

Does Local Spending Matter? Fiscal Allocation in Basic Services and Human Development across the Sumatra Region, Indonesia

Widya Sylviana*^{ID}, Fadil Rizki Irawan^{ID}, Zulkefly bin Abdul Karim^{ID}

^{1,2} Economics Department, Faculty of Economy and Business, Airlangga University, Indonesia

³Faculty of Economics & Management, Universiti Kebangsaan Malaysia

Email: widya-s@feb.unair.ac.id

(Article history) Received: 2026-04-21, Revised: 2026-06-17, Accepted: 2026-06-17,
Available online: 2026-06-20

DOI: 10.24252/ecc.v7i1.13382,

Stable URL: <https://journal.uin-alauddin.ac.id/index.php/ecc/index>

Abstract

Fiscal decentralization is intended to achieve equitable regional economic development by granting local governments autonomy over revenue and expenditure management, with Gross Regional Domestic Product (GRDP) as a key indicator. However, the Southern Sumatra region continues to show relatively lower GRDP contributions compared to Northern Sumatra. This study aims to examine the role of district and city government expenditures in basic service sectors; education, health, and infrastructure, on GRDP growth in both the short and long term, while also considering the influence of the Human Development Index (HDI), labor force, and the COVID-19 pandemic. The novelty of this research lies in the integration of sectoral fiscal spending, human development, labor factors, and pandemic effects within a dynamic panel data framework. This comprehensive approach is expected to provide deeper insights for improving regional fiscal policy and enhancing sustainable economic development. This study employs a quantitative approach using a dynamic panel data regression model estimated through the Generalized Method of Moments (GMM). The data consist of 60 districts and cities across five provinces in Southern Sumatra: Lampung, Bengkulu, South Sumatra, Bangka Belitung, and Jambi. The results reveal that, in both the short and long term, infrastructure spending and the COVID-19 pandemic have a negative and significant effect on GRDP. Conversely, HDI has a positive and significant impact on GRDP. Meanwhile, education spending, health spending, and labor force variables do not have a significant effect on GRDP. The implications of this study highlight the importance of optimizing regional budget allocation, particularly in infrastructure and human development, to effectively promote regional economic growth.

Keywords: Fiscal decentralization; Government expenditure; Basic Service Sectors; Human Development Index; GRDP

1. Introduction

Economic growth plays a central role in shaping societal well-being. One way to improve people's standard of living is by boosting national economic growth (Sahoo and Dash, 2009). Economic growth refers to an increase in the production of goods and services over a specific period and serves as an indicator of a country's development success (Mankiw and Beren, 2021). Economic growth can also be defined as the sustained expansion of production capacity over time (Barro and Idem, 2004).

Gross Domestic Product (GDP) is a commonly used indicator for evaluating the scale and rate of expansion of an economy. It represents the total value of all goods and services produced within a country's borders over a specific period (Almarashi et al., 2024; Heys & Taylor, 2025). By monitoring changes in GDP over time, policymakers, economists, and analysts can assess the overall well-being and effectiveness of the economy. GDP serves as a key indicator of economic growth in Indonesia. Over the past several decades, Indonesia's GDP growth has reflected the state of the country's economy. Indonesia's average economic growth has generally remained stable between 4-7% during periods of economic stability, while negative GDP growth has indicated periods of economic slowdown. Indonesia has experienced several economic and monetary crises, such as in 1998, 2008, and 2020, during which GDP growth turned negative.

In the regional context, the term Regional Gross Domestic Product (RGDP) is used to measure economic performance at the regional level. The government seeks to implement equitable regional development as part of its mission to promote sustainable economic growth. Equitable development is intended not only to drive and accelerate regional economic growth but also to reduce social disparities, economic inequalities, and gaps in human development. It also aims to foster inclusive regional development (J. Li et al., 2025). Regions across Indonesia contribute differently to national GDP growth. The largest contribution still comes from Java Island, accounting for 57.27% of the national economy. Sumatra contributes 21.94% and is the second-largest contributor to the national economy (Statistics Indonesia, 2022). This indicates that Indonesia's economy remains concentrated on Java, while Sumatra represents the largest economic region outside Java. Therefore, examining the economic potential of Sumatra is important.

Recent studies suggest that regional economic disparities remain a major challenge in decentralized economies. Although fiscal decentralization is expected to improve allocative efficiency and regional development outcomes, differences in fiscal capacity, infrastructure quality, and human capital often generate uneven growth patterns across regions. Empirical evidence indicates that regions with stronger fiscal capacity and higher-quality public services tend to achieve faster economic growth than regions characterized by limited infrastructure and lower human development outcomes (Sima et al., 2023; Sofilda et al., 2023). Consequently, understanding the determinants of regional economic performance remains crucial for designing effective development policies aimed at reducing interregional disparities.

Sumatra Island plays a significant role in supporting national economic growth (Statistics Indonesia, 2022). The sectors contributing most strongly to the island's economy are trade, agriculture, forestry, and fisheries. This differs from Java, where manufacturing dominates, and from Kalimantan and the Bali–Nusa Tenggara region, where mining and quarrying are the leading sectors. These differences indicate a diversified distribution of economic activities across Indonesia (Statistics Indonesia, 2023). Within Sumatra, the provinces in the northern part of the island, such as North Sumatra, Riau, and the Riau Islands, contribute relatively larger shares to the national GDP. In contrast, provinces in Southern Sumatra, such as Jambi, South Sumatra, and Bengkulu, contribute smaller shares. Bengkulu Province records the lowest GDP contribution on Sumatra Island. This condition raises questions about why the Southern Sumatra region contributes less to GDP compared to the northern region. Southern Sumatra consists of the provinces of Jambi, South Sumatra, Bengkulu, Bangka Belitung, and Lampung. Recent evidence suggests that regional inequality remains closely associated with differences in human capital, infrastructure development, and labor market conditions. Regions characterized by higher levels of human capital and stronger public service provision generally experience more sustainable economic growth than regions facing development constraints. Empirical findings from Indonesia indicate that human capital development and regional inequality significantly influence economic growth outcomes across provinces and local governments (Suparman and Muzakir, 2023). These findings highlight the importance of examining the determinants of regional growth within regions experiencing persistent development disparities.

In an effort to promote equitable regional development throughout Indonesia, the

Indonesian government has implemented a regional autonomy policy based on Law No. 23 of 2014 on Regional Government. Regional autonomy in Indonesia involves granting authority to local governments to administer and manage community affairs and interests in accordance with applicable regulations (Wadipalapa et al., 2024). One application of regional autonomy is the policy of fiscal decentralization. Fiscal decentralization involves the delegation of budgetary authority, such as decision-making regarding revenue and expenditures, from the central government to local governments (Y. Li & Bai, 2024).

Despite extensive studies on fiscal decentralization and regional economic growth in Indonesia, limited research has specifically examined the dynamic effects of local government expenditures on economic growth at the regency and city levels in the Southern Sumatra region. Most previous studies have focused primarily on national or provincial-level analysis, thereby overlooking disparities among local governments within regions outside Java. In addition, earlier studies generally emphasized aggregate government spending without distinguishing the role of sectoral expenditures such as education, health, and infrastructure in influencing regional economic performance. Furthermore, only limited studies have incorporated dynamic panel approaches and post-pandemic conditions to capture both temporal persistence and structural economic changes following the COVID-19 crisis. Recent studies have increasingly applied dynamic panel estimators to investigate the determinants of economic growth because economic performance exhibits strong persistence over time and is often affected by endogeneity issues. Dynamic panel Generalized Method of Moments (GMM) models have been widely recognized as effective tools for addressing these challenges while simultaneously estimating short-run and long-run relationships among fiscal, social, and economic variables (Farzana et al., 2024). However, applications of this approach remain limited in studies focusing on regional growth dynamics within Indonesia, particularly at the regency and municipality levels.

