional economic development is not only an issue of income distribution but also a reflection of structural imbalances, policy inefficiencies, and the deep-rooted legacy of Java-centric development that has dominated Indonesia's post-independence economic narrative (Lu, 2024). As the country advances toward its development targets under the Vision Indonesia 2045, resolving these persistent disparities is central to ensuring inclusive and sustainable national growth.

Inter-regional inequality in Indonesia manifests most visibly in the concentration of economic activities in western Indonesia particularly Java and Sumatra while the eastern provinces such as Papua, Maluku, and Nusa Tenggara continue to lag behind in most key development indicators (Rosidin, 2021). This unbalanced pattern of growth has led to multiple consequences, ranging from underutilization of regional potential and internal migration pressures to social and political discontent in marginalized regions. The urgency of addressing this imbalance is heightened by global economic shifts, climate vulnerabilities, and technological transformations that risk further marginalizing regions unprepared for industrial and digital transitions.

While national economic growth in Indonesia has generally remained robust—averaging around 5% over the past decade this aggregate figure masks sharp intra-national disparities. Jakarta's gross regional domestic product (GRDP) per capita exceeds that of Papua by more than tenfold, indicating a severe gap in economic prosperity. Such inequality reflects not only differences in economic output but also disparities in infrastructure development, access to education and healthcare, labor market opportunities, and fiscal capacity (Cerra et al., 2021).

A key instrument in understanding regional disparity quantitatively is the Williamson Index, which measures inequality in economic output across regions relative to population size and averages. This index has been widely used in development economics and regional science to assess the degree of inequality over time and to monitor the effectiveness of regional development policies. Applied in the Indonesian context, the Williamson Index enables the analysis of regional disparities in a standardized, comparative manner useful for informing targeted interventions and long-term planning.

Despite extensive decentralization reforms launched in 2001 which were aimed at empowering regional governments through fiscal transfers and autonomy the expected convergence in regional development has not materialized uniformly. Instead, some studies show that decentralization has sometimes exacerbated local inequalities, with better-governed regions taking greater advantage of autonomy, while less-capable regions fall behind (Hirakawa & Maquito, 2024). This unevenness invites deeper inquiry into what determines the success of regional development policies and what structural or policy variables are most influential in reducing inequality.

Among the most studied determinant factors of inter-regional inequality are infrastructure investment, human capital development, fiscal transfers, industrial structure, and natural resource dependency. Infrastructure is critical in linking underdeveloped regions to markets and services, while human capital influences labor productivity and the capacity for innovation. Fiscal transfers, when well-targeted, can alleviate disparities, but their effectiveness is contingent on governance quality and absorptive capacity.

In the Indonesian context, regions with greater access to public investment and better education outcomes tend to have faster growth rates and better socio-economic indicators (Telaumbanua et al., 2024). However, the role of natural resources remains contentious. While resource-rich regions like East Kalimantan enjoy higher GRDP per capita, they often experience the “resource curse,” with weaker diversification and volatility in revenue streams.

Indonesia’s development agenda, especially under the current National Medium-Term Development Plan (RPJMN) 2020–2024, has emphasized reducing regional gaps through infrastructure equalization, human capital investments, and strengthening local economic resilience. Yet, to evaluate the effectiveness of such policies, empirical assessments using robust indicators and statistical models are essential. The present study contributes to this need by analyzing inter-regional inequality using the Williamson Index and identifying the economic and institutional factors that determine this inequality.

Unlike qualitative investigations that explore perceptions or institutional dynamics behind disparities, this study adopts a quantitative approach to provide a rigorous, data-driven analysis of inequality patterns across Indonesian provinces. It leverages secondary data from official government sources and applies regression techniques to empirically identify which variables

most significantly impact the level of inter-regional economic inequality. In doing so, the research not only enhances the academic understanding of spatial disparities in Indonesia but also provides evidence-based recommendations for policymakers seeking to craft more equitable development strategies.

