Fiscal decentralization, monetary policy, and economic growth in Indonesia: A panel data analysis

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DOI:	Received:	Revised:	Accepted:	Published:
10.22437/ppd.v13i4.42111	28.02.2025	06.07.2025	23.10.2025	31.10.2025

Abstract

The implementation of regional governance through fiscal decentralization, particularly in the management of Local Own-Source Revenue (PAD), demonstrates that regional fiscal autonomy can effectively enhance community welfare under a decentralized government structure. Using the Ordinary Least Squares (OLS) method with panel data for the period 2010–2024, this study provides empirical evidence that community welfare—measured by the growth of real Gross Regional Domestic Product (GRDP) per capita—is significantly and positively influenced by several key factors. These include Local Own-Source Revenue (PAD) with a coefficient of 0.258, Transfer Funds to Regions and Village Funds (TKDD) with a coefficient of 0.046, the Human Development Index (HDI) with a coefficient of 0.070, and Regional Investment (FDI) with a coefficient of 0.006. However, the study also identifies challenges to sustaining real GRDP growth per capita, particularly from interest rates and income inequality, which exhibit significant negative relationships with coefficients of –0.202 and –0.011, respectively. These findings suggest that disparities in population income distribution and fluctuations in borrowing costs can hinder regional economic performance. To address these challenges, regional governments must adopt fiscal incentive policies that stimulate revenue generation and investment while prioritizing human resource development. Moreover, closer collaboration with central banking authorities is essential to manage monetary policy—especially in controlling interest rates—to maintain stability and ensure balanced, inclusive regional growth.

Keywords: *Fiscal decentralization; Human Development Index (HDI); Income inequality; Real GRDP per capita; Regional investment*

JEL Classification: O13, O44, Q22, Q54

INTRODUCTION

Community welfare can be measured through one of the key macroeconomic indicators—real Gross Domestic Product (GDP) per capita —or, at the regional level, real Gross Regional Domestic Product (GRDP) per capita. According to data from the Indonesian Central Statistics Agency (2024), Indonesia's real GDP per capita at current prices reached IDR 78.6 million, equivalent to USD 4,960.3. This represents an increase from IDR 74.9 million in 2023, or a growth rate of 4.88 percent, which may indicate an

improvement in welfare in line with economic growth. Meanwhile, Gross National Income (GNI) per capita is another macroeconomic variable used to measure national welfare based on marginal material well-being, serving as an alternative to translate GDP per capita into material welfare (Saha, 2023).

The development of Indonesia's real GDP per capita is closely linked to the condition and progress of real GRDP per capita across regional governments. This study examines the varying levels of real GRDP per capita growth across regional governments, focusing on key economic sectors. In the fisheries, forestry, and agriculture sectors, the regional contributions are North Sumatra (20.53%–23.59%), Jambi (27.89%–31.83%), South Sulawesi (21.35%–22.54%), and North Sulawesi (20.83%–21.51%). From the mining and quarrying sector, East Kalimantan (41.27%–53.18%) and South Kalimantan (19.06%–32.05%) are highlighted. The processing industry sector is represented by East Java (30.32%–30.71%) and West Java (41.12%–42.24%). The accommodation and food and beverage sector is represented by Bali (16.60%–23.25%), while the motor vehicle repair and wholesale–retail trade sector is represented by DKI Jakarta (16.63%–17.67%). These selections are based on the dominant GRDP contributions of business fields that most strongly influence regional economic growth.

Although the development of real GRDP per capita shows an upward trend, on average, only two regions—DKI Jakarta Province and East Kalimantan Province—consistently maintain real GRDP per capita levels above the national real GDP per capita, as illustrated in Figure 1. Regional governments have thus played a crucial role in increasing real GRDP per capita by leveraging their specific potentials and regional characteristics.

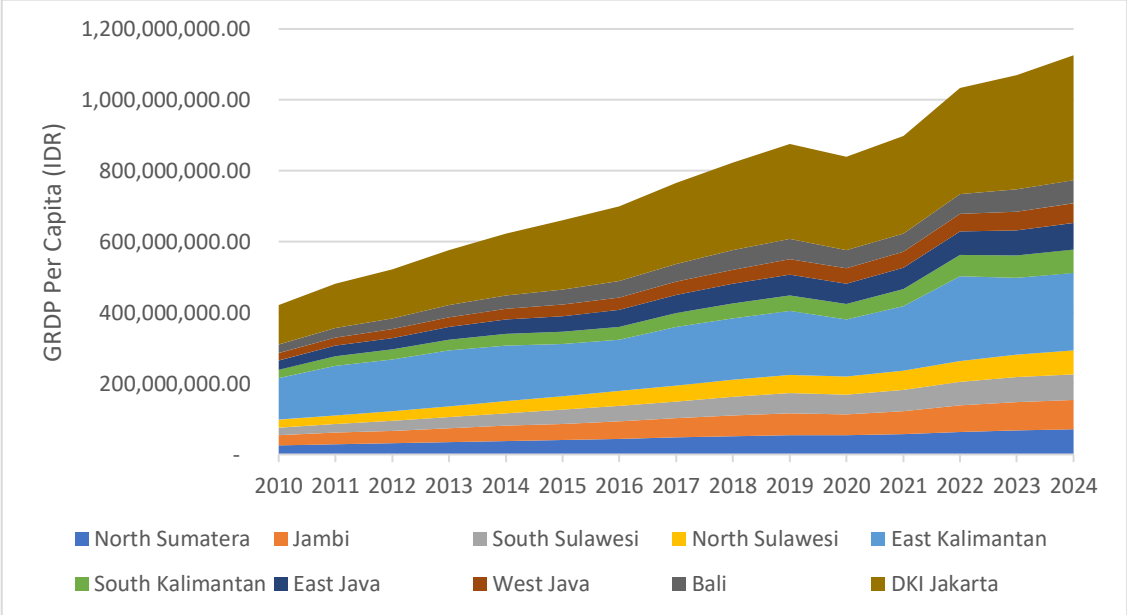

Figure 1. Trend of real GRDP per capita, 2010-2024
Source: Indonesian Central Statistics Agency, processed data (2024)

Under Indonesia's framework of regional autonomy, local governments are granted flexibility and authority to strengthen fiscal decentralization through their own-source revenue (*Pendapatan Asli Daerah*/PAD), including income from regional taxation, regional levies, management of separated regional assets, and other legitimate sources of regional income as stipulated by law. Local governments can reinforce fiscal reform and

tax systems at the sub-provincial level, enhance direct transfer mechanisms, and adapt standard and performance-based norms by leveraging modern information technology to meet growing demands for public services (Wang et al., 2024). Furthermore, the government should strive to make the tax system more effective and comprehensible to ensure compliance with applicable regulations (Javeed Iqbal et al., 2024). Fiscal decentralization reform and structural transformation have been shown to reduce poverty rates, thereby positively impacting regional economic performance (Korotun et al., 2020).

Mandatory transfer funds to regional governments include tax revenue–sharing funds, general allocation funds, special allocation funds, and regional incentive funds, all designed to reduce interregional disparities. Government transfer programs targeted at low-income individuals should be closely monitored to identify local challenges and align with the national objective of minimizing inequality (Dharmadasa, 2023). Regional governments may also adopt partnership models to attract investment, fostering growth and increasing real GRDP per capita. To this end, new policies and incentives are necessary to attract both domestic and foreign investment, thereby stimulating inclusive economic growth and alleviating poverty (Keita & Yu, 2021).

Achieving high real GRDP per capita growth requires skilled human resources. Education provides substantial benefits for low- and middle-income countries seeking to transition toward high-income status and achieve sustained growth (Bah, 2023). For instance, China's fiscal decentralization policy in preschool education has been shown to have long-term effects on GDP per capita growth. Governments may also adopt income-driven growth strategies to raise wages and household incomes and stimulate economic development (Lee, 2024).