Based on these gaps, this study seeks to answer the following research question: how do local government expenditures on education, health, and infrastructure affect regional economic growth in regencies and cities in Southern Sumatra during the period 2010–2022? This question is important because Southern Sumatra represents a strategically important economic region outside Java, yet it continues to experience relatively lower economic contributions and regional disparities compared to other major regions in Indonesia. Understanding the determinants of regional economic growth in this area is therefore essential for supporting more equitable and inclusive development policies.

This study offers several contributions to the existing literature. First, the study provides empirical evidence at the regency and city levels, thereby offering a more detailed perspective on regional economic disparities within Southern Sumatra. Second, the study simultaneously examines the effects of government expenditures on education, health, and infrastructure, enabling a more comprehensive evaluation of public spending effectiveness in promoting economic growth. Third, this study applies a dynamic panel data approach using the Generalized Method of Moments (GMM), which allows the analysis to address endogeneity issues and capture the dynamic nature of regional economic growth. Fourth, the inclusion of the COVID-19 dummy variable enables the study to identify differences in economic conditions before and after the pandemic period.

The findings of this study are expected to provide important implications for future research, policymaking, and regional development practices. From an academic perspective, this study enriches the literature on fiscal decentralization and regional economic growth, particularly in developing countries with significant regional disparities. From a policy perspective, the results may assist local and central governments in designing more effective expenditure allocation strategies to support equitable regional development. In practical terms, the study may also serve as a reference for improving the effectiveness of public spending on basic services, especially in regions outside Java that continue to experience development gaps. Finally, this study can provide a foundation for future research examining regional growth dynamics, fiscal policy effectiveness,

and post-pandemic economic recovery in Indonesia and other emerging economies.

2. Literature Review

Gross Domestic Product (GDP) is defined as the total value of all final goods and services produced within a region over a specific period and is widely used as an indicator of economic performance (Karunanithi et al., 2024). GDP also serves as the primary measure of economic growth, which refers to an increase in aggregate output over time (Mankiw, 2018). From a theoretical perspective, economic growth can be explained through Keynesian theory, which emphasizes the role of aggregate demand as the main driver of output in the short run. Aggregate demand consists of consumption, investment, government expenditure, and net exports (Fontana and Sawyear, 2016). This framework highlights that changes in macroeconomic variables, particularly government expenditure, directly influence GDP. Empirical studies confirm that aggregate demand components significantly affect economic growth, especially in developing economies (Farzana et al., 2024).

Government expenditure is a key fiscal policy instrument used to influence macroeconomic performance (Atkinson and Stiglitz, 2015). It includes spending on public goods and services, transfers, and debt obligations. Government spending on healthcare contributes positively to GDP growth and income per capita through improvements in health outcomes (Kaur et al., 2024). Wagner's Law suggests that government expenditure increases alongside economic growth due to rising demand for public services, while the Peacock-Wiseman hypothesis explains that government spending tends to increase during periods of crisis and remains at a higher level afterward. Musgrave's theory further highlights the roles of allocation, distribution, and stabilization in public finance. Within the Keynesian framework, government expenditure plays an important role in stimulating aggregate demand and economic growth. However, empirical findings remain mixed. Some studies indicate that excessive or inefficient spending may hinder economic growth (Kitutilla, 2024). In contrast, other studies find that government expenditure has a positive and significant effect on economic growth, particularly when allocated to productive sectors (Akinlo, 2012).

Recent empirical evidence supports the importance of government expenditure in promoting economic growth. Arawatari et al., (2023) found that productive government expenditure contributes positively to economic growth, although excessive public spending may generate diminishing returns when it exceeds its optimal level. Similarly, Nguyen and Bui (2022) demonstrated that government expenditure significantly affects economic growth, although the effectiveness of public spending depends on institutional quality and corruption control. These findings support Keynesian theory, which emphasizes the role of fiscal policy in stimulating aggregate demand and economic output. Furthermore, Buthelezi (2023) found that government expenditure positively affects long-run economic growth, particularly when public spending is directed toward productive sectors and development-oriented programs.

In addition to its direct contribution to aggregate demand, government expenditure also plays an important role in stimulating private sector activities. Carvelli (2023) argued that public expenditure enhances private investment through improvements in infrastructure, institutional support, and economic stability. Likewise, recent evidence suggests that government spending generates positive multiplier effects on output regardless of whether expenditures are allocated to government consumption or public investment activities. These findings indicate that the effectiveness of government expenditure depends not only on the amount of spending but also on expenditure composition and fiscal management quality. These differences indicate that the impact of government expenditure depends on its composition and efficiency. Health expenditure is increasingly recognized as a productive investment because improvements in population health contribute directly to labor productivity and economic performance. Recent empirical studies indicate that healthcare expenditure positively affects economic growth by improving workforce participation and reducing productivity losses caused by health-related problems (Kaur et al., 2024). Health improvements contribute significantly to economic growth, although the magnitude of the effect may vary across development levels and institutional settings (Chakroun, 2024). A

growing body of evidence indicates that population health constitutes an important source of cross-country differences in income and economic growth (Fumagalli et al., 2024). Recent evidence suggests that government expenditure on education positively contributes to long-run economic growth by enhancing labor productivity and human capital accumulation (Rahman and Anis, 2023). Healthcare expenditure positively affects economic growth by improving workforce productivity and supporting human capital development (Sethi et al., 2024). Furthermore, recent literature reviews conclude that health improvements constitute an important driver of long-run economic growth through both direct and indirect productivity effects. Based on these theoretical and empirical considerations, the following hypothesis is proposed:

H1: Education expenditure has a significant effect on economic growth.

H2: Health expenditure has a significant effect on economic growth.

H3: Infrastructure expenditure has a significant effect on economic growth.

In addition to government expenditure, human capital is an important determinant of economic growth. Public investment in education remains an important policy instrument for strengthening human capital formation and supporting economic development (Naurin and Pourpourides, 2023). The Human Development Index (HDI) reflects the quality of human capital, including education, health, and living standards. Human capital theory emphasizes that improvements in these dimensions enhance productivity and economic performance (Becker, 1983). Empirical studies confirm that HDI has a positive and significant impact on economic growth (Kurniawan and Huda, 2024; Soleman et al., 2022). These findings suggest that higher human development contributes to sustainable economic growth. Infrastructure development remains a key determinant of economic performance because it improves connectivity, reduces transaction costs, and enhances production efficiency. Recent empirical evidence confirms that physical infrastructure contributes positively to economic growth by facilitating market integration and improving productivity across economic sectors (Timilsina et al., 2024).

Consequently, infrastructure expenditure remains one of the most important instruments of regional development policy. Recent studies provide further evidence that human development plays a crucial role in promoting economic growth through improvements in education, health, and labor productivity. Human development enhances the quality of human capital, facilitates technological adoption, and strengthens economic competitiveness. Kumar and Batra (2023) found that human development significantly contributes to long-run economic growth and may exert a stronger influence than financial development in developing economies. Similarly, Tassinari (2023) emphasized that productivity, equity, and sustainability are fundamental dimensions of human development that support long-term economic performance. These findings suggest that improvements in HDI contribute positively to sustainable economic growth. Based on this theoretical and empirical review, the following hypothesis is proposed:

H4: The Human Development Index (HDI) has a significant effect on economic growth.

