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ANALYSIS OF INCOME INEQUALITY AND CORRUPTION IN INDONESIA

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Abstract*:* This research analyzes the relationship between income inequality and corruption in Indonesia, considering the influence of economic factors and the spatial dimensions between regions. Secondary panel data from 34 provinces for the 2017–2022 period were used, including government expenditure, per capita GDP, domestic direct investment (DDI), poverty ratio, Gini Ratio, and the Integrity Assessment Survey (IAS) as a proxy for the level of corruption. The methods used include the Granger causality test, spatial panel data regression, and spatial autocorrelation analysis with Moran's I and Local Indicator of Spatial Association (LISA). The research results show a two-way causal relationship between DDI and the poverty ratio, between corruption and per capita GDP, and between corruption and DDI. The Spatial Error Model (SEM) test reveals that per capita income, DDI, and the poverty ratio have a significant effect on income inequality, while in the corruption model, only DDI is significant. The Moran's I and LISA tests found that income inequality and corruption in Indonesia have a spatial pattern that tends to form clusters, both High-High and Low-Low, in certain regions. These findings indicate that policies for reducing inequality and eradicating corruption need to consider the spatial linkages between provinces to be more effective and equitable.

Keywords: Income inequality, Corruption, Spatial Regression, Domestic Direct Investment
JEL classification: D63, K42, O15

1. INTRODUCTION

The phenomena of corruption and income inequality are two interconnected structural issues that have long been major challenges in the economic development of developing countries, including Indonesia. Income inequality reflects an uneven distribution of economic resources among different segments of society, while corruption indicates weak institutions and governance (Wibowo, 2017). The two mutually influence each other and form a vicious cycle that hinders inclusive economic growth and social justice (Hellman & Kaufmann, 2001). Income inequality has been a focus in macroeconomic studies because it not only impacts people's purchasing power and social stability but is also closely related to the emergence of corruption (Dabla-norris & Kochhar, 2015). In Indonesia, although the Gross Regional Domestic Product (GRDP) per capita has continued to increase in recent years, the equitable distribution of development outcomes has not yet been fully achieved.

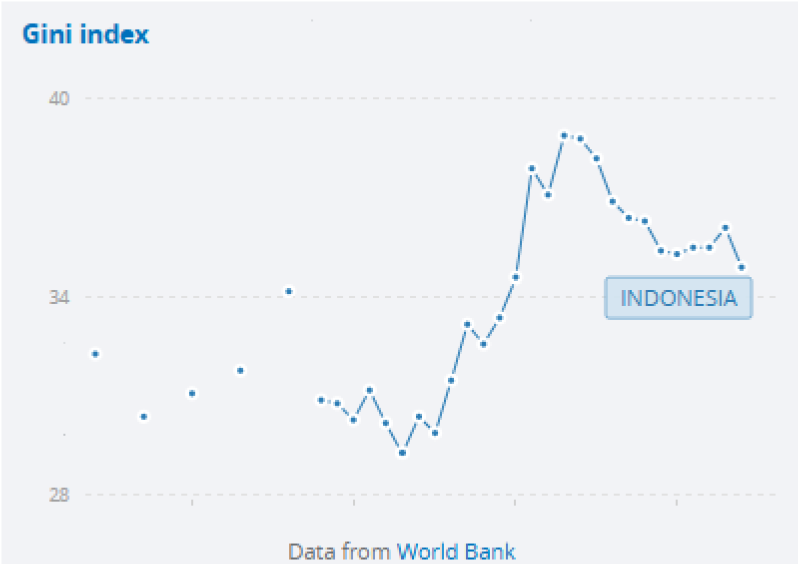


Figure 1.1 *Indonesia Gini Ratio*
Source : (BPS, 2025a)

Income inequality remains high, as reflected by the relatively high Gini Ratio Index (see Figure 1.1), which shows that poverty is still widespread and indicates that the benefits of growth have not fully reached the most vulnerable groups. In such conditions, corruption can more easily take root, especially when the government fails to allocate the budget fairly and efficiently. Government expenditure is also a fiscal policy instrument used to promote economic growth and equitable welfare. However, in practice, the allocation of public funds often becomes a source of corruption, especially in infrastructure projects. When governance is weak, government spending can become fertile ground for deviations and self-enrichment by unscrupulous officials.

Domestic Direct Investment (PMDN) also plays a crucial role in shaping the economic structure of a region. However, the disparity between regions in receiving investment flows contributes to economic inequality. Areas with good infrastructure and clean governance tend to be more attractive to investors, unlike regions with corruption and lagging infrastructure (OECD, 2023). This spatial inequality exacerbates the welfare gap between regions and can, in the long run, strengthen oligarchic structures, leading to rent-seeking practices. Additionally, the persistently high number of poor people on various islands in Indonesia indicates that development has not reached all segments of society (BPS, 2024b). The poor generally have limited access to education and information, and are weak in their ability to demand accountability from public officials. In such conditions, corruption becomes difficult to eradicate due to a lack of pressure from the bottom, while the economic incentives for the elite to maintain the status quo remain strong (Goudie & Stasavage, 1997).

The level of corruption is proven to correlate with several variables such as GDP per capita, urbanization rate, and dependency on natural resources. Countries with high urbanization rates and GDP per capita tend to have lower levels of corruption, while countries with a socialist legal heritage and a dependency on natural resources experience higher levels of corruption (Akçay, 2006). Corruption is not just a socio-political symptom but also a product of economic structures and institutional history.

However, corruption does not always exist in isolation within a single administrative boundary. Existing research indicates that corruption also has a spatial dimension, tending to spread to neighboring countries or regions through historical channels (Goel & Nelson, 2010).. In this respect, geographically close countries or regions tend to exhibit similar patterns of corruption. This can be attributed to shared individual and institutional characteristics (Meyer et al., 2025). The concept of corruption contagion becomes highly relevant. Anti-corruption policies must consider the type and primary source of corruption itself. Regarding causality, research by Huang, (2013) highlights a two-way relationship between income inequality and corruption. High-income inequality creates opportunities and incentives for the wealthy to engage in corruption to maintain or increase their wealth (Gupta, 1998). However, corruption also weakens the state's capacity to distribute resources fairly, worsening poverty and widening the inequality gap (Ongo Nkoa & Song, 2022).. In this situation, the poor are not only direct victims of corruption but also face limited access to justice and public services. This makes corruption both a driver and a product of economic inequality.

Based on this, the research is important to examine how variables such as government expenditure, GRDP per capita, DDI, the ratio of poor people, and income inequality can directly or indirectly influence the level of corruption. Additionally, it aims to analyze whether there are patterns of inequality and corruption contagion among regions in Indonesia, and how social and institutional structures contribute to this situation. By using Granger causality analysis, this research is expected to contribute to understanding the structural roots of corruption and formulating more inclusive and deviation-free development policies.

2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

2.1. Income Inequality

Income inequality is a complex economic and social issue influenced by global dynamics, domestic policies, and a country's socio-economic structure. Classical theories, such as the Kuznets Curve, suggest that inequality tends to rise during the early stages of development and then decline as the economy matures (Martínez-Navarro et al., 2020). However, contemporary literature, such as that by Secilmis, (2015), emphasizes that inequality can actually slow down economic growth. In addition, research by Sepúlveda et al., (2022) highlights the influence of social structures, systemic exclusion, and global systems in producing and reproducing income inequality, including through education systems, global capitalism, and the distribution of power. High inequality not only hinders growth but also increases the potential for social conflict and reduces social mobility (Albert & Hilmermeier, 2004). Inequality is measured using tools like the Gini Ratio, the Lorenz Curve, and the Theil Index. The Lorenz Curve illustrates the relationship between the percentage of the population and the income they receive, with the degree of curvature indicating the level of inequality (Sitthiyot & Holasut, 2021). The Gini Ratio is calculated from the deviation between the line of perfect equality and the actual income distribution curve, with a value ranging from 0 (perfect equality) to 1 (perfect inequality) (Luptáčik & Nežinský, 2020). Studies by the IMF and the World Bank show that an increase in the income of the rich actually slows down growth, while an increase in the income of the poor accelerates it (Bourguignon, 2004; Dabla-norris & Kochhar, 2015).