However, rapid real GRDP per capita growth can also drive regional inflation by increasing demand for goods and services. Thus, regional governments must collaborate with central banking authorities to manage interest rates effectively. Reforms in monetary policy and money market dynamics are essential to enhance competitiveness, stabilize interest rates, and support capital formation, investment, and economic growth (Bista & Basnet, 2022). Several variables, including interest rates, significantly influence the growth rate of GDP per capita, as part of monetary policy, and government spending deficits or surpluses, as part of fiscal policy (Stawska & Miszczyńska, 2022).

This study seeks to address key challenges faced by regional governments by examining the influence of PAD, transfer funds, the Human Development Index (HDI), regional investment, interest rates, and income inequality on real GRDP per capita growth in ten Indonesian regions. Specifically, the research hypothesizes that interest rates and income inequality significantly reduce real GRDP per capita across these ten provinces. Employing an Ordinary Least Squares (OLS) panel data methodology, the study evaluates the impact of these variables on real GRDP per capita.

Previous studies have explored various factors influencing regional real GRDP per capita growth; however, this research offers a novel perspective by conducting an in-depth comparative analysis of fiscal decentralization implementation—particularly focusing on local own-source revenue—to examine differing regional policies based on each region's potential, characteristics, and unique challenges.

METHODS

The data and methodology employed in this study are incorporated into the influence analysis framework, which utilizes both time-series and cross-sectional indicators for the period 2010–2023 across ten provinces in Indonesia. The variables

examined include real Gross Regional Domestic Product per capita (lnGRDP), Local Own-Source Revenue (lnPAD), Transfer Funds to Regions and Village Funds (lnTKDD), Human Development Index (HDI), Regional Investment (lnFDI), Interest Rate (IS), and Income Inequality (GINI).

The estimation process was conducted using EViews 12 software, which provides comprehensive support for panel data analysis. Three model specifications were considered: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The Chow test was employed to determine whether there were significant structural differences across the cross-sectional units (provinces), warranting the adoption of the Fixed Effect Model over the Common Effect Model. This test compares restricted and unrestricted models to assess whether individual effects should be incorporated in the estimation.

Subsequently, the Hausman test was performed to choose between the Fixed Effect Model and the Random Effect Model by examining whether the individual (entity-specific) effects were correlated with the independent variables. A significant p-value from the Hausman test indicated that the Fixed Effect Model was more appropriate, as it better captures unobserved heterogeneity across provinces. The final estimation was carried out using the Least Squares (Fixed Effects) procedure in EViews, with semi-log transformations applied to several variables to mitigate instability in the variance.

In addition to reporting the R-squared and t-statistics, the study conducted several diagnostic tests to ensure the robustness and validity of the model. The Durbin–Watson statistic was used to detect autocorrelation in the residuals. In contrast, Cross-Section Dependence Tests (Pesaran Scaled LM and Bias-Corrected LM) were used to examine contemporaneous correlation among entities. The Jarque–Bera test assessed the normality of the residuals, and the correlation matrix was analyzed to identify potential multicollinearity. Panel data stationarity was tested using both the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests at the level and first-difference stages. The results confirmed that the model satisfies the classical linear regression assumptions, thereby reinforcing the reliability of the estimated relationships between fiscal and monetary policy variables and regional economic growth.

The functional relationship for the research model can be expressed as follows:
The functional relationship for the research model can be expressed as follows:

$$\text{lnGRDP}_{it} = f(\text{lnPAD,lnTKDD,HDI,lnFDI,IS,GINI}) \quad \text{.....(1)}$$

From function (1), the regression equation for the study's model using semi-natural logarithms for PAD, TKDD, and FDI—aimed at reducing data variance inequality relative to HDI, IS, and GINI—can be specified as:

$$\text{lnGRDP}_{it} = \alpha_{0it} + \alpha_1 \text{lnPAD}_{it} + \alpha_2 \text{lnTKDD}_{it} + \alpha_3 \text{HDI}_{it} + \alpha_4 \text{lnFDI}_{it} + \alpha_5 \text{GINI}_{it} + \alpha_6 \text{IS}_{it} + e_{it} \quad \text{..... (2)}$$

GRDP is GRDP real per capita (logaritma natural); PAD is Local Own-Source Revenue (logaritma natural); TKDD is transfer funds to regions (logaritma natural); HDI is Human Development Index; FDI is Foreign Direct Investment (logaritma natural); IS is Interest Rate; GINI is Gini Index; α_0 is a Constant; $\alpha_1 - \alpha_6$ is a parameter; i is the number of observations (cross-section); t is a time series; e is the error term.

Table 1. Variable operational

Variable	Variable Description	Data Source
lnGRDP	Real GRDP per capita, calculated as gross regional domestic product divided by mid-year population (current IDR)	Indonesian Central Statistics Agency
lnPAD	Total Local Own-Source Revenue, comprising levy income, tax income, proceeds from the management of separated regional assets, and other legitimate PAD (current IDR)	DJPK, Ministry of Finance
lnTKDD	Total Transfers to Regions and Village Funds, including General Allocation Funds, Profit Sharing Funds, Regional Incentive Funds, Special Allocation Funds, and Village Funds (current IDR)	DJPK, Ministry of Finance
HDI	Measures the quality of human capital through a composite index of health, education, and standard of living; recorded annually on a normalized scale (0–100)	Indonesian Central Statistics Agency
lnFDI	Total Regional Investment (current IDR)	Indonesian Central Statistics Agency
IS	Commercial bank interest rates, including consumer, investment, and business loans (annual average, %)	Bank Indonesia and Indonesian Financial Services Authority
GINI	Income inequality level based on the cumulative proportion of expenditure and population (Index)	Indonesian Central Statistics Agency

This study employs the Fixed Effect Model (FEM) to estimate the relationship between real GRDP per capita and various fiscal and monetary variables. However, it is acknowledged that certain independent variables—such as PAD and FDI—may exhibit bidirectional relationships with economic growth, potentially introducing endogeneity. Consequently, the relationships identified in this model are interpreted as associative rather than strictly causal. Due to data limitations, instrumental variable techniques or dynamic panel models, such as the Generalized Method of Moments (GMM), were not applied but are recommended for future research.

RESULTS AND DISCUSSION

Results

Trends in real GRDP per capita

The growth of real GRDP per capita in the study area demonstrates a positive trend, with dominant contributions arising from different business sectors across provinces. The fisheries, agriculture, and forestry sectors are the main contributors in the provinces of North Sumatra, Jambi, South Sulawesi, and North Sulawesi. The mining and quarrying sector plays a leading role in East Kalimantan and South Kalimantan, while the processing industry dominates in East Java and West Java. In DKI Jakarta Province, the retail and wholesale trade, as well as motor vehicle and car repair sectors, contribute most significantly. Meanwhile, in Bali Province, the accommodation, food, and beverage sectors serve as the main drivers of GRDP.

Regional governments can further maximize these sectoral potentials to enhance their populations' welfare. Economic growth, when accompanied by equitable income distribution, provides strong empirical evidence of efforts to harmonize social welfare and achieve greater societal well-being (Chen & Hsu, 2024).

The trend data presented in Figure 2 indicate that the two provinces with the highest real GRDP per capita are DKI Jakarta and East Kalimantan. In DKI Jakarta, the economic structure is supported by its role as the center of national economic activity, characterized by high human resource productivity, comprehensive infrastructure connectivity, and substantial regional investment.