The labor force is another key factor influencing economic growth. Growth theory suggests that both the quantity and quality of labor contribute to increased productivity and output (Aghion, 2017). Empirical evidence supports this relationship. Studies conducted in Indonesia and Malaysia show that labor force participation has a positive and significant effect on economic growth (Saputra et al., 2022). Tassinari (2023b) emphasized that productivity, equity, and sustainability constitute fundamental dimensions of human development that contribute to long-term economic growth. Empirical studies consistently show that labor force participation and labor quality contribute significantly to economic growth. Labor serves as a primary factor of production and plays a crucial role in enhancing productivity and output. Recent evidence indicates that improvements in labor market participation, workforce skills, and employment opportunities positively affect economic performance. Suparman and Muzakir (2023) found that human capital and labor market conditions significantly influence regional economic growth. Likewise, Goh et

al., (2017) reported that labor force participation positively contributes to economic growth through productivity enhancement and labor utilization. Labor force participation remains an important determinant of economic growth. Evidence from Southeast Asian countries shows that higher labor force participation contributes positively to economic performance by increasing productive capacity and supporting long-term economic expansion (Sulaiman et al., 2024). Increased labor force participation contributes to higher per capita income by expanding the proportion of the population engaged in productive activities (Baerlocher et al., 2021). Deryag & Khalifa (2024) stated in its findings that technological innovation (Solow residual) was later incorporated into the Solow model as a driver of growth. In line with the findings, for Saudi Arabia and many Sub-Saharan African countries, the labor force positively contributes to economic growth (Islam & Alhamad, 2023; Kassi et al., 2023). Therefore, the following hypothesis is proposed:

H5: The labor force has a significant effect on economic growth.

Furthermore, the COVID-19 pandemic represents a major external shock that has significantly affected global and regional economic performance. The COVID-19 pandemic significantly reduced economic activities in developing countries through disruptions in production, mobility, and consumption patterns, leading to substantial declines in economic growth (Takyi et al., 2023). The pandemic disrupted production, consumption, labor markets, and overall economic stability (Ozili, 2018). Similarly, (Ashraf, 2020) found that government responses to COVID-19 had substantial implications for economic performance, particularly through their effects on mobility, consumption, and business operations. More recent studies confirm that the pandemic generated persistent negative impacts on economic growth, especially in developing economies characterized by limited fiscal capacity and high economic vulnerability. These findings highlight the importance of incorporating external shocks such as COVID-19 into economic growth models. Empirical evidence shows that the COVID-19 pandemic negatively impacted economic growth, including in Indonesia, where it caused a prolonged economic contraction (Tulus Rahayu and Muharam, 2021; Purba, 2022). Global uncertainty associated with pandemic periods negatively affects economic growth and amplifies economic vulnerabilities across countries (Bannigidadmath et al., 2024). These findings highlight the importance of incorporating external shocks into economic growth analysis. Based on this, the following hypothesis is proposed:

H6: The COVID-19 pandemic has a significant effect on economic growth.

3. Methods

3.1 Data description

This study covers the period from 2010 to 2022, and the data analyzed in this study consists of secondary data. The research subjects consist of a total of 60 regencies and cities in the Southern Sumatra region, with the following breakdown: 13 regencies and 4 cities in South Sumatra Province, 9 regencies and 1 city in Bengkulu Province, 6 regencies and 1 city in Bangka Belitung Province, 9 regencies and 2 cities in Jambi Province, and 13 regencies and 2 cities in Lampung Province. The period 2010-2022 was selected because it provides a sufficiently long observation horizon to capture both the short-run and long-run dynamics of regional economic growth and government expenditure. This period also reflects a relatively mature stage of fiscal decentralization in Indonesia, during which local governments had greater authority in managing public expenditures and regional development programs. In addition, district- and municipality-level data on government expenditure, Gross Regional Domestic Product (GRDP), Human Development Index (HDI), and labor force indicators are available and consistently reported throughout this period. The selected timeframe further encompasses both pre-pandemic and pandemic conditions, allowing the analysis to account for the economic effects of the COVID-19 shock while examining the role of fiscal and socioeconomic factors in regional economic growth.

Moreover, the thirteen-year panel provides sufficient temporal variation for the application of the Generalized Method of Moments (GMM), enabling the estimation of dynamic relationships and addressing potential endogeneity issues.

Table 1. Descriptive Variables

Variables	Description of Variables	Measurement	Source of Data
GRDP (lnGRDP)	Gross Regional Domestic Product of regencies/cities	Natural logarithm of GRDP at constant prices (Rupiah)	Statistics Indonesia (BPS)
Education Expenditure (lnEDU)	Local government expenditure on the education sector	Natural logarithm of education expenditure (Rupiah)	Directorate General of Fiscal Balance
Health Expenditure (lnHEALTH)	Local government expenditure on the health sector	Natural logarithm of health expenditure (Rupiah)	Directorate General of Fiscal Balance
Infrastructure Expenditure (lnINFRA)	Local government expenditure on infrastructure development	Natural logarithm of infrastructure expenditure (Rupiah)	Directorate General of Fiscal Balance
Human Development Index (HDI)	Indicator of human development achievement	Index value (0–100)	Statistics Indonesia (BPS)
Labor Force (lnLABOUR)	Total labor force in each regency/city	Natural logarithm of number of the labor force	Statistics Indonesia (BPS)
COVID-19 Dummy Variable (DCOVID)	Dummy variable representing the COVID-19 pandemic period	0 = Before pandemic (2010–2019); 1 = During/after pandemic (2020–2022)	Constructed by a researcher
Investment (lnINVEST)	Total capital invested in a region	Natural logarithm of Realization of PMA and PMDN (Rupiah)	Statistics Indonesia (BPS)
Population density (lnPOP)	Number of people per square kilometer	Natural logarithm of the total population divided by land area (Person/km)	Statistics Indonesia (BPS)
Inflation rate	Annual percentage change in regional price level	Regional Consumer Price Index (CPI) percentage change (%)	Statistics Indonesia (BPS)

3.2 Research Methodology

This study employs a quantitative approach using dynamic panel data regression analysis. Dynamic panel data regression analysis aims to provide a robust and effective method for analyzing data that encompasses both time-series and cross-sectional dimensions. Dynamic panel data models are particularly important when research seeks to understand how variables evolve while addressing individual heterogeneity, persistence effects, and potential endogeneity issues (Arellano and Bover, 1995; Blundell and Bond, 1998). The inclusion of lagged dependent variables allows the model to capture dynamic adjustment processes and distinguish between short-run and long-run effects. Dynamic panel estimators are widely applied in economic growth studies because they can address simultaneity bias, reverse causality, and omitted variable problems commonly encountered in panel datasets (Roodman, 2009; Farzana et al., 2024). Furthermore, the Generalized Method of Moments (GMM) estimator is considered particularly suitable for panels characterized by a relatively large number of cross-sectional units and a shorter time dimension, while also accommodating endogenous regressors, fixed effects, heteroskedasticity, and autocorrelation (Hansen, 1982; Roodman, 2009). Therefore, this study employs the System-GMM estimator to examine the effects of local government expenditure on basic service sectors on regional economic growth in 60 regencies and municipalities in Southern Sumatra. Data

processing and model estimation were conducted using STATA software.

To analyze the effect of government expenditures on regional economic growth, the following dynamic panel data model is employed:

$$\ln GRDP_{it} = \alpha + \beta_1 \ln PDRB_{i,t-1} + \beta_2 \ln EDU_{it} + \beta_3 \ln HEALTH_{it} + \beta_4 \ln INFRA_{it} + \beta_5 HDI_{it} + \beta_6 \ln Labour_{it} + \beta_7 DP_{it} + \beta_8 \ln INVEST_{it} + \beta_9 \ln POP_{it} + \beta_{10} INFL_{it} + \varepsilon_{it}$$

Equation explains that Gross Regional Domestic Product ($\ln GRDP_{it}$) is influenced by its previous value ($\ln GRDP_{i,t-1}$), indicating the dynamic nature of regional economic growth over time. The model also includes several explanatory variables consisting of local government expenditures on education ($\ln EDU_{it}$), health ($\ln HEALTH_{it}$), and infrastructure ($\ln INFRA_{it}$), which represent government spending on basic public services. In addition, the Human Development Index (HDI_{it}) is incorporated to capture the quality of human development, while the labor force variable ($\ln Labour_{it}$) reflects the availability of productive labor in each regency or city. The model further includes a dummy variable for the COVID-19 pandemic period (DP_{it}), where a value of 0 represents the period before the pandemic and 1 represents the period during and after the pandemic. The model also includes three control variables; investment ($\ln INVEST_{it}$), measured as total domestic and foreign investment; population density ($\ln POP_{it}$), which captures the total population divided by land area; and inflation rate ($INFL_{it}$), which reflects the Regional Consumer Price Index (CPI) percentage change. Lastly, ε_{it} denotes the error term that captures other factors affecting regional economic growth outside the model.

