THE EFFECT OF INFRASTRUCTURE (ROADS), REGIONAL FINANCE, AND POVERTY ON GDP IN INDONESIA

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ABSTRACT

Infrastructure development, fiscal capacity, poverty, and economic growth remain critical issues in developing economies. This study analyzes the impact of unpaved road infrastructure, regional finance, and poverty on Gross Domestic Product (GDP) in Indonesia. Utilizing secondary data from the Central Bureau of Statistics (BPS) spanning 2011–2019, The selection of data up to 2019 aims to observe normal macroeconomic dynamics, single digit poverty rates, and national logistics issues without being distorted by the extraordinary impacts of the COVID-19 pandemic in subsequent years. a multiple linear regression model was estimated using the Ordinary Least Squares (OLS) method in EViews. The empirical findings indicate that unpaved road infrastructure has a negative but statistically insignificant effect on GDP, implying that poor road quality retards economic expansion. In contrast, regional finance exerts a statistically significant positive effect on GDP, underscoring the crucial role of fiscal expenditure in stimulating economic activity. Furthermore, poverty has a statistically significant negative effect on GDP, demonstrating that high poverty levels severely constrain aggregate output. These results highlight the need for targeted infrastructure investment and optimal fiscal management to achieve sustainable and inclusive economic growth. Previous studies generally analyzed infrastructure, regional finance, and poverty separately, leaving a gap in evaluating the specific macro-level national impact of unpaved road quality. Furthermore, the effectiveness of fiscal decentralization and the transmission mechanisms of poverty on GDP have not been extensively examined in a comprehensive manner. Therefore, this study addresses this research gap by integrating all three variables into a national empirical model.

Keywords: *Gross Domestic Product (GDP), Infrastructure, Poverty, Regional Finance.*

A. INTRODUCTION

Fluctuations in unpaved road lengths in Indonesia during the 2011–2019 period, based on data from the Central Bureau of Statistics (BPS), demonstrate that road infrastructure development has not been realized evenly across regions. This condition is a fundamental concern because road availability serves as the primary physical capital supporting national and regional economic growth and development. Concurrently, poverty alleviation efforts have not shown significant reductions. This relatively stagnant poverty condition remains one of the primary indicators placing Indonesia within the developing country category. In alignment with this dynamic, regional financial management sourced from central government transfers through the State Budget (APBN) such as Balancing Funds, Regional Incentive Funds (DID), Special Autonomy Funds, Special Funds for the Special Region of Yogyakarta (DIY), and Village Fund allocations—has recorded a nominal upward trend year over year. However, the substantial budget allocation has not yielded optimal contributions to economic development and growth due to inefficient regional budget governance. Road infrastructure issues during the 2011–2019 period encompassed three crucial challenges: First, Inter-Regional Connectivity Disparities, where road infrastructure development remained concentrated in Java, whereas Eastern Indonesia experienced shortages of arterial road networks and logistic connectors. Second, High National Logistics Costs, where poor district/regency road conditions and weak port-to-production-center integration caused national logistics costs to soar to 23–24% of GDP (the highest in ASEAN during that period). Third, Strategic Project Delays, driven by structural barriers such as land acquisition, limited financing frameworks (funding gap), and suboptimal implementation of Public-Private Partnerships (PPP) in the early 2011–2014 phase. The regional finance sector during the same period faced several major obstacles: First, High Dependence on Central Transfers, where Original Regional Revenue (PAD) across most regencies/cities was relatively low, leaving fiscal flexibility heavily dominated by General Allocation Funds (DAU) and Special Allocation Funds (DAK). Second, Dominance of Personnel Expenditure, where local budgets (APBD) were predominantly absorbed by operational needs and civil servant salaries rather than productive capital expenditures for physical development and public facilities. Third, Low Budget Absorption, marked by the accumulation of APBD funds in regional banks near the end of the fiscal year (high SiLPA), which delayed the stimulus effect of fiscal policy on local GDP growth. Meanwhile, poverty issues encompassed: First, Less Inclusive Economic Growth, where economic expansion heavily relied on capital-intensive sectors and commodities, limiting labor absorption for skilled workers. Second, Vulnerability of the Near-Poor Population, where although the poverty headcount ratio dropped below 10% in 2018, a large portion of the population hovered just above the poverty line, making them highly vulnerable to falling back into poverty due to staple food inflation. Third, Disparities in Basic Service Access, where limited human capital quality, capital, and infrastructure in 3T regions (Disadvantaged, Frontier, and Outermost) slowed down the purchasing power of low-income communities.As emphasized by (Maimunah, 2010), infrastructure development priorities within the National Me dium-Term Development Plan (RPJMN) tied to the National Long-