2.2.Corruption

Corruption is a complex phenomenon that has attracted widespread attention in economic studies since the mid-1990s, especially due to its impact on the quality of institutions, efficiency of resource allocation, and economic growth (Abed & Gupta, 2002). Research shows that corruption is closely related to weak governance, income inequality, and the low effectiveness of public spending, education, and healthcare (Naher et al., 2020). Although there is a view that corruption can accelerate bureaucratic processes, most literature confirms that corruption has a negative impact on productivity and investment, increases intra- and inter-generational inequality, and weakens institutional structures (Lecuna et al., 2020). Factors such as personal greed, inefficient regulations, and a lack of transparency are the main drivers of corrupt practices, which ultimately lead to distortions in economic growth and macro efficiency (Mazaraki et al., 2023). In an effort to measure and control corruption, various indicators have been used, including the Corruption Perception Index (CPI), the Anti-Corruption Perception Index (ACPI), and the Integrity Assessment Survey (IAS). Empirical evidence shows that corruption affects macroeconomic variables such as GDP, inflation, foreign direct investment, and the efficiency of state spending (Nguyen et al., 2021).

2.3.Integrity Assesment Survey

The Integrity Assessment Survey (IAS) is a tool developed by the Corruption Eradication Commission (KPK) to map corruption risks and evaluate the progress of corruption prevention efforts at the ministry, institutional, and regional government levels throughout Indonesia (KPK, 2025b). The survey uses a score scale from 1 to 100, where the higher an entity's integrity score, the better its resilience to corrupt practices (Dewantara Susilo et al., 2019). The IAS not only measures internal perceptions but also reflects the external perceptions of stakeholders who interact directly with the assessed institution (MK, 2025). The IAS includes seven main indicators that are systematically assessed: transparency, human resource management, budget management, integrity in task execution, trading in influence practices, procurement management, and anti-corruption socialization (Kemenkes, 2023). These indicators were chosen to reflect key dimensions in public governance that are vulnerable to corruption.

2.4.Corruption Perception Index

In addition to the Integrity Assessment Survey (IAS) which is used to assess the level of corruption at the organizational level such as ministries, institutions, and regional governments, there is also the Corruption Perception Index (CPI), which is used internationally to measure the perception of corruption at the country level. The fundamental difference between the IAS and the CPI lies in their scope and object of measurement. The IAS highlights the dimension of internal integrity of government agencies within the country, while the CPI reflects the perception of the global public and stakeholders regarding the level of corruption in a country's public sector as a whole (Suyatmiko & Ratnaningtyas, 2019). The CPI is an important indicator that shows the reputation of a country's public sector governance in the eyes of the world. Indonesia's CPI score in 2024 was recorded at 37 out of a scale of 100, which ranked it 99th out of 180 countries (KPK, 2025a).

Table 2.1 Corruption Perception Index Scoring

Perception Score	Corruption Perception Score	CPI Conversion Interval	Service Quality	Unit Performance
1	1.00-1.75	25.00 - 43.75	D	Not free from corruption
2	1.76-2.50	43.76 - 62.50	C	Less free from corruption
3	2.51-3.25	62.51 - 81.25	B	Fairly free from corruption
4	3.26-4.00	81.26 - 100.00	A	Free from corruption

Source : Transparancy International, (2025)

CPI scores are converted into four categories of service quality and performance (see Table 2.1): D (not free from corruption), C (less free), B (fairly free), and A (free from corruption) Suyatmiko, 2025). The higher the CPI score, the better a country's anti-corruption image, which is not only a source of national pride but also reflects a commitment to clean, transparent, and accountable governance.

2.5.Anti-Corruption Perception Index

The Anti-Corruption Perception Index (ACPI) is a measuring tool used to determine the level of public understanding and experience with anti-corruption principles (MK, 2021). The ACPI is based on a survey that evaluates the public's perception and direct experience with two types of corruption, namely petty corruption and grand corruption (BPS, 2024a). The actions included in this category are bribery and extortion that occur in the social environment. The ACPI is a complement to the system for measuring the success rate of corruption eradication in Indonesia. The three types of indexes used, the CPI, IAS, and ACPI, have different but complementary measurement objects (KPK, 2022). At the macro level, the CPI is used to measure the level of corruption at the country level. At the organizational level, especially ministries, institutions, and regional governments, the Integrity Assessment Survey (IAS) is used. Meanwhile, the ACPI is used to capture perceptions at the individual level as part of the general public (KPK, 2022). With this multi-level approach, the measurement of corruption in Indonesia becomes more comprehensive and can be used as a proxy to describe the level of integrity and effectiveness of anti-corruption efforts at every level of government and society.

2.6.Government Expenditure

Government expenditure is a key instrument in fiscal policy to encourage economic growth, reduce income inequality, and provide public goods and services (Muinelo-Gallo & Roca-Sagalés, 2013). Keynesian theory emphasizes that government intervention through spending can increase aggregate demand, create jobs, and reduce poverty (Jumayeva, 2025). The government not only incurs routine expenditures such as employee salaries, subsidies, and operational costs but also development expenditures to improve infrastructure and public services. According to Musgrave, the government has four main roles in the economy: allocative, distributive, stabilization, and dynamic (Dumairy, 1997). The structure of government expenditure is also regulated in detail in APBN/APBD documents in accordance with statutory provisions and is categorized into operational, capital, and transfer expenditures (Dumairy, 1997). Several classical theories also explain the growth of government expenditure along with economic development. Wagner argued that government expenditure would increase relative to per capita income growth as a consequence of industrialization and societal demands (Bazán et al., 2022). Peacock and Wiseman added that the increase in government spending occurs gradually, triggered by crises or wars, and does not return to previous levels after the crisis ends (displacement effect) (Peacock & Wiseman, 1961). Government expenditure is not just seen as a fiscal figure but as a relationship between public needs, government capabilities, and economic dynamics.

2.7.Gross Domestic Product

Gross Domestic Product (GDP) per capita is a key indicator used to measure the level of prosperity of a region by dividing the total economic output (GDP) by the number of inhabitants (Nolan et al., 2019). GDP per capita reflects the average productivity and purchasing power of individuals, and it is used as a standard measure to assess economic growth and development. In the context of inequality and poverty (UN, 2007), a high GDP per capita does not always indicate an even distribution of income, because non-inclusive economic growth can widen the gap and trigger social exclusion (Scognamillo et al., 2016). Previous studies show that an increase in GDP per capita tends to reduce the absolute level of poverty, but its impact on inequality depends on the economic structure and redistribution policies implemented diterapkan (Lakner et al., 2022; Michálek & Výbošťok, 2019; Scognamillo et al., 2016).

2.8.Investment Theory

Investment theory in the context of Domestic Direct Investment (DDI) emphasizes that investment plays a crucial role in driving economic growth by increasing production capacity, creating jobs, and strengthening national income (Verbivska et al., 2024). DDI is a form of investment that uses capital from within the country and is carried out by Indonesian citizens or business entities (Soegoto et al., 2022). Investment, both domestic and foreign, not only strengthens the domestic economic structure but also has social benefits such as poverty and inequality reduction (Cook, 2006).. In the long term, investment will have a positive impact on economic growth if accompanied by the strengthening of human capital, technology, and institutions (Ngqoleka et al., 2025; Surya et al., 2021).