Based on the theoretical framework and previous empirical studies, the conceptual relationship between government expenditure, human development, labor force, the COVID-19 pandemic, and regional economic growth can be illustrated in the following research framework.

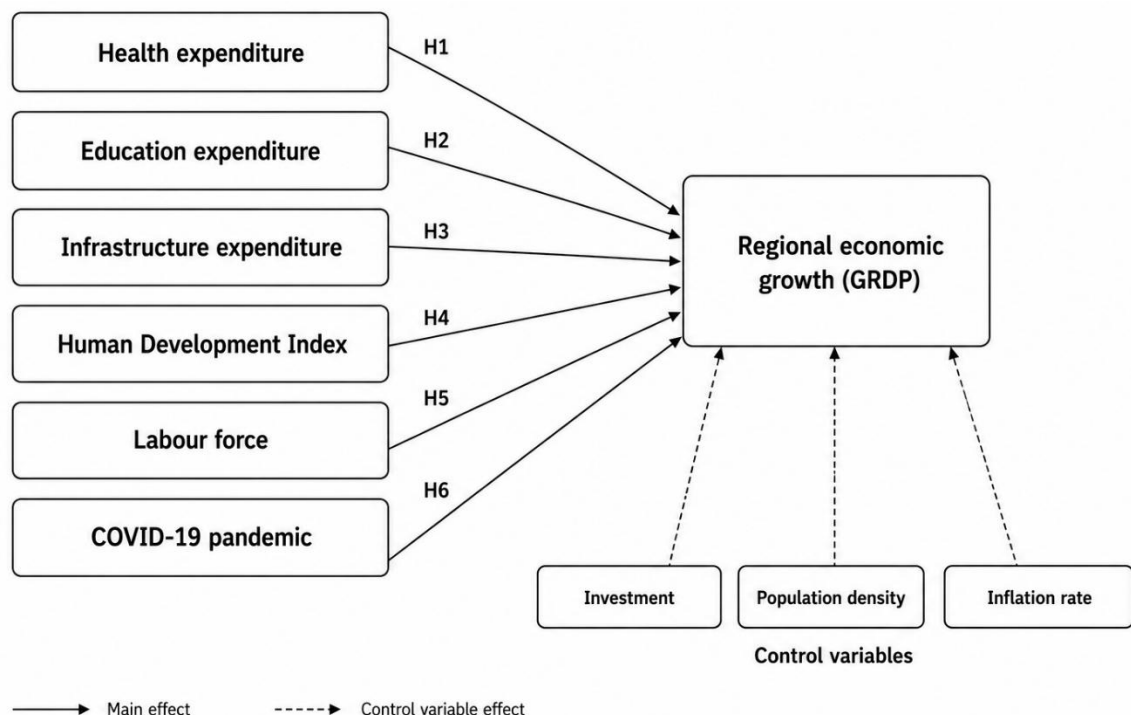


Figure 1. Research Framework

Figure 1 illustrates the conceptual framework of this study. Government expenditure in education, health, and infrastructure, along with the Human Development Index (HDI), labor force, and the COVID-19 pandemic, are proposed as factors influencing Gross Regional Domestic Product (GRDP) in Southern Sumatra. The framework reflects the theoretical relationships underlying the hypotheses tested in this study.

4. Results

The descriptive analysis shows that Gross Regional Domestic Product (GRDP) across regencies and cities in Southern Sumatra generally followed an upward trend over the study period, indicating sustained regional economic expansion. However, a contraction occurred in 2020, reflecting the negative impact of the COVID-19 pandemic on economic performance. This decline was followed by a recovery phase in subsequent years, suggesting that regional economies demonstrated resilience in responding to external shocks.

Government expenditure in the sectors of education, health, and infrastructure exhibits distinct patterns. Education expenditure consistently represents the largest share of government spending, followed by health and infrastructure. While education and health expenditures tend to increase steadily over time, infrastructure expenditure shows greater fluctuation, particularly declining after 2019 in several regions. This pattern suggests differences in fiscal priorities and possible budget adjustments during periods of economic uncertainty.

In addition, the Human Development Index (HDI) shows a consistent upward trend, reflecting continuous improvements in human capital, particularly in education, health, and living standards. Similarly, the labor force has increased steadily throughout the study period, indicating growing labor participation and the potential for enhanced productivity. Overall, these trends suggest a positive association between government expenditure, human capital, labor force, and GRDP, although external shocks such as the COVID-19 pandemic have significantly disrupted economic performance.

Descriptive statistics are used to summarize the main characteristics of the data through measures such as the mean, standard deviation, and minimum–maximum values. As presented in Table 1, this study uses 768 observations for each variable. The GRDP variable has an average value of 11,700 billion rupiah, with a relatively large standard deviation of 13,890 billion rupiah, indicating substantial disparities in economic output across regions. The values range from a minimum of 1,342 billion rupiah to a maximum of 112,800 billion rupiah.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GRDP	768	11.700	13.890	1.342	112.800
Health Expenditure	768	143.5	100.4	0.05	900.3
Education Expenditure	768	314.5	201.9	8.091	1,208
Infrastructure Expenditure	768	163.9	135.5	1.389	936.8
HDI	768	67.43	4.459	57.17	80.99
Labour Force	768	184,517	140,029	12,671	782,729
COVID-19 Dummy	768	0.234	0.424	0	1

Government expenditure variables also show considerable variation across regencies and cities in Southern Sumatra. Health expenditure has an average value of 143.5 billion rupiah with a standard deviation of 100.4 billion rupiah. Education expenditure records the highest average among expenditure variables at 314.5 billion rupiah, indicating that education receives the largest allocation of local government spending. Meanwhile, infrastructure expenditure has an average value of 163.9 billion rupiah with relatively high variation, reflecting differences in infrastructure development priorities among regions.

For the control variables, the Human Development Index (HDI) has an average value of 67.43, indicating moderate variation in human development across regions. The labor force variable records an average of 184,517 workers, with substantial variation among regencies and cities. Meanwhile, the COVID-19 variable is represented as a dummy variable ranging from 0 to 1, with an average value of 0.234, reflecting the proportion of observations during the pandemic period. Before estimating the dynamic panel model, a multicollinearity test was conducted using the Variance Inflation Factor (VIF). The results indicate that all independent variables have VIF values below 10, with a mean VIF of 2.65, suggesting that the model does not suffer from multicollinearity problems.

Since this study employs a dynamic panel model, static estimation methods such as Ordinary Least Squares (OLS) may produce biased and inconsistent estimates (Baltagi et al., 2005). Therefore, the study compares the OLS, Fixed Effects Model (FEM), and First-Difference Generalized Method of Moments (FD-GMM) estimations to identify the most appropriate model. The lagged dependent variable coefficient from the FD-GMM estimation lies between the FEM and OLS coefficients, indicating that the FD-GMM model does not suffer from upward or downward bias and is therefore selected as the preferred estimation model.

Model validity was further evaluated using the Sargan, Hansen, and Arellano-Bond (AR) tests. The Sargan and Hansen tests produce p-values greater than 0.05, indicating valid overidentifying restrictions. In addition, the AR(2) test result confirms the absence of second-order autocorrelation in the residuals. These results indicate that the FD-GMM model is statistically valid and appropriate for analysis. The FD-GMM estimation results for the short-run effects are presented in Table 2. The results indicate that infrastructure expenditure has a significant negative effect on GRDP, while the Human Development Index (HDI) has a significant positive effect. In contrast, the COVID-19 pandemic variable shows a significant negative relationship with GRDP. Meanwhile, health expenditure, education expenditure, and labor force variables are not statistically significant.

