Research Paper

The Impact of Urbanization on Income Inequality in Indonesia

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Received : Sept 27, 2025	Revised : Sept 30, 2025	Accepted : Sept 30, 2025	Online : October 14, 2025

Abstract

Urbanization is often assumed to increase inequality in the early stages of development, but the evidence for Indonesia is inconsistent due to interprovincial heterogeneity and spatial fragmentation. A major gap is the lack of studies that combine the dynamics of the cross-time panel with explicit spatial diagnostics. This study reassesses the impact of urbanization on income inequality in Indonesia by highlighting variations between regions and their spatial grouping patterns. We used 33 provincial balanced panel data from 2010–2023 (462 observations), Hausman test-based estimator selection, cross-dependency tests (Pesaran, Frees, Friedman), and descriptive spatial diagnostics: Moran's I annual, Moran scatterplot, and thematic maps. Concise statistics (mean Gini ~0.36; range ~0.23–0.45) were examined to uncover hidden heterogeneities, while distance-based weight matrices were critically evaluated against the archipelago context. The main results show that urbanization has no significant effect nationally on inequality, indicating that national urbanization masks local variations. Cross-dependencies appear unevenly: Frees indicates a strong correlation across sub-clusters, while global sizes are weaker, reflecting fragmented economic integration. Moran's I increased to a peak around 2018 and remained significant into 2023, signaling persistent spatial polarization. Moran scatterplots reveal High–High clusters (e.g. DKI–West Java–DIY), Low–Low (e.g., North Maluku–NTT–West Papua), as well as High–Low outliers (e.g. Aceh, Papua), which is in harmony with the symptoms of the resource curse. The contribution of this study is a panel–spatial integrated reading framework that revises the illusion of urbanization homogeneity, and guides regional-based policy recommendations: strengthening inter-island connectivity, medium-sized urban development, and cluster-sensitive intervention design.

Keywords: *Income Inequality, Urbanization.*

INTRODUCTION

Indonesia's rapid, uneven urbanization and persistent income inequality are complicated by fragmented research across periods, methods, and indicators. Many studies overlook cross-provincial dependencies and domestic shocks, with minimal treatment of heteroscedasticity, autocorrelation, and spatial correlation, making causal conclusions fragile. Variations in urbanization indicators hinder comparability. This study addresses these gaps by analyzing 33 provinces within the frameworks of Kuznets, dual economics, and new economic geography, aiming to provide measurable, transparent, policy-relevant insights for updating evidence and informing policy discourse. This study's novelty is a methodology combining static and dynamic panel estimations with strong inferential corrections. We use OLS, fixed and random effects with Driscoll–Kraay standard deviations to handle heteroscedasticity, autocorrelation, and cross-sectional dependencies. Additionally, a pooled mean group approach separates short- and long-term effects and tests implicit cointegration. The data span 2010–2023, capturing periods of fiscal decentralization, digital transformation, and shocks like pandemics. The model includes the interaction of initial inequality with GDP per capita to see if growth is pro-inequality or inequality-reductive. Controls include export share, public spending, education, and agricultural share, reflecting trade, fiscal, human capital, and sectoral factors. Robustness checks and data

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completeness address potential panel imbalances, reducing bias and enhancing external validity at the provincial level. These methods help identify policy thresholds for inclusive urbanization. The study offers current, robust evidence for policy development.

LITERATURE REVIEW

Income inequality denotes the uneven distribution of income among individuals or households, often viewed as injustice when high-income groups control a disproportionate share of wealth (Todaro, 1989). It can be measured using various indicators such as the Lorenz curve, Gini coefficient, and entropy indices like Theil, with this study choosing the Gini coefficient for its conciseness and comparability across regions and time. Nonetheless, these measures have sensitivities related to specific distribution segments and data sources. Urbanization, encompassing demographic, social, and economic shifts associated with urban growth and migration, is typically measured by the proportion of the population living in urban areas (Dodman et al., 2017). Different metrics, including population density and night light proxies, capture various aspects of urbanization; this study uses the share of urban population for consistency across provinces..