2.9.Poverty

Poverty is a multidimensional condition that reflects the inability of individuals or households to meet basic living needs such as food, clothing, and shelter (Adji et al., 2020). This definition varies, ranging from measurements based on income, consumption, to other social indicators (Hidayat et al., 2022). The World Bank sets the global poverty line for upper-middle-income countries like Indonesia at USD 6.85 per day, while in Indonesia, the approach used is more focused on daily caloric needs (BPS, 2025b).

Berdasarkan tinjauan literatur di atas, terdapat hubungan teoretis antara ketimpangan pendapatan dan korupsi. Ketimpangan pendapatan yang tinggi dapat melemahkan struktur kelembagaan dan tata kelola, yang pada gilirannya menciptakan peluang untuk praktik korupsi. Sebaliknya, korupsi dapat mengakibatkan distorsi ekonomi dan memperlebar jurang antara si kaya dan si miskin. Meskipun kedua fenomena ini dapat menghambat pertumbuhan ekonomi, interaksi spesifik dan efek spasialnya di Indonesia masih memerlukan investigasi empiris. Dengan menganalisis Gini Ratio sebagai proksi ketimpangan pendapatan dan Survei Penilaian Integritas (SPI) sebagai indikator korupsi di tingkat lokal, penelitian ini bertujuan untuk mengeksplorasi sifat hubungan ini. Dimensi spasial juga merupakan pertimbangan penting, karena dampak ketidaksetaraan dan korupsi tidak terbatas pada batas-batas administratif, tetapi dapat menyebar ke wilayah-wilayah tetangga. Berdasarkan kerangka teoritis dan fenomena yang diamati ini, penelitian ini mengajukan hipotesis berikut.

H1: It is suspected that income inequality has a causal relationship with corruption in Indonesia.

H2: It is suspected that income inequality (Gini Ratio) and Corruption (SPI) in Indonesia have a spatial effect.

3. DATA SELECTION AND RESEARCH DESIGN

3.1.Data selection

This study uses secondary panel data from 34 provinces in Indonesia during the 2017–2022 period. The main data sources include: the Integrity Assessment Survey (IAS) from the Corruption Eradication Commission (KPK) as a proxy for the level of corruption; and data from the Central Statistics Agency (BPS) regarding the Gini Ratio (inequality), poverty rate, GDP per capita (economic well-being), Domestic Direct Investment (DDI) as an indicator of investment, and government expenditure as a representation of regional fiscal policy. All data were aligned, and only provinces with complete data were included to maintain the validity of the analysis. This study is quantitative and aims to formulate general laws (nomothetic) through an objective, measurable, and emotionally detached approach. The analysis was conducted after all data were collected, using statistical techniques to produce generalizations and predictions. Given the possibility of spatial effects between regions, such as spatial dependence and heterogeneity, the use of classical regression models can produce inaccurate estimates (Anselin, 1988). Therefore, this study uses a spatial regression model that is more suitable for cross-regional data, in order to capture the inter-provincial interactions that affect the economic and social variables being analyzed. The spatial model is used to capture the influence of geographical linkages between regions in affecting the dependent variable, such as the level of corruption measured through the Integrity Assessment Survey (IAS). The analysis begins with multiple regression to identify influential factors, and then continues with spatial regression to accommodate spatial effects that cannot be explained by classical regression. The spatial weighting matrix is a key component in this model, reflecting the proximity or interconnectedness between regions.

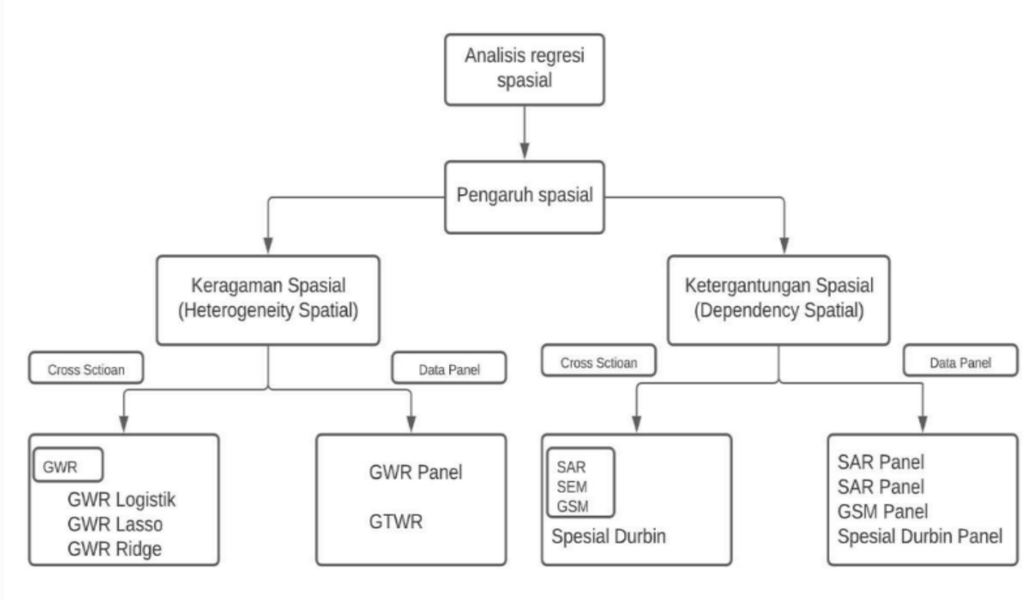


Figure 3.1 Spatial Analysis Process

The spatial approach method used in this research includes an area-based approach for cases of spatial dependency, with models such as the Spatial Autoregressive Model (SAR), Spatial Error Model (SEM), Spatial Durbin Model (SDM), and Conditional Autoregressive Models (CAR). This study uses a number of variables to test the formulated hypotheses, with operational definitions detailed in Table 3.1.

Table 3.1. Definisi Operasional Variabel

No	Variable	Definition	Source
1	X1 (Government Expenditure)	The routine government expenditure and provincial government development expenditure in the annual APBD.	Kemenkeu 2023
2	X2 (GDP per Capita)	GDP per capita is the value of a region's Gross Regional Domestic Product (GRDP) divided by the number of inhabitants in that region. GRDP itself is the total value of goods and services produced in a region during a specific period. In other words, GDP per capita reflects the average income per person in a region.	BPS 2023
3	X3 (Domestic Direct Investment)	Annual domestic direct investment from both the private and government sectors.	BPS 2023
4	X4 (Poverty Rate)	The poverty rate is defined as the percentage of the total population of a region (province, regency/city, or village) whose per capita income is below the poverty line set by BPS at a specific time period in each province.	BPS 2023

5	Y1 (Income Inequality)	Income inequality is the difference in the amount of money a person receives from the total amount of money in a region. In this study, the Gini Ratio is used as an indicator of inequality.	BPS 2023
6	Y2 (Integrity Assessment Survey)	The results of the Integrity Assessment Survey in the context of mapping corruption risks and the progress of corruption prevention efforts in a region. It is conducted in the environment of Ministries, State Institutions, and Regional Governments throughout Indonesia. A high Provincial Integrity value indicates a low level of corruption, and vice versa.	KPK 2023

Source: processed, 2023

The variables include: government expenditure (X1), GDP per capita (X2), Domestic Direct Investment (X3), poverty rate (X4), income inequality measured by the Gini Ratio (Y1), and the level of corruption proxied by the Integrity Assessment Survey (IAS) from the KPK (Y2). This table presents the definition of each variable according to its official source, such as BPS, Kemenkeu, and KPK in 2023. For example, GDP per capita (X2) is defined as the result of dividing a region's Gross Regional Domestic Product by the number of inhabitants in a year; the IAS (Y2) reflects the level of integrity and corruption risk of a region, where a high integrity value indicates a lower level of corruption.