Term Development Plan (RPJPN) are directed toward spurring national economic growth through the acceleration of regional economies. Within the decentralization framework, Balancing Funds are distributed from the APBN to fund regional needs in order to minimize inter-governmental fiscal disparities ((Akhadi, 2020); Law No. 33 of 2004; Government Regulation No. 55 of 2005). Balancing Funds comprise: Revenue Sharing Funds (DBH), sourced from taxes (PBB P3 Sector, Income Tax Articles 21, 25, and 29) as well as Natural Resources (SDA) revenues such as forestry, mining, fisheries, oil, gas, and geothermal energy. The allocation of DBH as economic infrastructure financing is expected to stimulate private and public investment, generate employment, and create multiplier effects on PDRB. General Allocation Budget (DAU), allocated to equalize fiscal capacity across regions to fund decentralization needs. Special Allocation Budget (DAK), specifically allocated to help fund regional activities aligned with national priorities.

To measure economic development progress, Mankiw (2002) in (Hasnaa dan Novitasari, 2018)cited three main macroeconomic indicators: economic growth rate, employment absorption, and price stability. Regional fiscal independence is measured via the Degree of Fiscal Autonomy (DOF) ratio and Routine Capability Index (IKR) using the formulas: DOF = (Original Regional Revenue / Total Regional Revenue) × 100% and IKR = (Original Regional Revenue / Total Routine Expenditure) × 100%, with criteria: Good (>40%), Moderate (20–30%), Poor (10–20%), and Very Poor (0–10%). These ratios evaluate fiscal independence, budgetary receipt efficiency, and regional expenditure development patterns. Regional economic performance is generally represented by Gross Regional Domestic Product (GRDP), the Human Development Index (HDI), and the Gini Ratio. In this context, government expenditure (G) functions as a provider of public goods such as road networks, education, and health. Increased production of goods and services resulting from infrastructure provision ultimately boosts GRDP and enhances overall economic performance in the short and long run. This study employs a quantitative approach utilizing secondary data from BPS and related institutions covering the 2011–2019 period. The analytical method is Multiple Linear Regression via Ordinary Least Squares (OLS) processed using EViews software. The analytical framework and discussion are supported and reinforced by macroeconomic theories and syntheses of relevant prior studies.

B. LITERATURE STUDY

The theoretical foundation and empirical framework of this study are constructed through a systematic synthesis of macroeconomics, regional finance, and development economics literature. Regarding long-term economic expansion, Mankiw (2019) emphasizes that physical capital accumulation especially transportation infrastructure and road networks serves as a primary catalyst that enhances marginal capital productivity and drives aggregate output. In the context of public sector economics and decentralization, (Todaro & Smith, 2012) argue that public expenditure through fiscal transfers and regional development funds functions as an essential redistributive mechanism to rectify market imperfections and accelerate regional growth. (Maimunah, 2010) examined the role of road infrastructure on the regional economy in Indonesia, establishing that road