Economic models differentiate between urban and rural areas by analyzing four key elements: urbanization level, urban–rural income gap, intra-urban inequality, and intra-rural inequality. Kuznets (1955) proposed an inverse U-shaped relationship between development and inequality, suggesting that early development increases inequality due to labor shifts from agriculture to high-productivity sectors, while later stages see a reduction as development benefits, public services, and redistributive policies expand. Urbanization acts both as a consequence and driver of structural change, often coupled with rising inequality, as cities attract industrial and skilled labor, creating higher wages and productivity but also widening spatial and intracity disparities, especially when infrastructure lags. These effects are mediated by factors like skill-based migrant selection, labor market segmentation, and unequal access to social services. Ultimately, the impact of urbanization on inequality varies with development stages, institutional capacity, public policy quality, and local economic structures.

Cross-country and cross-time research reveals significant heterogeneity in the relationship between urbanization and inequality. Kanbur and Zhuang (2013) found that urbanization's contribution to inequality varied across Asian countries, being positive and substantial in the Philippines, moderate in Indonesia, small in India, and negative in China, influenced by factors such as the urban-rural gap and intra-group disparities. In Indonesia, (Zhao & Liu, 2022) identified an inverted U-shaped relationship between urbanization and provincial inequality. Conversely, Maket et al. (2023) reported a U-shaped pattern globally, highlighting how definitions, indicators, and context influence results. Additionally, structural factors like land tenure inequality and risks of overurbanization also shape these dynamics, emphasizing the need for nuanced policy considerations tailored to regional heterogeneity.

Building on Kuznets' theory, dual economics, and economic geography, this study examines urbanization as a driver of inequality through channels such as inter-sectoral labor transitions, urban productivity gains, wage and skill changes, and access to public services. It incorporates non-linear effects by including squared terms of GDP per capita and urbanization, alongside control variables like export share, public spending, human capital, and agricultural share. The interaction between initial inequality and economic growth further explores whether growth impacts inequality differently depending on initial distribution. Methodologically, the study updates Indonesian data from 2010 to 2023 using various panel estimators, OLS, FE, RE, Driscoll–Kraay, and dynamic pooled mean groups, to robustly analyze short- and long-term effects, aiming to provide a clearer understanding of how urbanization influences income inequality and inform policy.

RESEARCH METHOD

This study employs a quantitative approach using provincial panel data from 33 Indonesian provinces from 2010 to 2023 to examine urbanization's impact on income inequality, measured by the Gini coefficient. Data were sourced from the Central Statistics Agency and relevant provincial agencies. Variable selection and model design were guided by literature, with urbanization defined as the proportion of urban residents, and macroeconomic variables including GDP per capita and its square to capture potential nonlinear relationships. Additionally, the study investigates how initial inequality moderates the effect on inequality through interaction terms. Control variables include: the share of exports to provincial GDP (*rEXP*), public spending to provincial GDP (*rGOV*), enrollees/high school students as a proportion of the province's average population (*rEDU*) as a proxy for human capital, and the share of the agricultural sector to GDP (*rAGR*). Based on the theory and previous findings, the expected coefficient signs are: (+), (+), and ^{2} (–) to form an inverse U-curve, (–), (–), (–), (–), and (–); The signs on the interaction are empirical. Formally, the estimated quantitative model can be summarized as follows:

$$:INEQGRDPpcGRDPpc^2InitialINEQ \times$$
$$GRDPpcrEXPrEDUrAGRURBGRDPpcGRDPpcrEXPrGOVrEDUrAGRInitialINEQ \times GRDPpc$$
$$INEQ_{itu} = \alpha + \beta 1\, URB_{itu} + \beta 2\, GRDPpc_{itu} + \beta 3\, GRDPpc\_sq_{itu} +$$
$$\beta 4\, initialINEQGRDPpc_{itu} + \beta 5\, rEXP_{itu} + \beta 6\, rGOV_{itu} + \beta 7\, rEDU_{itu} + \beta 8\, rAGR_{itu} + \varepsilon_{itu}$$

With i denoting province and t denoting time. This specification allows for the separation of the influence of urbanization from other structural factors relevant to income distribution.