3.2.Research Design

3.2.1. Granger Analysis

Granger causality test (Gujarati, 2013) is used to test the causal relationship between two variables, whether it is bidirectional, unidirectional, or not mutually influential. The equations used to perform the Granger causality test can be written as follows:

$$X1 = \sum_{i=1}^{m} \alpha_1 X_{t-i} + \sum_{j=1}^{n} b_j Y_{t-j} + \mu_t$$

$$Yt = \sum_{i=1}^{m} c_1 X_{t-i} + \sum_{j=1}^{n} d_j Y_{t-j} + v_t$$

The steps include:

1. Stationarity Test with Augmented Dickey Fuller (ADF) to check if a time series is stationary.

$$\Delta Y_t = \sigma_1 + \sigma_2 t + \delta Y_{t-1} + \lambda_1 \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t$$

2. Test for Degree of Integration, to determine the order at wich the data becomes stationary.

$$\Delta Y_t = \beta_1 + \beta_2 T + \delta Y_{t-1} + \alpha_1 \sum_{i=1}^{m} \Delta Y_{t-1} + e_t$$

3. Determine Optimal Lag Length, based on the Akaike Information Criterion (AIC).

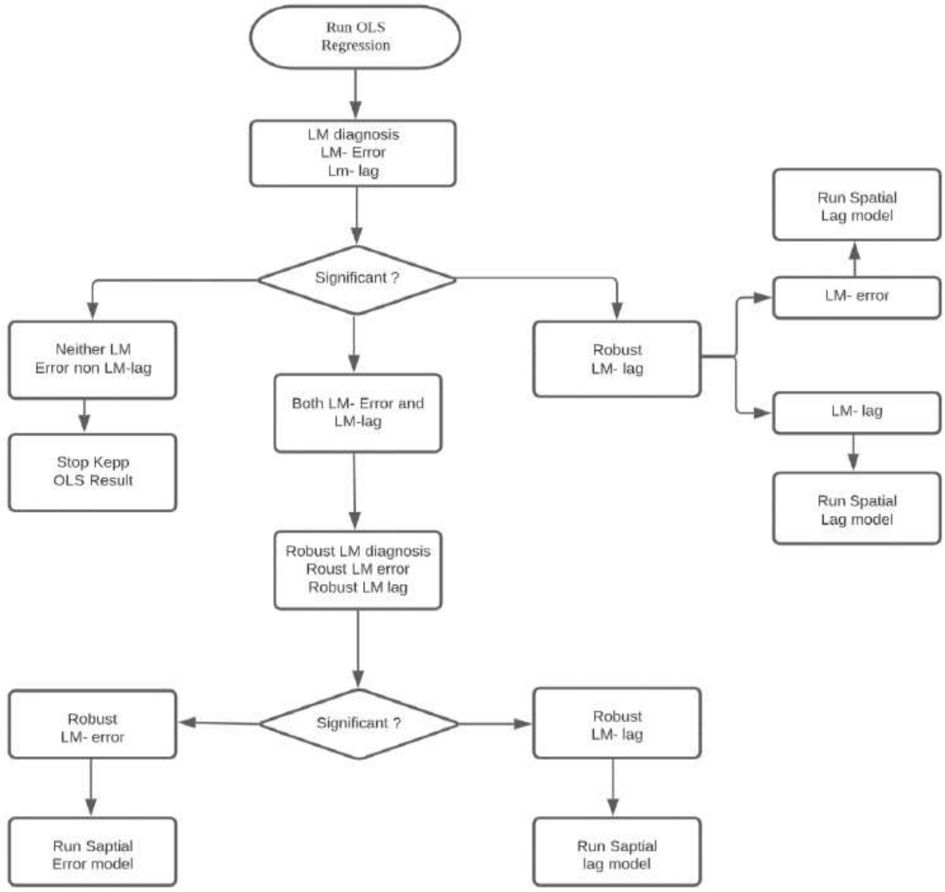
$$AIC = e^{2k/n} \frac{RSS}{n}$$

3.2.2. Spatial Panel Data Regression

The spatial panel data model allows for the analysis of relationships between economic variables while considering spatial effects between regions (Baltagi, 2005; Arbia et al., 2005).

Figure 3.2 Spatial Regression Model Decision Diagram

Sumber: (Aselin, 2004)



A spatial model (see Figure 3.2) is used to observe how a random shock in one region not only impacts that region but can also affect other regions through spatial relationships. This reflects the global externalities caused by the random shock (Fingleton & López-Bazo, 2006). To determine the appropriate spatial regression model, a decision diagram developed by Anselin, (1988) can be used (see 3.2). The General Spatial Regression Model (LeSage, 1999) in (Yasin et al., 2019) is:

$$\boldsymbol{y} = \rho \boldsymbol{W}\boldsymbol{y} + \boldsymbol{X}\beta + u$$

$$\boldsymbol{u} = \lambda \boldsymbol{W}\boldsymbol{u} + \boldsymbol{\varepsilon}, \boldsymbol{\varepsilon} \sim \boldsymbol{N}\left(0, \boldsymbol{\sigma}_{\varepsilon}^{2}\boldsymbol{I}_{n}\right)$$

Where:

y = vector of response variables of size (n x 1)
ρ = coefficient of the spatial lag parameter of the response variable
W = spatial weighting matrix of size (n x n)
X = matrix of predictor variables of size n x (p + 1)
B = vector of regression parameter coefficients of size (p + 1) x 1
λ = coefficient of the spatial error parameter

The steps of this research analysis begin with data visualization and exploration to understand the patterns, distribution, and potential relationships between variables. Next, a contiguity-based or distance-based weighting matrix is determined as the basis for spatial analysis. After that, the Breusch-Pagan test is performed to detect heteroscedasticity in the model, followed by the Moran's I test to identify spatial autocorrelation. Based on these results, an initial model is developed and then evaluated to select the best model, considering the R^2 and Akaike Information Criterion (AIC) values. The final stage is to interpret the results to draw conclusions that are relevant to the research objectives.

4. EMPIRICAL RESULTS

Before performing the Granger test, time series data needs to be confirmed as stationary to avoid the problem of spurious regression.

4.1.Stationarity Test

The stationarity test is carried out using the Augmented Dickey-Fuller (ADF) method with the null hypothesis that the data is not stationary. The data is said to be stationary if the calculated ADF value is smaller than the critical value at a certain significance level.

Table 4.1 Stationarity Test Results

	X1 (Government Expenditure))	**X2 (GRDP per capita)**	**X3 (Domestic Direct Investment)**	**X4 (Poverty Rate)**	**Y1 (Income Inequality)**	**Y2 (Corruption)**
ADF-test statistic	-2.8137**	-4.6940*	-3.0025*	-2.9461*	5.4080*	-6.6382*
ADF-table	0.056	8.633e-05	-0.034	0.040	1.786e-05	5.493e-09

Source: appendix, processed
Notes:
*) significant at α=1%
**) significant at α=5%

The results of the ADF test in Table 4.1 show that the variables Government Expenditure, GDP per capita, DDI, Poverty Rate, Income Inequality, and Corruption are stationary in the first stage test (level 0). This means there is no need to proceed with further stationarity tests. Since the DF and ADF values are significant at the 1% level, they will also be significant at the 5% level. Therefore, the next step is to perform a cointegration test.

4.2.Cointegration Test for Y1

The cointegration test is performed to determine if the variables in the model have a long-term relationship. The determination of the optimal lag length is based on the lowest Akaike Information Criterion (AIC) value.