availability is vital for regional connectivity. However, prior studies had not thoroughly evaluated the specific macro-level implications of unpaved road proportions on national GDP formation, as most literature focused on general road availability in Java. Expanding on regional disparities, (Amalia, 2019) analyzed infrastructure impacts across 33 Indonesian provinces (2008–2017) and identified a critical "growth mismatch" where vehicle volume growth outpaced road capacity expansion, leading to congestion and reduced economic efficiency. Similarly (Anggraini et al, 2021) demonstrated that physical infrastructure quality particularly basic road networks directly affects manufacturing sector distribution and supply chain performance. Integrating these physical dimensions, (Rokhmat et al, 2020) confirmed a reciprocal causal relationship between infrastructure expansion and regional economic activity, highlighting that basic infrastructure investment stimulates regional multiplier effects. To finance such infrastructure and stimulate regional development, regional financial governance plays an indispensable role. (Nurhemi dan Suryani, 2015) investigated regional financial autonomy and economic growth, revealing that while fiscal decentralization and transfer funds grew annually, APBD governance effectiveness remained constrained by personnel expenditure dominance and low budget absorption. Focusing on specific regional fiscal performance, (Hasnaa dan Novitasari, 2018) analyzed fiscal independence indicators (Degree of Fiscal Autonomy/DOF and Routine Capability Index/IKR) in Banten Province, noting that most regional literature remained partial or micro-based, thus requiring nationwide comparative frameworks. Complementing this, (Akhadi, 2020) evaluated regional revenue and capital expenditure in DKI Jakarta, demonstrating that Original Regional Revenue (PAD) and Revenue Sharing Budget (DBH) are vital for sustaining economic performance, though macro studies needed broader geographic generalizability beyond metropolitan centers.

Furthermore, synthesizing empirical findings, Capital expenditure targeted at public infrastructure directly stimulates economic growth (GRDP) by creating a broad economic multiplier effect (Tiya Sari & Setya Wijaya, 2024). Complementing this, Proper, efficient regional financial management amplifies this impact by ensuring budget allocations effectively expand infrastructure and public services, thereby boosting labor productivity and regional competitiveness (Nisak et al , 2024). Moreover, Essential infrastructure specifically road networks, power supply, and clean water serves as the critical foundation for macroeconomic growth. In particular, improved road connectivity lowers logistics costs, streamlines distribution, and removes trade barriers between regions (Amir, et al, 2026). The conclusion is Directing capital expenditure toward core public infrastructure backed by efficient regional financial managementdr ives economic growth by lowering logistics costs, enhancing productivity, and creating strong economic multiplier effects.

C. RESEARCH METHOD

This study employs a quantitative approach utilizing secondary data from BPS and related institutions covering the 2011–2019 period. The analytical method is Multiple Linear Regression via Ordinary Least Squares (OLS) processed using

EViews software. The analytical framework and discussion are supported and reinforced by macroeconomic theories and syntheses of relevant prior studies.

D. RESULTS AND DISCUSSION

Results:

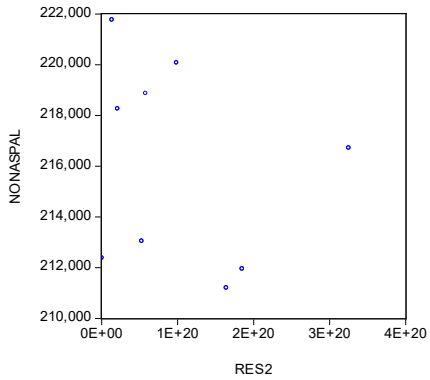
The empirical results of the multiple linear regression model estimating the impact of unpaved road infrastructure, regional finance, and poverty on GDP in Indonesia are presented below.Empirical results indicate that unpaved road conditions exhibit a negative correlation with GDP, meaning that as unpaved roads increase, GDP decreases. However, the regression result is statistically insignificant, indicating that unpaved roads do not have a statistically significant effect on GDP. Regional finance exhibits a positive correlation with GDP, implying that higher regional finance (expenditures directed to regions via intergovernmental transfers and village funds) increases GDP. The regression result is statistically significant, confirming that regional finance exerts a significant effect on GDP. Poverty headcount exhibits a negative correlation with GDP, meaning that when poverty increases, GDP decreases. The regression result is statistically significant, demonstrating that poverty exerts a significant effect on GDP. The R-squared value of 0.99 indicates that the independent variables (unpaved roads, regional finance, and poverty) explain 99% of the variation in the dependent variable (GDP), with the remaining 1% explained by other variables outside this study. Classical assumption testing revealed negative autocorrelation.