METHODOLOGY

Research Design

This study adopts a quantitative, explanatory research design, with the primary objective of measuring and analyzing the extent of inter-regional economic inequality across Indonesian provinces and identifying its determinant factors. The explanatory approach is chosen to establish and examine causal relationships between economic inequality (as the dependent variable) and a set of independent economic and institutional variables. The use of quantitative methods enables the research to provide measurable, replicable, and generalizable findings that contribute to policy-oriented discussions in regional development. This study is grounded in empirical analysis through the application of the Williamson Index and regression-based modeling to assess the disparity levels and explore significant predictors of inequality over a defined temporal and spatial scope.

Type and Source of Data

The data utilized in this study are secondary and panel in nature, comprising annual observations for each Indonesian province. These data are collected over a period spanning from 2010 to 2023, enabling longitudinal assessment of inequality dynamics. The main sources of data include official publications from the Central Bureau of Statistics, the Ministry of Finance, the Ministry of Public Works and Housing, and the World Bank Indonesia Database. Variables such as gross regional domestic product (GRDP) per capita, population, education index, infrastructure expenditure, and fiscal transfers are extracted from these databases to construct both the dependent and independent variables used in the analysis. All data are cross-checked across multiple years and official datasets to ensure accuracy, consistency, and reliability.

Population and Sample

The population in this research consists of all 34 provinces of Indonesia. Given the goal of inter-regional comparison, the research employs a total sampling technique, whereby all provinces are included in the analysis, assuming data availability for each indicator. This complete coverage strengthens the generalizability of the findings and allows for comprehensive national-level interpretations. Provinces with missing or incomplete time-series data are treated using interpolation or excluded from the specific year analysis to preserve the validity of the panel regression.

Operational Definitions of Variables

The primary dependent variable in this study is the Williamson Index, a statistical measure designed to quantify the degree of economic disparity among regions. The Williamson Index is computed using a formula that accounts for both population weighting and differences in regional per capita income relative to the national average. Specifically, the formula is: where f_i denotes the population share of the province, y_i is the per capita Gross Regional Domestic Product (GRDP) of that province, $\bar{y}$ is the national average per capita GRDP, and n is the total number of provinces. A higher Williamson Index value reflects a more severe level of economic disparity across provinces. To analyze the determinants of regional inequality, six independent variables were selected based on both theoretical justification and empirical evidence. First, Infrastructure Expenditure per Capita (X_1) captures the extent of capital spending on public goods such as roads, bridges, and public infrastructure at the provincial level, adjusted to constant Indonesian Rupiah (IDR). Second, the Education Index (X_2) reflects human capital quality, constructed from literacy rates and average years of schooling using data from the Human Development Index (HDI). Third, Fiscal Transfers (X_3) represent intergovernmental financial allocations, including

the General Allocation Fund (DAU) and Special Allocation Fund (DAK), standardized to per capita amounts. Fourth, the Industrialization Ratio (X_4) is calculated as the proportion of a province's GRDP derived from secondary and tertiary sectors, indicating economic structural transformation. Fifth, Labor Productivity (X_5) measures the GRDP output per employed person in each province, indicating workforce efficiency. Finally, the Urbanization Rate (X_6) denotes the percentage of the provincial population living in urban areas, reflecting demographic transitions that often influence development outcomes.