The optimal lag length determination was done using the Akaike Information Criterion (AIC) method, where the lowest AIC value of -5.343580 was obtained at lag 2. The variables of Government Expenditure, GDP per capita, DDI, and Poverty Rate are linked to Income Inequality over a three-year period. This lag choice is supported by a high LR value (71.10065), which indicates the accuracy of the model's prediction. The Johansen cointegration test was conducted using a linear deterministic assumption (intercept and trend) with the Trace Statistic and Max-Eigen Statistic at a 5% significance level. The results show that all statistical values are greater than their critical values (TS>CV and Max−Eigen>CV) with a probability of <0.05, which means there is a long-term relationship between the variables.

Table 4.2 Results of Optimal Lag and Johansen Cointegration Test for Y1

Test Stage	Criteria/ Statistic	Value	Critical Value (5%)	Prob.	Notes
Lag Optimal (AIC)	Lag 2	-5.343580	-	-	Optimal lag is 3 years
Trace Test	None	194.8217	69.81889	0.0000	Cointegrated
	At most 1	117.3844	47.85613	0.0000	Cointegrated
	At most 2	58.55744	29.79707	0.0000	Cointegrated
	At most 3	19.21402	15.49471	0.0131	Cointegrated
Max-Eigen Test	None	77.43733	33.87687	0.0000	Cointegrated
	At most 1	58.82691	27.58434	0.0000	Cointegrated
	At most 2	39.34342	21.13162	0.0001	Cointegrated
	At most 3	19.17225	14.26460	0.0077	Cointegrated

The results of this test prove the existence of four stable long-term cointegrating equations among the research variables. This means that although short-term fluctuations may occur, in the long run, all variables move together and influence each other.

4.3.Cointegration Test for Y2

The optimal lag length for the Corruption (Y2) model, determined using the AIC method, resulted in the lowest value of -0.217259 at lag 2. This indicates that the relationship between the variables of Government Expenditure, GDP per capita, DDI, and Poverty Rate with Corruption is significant over a three-year period. The Johansen cointegration test, using the Trace and Max-Eigen methods, shows that all null hypotheses are rejected at a 5% significance level up to the "at most 3" level, with a probability of <0.05. This indicates the existence of four stable long-term cointegrating equations. However, at the fourth period, the stability of the relationship begins to weaken, as shown by a probability value of >0.05.

Table 4.3 Results of Optimal Lag and Johansen Cointegration Test for Y2

Test Stage	Criteria/ Statistic	Value	Critical Value (5%)	Prob.	Notes
Lag Optimal (AIC)	Lag 2	-0.217259	-	-	Optimal lag is 3 years
Trace Test	None	162.4035	69.81889	0.0000	Cointegrated
	At most 1	93.79758	47.85613	0.0000	Cointegrated
	At most 2	44.67638	29.79707	0.0005	Cointegrated

	At most 3	19.37108	15.49471	0.0124	Cointegrated
Max-Eigen Test	None	68.60595	33.87687	0.0000	Cointegrated
	At most 1	49.12120	27.58434	0.0000	Cointegrated
	At most 2	25.30530	21.13162	0.0122	Cointegrated
	At most 3	19.02535	14.26460	0.0082	Cointegrated

These results show that the relationship between economic variables and Corruption in Indonesia has a strong long-term connection. However, when the model is extended to the fourth period, the stability of the relationship begins to decline, which indicates the need for caution in adding model complexity to maintain the validity of the analysis results.

4.4.Granger Analysis

Table 4.4 presents the results of the causality test between the research variables, showing the direction of the relationship, either bidirectional (bi-causal) or unidirectional (uni-causal). These results provide an overview of the patterns of linkage between variables in the model, which serves as a basis for understanding the interactions and reciprocal or unidirectional influence among the analyzed economic and social variables.

Table 4.4 Granger Result

No	Variable	Direction	Variable	Conslusion
1	Gov. Expenditure (X1)	↔	DDI (X3)	bi-causal
2	Peng. Pemerinta (X1)	↔	Poverty Rate (X4)	bi-causal
3	DDI (X3)	↔	Poverty Rate (X4)	bi-causal
4	GRDP per-capita (X2)	→	DDI (X3)	uni-causal
5	Corruption (Y2)	↔	GRDP per-capita (X2)	bi-causal
6	Corruption (Y2)	↔	DDI (X3)	bi-causal
7	Gov. Expenditure (X1)	↔	DDI (X3)	bi-causal
8	DDI (X3)	↔	Poverty Rate (X4)	bi-causal
9	GRDP per-capita (X2)	→	PMDN (X3)	uni-causal
10	Poverty Rate (X4)	→	GRDP per-capita (X2)	uni-causal
11	Poverty Rate (X4)	→	Gov. Expenditure (X1)	uni-causal

Source: Data processed, 2023.

The causality test results show that there is a bidirectional relationship between Government Expenditure and DDI, between Government Expenditure and the Poverty Rate, and between DDI and the Poverty Rate. In addition, GDP per capita has a unidirectional relationship with DDI, while Corruption has a bidirectional relationship with both GDP per capita and DDI. The test results also indicate that the Poverty Rate has a unidirectional relationship with both GDP per capita and Government Expenditure. These findings confirm a long-term linkage between the variables with a varying pattern of relationships, whether mutually influencing or in only one direction.

4.5.Moran's I Test

The Moran's I test is used to measure the degree of spatial autocorrelation, which is the extent to which a variable in a given region is influenced by the same variable's values in its neighboring regions. A positive value indicates clustering (neighboring regions tend to have similar values), while a negative value indicates a negative pattern (neighboring regions tend to have different values). The data used includes 34 provinces from 2017 to 2022

Table 4.5 Moran's I Test Results

Year	Income Inequality	Corruption	Government Expenditure	GRDP per-capita	DDI	Poverty Rate
2017	0,5462 (0,0016)	0,4404 (0,0098)	0,4667 (0,0032)	0,0994 (0,1894)	0,2773 (0,0594)	0,5580 (0,0003)
2018	0,6164 (0,0004)	0,3769 (0,0254)	0,4879 (0,0007)	0,1190 (0,1482)	0,5829 (0,0001)	0,5340 (0,0005)
2019	0,5035 (0,0034)	0,1844 (0,2387)	0,4442 (0,0009)	0,0960 (0,1904)	0,4437 (0,0016)	0,5612 (0,0003)
2020	0,5055 (0,0033)	0,2745 (0,0945)	0,4483 (0,0014)	0,0960 (0,1923)	0,4873 (0,0012)	0,5319 (0,0005)
2021	0,5422 (0,0017)	0,0031 (0,0031)	0,4718 (0,0009)	0,0976 (0,1877)	0,5263 (0,0004)	0,5736 (0,0002)
2022	0,3673 (0,0292)	0,5410 (0,0017)	0,4946 (0,0005)	0,4946 (0,0005)	0,4300 (0,0023)	0,2226 (0,0633)

Note: The numbers in parentheses are the p-values; a p-value <0.05 indicates significant spatial autocorrelation.

Table 4.5 shows that the variables Government Expenditure and Income Inequality have a significant and consistent positive spatial autocorrelation throughout 2017–2022, indicating a stable clustering pattern between regions. DDI also tends to be significant since 2018, reflecting a concentration of investment in certain regions. In contrast, Corruption and the Poverty Rate show high fluctuations, with some years being insignificant, although both experienced a drastic increase or decrease in 2022. GDP per Capita was not significant from 2017–2021, but in 2022 it showed a strong autocorrelation, indicating the emergence of a concentration of high- and low-income regions.