Figures and tables

Table 1.
OLS Regression Results (Dependent Variable: GDP)

Dependent Variable: GDP
Method: Least Squares
Sample: 2011 2019
Included observations: 9

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.66E+12	5.78E+11	2.866510	0.0351
Infrastructure	-1733469.	1523901.	-1.137521	0.3069
Reg Finance	549052.7	104323.3	5.262990	0.0033
Poverty	-2.75E+10	9.19E+09	-2.990362	0.0304
R-squared	*0.991859*	*Mean dependent var*		*8.67E+11*
Adjusted R-squared	*0.986974*	*S.D. dependent var*		*1.19E+11*
S.E. of regression	*1.36E+10*	*Akaike info criterion*		*49.79900*
Sum squared resid	*9.19E+20*	*Schwarz criterion*		*49.88666*
Log likelihood	*-220.0955*	*Hannan-Quinn criter.*		*49.60984*
F-statistic	*203.0569*	*Durbin-Watson stat*		*2.990698*
Prob(F-statistic)	0.000012			



Source: Author

Figure 1.
Heterocedasticity

Table 2.
Corellation

	Infrastrucure	Reg Finance	Poverty
Infrastrucure	1.000000	-0.068400	-0.182278
Reg Finance	-0.068400	1.000000	-0.913448
Poverty	-0.182278	-0.913448	1.000000

Source: (EViews Regression Results) – italicized on the left side

Note: table 1. Negative autocorrelation detected (Durbin-Watson stat = 2.99).

Discussion:

The high Durbin Watson statistic and R-squared in this equation were driven by data limitations specifically a sample size of 9 years where the effects of regional finance do not manifest instantaneously in the same year, but rather are felt 1 to 2 years later. In this estimation, the Durbin Watson statistic was successfully mitigated by applying logarithmic transformations and differencing to all variables, as well as incorporating lags for the regional finance variable. Consequently, the Durbin Watson value dropped to 1.8, indicating that the regression equation is reliable and free from spurious regression. Furthermore, the resulting correlations between the independent and dependent variables remain consistent with established economic theory and are justifiable. Therefore, future research is strongly recommended to expand the sample size by including more observation years.

Effect of Unpaved Road Conditions on GDP: GDP real in nominal monetary value and unpaved road in physical length. Unpaved road infrastructure reflects suboptimal physical capital quality. During 2011–2019, high proportions of unpaved roads negatively impacted GDP and GRDP growth through key transmission channels: Logistics and transportation cost inflation due to rapid fleet depreciation, fuel consumption, and maintenance costs, combined with sluggish goods mobility, pushing national logistics costs to 23–24% of GDP. Isolation of agricultural and plantation production centers, causing high post-harvest losses and