The Generalized Method of Moments estimation begins with the First-Difference GMM (FD-GMM) estimation. The FD-GMM estimation results are shown in the following table:

Table 3. First-Difference GMM Estimation Results

Variable	Coef (t)	P-Value
GRDP	0.9304219 (26.54)**	0.000
Health Expenditure	0.0051832 (1.59)	0.117
Education Expenditure	-0.0090934 (-0.98)	0.331
Infrastructure Expenditure	-0.0195656 (-11.02)**	0.000
HDI	0.0060288 (2.40)**	0.019
Labour Force	-0.0040155 (-0.92)	0.363
COVID-19 Dummy	-0.0556459 (-16.41)**	0.000
F	0 0.000	
AR Test (2)	0.378	
Sargan Test	0.142	

Notes: *** p < 0.01, **p < 0.05, *p < 0.1

To estimate the long-run effects, further calculations were performed using the lagged

dependent variable coefficient from the FD-GMM model. The long-run estimation results are presented in Table 3. The results indicate that infrastructure expenditure continues to have a significant negative effect on GRDP, while HDI has a significant positive effect. In addition, the COVID-19 pandemic variable also shows a significant negative relationship with regional economic growth in the long run.

Table 4. Estimation Results for Long-Term Effects

Variable	Coef (t)	P-Value
Health Expenditure	0.0744948 (-1.42)	0.155
Education Expenditure	-0.1306932 (-0.79)	0.431
Infrastructure Expenditure	-0.2812036 (-1.00)*	0.061
HDI	0.0866486 (4.72)**	0.000
Labour Force	-0.0577116 (-0.71)	0.477
COVID-19 Dummy	-0.7997622 (-1.87)*	0.062

Notes: *** p < 0.01, **p < 0.05, *p < 0.1

Based on the short-run and long-run FD-GMM estimation results, the relationships between the proposed hypotheses and the empirical findings can be summarized more clearly. This summary is intended to provide a direct comparison between the theoretical expectations, empirical results, and the significance of each variable in explaining regional economic growth in Southern Sumatra.

Table 5. Summary of Hypotheses Testing Results

Hypothesis	Relationship	Expected Sign	Empirical Result	Significance	Conclusion
H1	Education Expenditure to GRDP	Positive	Negative	Not Significant	Not Supported
H2	Health Expenditure to GRDP	Positive	Positive	Not Significant	Not Supported
H3	Infrastructure Expenditure to GRDP	Positive	Negative	Significant	Not Supported
H4	HDI to GRDP	Positive	Positive	Significant	Supported
H5	Labor Force to GRDP	Positive	Negative	Not Significant	Not Supported
H6	COVID-19 Pandemic to GRDP	Negative	Negative	Significant	Supported

Table 5 summarizes the relationship between the proposed hypotheses and the empirical findings obtained from the FD-GMM estimation model. The results indicate that only the Human Development Index (HDI) and the COVID-19 pandemic variables support the proposed hypotheses. Meanwhile, education expenditure, health expenditure, infrastructure expenditure, and labor force variables do not support the expected hypotheses, indicating that government expenditure and labor quantity alone are insufficient to promote regional economic growth without improvements in effectiveness, productivity, and institutional quality.

5. Discussion

5.1 Education Expenditure and GRDP

Education expenditure is found to have a negative and insignificant effect on GRDP in both the short and long run. This result indicates that increases in government spending on education

have not been able to significantly stimulate regional economic growth in Southern Sumatra during the study period. Therefore, the finding does not support the study hypothesis derived from human capital theory, which argues that investment in education improves labor productivity, human capital quality, and ultimately economic growth.

One possible explanation is that education expenditure constitutes a long-term investment whose economic benefits cannot be immediately reflected in regional output growth. Improvements in education generally require a relatively long adjustment process before generating measurable impacts on productivity and economic performance. The effectiveness of education spending depends not only on the amount of expenditure allocated by local governments but also on the efficiency, quality, and targeting of educational programs. In several regencies and cities in Southern Sumatra, education spending may still be concentrated on administrative and operational expenditures rather than investments that directly improve educational quality, skills development, and workforce competitiveness.

In addition, the insignificant effect may indicate a mismatch between educational outcomes and labor market needs. Increased education expenditure may not directly contribute to economic growth if labor market absorption remains limited or if the education system is unable to produce skills that align with regional economic structures. This condition is particularly relevant in Southern Sumatra, where economic activities are still dominated by primary sectors such as agriculture, forestry, fisheries, and trade, which may not fully utilize higher educational attainment as a driver of productivity growth.

Another explanation is that government expenditure on education alone may be insufficient to promote economic growth without support from complementary factors such as infrastructure development, technological adoption, institutional quality, and employment opportunities. This suggests that the effectiveness and productivity of public spending are more important than merely increasing the expenditure allocation.

This finding is consistent with Kausar et al., (2024), Chen & Guo (2023) and Zamir et al., (2023) who find that education expenditure has a positive and significant effect on economic growth, particularly when supported by improvements in infrastructure, human capital quality, and higher education participation. These differences imply that the impact of education spending on economic growth may vary across regions depending on institutional effectiveness, labor market conditions, and the quality of policy implementation.

5.2 Health Expenditure and GRDP

Health expenditure is found to have a positive but statistically insignificant effect on GRDP in both the short and long run. This result indicates that increases in government spending on the health sector have not significantly contributed to regional economic growth in Southern Sumatra during the study period. Therefore, the finding does not support the study hypothesis and the theoretical expectation that improvements in health conditions enhance labor productivity, human capital quality, and economic performance.

One possible explanation for this result is the inefficiency in the allocation and utilization of health expenditure, where increases in government budgets do not necessarily translate into improvements in public health outcomes. In many developing regions, including several regencies and cities in Southern Sumatra, health expenditure tends to be more consumptive than investment-oriented. A substantial portion of spending may be allocated to administrative and operational costs rather than to improving healthcare infrastructure, medical services, or preventive healthcare programs that directly contribute to long-term productivity enhancement.

Another explanation is that the economic impact of health investment generally requires a relatively long period to materialize. Improvements in population health status depend not only on government expenditure but also on broader structural conditions, such as access to healthcare facilities, quality of medical services, sanitation, nutrition, and public awareness regarding healthy lifestyles. Without substantial improvements in these supporting factors, increases in health expenditure may not immediately generate measurable impacts on regional

economic output.

The insignificant relationship may also reflect disparities in healthcare accessibility and service quality across regions in Southern Sumatra. Unequal distribution of healthcare facilities and medical personnel among regencies and cities may reduce the effectiveness of government health spending in supporting economic productivity. Consequently, higher health expenditure alone may be insufficient to stimulate regional economic growth without improvements in governance quality and spending effectiveness. Jiang & Wang (2023) and Govdeli (2023) which find a significant positive relationship between health expenditure and economic growth. These differences suggest that the effectiveness of health spending may vary across regions depending on institutional quality, policy implementation, healthcare accessibility, and the efficiency of public expenditure management.

5.3 Infrastructure Expenditure and GRDP

Infrastructure expenditure is found to have a negative and significant effect on GRDP in both the short and long run. This result indicates that increases in government spending on infrastructure have not been able to promote regional economic growth in Southern Sumatra during the study period. Therefore, the finding does not support the study hypothesis and contradicts conventional theory, which argues that infrastructure investment improves productivity, connectivity, and economic growth.

One possible explanation is the inefficiency and misallocation of infrastructure spending. Infrastructure projects may experience delays, budget overruns, weak planning, or low economic returns, causing the benefits of investment to be lower than the associated costs. In addition, infrastructure investment generally requires a long period before generating economic benefits. In the short run, large infrastructure expenditures may instead create fiscal burdens and reduce spending on other productive sectors. The negative effect may also reflect uneven infrastructure development across regencies and cities in Southern Sumatra, reducing the effectiveness of public investment in supporting overall regional growth.

This finding is consistent with Abdulkarim (2023) who reports a negative relationship between infrastructure spending and economic growth. However, it contradicts Meka'a et al., (2024) and Calderón & Servén (2010) who emphasize the positive role of infrastructure in enhancing productivity and economic performance. These differences suggest that the impact of infrastructure expenditure depends largely on investment efficiency, governance quality, and institutional effectiveness.