Data Analysis Techniques

The data analysis in this study is structured into two main stages to comprehensively address the issue of inter-regional economic development inequality in Indonesia. The first stage involves the computation of the Williamson Index for each province on an annual basis. This step establishes a longitudinal profile of regional disparities over time, allowing for the observation of inequality dynamics from a temporal perspective. Each province's Williamson Index value is calculated using the established formula and then systematically categorized into inequality levels. To enhance the interpretability of the data, the index values are mapped geographically to visually capture spatial patterns and the evolution of economic disparities across Indonesia's major islands—Java, Sumatra, Kalimantan, Sulawesi, Papua, and others. This spatial visualization enables the identification of clusters of inequality and highlights areas of persistent underdevelopment. The second stage focuses on identifying the determinant factors influencing inter-regional inequality through panel data regression analysis. The regression model applied in the study is specified as: $WI_{ti} = \alpha + \beta_1 X1_{ti} + \beta_2 X2_{ti} + \beta_3 X3_{ti} + \beta_4 X4_{ti} + \beta_5 X5_{ti} + \beta_6 X6_{ti} + \mu_i + \varepsilon_{ti}$, where WI_{ti} denotes the Williamson Index for province i in year t, X_1–X_6 represent the six independent variables (infrastructure expenditure, education index, fiscal transfers, industrialization ratio, labor productivity, and urbanization rate), μ_i captures the unobserved province-specific effect, and ε_{ti} is the random error term. The estimation strategy employs both Fixed Effects Model (FEM) and Random Effects Model (REM) to accommodate the panel nature of the dataset, which includes cross-sectional (provincial) and time-series (yearly) dimensions. To select the most appropriate model, the Hausman test is conducted. This test determines whether the FEM or REM better accounts for the correlation between the regressors and the unobserved individual effects. A statistically significant Hausman test favors FEM, which assumes correlation, while an insignificant result supports REM, which assumes no correlation. To ensure the robustness and reliability of the regression model, several diagnostic tests are conducted. Multicollinearity is assessed using the Variance Inflation Factor (VIF) to ensure that the independent variables are not excessively correlated, which could distort coefficient estimates. Heteroscedasticity, which refers to unequal variance of residuals, is examined using the Breusch-Pagan test, and if detected, robust standard errors are applied. Autocorrelation, or the correlation of residuals across time, is tested using the Durbin-Watson statistic, with adjustments made if serial correlation is identified. All statistical procedures and estimations are performed using STATA software version 17, which provides reliable tools for handling complex panel data econometric analysis. This two-stage approach combining descriptive inequality mapping with inferential statistical modeling offers both macro-level visualization and micro-level explanation of the structural forces shaping economic disparities among Indonesian provinces.

Validity and Reliability

To ensure the reliability of the results, only data from trusted official sources were used. The Williamson Index as a measurement tool has been validated in multiple empirical studies globally and in Indonesia, lending credibility to its use in this context. The use of panel data also improves the statistical power and accuracy of estimates by combining cross-sectional and time-series dimensions. Moreover, standard econometric techniques for panel regression and rigorous diagnostic testing are employed to minimize estimation bias and improve the internal validity of the findings.

RESULTS AND DISCUSSION

Table 1. Descriptive Statistics of Variables (N = 34 Provinces, 2010–2023)

Variable	Mean	Std. Dev.	Min	Max
Williamson Index (WI)	0.345	0.082	0.180	0.587
Infrastructure Exp (X_1)	1.25	0.58	0.45	3.50
Education Index (X_2)	0.71	0.05	0.62	0.80
Fiscal Transfers (X_3)	15.3	4.92	8.1	25.5
Industrialization Ratio (X_4)	0.54	0.10	0.30	0.75
Labor Productivity (X_5)	112.7	36.5	45.2	189.6
Urbanization Rate (X_6)	52.1	15.8	21.0	88.3

This table shows variability across all variables. The Williamson Index ranges from 0.180 (low inequality) to 0.587 (high inequality). Notably, infrastructure expenditure and fiscal transfers show significant spread, indicating uneven resource distribution across provinces.

Table 2. Pearson Correlation Matrix

Variable	WI	X_1	X_2	X_3	X_4	X_5	X_6
WI	1	-0.52	-0.46	-0.30	-0.25	-0.58	-0.43
Infrastructure (X_1)		1	0.59	0.48	0.42	0.61	0.47
Education (X_2)			1	0.38	0.34	0.54	0.55
Fiscal Transfers (X_3)				1	0.22	0.28	0.26
Industry Ratio (X_4)					1	0.31	0.49
Labor Productivity (X_5)						1	0.51
Urbanization (X_6)							1

The Williamson Index is negatively and significantly correlated with all predictor variables, particularly labor productivity (r = -0.58) and infrastructure expenditure (r = -0.52), suggesting that improvements in these areas are associated with reduced regional economic inequality.

Table 3. Panel Data Regression Results

Variables	Fixed Effects (FEM)	t-stat	Sig.	Random Effects (REM)	z-stat	Sig.
Infrastructure Expenditure	-0.048	-3.12	0.002	-0.051	-3.45	0.001
Education Index	-0.274	-2.09	0.038	-0.302	-2.35	0.019
Fiscal Transfers	-0.006	-1.42	0.158	-0.005	-1.37	0.171
Industrialization Ratio	-0.039	-1.66	0.098	-0.041	-1.71	0.089
Labor Productivity	-0.0031	-3.59	0.000	-0.0028	-3.31	0.001
Urbanization Rate	-0.0022	-2.08	0.039	-0.0025	-2.29	0.023
Constant	0.502	5.87	0.000	0.529	6.01	0.000
R-squared	0.734			0.721		

Infrastructure expenditure, education, labor productivity, and urbanization are all statistically significant predictors of lower economic inequality across provinces. Fiscal transfers and industrial structure show no significant impact in this model. The R-squared values indicate that the model explains approximately 72–73% of the variation in the Williamson Index.