reduced value added. Investment and Gross Fixed Capital Formation (GFCF) barriers due to supply chain risks and regional infrastructure disparities. As noted by (Anggraini et al, 2021), inclusive infrastructure development is vital for national economic movement. (Maimunah, 2010) explained that road infrastructure requires large budgets as roads facilitate 70% of human and goods mobility. (Amalia, 2019) found that road length variables are not always significant due to growth mismatch (vehicle volume growth outpacing capacity expansion, causing congestion).(Rokhmat et al, 2020) confirmed a causal relationship between infrastructure and economic activity, where infrastructure expansion drives economic multiplier effects. *Effect of Regional Finance on GDP*: Fiscally, DAU and DAK are components of Balancing Funds, a subcategory under the Intergovernmental Transfers system. This transfer scheme fundamentally encompasses all central budget allocations to regional and village governments, with Balancing Funds serving specifically as the vehicle for DAU, DAK, and Revenue Sharing Funds (DBH). Regional finance in monetary value / Rupiah of regional financial budgets. In accordance with the Keynesian framework, government expenditure (G) acts as a direct fiscal stimulus driving GDP via the aggregate equation Y = C + I + G + (X - M). During 2011–2019, regional finance contributed significantly through direct spending and fiscal autonomy. Transmission channels include Capital Expenditure (enhancing long-term productive physical capital and crowding in private investment), Original Regional Revenue (PAD reflecting local economic transactions and providing fiscal space), Transfer to Regions and Village Funds (TKDD acting as redistributive stimuli), and Personnel Expenditure (boosting short-term household consumption C though less productive long-term). Structural hurdles during this period included operational expenditure dominance, budget absorption delays (high SiLPA), and high fiscal dependency. These findings align with (Akhadi, 2020) regarding PAD and DBH contributions. A number of empirical studies reveal varying findings regarding the impact of regional financial instruments including Local Own Source Revenue (PAD) or regional taxes, the General Allocation Fund (DAU), and the Special Allocation Fund (DAK) on Gross Regional Domestic Product (GRDP) and economic growth. Based on research conducted by (Sinaga, Purba, & Panjaitan, 2020) in Simalungun Regency, the variables of PAD and DAK partially showed no significant effect on economic growth, whereas DAU proved to be the most dominant and statistically significant factor. In contrast, a study by (Afferina et al, 2024) in West Sumatra Province found that regional taxes, DAK, and regional expenditures had a positive and significant impact on GRDP, while DAU conversely exhibited a negative and significant effect due to a large portion of funds being absorbed by personnel expenditures. Meanwhile, utilizing the VECM model approach in Batu City, (Hidayatulloh & Agustin, 2025) demonstrated that PAD, DAU, and DAK exert a strong influence on GRDP in the long term, supported by a unidirectional causality pattern running from PAD to GRDP. Although the partial relationships exhibit different characteristics across regions, overall, these financial variables collectively prove capable of explaining regional economic fluctuations with a very high level of determination.

Effect of Poverty on GDP: This research use poverty headcount (in millions).The relationship between poverty population and GDP during 2011–2019 was negative and significant. High poverty restricts GDP via four main mechanisms: Household consumption reduction (C), as poor households with limited purchasing power fulfill only subsistence needs. Decline in human resource productivity and quality, where poverty limits access to higher education and health facilities, creating unskilled labor. Fiscal allocation burden, where large poor populations demand heavy social protection spending (PKH, Social Assistance), narrowing fiscal space for productive capital investment. Savings and capital formation barriers, as extremely low incomes prevent savings, reducing domestic liquidity for private investment and GFCF. During 2011–2019, Indonesia successfully reduced poverty into single digits (from 12.49% or 30.02 million in 2011 to 9.22% or 24.79 million in September 2019), while maintaining stable economic growth of 5.0%–6.2%. As (Munir dan Nurohman, 2021) noted, poverty significantly impacts GRDP by reflecting individuals' inability to meet basic living needs, directly impacting low productive contributions to GDP. Based on economic literature, regional development dynamics are heavily influenced by the interaction among economic growth, poverty rates, and income distribution. In Gorontalo Province, (Novriansyah, 2018)showed that unemployment and poverty rates have a significant impact on the decline of economic growth rates, with poverty acting as the most dominant factor. The positive effect of economic growth was also emphasized by (Simarmata & Iskandar, 2022) regarding the improvement of the Human Development Index (HDI) nationally. Nonetheless, a study by (Ardina & Esya, 2026) found that partially, variables such as poverty, inflation, and zakat do not always show a significant influence on Gross Domestic Product (GDP). On the other hand, the issue of economic inequality has also been examined through economic growth and regional welfare. (Syahri & Gustiara, 2020) identified that economic growth in North Sumatra has a positive yet insignificant impact on income inequality confirming the Kuznets hypothesis while poverty exerts a negative effect on inequality. Harmonious findings were (Aisyah & Sishadiyati, 2024) in Greater Surabaya, where high per capita GRDP widens inequality due to uneven progress across sectors, whereas poverty rates and minimum wage policies have proven capable of significantly suppressing income disparity.