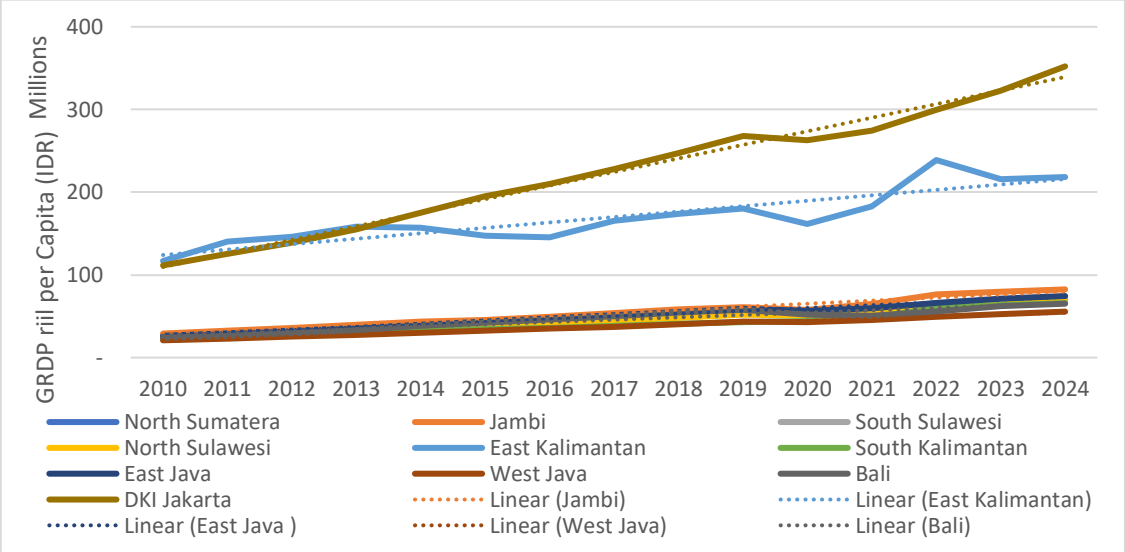

Figure 2. Trend of real GRDP per capita, 2010-2024
Source: Indonesian Central Statistics Agency, processed data (2024)

In contrast, West Java and East Java, which are located on the same island and engage in similar economic activities, have lower real GRDP per capita values due to their large populations. The high real GRDP per capita in East Kalimantan is largely driven by abundant natural resources, particularly within the mining and quarrying sector, combined with a relatively small population base. Conversely, South Kalimantan, which also relies on mining and quarrying, records a comparatively lower real GRDP per capita.

Other provinces exhibit relatively similar average real GRDP per capita values, which remain below the national real GRDP per capita level.

Trends in PAD

Over the past two decades of regional autonomy, accompanied by fiscal decentralization that grants regions authority over revenues derived from their own potential and characteristics, PAD has shown consistent positive growth. This increase aligns with the growing need for regional development financing. The delegation of authority to regional governments is intended to enhance efficiency and responsiveness, as local administrations are closer to the community and can provide public services directly.

The sectors contributing most significantly to PAD are primarily those related to regional taxation, including motor vehicle tax, motor vehicle title transfer fee tax, motor vehicle fuel tax, surface water tax, and cigarette tax. With this authority to levy regional taxes, local governments must identify the sectors that most substantially contribute to real GRDP per capita growth. These sectors should be supported by appropriate fiscal incentives, such as reduced tax rates, to stimulate regional economic growth.

Two key aspects of fiscal policy that must be considered to promote GDP per capita growth are government expenditure and taxation on income and capital gains, both of which are highly dependent on population size and structure (Aye & Odhiambo, 2022).

As illustrated in Figure 3, PAD has shown a steady annual increase, with the largest contributions derived from regional tax revenues. The three provinces with the highest PAD are East Java, West Java, and DKI Jakarta. These regions benefit from large populations, which provide an extensive tax base—particularly from motor vehicle taxes and motor vehicle title transfer fees. Moreover, the high concentration of companies and investment activity in these provinces positively affects revenues from motor vehicle fuel taxes and surface water taxes.

In contrast, the other provinces exhibit relatively similar PAD levels, indicating that regional tax potential outside these major economic centers remains comparatively modest.

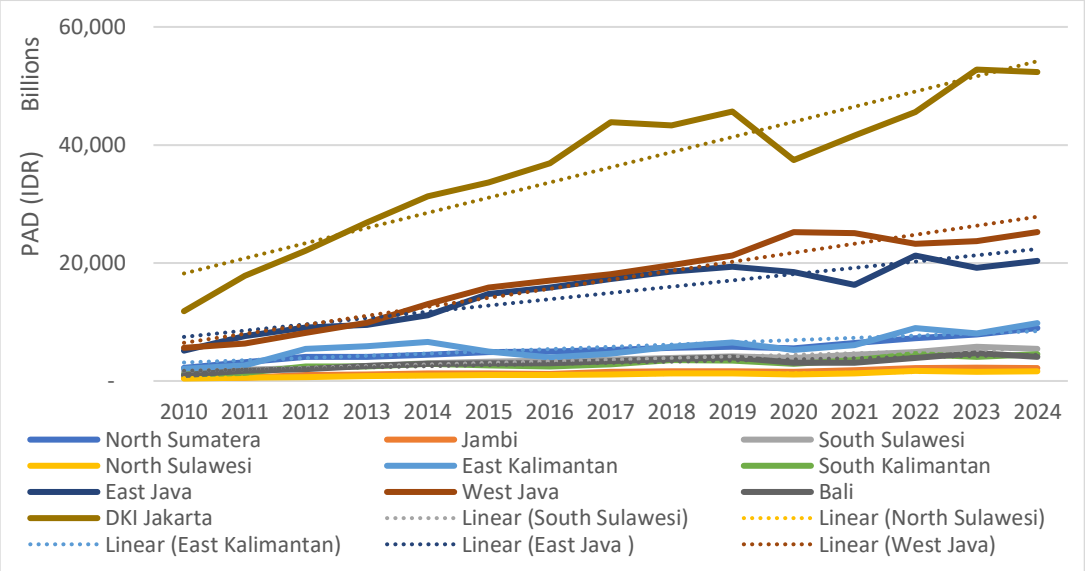

Figure 3. Trend of PAD, 2010-2024
Source: DJPK Ministry of Finance, processed data, (2024)

Trends in TKDD

The unequal growth of real GRDP per capita in the study area reflects differences in regional potential and resource endowments. To address these disparities, the central government, through centralized fiscal policy, manages the distribution of transfer funds to regions and village funds (TKDD). The objective is to reduce interregional inequality and create a fair and balanced allocation of fiscal resources. For example, revenue-sharing from mining and quarrying activities is distributed not only to producing regions but also to neighboring areas to mitigate regional imbalances (Peluso, 2018).

Transfers to regions and village funds include Profit Sharing Funds (DBH), General Allocation Funds (DAU), Special Allocation Funds (DAK), Regional Incentive Funds (DID), and Village Funds (DD). The value of these transfers has shown consistent annual growth, reflecting both the increasing fiscal needs of local governments and their ability to creatively harness local resources to qualify for central government incentives. A well-developed financial sector can stimulate economic growth, and the extent to which it supports the economy depends on its capacity to finance productive activities (El Yamani, 2024).

The growth of regional government revenues sourced from transfer funds and village funds demonstrates a positive upward trend, as illustrated in Figure 4. The provinces of East Java, West Java, and DKI Jakarta are the largest recipients of TKDD compared with other provinces. This is largely due to their substantial contribution to tax

revenue sharing managed by the central government—particularly from Income Tax Article 21 (PPh 21)—as well as their status as major recipients of General Allocation Funds, which reflect the high number of regional government employees in these areas (Direktorat Jenderal Perimbangan Keuangan, 2018).