The estimation combines static and dynamic panel models to ensure robustness, utilizing pooled OLS, fixed effects, and random effects based on theoretical considerations and Hausman tests to account for cross-sectional and temporal variations while controlling for unobserved heterogeneity at the provincial level. To address heteroscedasticity, autocorrelation, and cross-sectional dependencies common in regional data, Driscoll–Kraay standard deviation corrections are applied. Additionally, a pooled mean group (PMG) approach captures short-term dynamics and long-term relationships, enhancing inference reliability. Covering 2010–2023, the dataset comprises 378 observations from an unbalanced panel of 33 provinces due to data limitations, with data cleansing ensuring validity. Estimation results report coefficients, corrected standard deviations, and significance levels, emphasizing theoretical consistency, effect stability, and policy relevance.

FINDINGS AND DISCUSSION

Indonesia exhibits a paradoxical pattern of income inequality across its provinces. Despite a relatively stable national Gini coefficient averaging around 0.36 from 2010 to 2023 and a low coefficient of variation (~11%), the province-level data reveal substantial heterogeneity, with values spanning from approximately 0.23 to 0.45, comparable to the disparity between Norway and Brazil. For instance, in March 2025, Jakarta's Gini ratio is projected to reach 0.441, the highest in the country, whereas Bangka Belitung's is 0.222, below the national average of 0.375 (BPS, 2025). This diversity underscores Indonesia's internal divergence, effectively comprising multiple 'countries' with varying income distributions, where some provinces resemble developed economies with high disparities, and others are more evenly distributed due to lagging development (Kurniawan et al., 2019).

Variable	Obs	Mean	Std. dev.	Min	Max
province	0				
year	462	2016.5	4.035499	2010	2023
inequality	462	.3598864	.039886	.236	.453
urban	462	738.5649	2632.478	8	16158
grdp	462	3.85e+07	3.03e+07	9316790	1.92e+08
export	462	.5154833	.3689945	.0546783	4.651123
govtt	462	.0400328	.0306185	.0082457	.1883832
educ	462	.0873131	1.400698	.0047049	30.12869
agr	462	.1963327	.0960463	.0007	.4357

Figure 2. Description of Statistics
Source: Processed by researcher, 2025.

The urbanization rate in Indonesia reveals a highly fragmented economic landscape, with significant disparities between provinces. Jakarta is nearly fully urbanized, whereas provinces like Papua and East Nusa Tenggara have less than 30% urbanization (Jones & Mulyana, 2015). The national average of around 56–58% masks this heterogeneity, with urban populations heavily concentrated in Java and major cities, leaving many provinces predominantly rural. This variability affects the relationship between urbanization and inequality. Nationally, urban areas exhibit higher inequality (Gini ~0.399) than rural regions (~0.306), suggesting that urbanization's impact on inequality varies regionally, widening income gaps in developed provinces but having a limited effect in disadvantaged areas where migration does not necessarily improve welfare (Wan et al., 2022).

	---- Coefficients ----			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
export	.0005211	.000487	.0000341	.0001072
govtt	.0164714	.0130649	.0034065	.0030842
educ	-.0000686	-.0000589	-9.64e-06	7.45e-06
agr	-.0035014	-.005852	.0023506	.0050341
ln_urban	-.0036544	.0000698	-.0037243	.0017081
ln_grdp	-.3512948	-.3531075	.0018127	.0011865
ln_initial~p	.3515933	.3525716	-.0009783	.0008188

b = Consistent under H0 and Ha; obtained from xtreg.
B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 5.71
Prob > chi2 = 0.5745

Figure 2. Hausmann Test FE vs RE
Source: Processed by researcher, 2025.