4.6.Local Indicator of Spatial Association (LISA) Income Inequality in Indonesia

The Local Indicator of Spatial Association (LISA) analysis was performed to identify the spatial correlation patterns of income inequality among Indonesian provinces. The results of this analysis are visualized through a LISA map, which is then summarized in the following table for easier interpretation. The High-High category indicates provinces with high inequality surrounded by provinces with high inequality, while Low-Low represents provinces with low inequality surrounded by provinces with low inequality. Meanwhile, High-Low and Low-High indicate provinces with significantly different inequality compared to their surrounding areas.

Table 4.6 LISA Map Summary Income Inequality

Year	***High-High***	***High-Low***	***Low-High***	***Low-Low***
2017	Central Java, Central Sulawesi, Southeast Sulawesi	Bali, West Nusa Tenggara, East Nusa Tenggara	West Sulawesi	Bangka Belitung, Riau, Riau Islands, Jambi, Bengkulu, Lampung, Maluku, North Maluku
2018	Banten, Central Java, Central Sulawesi, Southeast Sulawesi	Riau Islands, Bali, West Nusa Tenggara	-	North Sumatra, West Sumatra, Bangka Belitung, Jambi, Maluku, North Maluku, East Nusa Tenggara
2019	Banten, Central Java, Central Sulawesi, North Sulawesi	Bali, West Nusa Tenggara, East Nusa Tenggara	-	Bangka Belitung, Bengkulu, Lampung, Maluku, North Maluku
2020	Banten, Central Java, Central Sulawesi, North Sulawesi	Bali, West Nusa Tenggara, East Nusa Tenggara	-	Bangka Belitung, Riau Islands, Jambi, Bengkulu, Lampung, Maluku, North Maluku
2021	Banten, Central Java, Central Sulawesi	Bali, West Nusa Tenggara, East Nusa Tenggara	-	Bangka Belitung, Riau Islands, Jambi, Bengkulu, Lampung,

				Maluku, North Maluku
2022	Banten, Central Java	Bali, West Nusa Tenggara	-	Bangka Belitung, Riau Islands, Maluku, North Maluku, East Nusa Tenggara, West Papua

Based on the summary of the LISA map results, it is evident that the provinces in the High-High category consistently appear in Central Java, Banten, and some provinces in Sulawesi. This indicates a relatively stable cluster of high inequality from year to year. Meanwhile, the Low-Low group is dominated by provinces in the central and southern Sumatra regions, Maluku, and North Maluku, which have low inequality with a low-inequality environment. The High-Low phenomenon is frequently found in Bali and West Nusa Tenggara, showing high inequality in these regions despite being surrounded by provinces with low inequality.

4.7.SEM (Spatial Error Model) for Income Inequality in Indonesia

Based on the spatial model selection results, the Spatial Error Model (SEM) was chosen as the most suitable model to explain the variation in income inequality among provinces in Indonesia. This model was used because it can capture the influence of spatially correlated errors between regions, providing more accurate estimates than conventional regression models. The SEM estimation results are shown in the table below.

Table 4.7 SEM (Spatial Error Model) Estimation Results Income Inequality

Variable	Estimate	Probability
Intercept	2.5504958	2.117e-15 ***
Government Expenditure (GE)	0.0280924	0.266689
GDP per capita (GDPC)	0.0569063	0.005059 **
Domestic Direct Investment (DDI)	-0.0073115	0.058121.
Poverty Rate (PR)	0.0841313	0.03264 **
Phi	3.4796	0.0005021***
R-Square		0.04662663

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The findings of this study show that the best model for analyzing income inequality in Indonesia is the Spatial Error Model (SEM) with Random Effects (REM). The significant phi value (p-value < 0.05) indicates a strong spatial correlation in the model's errors. This positive spatial correlation means that regions with positive errors tend to be close to other regions that also have positive errors, demonstrating a spatial spillover effect on income inequality across provinces.

4.8.Local Indicator of Spatial Association (LISA) for Corruption in Indonesia

The Local Indicator of Spatial Association (LISA) analysis is used to identify the spatial correlation patterns of income inequality among provinces in Indonesia. The results are visualized in a LISA map and then summarized in the table below for easier analysis. The High-High category indicates provinces with high income inequality surrounded by provinces with high inequality, while Low-Low indicates provinces with low inequality surrounded by provinces with low inequality. Meanwhile, High-Low indicates a province with high inequality surrounded by provinces with low inequality, and Low-High is the reverse.

Table 4.8 LISA Map Corruption

Year	High-High	High-Low	Low-High	Low-Low
2017	Central Java	Riau Islands, Bali, West Nusa Tenggara, East Nusa Tenggara	-	Bangka Belitung, Maluku, North Maluku, West Papua
2018	Central Java, D.I. Yogyakarta, East Java	Riau Islands, Bali, West Nusa Tenggara, East Nusa Tenggara	-	Bangka Belitung, South Sulawesi, Maluku, North Maluku, West Papua
2019	Banten, Central Java, East Java	Bengkulu, North Kalimantan, Central Sulawesi, Bali, West Nusa Tenggara	-	Bangka Belitung, East Nusa Tenggara, South Sulawesi, Maluku, North Maluku
2020	Central Java, D.I. Yogyakarta, East Java	Bali, West Nusa Tenggara, South Sulawesi	-	Bangka Belitung, Maluku, North Maluku, East Nusa Tenggara
2021	Central Java, D.I. Yogyakarta, East Java	Bali, West Nusa Tenggara	-	Bangka Belitung, Maluku, North Maluku, East Nusa Tenggara
2022	Central Java	Bali, West Nusa Tenggara	-	Bangka Belitung, Riau Islands, East Nusa Tenggara, Maluku,

				North Maluku, Papua

Based on the LISA map summary, it's clear that Central Java is almost always in the High-High category throughout the 2017–2022 period, indicating that this province has a high level of inequality with surrounding areas that are also highly unequal. A similar pattern is seen in East Java and D.I. Yogyakarta in some years, though the intensity of their appearance varies. In contrast, the provinces of Bangka Belitung, Maluku, and North Maluku are consistently in the Low-Low category, which indicates a low level of inequality with a low-inequality environment. The High-Low phenomenon is common in Bali and West Nusa Tenggara, showing high inequality in these regions despite being surrounded by provinces with low inequality. Overall, these results indicate the existence of spatial clusters of income inequality in Indonesia that are relatively stable over the medium term.

4.9.SEM (Spatial Error Model) for Corruption in Indonesia

Based on the spatial model selection results, the Spatial Error Model (SEM) was chosen as the most suitable model to explain the variation in corruption levels among provinces in Indonesia. This model considers the presence of spatial error effects, which can cause autocorrelation in the error component, thus yielding more reliable parameter estimates. The results of the model estimation are shown in the following table.

Table 4.9 SEM (Spatial Error Model) Estimation Results Corruption

Variable	Estimate	Probability
Intercept	3.93330059	< 2.2e-16 ***
Gini Ratio (GR)	0.02446900	0.6797
Government Expenditure (GE)	0.00064212	0.9714
GDP per Capita (GDPC)	0.00677735	0.6962
Domestic Direct Investment (DDI)	0.01756048	1.232e-06 ***
Poverty Rate (PR)	-0.01139032	-0.01139032
Phi	3.2867	0.00101
R-Square	0.1703537	

Based on the SEM estimation results, the only variable with a significant effect on the level of corruption in Indonesia is Domestic Direct Investment (DDI), with a positive coefficient of 0.01756 ($p<0.001$). This indicates that an increase in DDI tends to be followed by an increase in the level of corruption. This can be interpreted as domestic investment activities, when not accompanied by good governance, having the potential to increase opportunities for corrupt practices. Meanwhile, the variables Gini Ratio, Government Expenditure, GDP per capita, and Poverty Rate are not statistically significant in this model. This means their influence on corruption is not strong enough at a 95% confidence level. The significant Phi value indicates spatial autocorrelation in the error component, confirming that using the SEM is appropriate for capturing the spatial pattern of corruption between provinces. The R-Square value of 0.1703 shows that the model is able to explain approximately 17.03% of the variation in corruption levels, while the remainder is influenced by other factors outside the model.