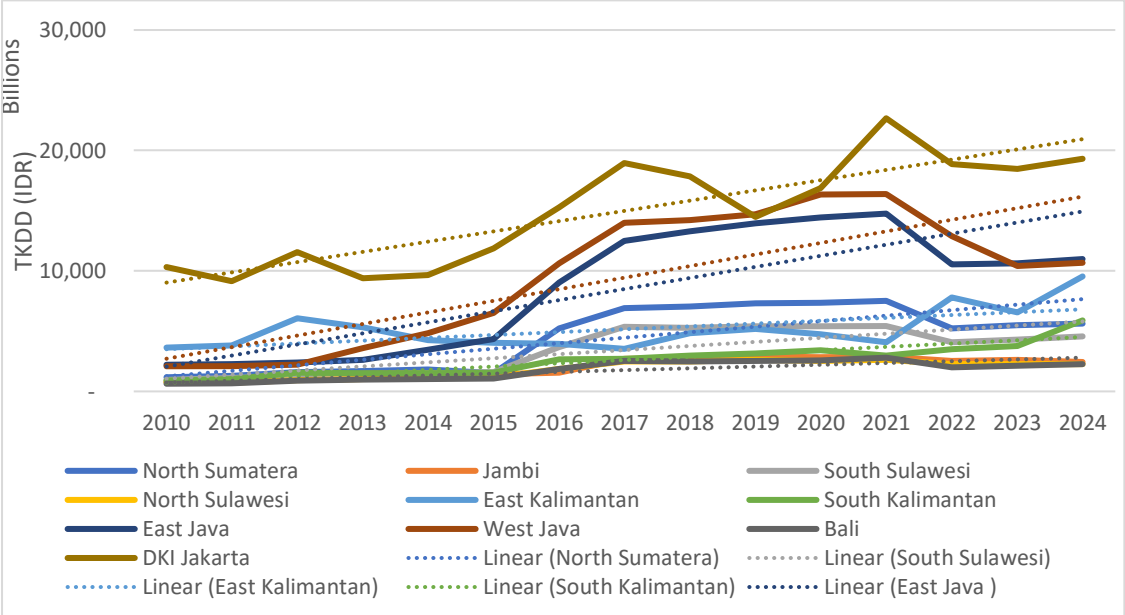

Figure 4. Trend of TKDD, 2010-2024
Source: DJPK Ministry of Finance, processed data, (2024)

However, a downward trend in TKDD allocations was observed in East Kalimantan and South Kalimantan starting in 2013, primarily due to declining profit-sharing from mining and quarrying activities, which were affected by lower global coal prices. This trend began to recover in 2022 as coal prices improved, leading to increased revenue-sharing from the sector.

Trends in FDI

The inflow of direct investment (FDI) into regional economies reflects growing investor confidence in the stability and attractiveness of the study areas. The role of regional leadership is crucial in creating a conducive investment climate by improving political stability and public security and ensuring competitive returns on investment. Economic freedom is positively associated with economic growth, income levels, and investment performance (Lawson et al., 2024).

The central government actively encourages regional governments to attract foreign capital investment to reduce the fiscal burden on local budgets while promoting development. For instance, agricultural investments utilizing swamp wetlands have been implemented in North Sumatra and South Sulawesi Provinces. Moreover, several Special Economic Zones (SEZs) have been developed to enhance regional competitiveness, including Sei Mangkei SEZ (North Sumatra), Lido SEZ (West Java), Gresik SEZ (East Java), Kura Kura SEZ (Bali), Maloy Batuta Trans Kalimantan SEZ (East Kalimantan), Setangga SEZ (South Kalimantan), Likupang and Bitung SEZs (North Sulawesi). In addition to foreign investment, collaboration between government and private entities has been pursued through Public–Private Partnerships (PPP). Notable examples include the provision of Umbulan SPAM drinking water infrastructure and toll road projects in East Java and West Java, as well as telecommunications, informatics, and transportation projects in South Sulawesi and DKI Jakarta.

As shown in Figure 5, regional direct investment has generally increased across provinces. In DKI Jakarta, investment levels experienced fluctuations between 2013 and 2020 but have shown a marked improvement since 2020. The transportation, warehousing, and telecommunications sectors account for the largest contributions, driven by both domestic and foreign capital flows.

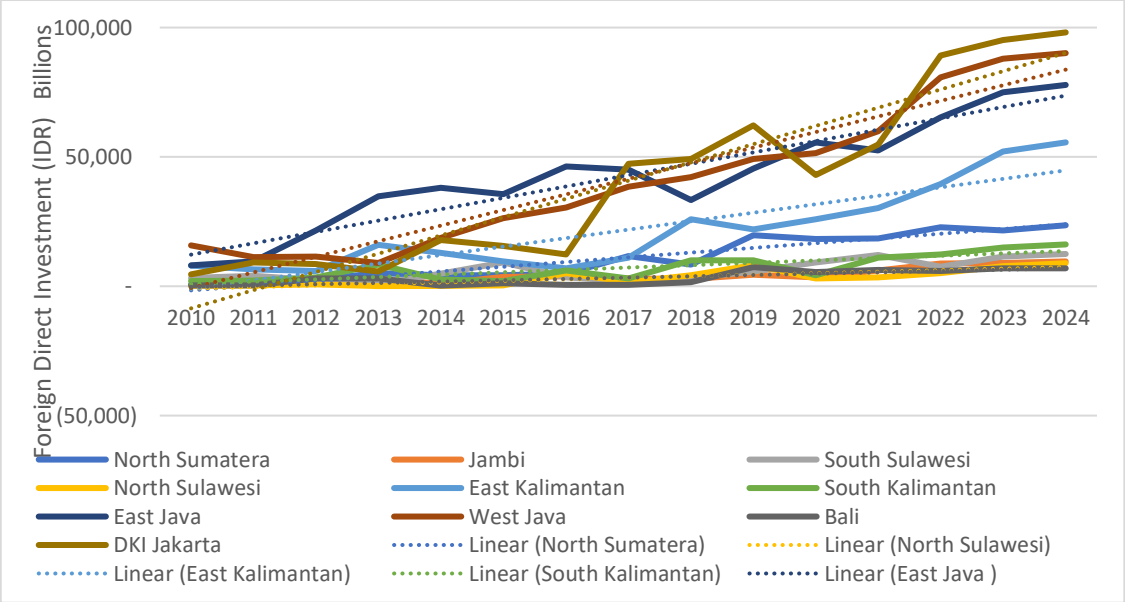

Figure 5. Trend of FDI, 2010-2024
Source: Indonesian Central Statistics Agency, processed data, (2024)

Similarly, East Java Province exhibited a fluctuating investment pattern, with a decline in 2018 followed by recovery and a steady upward trend beginning in 2019. The processing industry remains the principal contributor to East Java's investment value, a pattern also observed in West Java Province, where investment continues to trend upward.

Trends in HDI

Human development plays a vital role as fundamental capital in the growth of real GRDP per capita, as a highly skilled and educated population drives productivity and creativity, thereby increasing income levels. The presence of competitive human resources significantly reduces unemployment and poverty. Furthermore, the steady increase in life expectancy—supported by government spending on healthcare per capita—demonstrates that appropriate investment in healthcare has a significant and positive impact on population well-being.

An effective institutional and regulatory framework is also essential for strengthening domestic human resource capacity, particularly in research and development, technology, infrastructure, and creative industries, which are key outputs of a dynamic and innovative economy (Dempere et al., 2023).

On average, DKI Jakarta Province records the highest HDI value. This performance is largely driven by its status as the center of national economic activity and a major destination for foreign investment, both of which require a highly competitive, skilled workforce to maintain high productivity levels. Bali Province follows closely, as its globally renowned tourism industry requires human resources capable of competing in an international market. Similarly, East Kalimantan Province, which has the highest real GRDP per capita, also exhibits a high HDI, indicating that strong economic performance in the region is supported by equally strong human capital development (Figure 6).