Empirical analysis using provincial panel data indicates that regional characteristics, such as culture or institutions, do not significantly influence the determinants of inequality (Lastuti & Khoirunurrofik, 2022) as evidenced by the Hausman test favoring the Random Effects model (chi-square 5.71, p=0.57). The minimal difference (<7%) in regression coefficients between Fixed and Random Effects models suggests similar effects across provinces, likely due to the centralization of economic development and limited policy differentiation, resulting in parallel trajectories of provincial inequality and homogenous development patterns. This implies that national policies tend to produce uniform regional economic outcomes regardless of regional autonomy (Rothenberg et al., 2025).

inequality	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
export	.00049	.00043	1.14	.25252	-.00035	.00132	
govtt	.01306	.0057	2.29	.02189	.00189	.02424	**
educ	-.00006	.00001	-10.79	0	-.00007	-.00005	***
agr	-.00585	.00502	-1.17	.24376	-.01569	.00399	
ln_urban	.00007	.00028	0.25	.8005	-.00047	.00061	
ln_grdp	-.35311	.00636	-55.50	0	-.36558	-.34064	***
ln_initialgrdp	.35257	.00616	57.20	0	.34049	.36465	***
Constant	.73169	.01818	40.25	0	.69607	.76732	***

Mean dependent var	0.360	SD dependent var	0.040
Overall r-squared	0.995	Number of obs	462
Chi-square	257712.103	Prob > chi2	0.000
R-squared within	0.990	R-squared between	0.996

*** p<.01, ** p<.05, * p<.1

Pesaran's test of cross sectional independence = 1.078, Pr = 0.2808
Average absolute value of the off-diagonal elements = 0.334
Friedman's test of cross sectional independence = 19.739, Pr = 0.9556

Figure 3. Random Effect
Source: Processed by researcher, 2025.

Although Table 2 suggests homogeneity, spatial dependency analysis reveals Indonesia's economic fragmentation. While Frees' test indicates strong cross-sectional dependence, the Pesaran and Friedman's tests do not support significant global dependencies, highlighting uneven economic linkages, particularly strong correlations within Java and its surroundings versus relative isolation elsewhere. The average interprovincial income correlation of 33.4% is low compared to European regional blocs, implying that a uniform national policy may be less effective due to provincial disparities (Usman, 2002). These findings underscore the need for regionally tailored development strategies over a one-size-fits-all approach.

Weighting matrix Wdis_panel

Type	idistance
Normalization	row
Dimension	33 x 33
Elements	
minimum	0
minimum > 0	.0383117
mean	.030303
max	1

Figure 4. Weighting Matrix
Source: Processed by researcher, 2025.

The reliance on a Euclidean distance-based spatial weight matrix highlights the limited and often misleading perception of geographical proximity in Indonesia, an archipelagic nation where

physical distance does not necessarily equate to economic connectivity (Harahap et al., 2025). While nearby provinces like those in Java are closely linked, distant regions such as Sumatra and Kalimantan exhibit weak interactions despite their relative closeness geographically. This disparity indicates that core regions dominate spatial integration, leaving much of the country economically disconnected.

Table 5. Moran's I

The results :

Moran's I (varname : inequality) Number of obs = 462
Group variable: _ID Number of groups = 33
Time variable: year Panel length = 14

year	I	E(I)	Sd(I)	Z	P-value
2010	0.2626	-0.0312	0.1055	2.7845	0.0054
2011	0.0327	-0.0312	0.1053	0.6071	0.5438
2012	0.1194	-0.0312	0.1053	1.4304	0.1526
2013	0.1250	-0.0312	0.1059	1.4752	0.1402
2014	0.1198	-0.0312	0.1059	1.4263	0.1538
2015	0.2241	-0.0312	0.1049	2.4349	0.0149
2016	0.2603	-0.0312	0.1049	2.7783	0.0055
2017	0.3031	-0.0312	0.1060	3.1541	0.0016
2018	0.3327	-0.0312	0.1047	3.4764	0.0005
2019	0.3221	-0.0312	0.1053	3.3553	0.0008
2020	0.3148	-0.0312	0.1048	3.3031	0.0010
2021	0.3114	-0.0312	0.1050	3.2630	0.0011
2022	0.2678	-0.0312	0.1047	2.8555	0.0043
2023	0.2779	-0.0312	0.1047	2.9533	0.0031

*2-tail test

Source: Processed by researcher, 2025.