5.4 Human Development Index (HDI) and GRDP

The Human Development Index (HDI) has a positive and significant effect on GRDP in both the short and long run. This finding supports the study hypothesis and confirms the theoretical expectation that improvements in human capital contribute positively to economic growth. Higher HDI reflects better education, health, and living standards, which enhance labor productivity and regional economic performance.

The significance of HDI, compared to the insignificant effects of education and health expenditure individually, suggests that development outcomes are more important than expenditure allocation alone. In other words, improvements in human development indicators have a more direct contribution to economic growth than increases in government spending without effective outcomes. This finding indicates that regions in Southern Sumatra with better human development conditions tend to achieve stronger economic performance. The result is consistent with Nayak & Pradhan (2024), Tong (2024), Zhao & Shah (2024) who also find a positive relationship between HDI and economic growth.

5.5 Labor Force and GRDP

The labor force variable is found to have a negative and insignificant effect on GRDP in both the short and long run. This finding does not support the study hypothesis and contradicts the theoretical expectation that an increase in labor contributes positively to economic growth. This result suggests that labor quantity alone is insufficient to stimulate economic growth without improvements in labor productivity, skills, and workforce quality. In many developing regions, including Southern Sumatra, labor force growth is often accompanied by underemployment, informal employment, and low-skilled labor, which limit its contribution to regional economic performance. The insignificant effect may also indicate that the available labor force has not been optimally absorbed into productive economic sectors. In addition, the absence of labor productivity indicators in the model may limit the ability to capture the actual contribution of labor to economic output. This finding contrasts with Immurana et al., (2024) who report a significant positive effect of labor on economic growth. These differences suggest that the impact of labor on economic growth depends not only on labor quantity but also on labor quality, productivity, and employment opportunities.

5.6 COVID-19 Pandemic and GRDP

The COVID-19 pandemic is found to have a negative and significant effect on GRDP in both the short and long run. This finding supports the study's hypothesis that external shocks negatively affect regional economic performance. The pandemic reduced economic activity, weakened consumer demand, disrupted supply chains, and created labor market instability, all of which contributed to regional economic contraction in Southern Sumatra.

The significant negative effect also indicates that regional economies in Southern Sumatra were highly vulnerable to external crises, particularly during periods of mobility restrictions and declining economic activity. Although economic recovery began after the pandemic period, the long-run effect suggests that the economic disruption continued to influence regional growth performance beyond the initial crisis period. This finding is consistent with Castillo et al., (2024), Lu et al., (2024), Morgenstern et al., (2024), Sun et al., (2024) who also report that the COVID-19 pandemic had a significant negative impact on economic growth across regions.

The short-run estimates in this study are derived from the first-difference GMM estimation results, while the long-run estimates are calculated using the lagged dependent variable coefficient from the FD-GMM model. The interpretation of the hypotheses remains consistent for both short-run and long-run estimations. Long-run estimation using GMM is intended to capture the sustained effects of explanatory variables over time through the dynamic adjustment process represented by the lagged dependent variable (Pickup & Hopkins, 2022).

6. Conclusion

Based on the research conducted and the analysis presented in the previous chapter, the results of the dynamic panel data estimation using the Generalized Method of Moments (GMM) indicate that the First Difference GMM (FD-GMM) is the most appropriate estimation method. The findings reveal that government expenditure on education, health, and labor does not have a statistically significant effect on the Regional Gross Domestic Product (RGDP) of districts and municipalities in Southern Sumatra, both in the short run and the long run. This finding is consistent with Trinh (2025), who argues that education expenditure does not necessarily promote economic growth unless supported by strong institutional quality and effective governance. Similarly, Iswahyudi and Cahyono (2025) found that government spending on education and health may not significantly contribute to economic growth when the allocation and utilization of public funds are inefficient. Although several studies have reported a positive relationship between education expenditure and economic growth (Contreras et al., 2025; Hidayah and Hariyani, 2024; Shapkova Kocavska, 2023), the results of this study suggest that the economic benefits of education spending may require a longer period to materialize or depend on the effectiveness of policy implementation at the regional level.

Furthermore, infrastructure expenditure and the COVID-19 pandemic have a significant negative effect on RGDP in both the short run and the long run. The negative impact of infrastructure spending may indicate inefficiencies in project implementation, delayed economic returns, or unequal distribution of infrastructure benefits across regions. This result contrasts with previous studies that found infrastructure expenditure to have a positive effect on economic growth through improved connectivity, productivity, and economic activity (Syadullah and Setyawan, 2021; Respitasari, 2021; Anderu and Tosin, 2023; Nhemhafuki, 2023). Therefore, the effectiveness of infrastructure spending may depend not only on the amount of expenditure but also on the quality, efficiency, and targeting of infrastructure development programs.

In contrast, the Human Development Index (HDI) has a positive and statistically significant effect on RGDP in both the short run and the long run. This finding supports the argument that improvements in human development contribute to higher productivity and stronger economic performance. The result is in line with Sasongko and Wibowo (2022), who found that government expenditure on health can enhance economic growth through improvements in HDI. Likewise, Irwandi and A'yun (2022) emphasize that health expenditure positively contributes to economic growth by improving the quality of human capital. Moreover, Millin et al., (2023) highlight that investment in human capital through education and health expenditure plays an essential role in supporting long-term economic development and sustainable growth.

7. Implication of research

The findings of this study carry important implications for both policy and academic development. From a policy perspective, the results indicate that local governments in regencies and cities across Southern Sumatra need to adopt more strategic approaches to managing public expenditure, particularly in the basic services sector. The empirical evidence shows that education and health spending do not have a significant effect on GRDP, while infrastructure spending exhibits a negative relationship. This suggests that the issue lies not in the magnitude of spending, but in its efficiency and effectiveness. Therefore, governments should prioritize improving the quality of budget allocation through better planning, targeting, and evaluation mechanisms to ensure that public spending contributes meaningfully to regional economic growth.

In practical terms, this implies a shift toward more productive and outcome-oriented expenditure policies. In the education sector, spending should be directed toward inputs that directly enhance educational quality, such as improving teacher capacity, upgrading learning facilities, and strengthening institutional performance. Similarly, in the health sector, expenditures should focus on increasing access to healthcare services, improving medical infrastructure, and ensuring the availability of qualified health personnel and essential medical supplies. For infrastructure, the negative impact found in this study highlights the need for stricter project selection, cost control, and monitoring systems. Infrastructure investments should be treated as long-term economic assets, ensuring that they generate real economic value by improving connectivity, reducing costs, and facilitating economic activities, rather than becoming inefficient fiscal burdens.

From an academic standpoint, this study contributes to the literature in public economics by emphasizing that government expenditure alone is not sufficient to drive economic growth without considering its efficiency and outcomes. The findings highlight the importance of distinguishing between spending inputs and development outcomes, particularly as reflected in the significant role of human development in influencing GRDP. This provides a useful reference for future studies examining the relationship between fiscal policy and economic performance, especially in developing regions.

Furthermore, this study opens opportunities for future research to build upon its limitations. Subsequent studies are encouraged to incorporate additional variables such as labor

productivity, governance quality, and institutional effectiveness to better capture the mechanisms through which government spending affects economic growth. The use of more advanced econometric methods and more detailed or disaggregated data is also recommended to improve analytical precision. Expanding the scope of analysis to include comparative regional or cross-country studies would further enrich the understanding of how public expenditure functions in different economic contexts.

Overall, this research offers broader contributions to the global discourse by reinforcing the idea that the effectiveness of public spending is a critical determinant of economic performance. The insights generated are not only relevant for Southern Sumatra but also applicable to other developing regions facing similar challenges in optimizing government expenditure to achieve sustainable and inclusive economic growth.