E. CONCLUSION AND RECOMMENDATIONS

Conclusion:

Based on empirical testing and comprehensive analysis regarding the impact of unpaved road infrastructure, regional financial management, and poverty levels on Indonesia's Gross Domestic Product (GDP) from 2011 to 2019, several key conclusions can be drawn: Unpaved road infrastructure exhibits an inverse (negative) relationship with GDP; however, it does not exert a statistically significant effect. This indicates that at the national macroeconomic level, the proportion of unpaved roads has not served as a primary decisive factor directly dictating GDP fluctuations, despite conceptually poor road conditions remaining an impediment to distribution efficiency. Conversely, regional finance representing

development budget allocations and intergovernmental fiscal transfers demonstrates a positive correlation and exerts a statistically significant positive effect on GDP enhancement. This empirical finding confirms that fiscal stimulus policies through regional budgets (APBD), balancing funds, and village funds play a vital role in generating a multiplier effect that drives national economic activity. Furthermore, the poverty headcount displays a negative correlation and a statistically significant impact in depressing GDP output. This confirms that high poverty levels directly constrain household purchasing power, reduce labor productivity, and narrow the government's fiscal space due to heavy social safety net expenditure burdens. Simultaneously, the three independent variables comprising unpaved road conditions, regional finance, and poverty headcount prove highly robust in explaining GDP fluctuations in Indonesia, achieving a coefficient of determination (R-squared) of 99.18%, with the remaining percentage influenced by other factors outside the scope of this study.

Recommendations for the Government:

First, accelerating the improvement of basic infrastructure quality: Both central and regional governments should prioritize the conversion of unpaved roads (earth or gravel surfaces) into paved or rigid pavement structures, particularly within agricultural production centers and regions outside Java. This strategic intervention is crucial for reducing persistently high national logistics costs and streamlining supply chain distribution networks. Second, optimizing regional financial governance: Local governments must restructure their Regional Budgets (APBD) to prioritize productive capital expenditures such as physical infrastructure and public facilities rather than being heavily dominated by personnel expenditures. Furthermore, accelerating budget execution at the beginning of the fiscal year is imperative to prevent excessive budget financing surpluses (SiLPA) and maximize the fiscal multiplier effect on Gross Domestic Product. Third, enhancing inclusive poverty alleviation programs: Given that poverty exerts a statistically significant negative impact on GDP, social protection policies (including targeted social assistance and subsidies) must be closely integrated with economic empowerment initiatives, improved educational access, and quality healthcare services to elevate the productivity of unskilled labor and expand formal labor market absorption.

Recommendations for Future Researchers:

First, expanding variable scope and observation timeframes: Future researchers are strongly encouraged to extend the study period (time series) or adopt panel data methodologies (cross-sectional data across provinces) to capture spatial and temporal dynamics among regions more comprehensively. Second, incorporating auxiliary macroeconomic variables: Subsequent studies could integrate relevant additional factors such as the Human Development Index (HDI), open unemployment rates, private investment (Gross Fixed Capital Formation), or specific Village Fund allocations to analyze deeper economic transmission mechanisms. Third, applying advanced econometric methodologies: Researchers may employ more sophisticated analytical approaches, such as the Vector Error Correction Model (VECM) to test short-run and long-run causality, or Spatial Panel

Regression models, to account for spatial autocorrelation and regional disparities more accurately.

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