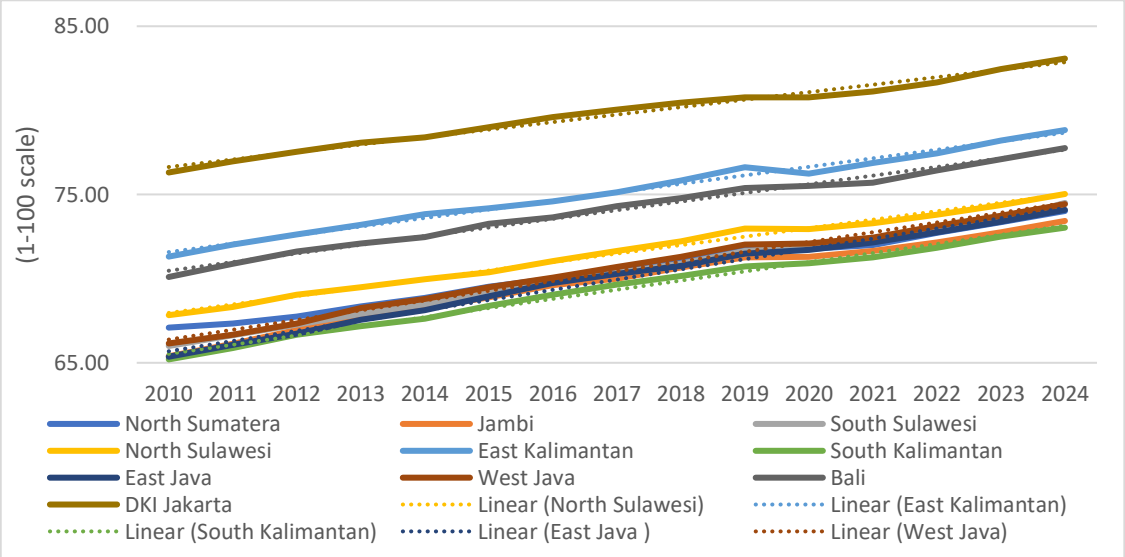

Figure 6. Trend of HDI, 2010-2024
Source: Indonesian Central Statistics Agency, processed data, (2024)

Trends in Gini Ratio

Income inequality remains evident in most of the provinces examined in this study, primarily due to unequal patterns of economic development. The gap between urban and rural populations often reflects disparities in access to employment opportunities and differences in human resource competitiveness. According to De Wettinck and van Mourik (2024), the availability of human resources, government expenditure, and market capitalization for social benefit purposes is associated with reductions in income inequality. However, a high unemployment rate tends to exacerbate income disparities.

As shown in Figure 7, the level of income inequality—measured using the Gini Index—is relatively similar across all provinces analyzed in this study, indicating a persistent challenge in achieving equitable income distribution. Notably, East Kalimantan and DKI Jakarta, which record the highest real GRDP per capita values, continue to experience income inequality similar to that of provinces with much lower GRDP levels.

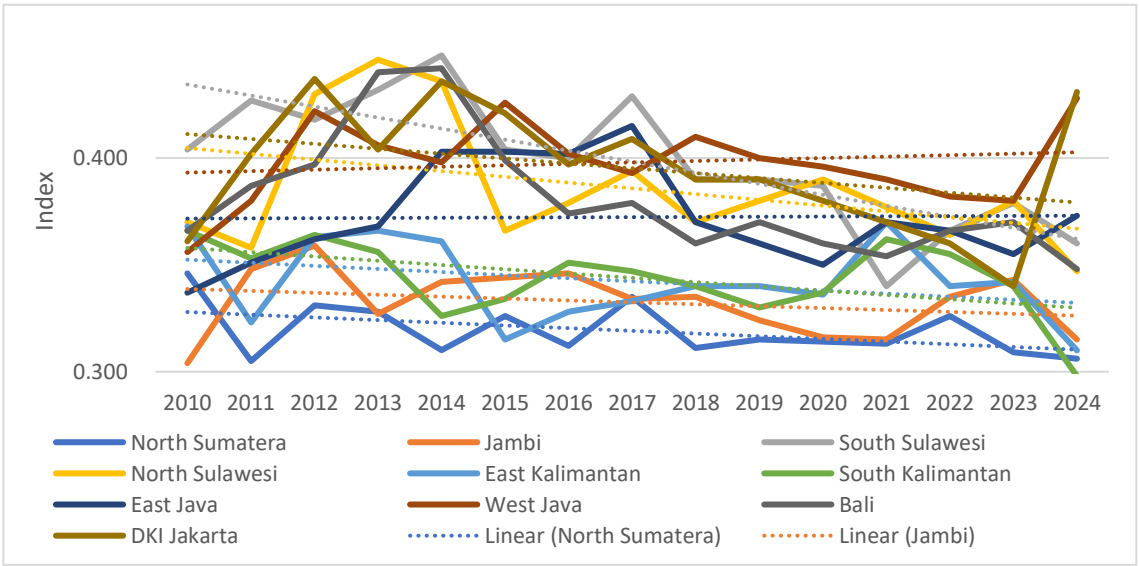

Figure 7. Trend of Gini Ratio, 2010-2024
Source: Indonesian Central Statistics Agency, processed data, (2024)

This finding demonstrates that high real GRDP per capita growth does not necessarily ensure equitable income distribution. In many cases, economic gains are disproportionately enjoyed by higher-income individuals, suggesting that strong economic growth alone is insufficient to guarantee social equity.

Trends in interest rates

The continuous positive growth in direct investment across regions indicates a strong relationship with interest rate control policies, which are part of Bank Indonesia's monetary policy framework. By managing interest rates, the central bank aims to mitigate inflationary shocks and stabilize macroeconomic conditions. There is a significant relationship among inflation, the money supply, and interest rates, all of which collectively influence GDP per capita growth (Isibor et al., 2023).

In addition, the regulation of bank lending rates plays a crucial role in stimulating credit activities. Lower interest rates encourage borrowing for consumption, business expansion, and investment, thereby promoting entrepreneurial development and enhancing workforce productivity. This monetary environment enables business actors to scale up their operations, foster innovation, and create employment opportunities.

As shown in Figure 8, the development of commercial bank interest rates—based on uniform provincial data—reveals a general downward trend. This decline corresponds with the success of Bank Indonesia's inflation control measures, which have contributed to greater monetary stability. The declining interest rate trend is also supported by improved regional inflation management, achieved through the collaborative efforts of local stakeholders organized within the Regional Inflation Control Teams (TPID). These teams play a strategic role in maintaining regional economic balance and mitigating potential inflationary shocks.