8. Limitation of study and future research

This study is subject to several limitations that should be considered when interpreting the results. One of the primary limitations relates to the availability of data at the district and city levels. The analysis relies on a limited set of variables due to the unavailability of more comprehensive indicators, such as labor productivity, governance quality, and detailed measures of education and health outcomes. As a result, the model may not fully capture the broader mechanisms through which government expenditure influences economic growth. The absence of these variables could also contribute to the insignificant findings observed for certain expenditure categories, as the effectiveness of public spending is often mediated by factors that were not included in the analysis.

Another limitation concerns the time span of the data, which covers the period from 2010 to 2022. Although this range is sufficient to capture medium-term trends, it may not be adequate to fully reflect long-term dynamics, particularly for variables such as education and infrastructure spending, whose impacts typically materialize over extended periods. Additionally, the relatively short observation period may limit the ability to capture structural changes in the economy or shifts in policy regimes that could influence the relationship between government expenditure and economic growth.

Given these limitations, future research is encouraged to expand both the scope of variables and the time horizon of analysis. Incorporating additional indicators, such as labor productivity, institutional quality, and governance effectiveness, would provide a more comprehensive understanding of how public spending translates into economic outcomes. Extending the study period and utilizing more granular or disaggregated data could also improve the robustness of the findings. Furthermore, applying alternative econometric approaches or conducting comparative studies across regions or countries would help validate and enrich the insights obtained from this research, contributing to a deeper understanding of the role of government expenditure in promoting sustainable economic growth.

Authors' contributions and responsibilities

Author 1 was responsible for the conceptualization of the study, development of the research design and methodology, and preparation of the discussion section of the manuscript. Author 1 also contributed significantly to framing the research ideas, data analysis, and interpreting the results. Author 2 was responsible for data collection, data tabulation, and data processing/analysis. Author 2 ensured the accuracy and organization of the dataset and contributed to the execution of the analytical procedures. Author 2 was responsible for developing the methodology and reviewing. All authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Acknowledgement

This research received no external funding

Competing interests

There are no potential conflicts of interest reported by the authors.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Widya Sylviana <https://orcid.org/0000-0002-3689-4021>

Fadil Rizki Irawan <https://orcid.org/0009-0006-8105-1847>

Zulkefly bin Abdul Karim <https://orcid.org/0000-0002-6782-3592>

References

- Abdulkarim, Y. (2023). A systematic review of investment indicators and economic growth in Nigeria. *Humanities and Social Sciences Communications*, 10, 1–13. <https://doi.org/10.1057/s41599-023-02009-x>
- Aghion, P. (2017). Entrepreneurship and growth: lessons from an intellectual journey. *Small Business Economics*, 48(1), 9–24.
- Akinlo, A. E. (2012). 'How Important is Oil in Nigeria's Economic Growth?', *Journal of Sustainable Development*, 5(4). doi: 10.5539/jsd.v5n4p165.
- Anderu, K. S. and Tosin, K. O. (2023). 'Public expenditure on infrastructural development and economic growth: Evidence from Nigeria', *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah*, 11(2), pp. 129–142. doi: 10.22437/ppd.v11i2.21064.
- Arawatari, R., Hori, T. and Mino, K. (2023). 'Government expenditure and economic growth: A heterogeneous-agents approach', *Journal of Macroeconomics*, 75, p. 103486. doi: <https://doi.org/10.1016/j.jmacro.2022.103486>.
- Arellano, M. and Bover, O. (1995). 'Another look at the instrumental variable estimation of error-components models', *Journal of Econometrics*, 68(1), pp. 29–51. doi: [https://doi.org/10.1016/0304-4076\(94\)01642-D](https://doi.org/10.1016/0304-4076(94)01642-D).
- Ashraf, B. N. (2020). 'Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets', *Journal of Behavioral and Experimental Finance*, 27, p. 100371. doi: <https://doi.org/10.1016/j.jbef.2020.100371>.
- Atkinson, A. B. . and Stiglitz, J. E. . (2015) *Lectures on public economics*. Princeton University Press.
- Almarashi, A., Daniyal, M., & Jamal, F. (2024). Modelling the GDP of KSA using linear and non-linear NNAR and hybrid stochastic time series models. *PLOS ONE*, 19. <https://doi.org/10.1371/journal.pone.0297180>
- Baltagi, B. H., Bratberg, E., & Holmås, T. H. (2005). A panel data study of physicians' labor supply: the case of Norway. *Health Economics*, 14(10), 1035–1045.
- Baerlocher, D., Parente, S. L. and Rios-Neto, E. (2021). 'Female Labor Force Participation and economic growth: Accounting for the gender bonus', *Economics Letters*, 200, p. 109740. doi: <https://doi.org/10.1016/j.econlet.2021.109740>.
- Bannigidadmath, D., Ridhwan, M. H. A. and Indawan, F. (2024). 'Global Uncertainty and Economic Growth – Evidence from Pandemic Periods', *Emerging Markets Finance and Trade*, 60(2), pp. 345–357. doi: 10.1080/1540496X.2023.2213377.
- Barro, R. J. . and Sala-i-Martin, Xavier. (2004) *Economic growth*. MIT Press.
- Becker, G. S. . (1983) *Human capital : a theoretical and empirical analysis, with special reference to education*. University of Chicago Press.
- Blundell, R. and Bond, S. (1998). 'Initial conditions and moment restrictions in dynamic panel data models', *Journal of Econometrics*, 87(1), pp. 115–143. doi: <https://doi.org/10.1016/S0304->

4076(98)00009-8.

- Buthlezi, E. M. (2023) 'Impact of government expenditure on economic growth in different states in South Africa', *Cogent Economics & Finance*, 11(1), p. 2209959. doi: 10.1080/23322039.2023.2209959.
- Calderón, C., & Servén, L. (2010). Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies*, 19(suppl_1), i13–i87.
- Castillo, M., Fujimi, T., & Tatano, H. (2024). Estimating medium-term regional monthly economic activity reductions during the COVID-19 pandemic using nighttime light data. *Int. J. Appl. Earth Obs. Geoinformation*, 135, 104223. <https://doi.org/10.1016/j.jag.2024.104223>
- Chen, L., & Guo, Y. (2023). The drivers of sustainable development: Natural resources extraction and education for low-middle- and high-income countries. *Resources Policy*. <https://doi.org/10.1016/j.resourpol.2023.104146>
- Carvelli, G. (2023) 'The long-run effects of government expenditure on private investments: a panel CS-ARDL approach', *Journal of Economics and Finance*, 47(3), pp. 620–645. doi: 10.1007/s12197-023-09617-y.
- Chakroun, M. (2024) 'Health and economic growth: new evidence from a panel threshold model', *Cogent Economics & Finance*, 12(1), p. 2331010. doi: 10.1080/23322039.2024.2331010.
- Contreras, D., Galindo, A. J. and Lepe, I. (2025) *Education Spending and Economic Growth Short and Long-Term Effects*. Available at: <http://www.iadb.org>.
- Deryag, E., & Khalifa, W. (2024). A Panel Analysis on the Nexus between Financial Development, Oil Production, and Trade-Openness and Its Impact on Sustainable Economic Growth: Evidence from Selected Arab Economies. *Sustainability*. <https://doi.org/10.3390/su16125192>
- Erwin Iswahyudi and Hendry Cahyono (2025) 'THE IMPACT OF GOVERNMENT SPENDING IN EDUCATION AND HEALTH ON ECONOMIC GROWTH IN INDONESIA 2014-2023', *Finance: International Journal of Management Finance*, 3(1), pp. 102–106. doi: 10.62017/finance.v3i1.113.
- Farzana, A., Samsudin, S., & Hasan, J. (2024). Drivers of economic growth: a dynamic short panel data analysis using system GMM. *Discover Sustainability*, 5. <https://doi.org/10.1007/s43621-024-00612-9>
- Fontana, G. and Sawyear, M. (2016) *Towards Post-Keynesian Ecological Macroeconomics*.
- Fumagalli, E., Pinna Pintor, M. and Suhrcke, M. (2024) 'The impact of health on economic growth: A narrative literature review', *Health Policy*, 143, p. 105039. doi: <https://doi.org/10.1016/j.healthpol.2024.105039>.
- Govdeli, T. (2023). The nexus between economic growth, health expenditure, environmental quality: a comparative study for E7 countries. *Reviews on Environmental Health*, 39, 551–560. <https://doi.org/10.1515/reveh-2022-0246>
- Goh, S. K., Sam, C. Y. and McNown, R. (2017) 'Re-examining foreign direct investment, exports, and economic growth in asian economies using a bootstrap ARDL test for cointegration', *Journal of Asian Economics*, 51, pp. 12–22. doi: <https://doi.org/10.1016/j.asieco.2017.06.001>.
- Hansen, L. P. (1982) 'Large Sample Properties of Generalized Method of Moments Estimators', *Econometrica*, 50(4), pp. 1029–1054. doi: 10.2307/1912775.
- Heys, R., & Taylor, C. (2025). Inclusive Income Accounts: Practical Measures to Go Beyond GDP. *Review of Income and Wealth*. <https://doi.org/10.1111/roiw.70025>
- Immurana, M., Abdullahi, I., Kisseih, K. G., Azuug, M., Mohammed, A., Boachie, M. K., Kizhakkekara, T. J. M., Doegah, P., & Dalaba, M. (2024). Mental health disorders, labour productivity and economic growth in Africa. *Global Transitions*. <https://doi.org/10.1016/j.glt.2024.09.002>
- Irwandi, I. and Qurrota A'yun, I. (2022) 'Government Health Expenditures on Economic Growth in ASEAN-9 Countries', *ARBITRASE Journal of Economics and Accounting*, 3, pp. 128–132. doi: 10.47065/arbitrase.v3i1.468.