5. Discussion

5.1. Causal Relationship between Income Inequality and Corruption in Indonesia

This study found a bi-causal relationship between Domestic Direct Investment (DDI) and the Poverty Rate in Indonesia. This suggests that an increase in DDI can reduce poverty. For instance, it creates jobs, fosters economic growth, enables technology transfer, and improves access to basic services like education and healthcare (Daud et al., 2025). Programs such as the Investment Competitiveness Improvement Program, Fiscal Incentive Funds, and the National Action Plan for the Acceleration of Development in Underdeveloped Regions (RAN PPDT) can also encourage DDI in disadvantaged areas to empower local economies(BKPM, 2020; Energi et al., 2008; jdihkemenkeugoid, 2023). However, poverty can hinder DDI due to small markets, limited skills, and political instability. Studies by Fan et al., (2004) in China and (Do et al., 2021) in Vietnam show that DDI plays a role in poverty alleviation, especially in the manufacturing sector. Policies need to maximize the synergy between DDI and poverty reduction, for example, by creating a conducive investment climate, building infrastructure, and developing human resources (Lautier & Moreau, 2012).

The relationship between GDP per capita and DDI (uni-causal) indicates that an increase in GDP per capita attracts domestic investment. This is consistent with research by Andriansyah, (2016), which states that an increase in public income raises purchasing power, savings, and investment capital. This study also found a bi-causal relationship between Corruption and GDP per capita, which aligns with OECD, (2025) findings that corruption lowers GDP per capita through inefficient bureaucracy, special treatment, and political negotiations that harm the public. Conversely, a low GDP per capita increases the risk of corruption, especially in poor regions with weak institutions (Tanzi & Davoodi, 2000). This is consistent with Public Choice Theory, which explains that high inequality encourages officials and politicians to abuse their power, hindering economic growth and lowering GDP per capita (Alfada, 2019; Goel & Rich, 1989; Spyromitros & Panagiotidis, 2022). Corruption also reduces economic competitiveness, increases business costs, and inhibits investment (Ades & Tella, 1994).

The Granger Causality findings show a bi-causal relationship between Corruption and DDI. Corruption creates uncertainty, high costs, and bureaucracy that hinder investment (Ionescu et al., 2012; Mondez & Cruz, 2024; Tanzi & Davoodi, 1998). The government has tried to attract DDI through easier licensing and fiscal/non-fiscal incentives, but corruption remains an obstacle to investment and trade (KPMG US, 2015). Weak law enforcement makes investors hesitant to invest (Modigliani & Perotti, 2000; OECD, 2021).. Corruption also damages a country's image, creates conflicts of interest, and lowers investor confidence (Ionescu et al., 2012). The relationship between Corruption and DDI is complex, so corruption eradication and DDI enhancement must be done simultaneously. This situation is exacerbated by the uneven distribution of government expenditure, where developed provinces receive larger allocations than underdeveloped regions. As a result, developed regions advance while underdeveloped regions fall further behind (Lee & Rogers, 2019; Qin et al., 2024). This inequality affects the distribution of jobs, investment, and income, and also influences the level of corruption and social stability (Gupta et al., 1998; Mdingi & Ho, 2021; Schmid-Drüner, 2016).

There is also a uni-causal relationship between the Poverty Rate and GDP per capita, where a decrease in poverty increases GDP per capita. Regions with high GDP per capita generally have low poverty rates because investments in infrastructure, education, and social services increase (Balasubramanian et al., 2023). Conversely, high poverty slows economic growth and triggers social problems (Halleröd & Larsson, 2008; Škare & Družeta, 2016) and poor populations have low purchasing power, preventing them from fully participating in economic activities (Banerjee & Duflo, 2007). This can hinder economic growth and lower GDP per capita. In addition, high poverty can trigger social problems such as crime and unrest in every province (Sugiharti et al., 2023). The research shows strong evidence supporting a uni-causal relationship between a decrease in the Poverty Rate and an increase in GDP per capita in the study's findings. A reduction in poverty can drive economic growth through various mechanisms, such as increased aggregate demand, investment, and the quality of human resources (Erumban & de Vries, 2024).

5.2.Spatial Effects of Income Inequality and Corruption in Indonesia

The Moran's I test results show that the variable for income inequality had a significant and positive spatial autocorrelation throughout the study period. The highest value occurred in 2018 (Moran's I = 0.6164, p = 0.0004), which indicates a concentration of income inequality in neighboring regions. Although there was a decrease in 2022 (Moran's I = 0.3673, p = 0.0292), the clustering pattern was still visible. This shows that income inequality in Indonesia tends to form geographical clusters where regions with high inequality are clustered together. This finding aligns with Rodríguez-Pose (2018), who stated that regional development policies can worsen inequality. Meanwhile, the corruption variable also showed a positive spatial autocorrelation pattern, although it was more volatile than income inequality. The highest Moran's I value occurred in 2022 (Moran's I = 0.5410, p = 0.0017), indicating a strong spatial concentration of corruption in that year. In previous years, such as 2019 and 2020, the Moran's I values showed weak and insignificant autocorrelation. In 2021, the Moran's I value was very low (0.0031), although it was still statistically significant. This suggests that the spatial distribution of corruption tends to be unstable from year to year but has a tendency to concentrate in certain regions at specific times. Both income inequality and corruption have an important spatial dimension. Both variables show a tendency to be geographically concentrated, which may reflect the social, economic, and institutional structures between regions in Indonesia.

5.2.1. Income Inequality

Based on Table 4.6, from 2017 to 2022, Central Java was consistently in the High-High cluster, meaning the province had high income inequality surrounded by provinces with high income inequality. The High-Low cluster included Bali and West Nusa Tenggara, which showed high income inequality surrounded by provinces with low-income inequality. Meanwhile, the Low-Low cluster was consistently occupied by Maluku and North Maluku from 2017 to 2022. This means that both provinces had low levels of inequality surrounded by provinces with low inequality as well

Humans have a natural tendency to avoid injustice, both in the distribution of income and access to economic opportunities (Scanlon, 2018). Impoverished communities who feel disadvantaged by an unequal system will experience frustration and a sense of injustice (Barford, 2017; Montada & Schneider, 1989)..This feeling of injustice can prompt people to take actions they consider "fair" but that violate norms and laws, such as corruption (Ariely & Uslaner, 2017). The pattern of income inequality transmission in Indonesia from 2017 to 2022 has undergone various changes, both in scatterplots and in neighborhood relationships. However, some provinces have remained in the same cluster. Some provinces that had a significant influence on the transmission of income inequality in previous years continued to do so in 2022. This occurred due to changes in the level of income inequality in neighboring provinces as well as changes in the inequality of the provinces themselves.

The Spatial Error Model (SEM) estimation results in Table 4.7 show that several variables significantly influence inter-provincial income inequality in Indonesia. The significant intercept value of 2.5504958 indicates that factors outside the variables measured in this model also influence inequality. This finding suggests that besides measurable economic factors, there are also social, institutional, and structural variables not included in the model that play a role. Among the independent variables analyzed, three had a significant impact on inequality: GDP per capita, domestic direct investment (DDI), and the poverty rate. Meanwhile, government expenditure showed no significant effect on inequality.