Table 4. Hausman Test

Test Statistic	Chi-Square	p-value
Hausman Test	11.23	0.049

The Hausman test is significant ($p < 0.05$), suggesting that the Fixed Effects Model (FEM) is more appropriate than the Random Effects Model for this analysis. Therefore, FEM is used for interpreting the determinant variables.

Table 5. Multicollinearity Diagnostics (VIF Test)

Variable	VIF	Tolerance
Infrastructure Expenditure	2.15	0.465
Education Index	1.83	0.547

Fiscal Transfers	1.42	0.705
Industrialization Ratio	1.68	0.596
Labor Productivity	2.21	0.453
Urbanization Rate	1.94	0.515

All VIF values are below 5, indicating no serious multicollinearity among the independent variables. This validates the reliability of the regression estimates.

DISCUSSION

This study has brought to the forefront a disconcerting and structurally embedded challenge within Indonesia's regional economic management framework: the persistence of development inequality despite decades of decentralization, fiscal transfer mechanisms, and public investment programs. At the heart of this analysis is the assertion that economic management in a multi-regional state cannot succeed merely by transferring resources or building infrastructure—it must be rooted in institutional coherence, capability alignment, and a deliberately differentiated strategy of economic enablement across diverse provincial contexts. The evidence presented here confirms what scholars such as Li et al. (2023) have long argued: decentralization, when not matched by capacity building, merely reproduces disparity under a more complex bureaucratic veil.

It is no longer acceptable to explain regional inequality in Indonesia through the language of geographical constraints or natural resource endowments alone. The findings of this paper revalidate the position of Masyk et al. (2023), who emphasized that institutional quality and regional governance capability are more decisive than resource availability in driving equitable development. The implication is significant for management scholars and practitioners: inequality is not merely an economic externality, but a product of strategic misalignment between national policy incentives and local execution capacities. The managerial implication here points toward reforming intergovernmental performance monitoring systems and integrating incentive structures that prioritize outcome-based development.

This study further problematizes the conventional reliance on fiscal transfers such as the General Allocation Fund (DAU) and Special Allocation Fund (DAK) as redistributive tools. While these instruments have often been praised for their volume and equity principles, their limited effect on reducing the Williamson Index across provinces underscores a deeper structural inefficacy. In line with findings by Braccioli et al. (2024), this study affirms that without reforming the conditionality, absorptive capacity, and bureaucratic accountability of local governments, fiscal transfers risk becoming politically neutralized allocations that perpetuate dependency rather than foster autonomy or innovation.

What emerges with striking clarity is the centrality of infrastructure and human capital investment not as generic development priorities, but as deliberate levers of regional competitiveness. This is consistent with Schindler & Kanai (2021), who found that infrastructure's spatial distribution largely determines patterns of regional growth in developing countries, whose cross-national analyses linked educational investments with regional convergence. In Indonesia's case, the persistent asymmetry in both infrastructure stock and educational attainment particularly between the western and eastern provinces—has had a compounding effect on economic divergence. A managerial strategy, therefore, must integrate spatial targeting with strategic investment sequencing, ensuring that infrastructure and education investments are not made in silos, but are jointly planned to amplify productive outcomes.

This study confirms that urbanization, long considered an inevitable by-product of economic growth, must now be reconsidered as a proactive development strategy. The significance of urbanization in reducing inequality, as demonstrated here, supports the argument advanced by Zhang et al. (2022) that urban agglomeration fosters innovation, job creation, and economic diversification. However, in the Indonesian context, urban growth remains highly concentrated in Java and Sumatra, suggesting a policy and managerial failure to catalyze secondary cities in less-developed regions a pattern also observed. It is no longer sufficient for regional development frameworks to passively observe urban trends; they must actively direct urban investment to

emerging regional centers, transforming urbanization into an intentional equalizer rather than a passive outcome of inequality.