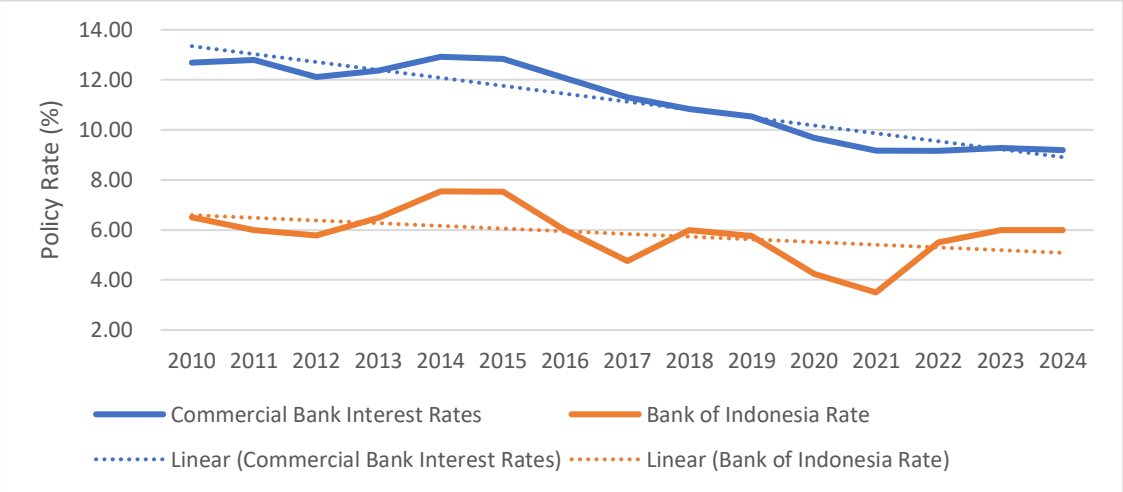

Figure 8. Trend of interest rates, 2010-2024
Source: Bank Indonesia and Indonesian Financial Services Authority (2024)

Summary of key economic indicators

Table 2 provides a descriptive overview of the key economic variables used in this study. The lnGRDP variable shows a mean value of 17.88, indicating strong real GRDP per capita performance across provinces in this study. The lnPAD variable, with a mean of 29.79 and a standard deviation of 1.09, reflects considerable variability, suggesting notable differences in local governments' capacity to generate original regional income. The lnTKDD variable has a mean of 30.66 and a positive skewness of 0.33, suggesting that transfer income from the central government is generally high across all provinces.

The HDI variable shows a mean of 72.05 and a relatively large standard deviation of 3.92, indicating that human development outcomes vary considerably depending on each regional government's effectiveness in implementing programs to enhance human resource quality. The lnFDI variable has a mean of 29.67 and a standard deviation of 1.53, indicating substantial differences in regional investment levels that align with variations in provincial characteristics and investment attractiveness. The interest rate (IS) variable has a mean of 11.13 and slight negative skewness (–0.19), suggesting that commercial bank interest rates tend to remain above Bank Indonesia's benchmark rate.

The highest real GRDP per capita (lnGRDP) growth was 19.68 percent in DKI Jakarta Province (2024), while the lowest was 16.86 percent in West Java Province (2010). The highest Local Own-Source Revenue (lnPAD) was recorded in DKI Jakarta (31.68 percent, 2024), whereas the lowest was 27.19 percent in North Sulawesi Province. Transfer funds to regions and village funds (lnTKDD) reached their highest value in DKI Jakarta (32.11 percent in 2024) and their lowest in Bali Province (29.36 percent in 2010).

For the HDI, the highest value was 83.08 percent in DKI Jakarta (2024), while the lowest was 65.20 percent in South Kalimantan Province (2010). The highest regional investment (lnFDI) was observed in DKI Jakarta (32.22 percent in 2024), with the lowest at 24.92 percent in North Sulawesi (2013). In terms of income inequality, the highest Gini Index value of 0.45 was recorded in South Sulawesi (2014), whereas the lowest, 0.29, was observed in South Kalimantan (2024).

Table 2. Descriptive statistical results

Description	lnGRDP	lnPAD	lnTKDD	HDI	lnFDI	IS	GINI
Mean	17.8796	29.7959	30.6652	72.0522	29.6708	11.1273	0.36682
Median	17.7550	29.7700	30.5550	71.7250	29.7700	11.3100	0.36500
Maximum	19.6800	31.6800	32.1100	83.0800	32.2200	12.9200	0.44800
Minimum	16.8600	27.1900	29.3600	65.2000	24.9200	9.16000	0.29800
Std. Dev	0.67567	1.08709	0.67136	3.91924	1.53400	1.46949	0.03610
Skewness	0.91843	-0.02747	0.32848	0.59721	-0.67669	-0.19868	0.28024
Kurtosis	3.03319	2.24138	2.36640	3.02101	3.50205	1.40025	2.35233
Jarque-Bera	21.0950	3.61569	5.20653	8.91924	13.0231	16.9817	4.58514
Probability	0.00002	0.16400	0.07403	0.01156	0.00148	0.00020	0.10100
Sum	2681.94	4469.39	4599.79	10807.8	4450.62	1669.10	55.0230
Sum Sq.Dev	68.0229	176.085	67.1581	2288.70	350.622	321.752	0.19428
Observation	150	150	150	150	150	150	150
Multicollinearity							
lnGRDP	1						
lnPAD	0.431660	1					
lnTKDD	0.164282	0.778050	1				
HDI	0.886235	0.505827	0.132737	1			
lnFDI	0.516428	0.792615	0.780656	0.452618	1		
IS	-0.401444	-0.311294	-0.393943	-0.538959	-0.510917	1	
GINI	-0.087748	0.221483	-0.005514	0.064134	-0.048302	0.254597	1

These descriptive results suggest that all variables exhibit reasonable variation and distributional characteristics suitable for panel data regression analysis. The correlation matrix indicates that no pair of independent variables shows a high correlation coefficient (above 0.9), suggesting that multicollinearity is not a concern in this model.

Unit root test

Table 3 presents the results of the panel data unit root tests using the Phillips–Perron Fisher Chi-square (PP–Fisher) approach to examine the stationarity properties of the time series data for all variables analyzed in this study. Testing the stationarity of data through the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) criteria provides insights into the stability of the variables over time.

The results indicate that a few variables are non-stationary at the level but become stationary at the first-difference level, suggesting that the time series data exhibit integrated order one (I(1)) characteristics. This finding confirms that differencing the data once is sufficient to achieve stationarity for inclusion in the regression model.

Table 3. Unit root test results

Variable	ADF-Test		PP-Test	
	level	1st diferensiasi	level	1st diferensiasi
$\Delta\ lnGRDP$	15,523	42,152***	86,695***	54,684***
$\Delta\ lnPAD$	32,816**	39,904***	137,266***	79,137***
$\Delta\ lnTKDD$	34,656**	33,570**	48,347***	72,215***
$\Delta\ HDI$	4,3597	38,624***	9,820	55,315***
$\Delta\ lnFDI$	18,839	83,234***	33,649**	168,671***
$\Delta\ IS$	4,827	40,235***	1,711	35,407**
$\Delta\ GINI$	29,853*	76,773***	52,996***	113,838***

*Note: *, ** and *** shows a significant level at level 10%, 5% and 1%*

Model Specifications

Table 4 presents the results of the model specification tests. The Chow test yields an F-statistic of 0.0000, with a p-value below the 0.01 significance level, leading to the rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_1). This confirms that the Fixed-Effects Model (FEM) is more appropriate than the Common-Effects Model (CEM). Subsequently, the Hausman test also reports a p-value of 0.0000, which is below the 1% confidence level, resulting in the rejection of H_0 and acceptance of H_1. Hence, the Fixed Effect Model is determined to be the most suitable estimation technique compared to the Random Effect Model (REM) for analyzing this panel dataset.

Table 4. Model estimation results

Dependent Variable: lnGRDP				
Variable	Coefficient	S.E	t-Statistic	ABS(RESID)
C	3.709981***	0.295075	12.57303	0.3585
lnPAD	0.258236***	0.009978	25.88006	0.9619
lnTKDD	0.046737***	0.012477	3.746006	0.6505
HDI	0.070282***	0.003385	20.76129	0.9356
lnFDI	0.006054***	0.001805	3.354078	0.5789
GINI	-0.202686***	0.057624	-3.517366	0.2032
IS	-0.011431***	0.003571	-3.201025	0.6047
R-squared			0.999198	
Adjusted R-squared			0.999109	
F-statistic			11136.36***	
Fixed Effects (cross)				
_North Sumatera_C	3.533	Cross-Section Dependence		t-Statitic
_Jambi_C	4.118	Pesaran scaled LM		-3.6523***
_South Sulawesi_C	3.627	Bias-corrected scaled LM		-4.0095***
_North Sulawesi_C	3.871			
_East Kalimantan_C	4.566	Normality Test		0.5566
_South Kalimantan_C	3.690	Chow Test		0.0000
_East Java_C	3.303	Hausman Test		0.0000
_West Java_C	2.958	Durbin–Watson		1.626218
_Bali_C	3.329			
_DKI Jakarta_C	4.101			

*Note: ***, ** and * represent statistical significance at 1%, 5% and 10%*

The results in Table 4 confirm that the Fixed Effect Model provides the best fit for the data. The variables lnPAD, lnTKDD, HDI, and lnFDI show positive, statistically significant effects on lnGRDP at the 1% confidence level. At the same time, GINI and IS have negative, significant effects on lnGRDP at the same significance level.