This finding is in line with the research of Kitaura & Miyazawa, (2021), who found that although government expenditure programs, such as cash transfers, can help reduce poverty, their impact on inequality is relatively small. Conversely, Fitriani, (2025) stated that the design and implementation of government expenditure play a crucial role in determining its effectiveness in curbing inequality. Therefore, further research is needed to understand the specific mechanisms that influence the relationship between government expenditure and inequality in Indonesia. The GDP per capita variable has a positive estimate of 0.0569063 with a 1% significance level (p=0.005059), indicating that an increase in GDP per capita tends to increase inequality. This finding aligns with the inverted U-shaped curve concept, where in the early stages of economic growth, inequality increases before eventually decreasing after reaching a certain income level (Ram, 1988; Stiglitz, 2015).The results are also consistent with previous research that found high economic growth can reduce inequality, particularly in OECD countries, although this effect depends on redistributive policies and labor market conditions (Immervoll & Richardson, 2021; Vuković & Damijan, 2025).

DDI has a significant negative effect on inequality with an estimated value of -0.0073115 and a significance level of 10% (p=0.058121). This means that an increase in DDI tends to decrease inequality in Indonesia. This is consistent with research by Goto & Endo, (2014), who showed that domestic investment directed toward labor-intensive and export-oriented sectors can open up broader employment opportunities for low- to middle-income groups. The poverty rate also has a significant positive influence on inequality, with an estimate of 0.0841313 ($p<0.05$). This result aligns with the research of Ceroni, (2001) and Chantarat & Barrett, (2012)), which stated that a high poverty rate can perpetuate inequality through mechanisms such as low human capital accumulation, limited access to economic opportunities, and weak social mobility. However, this relationship can be influenced by other factors, such as redistributive policies, education quality, access to healthcare, and labor market dynamics (Ceroni, 2001; Goto & Endo, 2014). From a spatial perspective, the significant phi value indicates spatial dependence in the error component, which means that inequality in one province is influenced by inequality in its neighboring provinces. This may be caused by spillover effects such as cross-regional policies, economic interactions, labor mobility, and regional structural factors.

5.2.2. Corruption

The Moran's I analysis of corruption in Indonesia reveals a tendency towards positive spatial autocorrelation. This indicates that provinces with a high level of corruption are clustered together, and the same is true for provinces with low corruption. The significant Moran's I values suggest that corruption patterns in Indonesia are not random but form geographically distinct clusters. This positive spatial autocorrelation implies that policy interventions to reduce corruption in one region could have a spillover effect on its neighbors. This finding aligns with previous studies by Khodapanah et al., (2022) in ASEAN and Yunan et al., (2025) in Indonesia, which noted that local corruption can spread across regions due to similar social, economic, and political characteristics.

The analysis was further extended using the Local Indicator of Spatial Autoregressive (LISA) to identify local clustering patterns. The LISA map showed High-High clusters in several areas, where provinces with high corruption were adjacent to other high-corruption provinces. Conversely, Low-Low clusters contained provinces with low corruption next to other low-corruption provinces. The presence of High-Low and Low-High patterns also pointed to spatial outliers—provinces with significantly different corruption levels than their neighbors. Both the Moran's I and LISA findings are consistent with a study by Sitorus (2021), which found that high-corruption clusters in Indonesia tend to be in regions with high economic growth but low transparency, while low-corruption regions typically have better governance and stronger public oversight. This suggests that institutional and socioeconomic factors are crucial in shaping the spatial patterns of corruption in Indonesia, implying that anti-corruption efforts should consider these spatial relationships for more effective and equitable policies.

The model estimation results show a significant intercept value of 3.9333, indicating that factors outside the studied variables influence corruption levels. Among the variables, only Domestic Direct Investment (DDI) proved to be a significant factor, with other variables like the Gini Ratio, government expenditure, GDP per capita, and poverty rate showing no significant effect. The lack of a significant relationship between the Gini Ratio and corruption, despite theoretical associations, suggests that institutional factors, social norms, and law enforcement effectiveness play a more dominant role in determining corruption levels than income distribution alone. This finding is consistent with Acemoglu & Verdier, (1998). Government expenditure also showed no significant effect, which contradicts the hypothesis that better public fund management should reduce corruption. This indicates that the effectiveness of government spending in curbing corruption is more dependent on the quality of its design and implementation, as supported by research from Acemoglu & Verdier (1998). Similarly, the lack of a significant relationship between GDP per capita and corruption challenges the traditional hypothesis that economic growth reduces corruption. Instead, factors like good governance and press freedom may be more critical in controlling corruption at different stages of economic development (Freille et al., 2007).

The main finding of this study is the significant positive relationship between DDI and corruption in Indonesia. This relationship points to a potential moral hazard in the investment climate, especially in environments with weak institutional frameworks. This is consistent with (Dreher & Langlotz, 2020), who found that DDI can increase corruption risks in countries with weak oversight. The ability of large domestic companies to influence public policy, navigate complex bureaucracy, and align their business strategies with weak law enforcement in a region indicates a spillover effect of corruption (Dusanjh & Sidhu, 2009; Gillies, 2020; Sartor & Beamish, 2020).. This aligns with the view that corruption thrives in conditions where officials have broad authority (discretion) and markets are dominated by a few players (monopoly) without sufficient accountability (Dusanjh & Sidhu, 2009; Kolstad et al., 2008; Philp, 2001). Therefore, limiting the authority of public officials and corporate dominance in strategic sectors is a crucial preventive measure. Finally, the poverty rate also showed no significant relationship with corruption. This supports the view of Abed & Gupta, (2002) that poverty is more often a consequence rather than a cause of corruption. This implies that poverty alleviation policies alone are not enough to reduce corruption without being accompanied by improved access to education, equal economic opportunities, and institutional reforms. Overall, the findings of this study affirm that corruption prevention in Indonesia cannot solely rely on improving macroeconomic indicators. Instead, it requires fundamental reforms in institutional aspects, governance, transparency, and accountability, especially in strategic sectors that involve large-scale investment.

6. Conclusions and Sugestions

Based on the results of the Granger causality and spatial analysis for the 2017–2022 period, this study concludes that the optimal lag length is three years, meaning the independent variables can predict the dependent variables within that timeframe. The Granger causality test shows no direct causal relationship between income inequality and corruption, which may be due to the complex nature of corruption involving multiple parties, making it difficult to identify. However, a bi-causal relationship was found between several variables: 1) DDI and corruption, where an increase in DDI can affect corruption levels and vice versa; 2) government expenditure and the number of poor people, which mutually influence each other; and 3) GDP per capita and DDI, which mutually encourage growth. Additionally, a uni-causal relationship was found from GDP per capita to DDI, from the number of poor people to GDP per capita, and from government expenditure to the number of poor people. Corruption was also identified as a factor that can create public sector inefficiency, hinder economic growth, and worsen income inequality. Spatial Analysis Findings The Spatial Error Model (SEM) analysis results show a significant spatial correlation in income inequality, indicating that conditions in one region are influenced by its neighbors. The variables that significantly affect income inequality in Indonesia include GDP per capita, government expenditure, DDI, and the poverty rate. Meanwhile, the spatial distribution pattern of corruption varies over the years: it showed significant spatial autocorrelation in 2017 and 2018, a random pattern in 2019 and 2021, and a strong spatial autocorrelation again in

2022. The Moran's I value indicates that income inequality generally has a strong positive spatial autocorrelation (>0.5), except in 2022 when it was weaker, while corruption only showed strong autocorrelation in 2022. The cluster analysis reveals four groups for income inequality (High-High, High-Low, Low-High, Low-Low) and four for corruption with complex distribution patterns.

The corruption panel model estimation identified DDI as the only variable with a significant effect on the level of corruption. In contrast, the Gini Ratio, government expenditure, GDP per capita, and the poverty rate showed no significant impact. These findings affirm that domestic investment requires transparent management to reduce corrupt practices and promote equitable development in Indonesia.

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