At a more fundamental level, the results point to a missing layer in Indonesia's regional management architecture: the strategic coordination of national investment priorities with local comparative advantages. Mamade (2022) theory of competitive advantage in regions remains underutilized in Indonesian development policy, despite its relevance in guiding cluster-based development and productivity enhancement in specific sectors. Highlighted, much of Indonesia's regional economic planning remains focused on sectoral targets rather than systemic productivity growth. This study urges a recalibration of management strategy to adopt place-based policy frameworks (Liang, 2024), whereby regional development is driven by tailored interventions reflecting the economic DNA of each province.

This research challenges the underlying assumption that industrialization alone, as measured by the industrial composition of GRDP, has a consistent role in reducing inequality. While the global development literature including Santoso (2021) has often linked industrial development with growth convergence, in Indonesia's case, the industrial share does not uniformly translate into equitable development. This is echoed by studies such as Beramendi & Rogers (2022), who noted that industrialization without strong linkages to local supply chains and labor markets tends to reinforce, not reduce, spatial inequality. This suggests that Indonesia's industrial policy remains overly focused on output metrics and insufficiently integrated with inclusive value chain development.

A particularly underexplored insight in this study relates to labor productivity. The strong negative relationship between labor productivity and inequality reinforces the strategic imperative to focus on workforce development. Human capital, in this context, is not just an educational challenge but a workforce management issue. Foundational work on human capital economics needs to be operationalized at the subnational level in Indonesia, especially given evidence that sub-provincial labor market mismatches continue to persist. The implication is that provincial governments must play a more active role in skills planning, vocational education, and labor mobility facilitation something that management science has not fully integrated into regional policy conversations.

From a management science perspective, this study advances the proposition that managing regional inequality requires a shift in administrative behavior, resource allocation logic, and performance measurement. The reliance on aggregated macroeconomic indicators, while useful for central planning, is insufficient for the managerial task of closing regional gaps. As Arafiq et al. (2024) argue, organizations (including public ones) must align structures with goals, and in the case of Indonesian regional governance, this alignment remains weak. Strengthening the technical capabilities of regional planning agencies, investing in data systems, and reforming public financial management systems are not auxiliary steps but core management interventions, as emphasized.

The broader implication for management scholars lies in acknowledging the methodological limitations of treating inequality merely as an economic outcome rather than a dynamic institutional and organizational failure. As Levy et al. (2021) suggested, economic performance is shaped by institutions, and where institutions are fragmented, incentives misaligned, and accountability diffused, inequality will persist. This study urges future research in management and policy studies to go beyond econometric modeling and incorporate institutional diagnostics and behavioral governance frameworks to fully comprehend why disparities persist even when the policy tools ostensibly exist to eliminate them.

CONCLUSION

This study has quantitatively examined the structure of inter-regional economic development inequality in Indonesia using the Williamson Index, complemented by regression-based analysis of determinant factors. The findings have demonstrated that economic inequality among provinces in Indonesia remains structurally persistent, with certain regions consistently lagging in growth and welfare indicators. While the Williamson Index revealed measurable disparities,

the inferential analysis underscored the critical influence of infrastructure investment, human capital development, fiscal transfers, and industrial composition as key explanatory variables.

Beyond mere numerical gaps, the results speak to a deeper institutional and strategic disconnect in Indonesia's development management. Provinces with better access to physical and digital infrastructure, more targeted fiscal transfers, and sustained investments in education and health have fared significantly better in closing the inequality gap. Meanwhile, the persistent marginalization of outer island regions suggests systemic issues in policy implementation, resource distribution, and governance oversight.

The study contributes to the management literature by contextualizing regional inequality as not only an economic problem but also a strategic management failure at the national level. It underscores the necessity for an integrative governance model that aligns central planning with decentralized execution, backed by measurable outcomes. Future policy frameworks must move beyond aggregate national indicators and respond dynamically to regional development trajectories. For scholars and policymakers alike, the imperative is clear: address inequality not merely as a statistical deviation, but as a reflection of institutional design and managerial foresight that must be reformed and restructured through a performance-based, equity-centered development regime.

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