Moran's I indicator reveals a rising trend of spatial income inequality across Indonesian provinces, increasing from 0.26 in 2010 to 0.33 in 2018, an approximate 26% rise ($p < 0.01$), suggesting growing clustering of similar income levels. Notably, the acceleration occurred around 2015–2018, coinciding with large-scale infrastructure efforts under President Joko Widodo, which ostensibly aimed to reduce regional disparities (Mulyani et al., 2023). However, the data indicate that infrastructure may have predominantly benefited already developed regions like Java and southern Sumatra, thus reinforcing existing inequalities rather than alleviating them. Although Moran's I decreased slightly to ~0.28 in 2023, this likely reflects a saturation point rather than genuine convergence. Overall, the persistent and significant high Moran's I underscores that spatial income inequality has become a lasting feature of Indonesia's economy over the past decade.

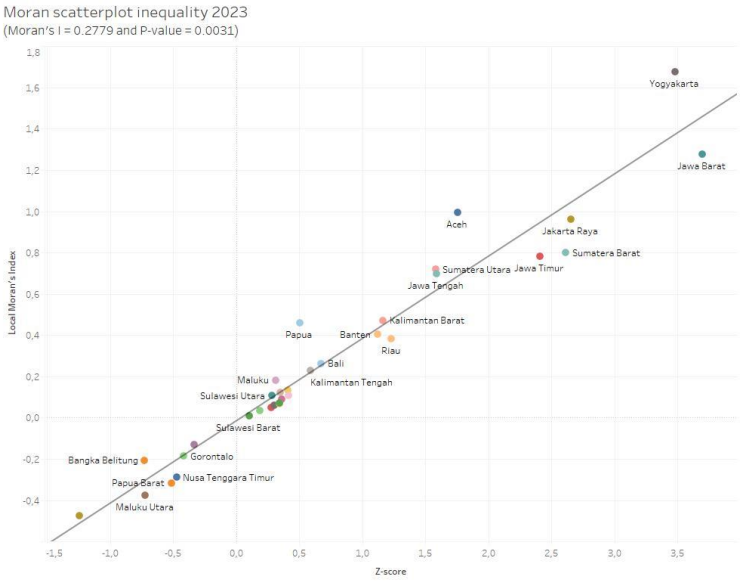

Figure 1. Moran Scatter Plot
Source: Processed by researcher, 2025.

The Moran Scatterplot analysis reveals that regions with high GDP per capita, such as Jakarta, West Java, and Yogyakarta, exhibit significant income inequality, challenging the notion that high economic development correlates with equality. Notably, Yogyakarta, despite its intermediate economic status, has remained the most unequal province for years, highlighting that inequality is not confined to industrial centers but can also occur in service- and education-based economies (Muhammad & Pudjihardjo, 2025). Structural factors like sectoral concentration and economic dualism contribute to these disparities, indicating that economic progress does not benefit all residents equally (Barbier, 2013).

The Low-Low quadrant of the scatterplot shows provinces with low inequality, such as North Maluku, East Nusa Tenggara, and West Papua, which often record Gini ratios below 0.30. While a low Gini coefficient suggests income distribution is relatively even, in this context, it mainly indicates widespread poverty, with these provinces among the poorest nationally; NTT's poverty rate is near 20%. This equality in poverty reflects a lack of economic development rather than success, as true progress requires economic growth that elevates welfare without increasing inequality (Corlet et al., 2021). Thus, a low Gini ratio can be misleading, signaling income uniformity at the subsistence level rather than desirable economic conditions.

The scatterplot reveals outliers in Quadrant IV (High-Low), notably Aceh and Papua, which exhibit high inequality amid surrounding less-unequal regions. Aceh, with Gini coefficients exceeding 0.40, and Papua, with similar levels, exemplify the resource curse, where resource-rich areas experience stark internal inequality without fostering regional prosperity (Chen et al., 2025). Despite substantial autonomy funds and resource wealth, these regions' economic enclaves benefit a few, leaving most residents behind. Central government transfers, even large-scale disbursements post-conflict, have failed to structurally reduce inequality, highlighting governance issues such as weak institutional capacity and lack of accountability that hinder effective redistribution (Baker, 2023).