The constant value of 3.709 indicates that when lnPAD, lnTKDD, HDI, lnFDI, GINI, and IS are all equal to zero, real GRDP per capita (lnGRDP) will increase by 3.71 percent. The coefficient on lnPAD (0.258) indicates that a 1% increase in local own-source revenue, holding other variables constant, leads to a 0.258% rise in real GRDP per capita, with a p-value below 0.01, confirming statistical significance at the 1% level. Similarly, the lnTKDD coefficient (0.046) indicates that a 1% increase in transfer funds to regions and village funds will result in a 0.047% increase in lnGRDP, which is also significant at the 1% confidence level.

The HDI coefficient (0.070) implies that a 1% increase in the HDI raises lnGRDP by 0.070%, reflecting a strong and significant positive effect at the 1% level. The lnFDI coefficient (0.006) indicates that a 1% increase in regional investment is associated with a 0.006% increase in lnGRDP, which is also significant at the 1% level. Conversely, the GINI coefficient (–0.203) indicates that a 1% increase in income inequality reduces lnGRDP by 0.203%, while the IS coefficient (–0.011) suggests that a 1% increase in commercial bank interest rates reduces lnGRDP by 0.011%. Both negative relationships are statistically significant at the one percent level.

The coefficient of determination (R^2 = 0.999198) indicates that approximately 99.92% of the variation in real GRDP per capita is jointly explained by the independent variables (lnPAD, lnTKDD, HDI, lnFDI, GINI, and IS). In comparison, the remaining 0.08 percent is attributed to factors outside the model. The F-statistic of 11,136.36, with a significance of 0.0000 (< 0.01), confirms that all explanatory variables collectively exert a statistically significant influence on real GRDP per capita across the ten provinces analyzed.

Among the provincial fixed effects, East Kalimantan shows the highest constant value (0.86 percent), reflecting the strongest baseline performance in real GRDP per capita, while West Java exhibits the lowest (–0.751 percent).

To ensure the model's robustness, several diagnostic tests were conducted. The Durbin–Watson statistic of 1.626 indicates no significant autocorrelation in the residuals, confirming that the regression errors are stable over time. The heteroscedasticity test results show that most variables are not significant at the 5% confidence level, suggesting no serious heteroscedasticity problems and confirming that the model satisfies the homoscedasticity assumption.

The Cross-Section Dependence Test reveals significant dependence among cross-sectional units, with the null hypothesis of no dependence rejected at the 1% level in several tests. The Breusch–Pagan LM test (statistic = 10.350, p = 1.000) indicates no significant dependence, whereas the LM scaled test (statistic = –3.652, p = 0.000) and the bias-corrected scaled LM test (statistic = –4.009, p = 0.000) both show significant dependence. However, the CD test (statistic = 0.786, p = 0.431) indicates no correlation between cross-sectional units.

Overall, the findings confirm that the Fixed Effect Model is the most appropriate specification, satisfying the main econometric assumptions and providing robust, statistically reliable results for explaining variations in real GRDP per capita across the ten provinces studied.

Discussion

The relationship between PAD and real GRDP per capita

The estimation results from the selected model indicate that PAD has a significant, positive effect on real GRDP per capita growth. This relationship arises because the regional government's strategy to increase PAD reflects greater fiscal independence in revenue generation. As PAD increases, regional governments gain stronger capacity to manage expenditures and finance development programs, thereby promoting growth in real GRDP per capita. These findings are consistent with those of Nizam et al. (2024) and Sima et al. (2023).

Strengthening regional tax databases based on taxpayer domicile and corporate investment locations can be pursued through tax extensification and fiscal incentives, such as reducing regional tax rates. For instance, the DKI Jakarta government applies lower motor vehicle and vehicle title transfer tax rates than other provinces to attract taxpayers, recognizing its role as the national economic hub. Similarly, West Java and East Java provide motor vehicle fuel tax incentives to stimulate the manufacturing sector. However, these findings diverge from the perspectives of Kaneva et al. (2023) and Korotun et al. (2020).

Taxes also play a central role in income redistribution (Cota et al., 2023). Effective tax administration strengthens taxpayer compliance and trust, supporting better governance. However, high PAD and TKDD levels in DKI Jakarta and East Java have also resulted in suboptimal local budget (APBD) management, as reflected in large excess budget balances (SiLPA) carried over from previous periods. These idle funds, stored in Regional General Cash Accounts at local banks, reduce the productivity of regional expenditure and the consumption of goods and services. This condition supports Klutse's (2021) findings.

The relationship between TKDD and real GRDP per capita

The model estimation results also show that Transfers to Regions and Village Funds (TKDD) from the central government have a significant and positive effect on real GRDP per capita. These results align with the findings of Ayala et al. (2021). The main objective of central government transfer schemes is to reduce interregional disparities and promote equitable development. Enhanced GRDP performance at the regional level is supported by effective coordination between central and local fiscal policies.

Harmonizing fiscal policy between the central and regional governments—through effective allocation of transfer funds and the optimization of local revenue—ensures that development outcomes can improve community welfare. Better synchronization and coordination, coupled with a balanced fiscal framework, can generate high-quality public services. Discretionary expenditure authority under fiscal decentralization must be exercised responsibly and transparently. Sound regional public finance plays a vital role in achieving development objectives and strengthening fiscal sustainability (Onofrei et al., 2022).

However, fiscal consolidation can have mixed effects. Sarwar et al. (2023) note that widening gaps between government expenditure and income can exacerbate income inequality. Similarly, Gong et al. (2021) argue that weak oversight of fiscal decentralization may lead to inefficient or even improper use of regional financial resources, undermining the positive potential of administrative decentralization for economic growth.

The relationship between FDI and real GRDP per capita

The estimation results further indicate that foreign direct investment (FDI) has a significant and positive impact on real GRDP per capita. The continued increase in direct regional investment reflects growing investor confidence in local economic stability. Regional efforts to improve welfare through GRDP growth cannot be separated from the contribution of private investment, which must be aligned with each region's economic potential and characteristics. For example, Bali Province continues to innovate in tourism-related investments. These findings are consistent with Keita and Yu (2021) but differ from Tvaronaviciene et al. (2023).

Regional governments must strategically identify and develop sectors with strong growth potential. For instance, North Sumatra and South Sulawesi have utilized swamp wetlands for agriculture, supported by technological investments. North Sumatra's strategic position near the Belawan Port, located within the Malacca Strait trade triangle linking Malaysia, Singapore, and Thailand, offers a competitive advantage in maritime trade. Increasing technological literacy and utilizing unproductive land for productive activities can further strengthen local economies.

To attract greater investor interest, both central and regional governments have established Special Economic Zones (SEZs) that provide investment facilitation and fiscal incentives, including tax reductions, in provinces such as North Sumatra, East Java, East Kalimantan, West Java, South Kalimantan, North Sulawesi, and Bali. Additionally, regional governments have formed Public–Private Partnerships (PPP) to accelerate service provision, as seen in South Sulawesi, East Java, West Java, and DKI Jakarta. Through the PPP framework, regions can develop transit-oriented and creative economic zones, transforming hinterlands into new growth centers. These results align with the findings of Štilić et al. (2023), Ibrahimov et al. (2023), and Kurteš et al. (2022).

The relationship between HDI and real GRDP per capita

The results also demonstrate that the HDI has a positive and significant influence on real GRDP per capita, consistent with the findings of Lakhan et al. (2023). Investments in human capital—through education, research, and vocational training—play an essential role in long-term regional growth by improving productivity and competitiveness. Human capital represents the most critical asset for enhancing economic resilience and competitiveness (Minhaj & Ahmed, 2023).

At the regional level, human development initiatives aim to prepare a highly skilled workforce capable of competing with both domestic and foreign labor markets. As foreign investment grows, so does the demand for competent local workers. Studies show that the accumulation of human capital, alongside population growth and foreign direct investment, has a long-term positive effect on GRDP per capita (Shah et al., 2023). Nevertheless, these findings differ from those of Djamal et al. (2023), who argue that the long-term relationship may not always hold.

To maintain long-term economic resilience, local governments should support human capital development through vocational education programs tailored to regional strengths—such as tourism-oriented training in Bali or mining-related vocational education in South and East Kalimantan. This approach aligns with the perspectives of Liu et al. (2023) and Ahmed (2022).

The relationship between the Interest Rate and real GRDP per capita

The estimation results also indicate that a decline in interest rates stimulates growth in real GRDP per capita, consistent with the findings of Bloise and Vailakis (2024), though this differs from those of Evemy et al. (2024). Regional investment contributes

positively to GRDP growth; however, local governments must mitigate the potential inflationary effects associated with rapid investment expansion. Inflation control requires coordinated fiscal and monetary policy, as noted by Khan and Khan (2023).

An increase in the consumption of goods and services following higher investment can lead to demand-pull inflation. To manage this, regional governments should collaborate with Bank Indonesia to regulate benchmark interest rates and maintain equilibrium between the goods and money markets. Lower interest rates also encourage borrowing for consumption, business, and investment, enabling entrepreneurs to expand operations and create jobs.

Providing credit stimulus for micro, small, and medium enterprises (MSMEs) is particularly vital. Reducing loan interest rates empowers MSMEs, fostering inclusive growth and entrepreneurship. Zhou and Liu (2024) argue that equality of opportunity in entrepreneurship significantly affects regional economic quality. For example, in Bali Province, MSME empowerment through tourism-based souvenirs and local products has become a key strategy for sustainable development.

The relationship between Income Inequality and real GRDP per capita

Finally, the findings reveal that reducing income inequality significantly promotes real GRDP per capita growth. This result aligns with the studies of Basumatary et al. (2024) and Lin and Brueckner (2024) but contrasts with Aysan et al. (2023). Regional governments must view income inequality as a critical policy challenge that requires balanced and inclusive development strategies to ensure that economic growth benefits all social groups.

High economic growth is not always inclusive; in some regions, only certain groups benefit from development. For example, in South Kalimantan and East Kalimantan, much of the mining sector's output is dominated by foreign companies, with limited spillover effects to lower-income populations. These results support Kuznets' hypothesis (Dharmadasa, 2023) and are further reinforced by Zhang (2022).

To address inequality, regional governments should expand labor-intensive programs that create employment and raise incomes among low-income groups, as demonstrated by South Sulawesi and North Sulawesi, which have encouraged labor-based regional investment initiatives. These findings align with the studies of Karangwa and Su (2023). Strengthening human resource development also plays a crucial role in reducing inequality (Adan et al., 2023). Likewise, Asrari and Wau (2023) emphasize that economic improvement and direct investment positively influence income distribution.

Beyond their immediate effects, income disparities may influence economic growth with lagged impacts. Persistent inequality might not immediately hinder GRDP growth, but could slow it over time as social and economic divides deepen. Future research could use dynamic panel models or lagged-variable approaches to more precisely capture these delayed effects. Nonetheless, the current results suggest that tackling inequality is not only a social obligation but also a strategic measure to ensure sustainable and inclusive long-term growth.

CONCLUSION AND RECOMMENDATION

Conclusion

An increase in local own-source revenue (PAD) provides greater flexibility for regional fiscal policy, enabling local governments to manage public spending effectively and support growth in real GRDP per capita. A well-developed regional tax database strengthens fiscal capacity, as demonstrated by DKI Jakarta Province, which offers fiscal

incentives through motor vehicle tax relief and lower title transfer fees, and by East Java and West Java, which apply fuel tax incentives to stimulate the processing industry. Moreover, downstreaming the coal industry—as implemented in East Kalimantan—adds value to the mining sector and stabilizes regional profit-sharing revenues, making them less vulnerable to fluctuations in global coal prices.

The central government's policy of managing transfer funds to regions and village funds (TKDD) has also contributed positively to reducing interregional disparities and increasing real GRDP per capita. However, the high PAD and TKDD values in provinces such as DKI Jakarta and East Java have led to large excess budget balances (SiLPA), much of which is deposited in regional banks rather than used for productive expenditure. This condition results in high savings and limited consumption of goods and services.

Regional investment serves as an innovative financing mechanism that supports local economic development and enhances real GRDP per capita growth. Increased investment stimulates consumption, particularly of domestic products, and encourages industrial productivity. The inflow of foreign direct investment (FDI) also plays a crucial role in enhancing the quality and competitiveness of human resources. Examples include North Sumatra and South Sulawesi, which have successfully transformed swamp lands into productive agricultural areas, and East Java, West Java, South Sulawesi, and DKI Jakarta, which have strengthened collaboration with private enterprises through Public–Private Partnerships (PPP).

To attract more investors, the development of Special Economic Zones (SEZs) in North Sumatra, West Java, East Java, Bali, East Kalimantan, South Kalimantan, and North Sulawesi has streamlined investment procedures and offered fiscal incentives, such as tax reductions. These initiatives not only foster economic expansion but also generate employment and regional income.

Nonetheless, regional governments face challenges in sustaining positive real GRDP growth while ensuring equitable distribution of development benefits. Continuous efforts are needed to promote inclusive economic development that reduces income inequality and maintains price stability through effective interest rate control. Although regions such as DKI Jakarta and East Kalimantan have achieved high GRDP per capita, the benefits have not yet been evenly distributed across all income groups, indicating that income inequality remains a persistent issue.

Recommendations

Within the framework of fiscal decentralization, regional governments should use their authority over local revenue policies to stimulate investment growth by offering targeted fiscal incentives, such as reductions in regional tax rates. With increased fiscal autonomy, regional governments should also prioritize strategic spending to enhance human resource capacity, particularly through vocational training and education programs aligned with regional economic potential.

In managing transfer funds to regions and village funds (TKDD), local governments should strengthen fiscal coordination with the central government to promote policy harmonization that supports real GRDP per capita growth. Improving the governance of transfer fund utilization is essential, with a focus on enhancing public service delivery, transparency, and accountability to ensure efficient allocation of fiscal resources.

Regional governments are also encouraged to strengthen collaboration with Bank Indonesia's regional offices, which are responsible for monetary policy implementation, particularly in interest rate management and inflation control. Greater flexibility in bank lending rates can attract investors and stimulate regional economic activity. However,

interest rate reductions—especially those aimed at stimulating micro, small, and medium enterprises (MSMEs)—must be carefully calibrated to prevent inflationary pressures.

Such monetary–fiscal coordination should be institutionalized through the Regional Inflation Control Team (TPID), involving local governments, Bank Indonesia, the Financial Services Authority (OJK), and other relevant stakeholders. This collaborative mechanism will strengthen inflation management, support investment stability, and ensure that regional economic growth remains inclusive, sustainable, and resilient over the long term.

AUTHOR CONTRIBUTIONS

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Validation: Ariodillah Hidayat
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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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