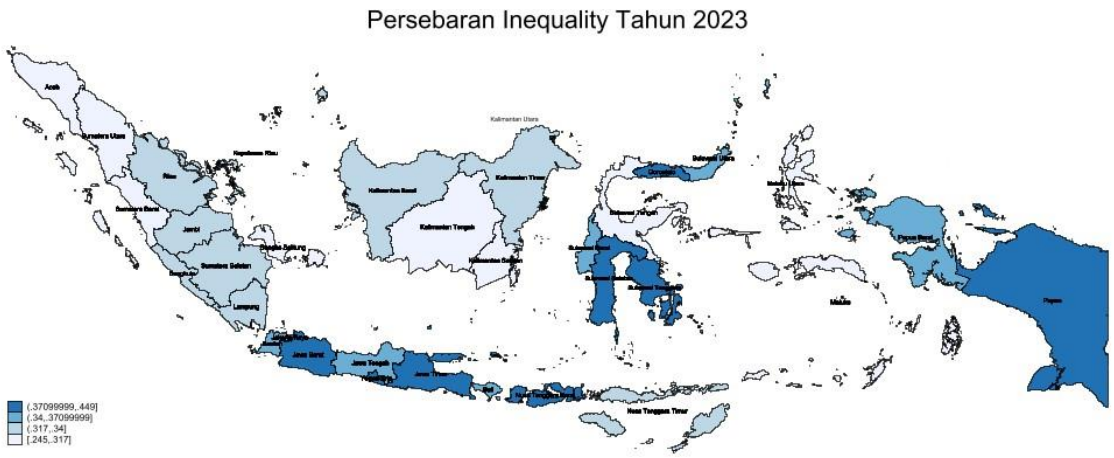

Figure 2. The Spread of Inequality in Indonesia
Source: Processed by researcher, 2025.

The regional inequality map reveals a polarized pattern with high inequality (Gini > 0.40) concentrated in two poles: Java (including DIY in Central Java) in the west and Papua in the east. An inequality belt exists in central Java, while Papua contrasts with natural resource wealth and high inequality. This bipolar distribution reflects colonial economic structures, Java as an administrative hub with internal disparities, and resource-rich outer islands as peripheries. Most provinces cluster outside the middle Gini range (0.35–0.37), indicating a polarization of inequality levels, akin to the erosion of a middle class. This pattern poses challenges for policymakers, who must tailor interventions, redistribution for highly unequal provinces, and growth stimuli for more egalitarian, lower-income regions.

CONCLUSIONS

This study analyzes income inequality in Indonesia from 2010 to 2023 across 33 provinces, revealing significant regional heterogeneity and spatial polarization, particularly in Java and isolated provinces. Spatial analyses using Moran's I and cluster mapping show increasing geographic concentration of similar inequality levels, evident in distinct High–High and Low–Low clusters, and notable segregation, such as resource curse effects without spillover. The findings also highlight a "bipolar' inequality pattern and the decline of middle-class provinces, emphasizing that a uniform national policy may be ineffective. Instead, context-specific regional strategies, enhancing inter-island connectivity, and developing medium-sized cities are recommended. The research's contribution lies in combining panel data with spatial visualization to uncover hidden heterogeneity, though future work should refine spatial weights and analyze more granular geographic data to monitor polarization trends and policy impacts better.

LIMITATIONS & FURTHER RESEARCH

This study has several limitations that open avenues for further research. First, data gaps and inconsistencies across provinces may affect result accuracy; future studies should use more detailed district- or household-level data. Second, the model mainly covers macroeconomic variables, omitting institutional and social factors such as governance, digital access, and labor informality that may influence inequality. Third, the spatial analysis relies on Euclidean distance, which may not fully represent Indonesia’s archipelagic connectivity; alternative economic or network-based spatial weights are recommended. Fourth, although robust estimations were applied, the analysis remains correlational, not causal. Future research could apply instrumental or longitudinal models to strengthen inference. Finally, deeper mixed-method or regional case studies

are needed to explain the mechanisms behind inequality patterns and assess how technological and policy changes shape regional disparities.

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