- Islam, M., & Alhamad, I. (2023). Do personal remittance outflows impede economic growth in Saudi Arabia? The role of trade, labor force, human, and physical capital. *Humanities and Social Sciences Communications*, 10, 1–9. <https://doi.org/10.1057/s41599-023-01607-z>
- Jiang, W., & Wang, Y. (2023). Asymmetric Effects of Human Health Capital on Economic Growth in China: An Empirical Investigation Based on the NARDL Model. *Sustainability*. <https://doi.org/10.3390/su15065537>
- Karunanithi, K., Bui, W. K. T., & Tan, H. C. (2024). Green gross domestic product: A bibliometric analysis. *Sustainable Development*. <https://doi.org/10.1002/sd.3006>
- Kassi, D., Li, Y., Gnangoin, Y. T. B., N'Drin, M. G.-R., Gnahe, F., & Edjoukou, A. (2023). Investigating the Finance-Energy-Growth Trilogy in Sub-Saharan Africa: Evidence From the NARDL Framework. *SAGE Open*, 13. <https://doi.org/10.1177/21582440221149714>
- Kausar, F. N., Cui, Y., Ghazala, N., Khan, Q.-U.-A., Shah, M. U., & Sajjad, M. (2024). Connection and Interaction Between Education and Economy: An Empirical Study From Pakistan by Using the ARDL Technique. *SAGE Open*, 14. <https://doi.org/10.1177/21582440241292431>
- Kaur, Sumandeep, Kiran, Ravi and Sharma, Rakesh (2024) 'Healthcare Expenditure, Health Outcomes and Economic Growth: A Study of BRICS Countries', *Millennial Asia*, p. 09763996241266393. doi: 10.1177/09763996241266393.
- Kumar, Gulshan and Batra, Shallu (2023) 'Interrelationship Between Human Development, Financial Development and Economic Growth: Empirical Evidences from Indian Economy', *Indian Journal of Human Development*, 17(1), pp. 60–81. doi: 10.1177/09737030221146022.
- Kurniawan, R. and Huda, S. (2024) 'Analisis Pertumbuhan Ekonomi dan Ketimpangan Distribusi Pendapatan Provinsi Bali', *Jurnal Dinamika Ekonomi Pembangunan*, 3(2), pp. 91–99. doi: 10.33005/jdep.v3i2.115.
- Kitutula, K. (2024). Estimation of the public debt threshold effects on economic growth in sub-Saharan African countries. *African Development Review*. <https://doi.org/10.1111/1467-8268.12749>
- Li, J., Yousaf, T., Ain, Q., & Zhong, K. (2025). Equilibrium in Action: Unveiling SDG 10 Through Inequality and Sustainable Economic Growth. *Sustainable Development*. <https://doi.org/10.1002/sd.3512>
- Li, Y., & Bai, L. (2024). Analyzing Green Growth Efficiency in China and Investigating the Spatial Effects of Fiscal Decentralization: Case Study of Prefecture-Level Cities. *Sustainability*. <https://doi.org/10.3390/su16083408>
- Lu, Z.-N., Gao, Z., & Hao, Y. (2024). The economic consequence of large-scale epidemic outbreak: The path and loss evaluation of COVID-19 in China based on input-output analysis. *Global Public Health*, 19. <https://doi.org/10.1080/17441692.2024.2341403>
- Mankiw, N. Gregory. (2018) *Principles of economics*. Cengage Learning.
- Meka'a, C. B., Fotso, S. R., & Kamdem, B. R. G. (2024). Investments in basic public infrastructure and their effects on economic growth in a developing country: The case of Cameroon. *Heliyon*, 10. <https://doi.org/10.1016/j.heliyon.2024.e26504>
- Millin, M., Fielding, D. and Owen, P. (2023) 'Education spending, economic development, and the size of government', *Public Sector Economics*, 47, pp. 285–333. doi: 10.3326/pse.47.3.1.
- Morgenstern, C., Laydon, D., Whittaker, C., Mishra, S., Haw, D., Bhatt, S., & Ferguson, N. (2024). The interaction of disease transmission, mortality, and economic output over the first 2 years of the COVID-19 pandemic. *PLOS ONE*, 19. <https://doi.org/10.1371/journal.pone.0301785>
- Nayak, A. R., & Pradhan, K. (2024). Institutional Quality and Economic Performance: A Study of Asian Countries. *Millennial Asia*. <https://doi.org/10.1177/09763996241233818>
- N. Gregory Mankiw and Robert M. Beren (2021) *Principles of Economics*. Available at: www.ebookslides.com.
- Naurin, A. and Pourpourides, P. M. (2023) 'On the causality between household and government

- spending on education: evidence from a panel of 40 countries', *Empirical Economics*, 65(2), pp. 567–585. doi: 10.1007/s00181-022-02345-y.
- Nguyen, M.-L. T. and Bui, N. T. (2022) 'Government expenditure and economic growth: does the role of corruption control matter?', *Heliyon*, 8(10). doi: 10.1016/j.heliyon.2022.e10822.
- Nhemhafuki, S. (2023) 'Government Expenditure and Economic Growth: A Cross-Country Analysis', *Journal of Economics Students*, 1, pp. 43–56. doi: 10.3126/joess.v1i1.65691.
- Ozili, P. K. (2018) 'Impact of digital finance on financial inclusion and stability', *Borsa Istanbul Review*, 18(4), pp. 329–340. doi: 10.1016/j.bir.2017.12.003.
- Pickup, M., & Hopkins, V. (2022). Transformed-likelihood estimators for dynamic panel models with a very small T. *Political Science Research and Methods*, 10(2), 333–352.
- Purba, J. H. V. (2022) 'Analysis Driving Factors of Economic Growth During Covid-19 Pandemic: Indonesian Experiences', *Jurnal Ilmiah Manajemen Kesatuan*, 10(1), pp. 73–86. doi: 10.37641/jimkes.v10i1.1296.
- Rahman, Md. M. and Anis, T. B. (no date) 'Government expenditure on education and economic growth: a panel data analysis', *Journal of Community Positive Practices*, (2), pp. 30–46. doi: 10.35782/JCPP.2023.2.03.
- Respitari, R. (2021) 'Public Infrastructure and Economic Growth in the Local Region', *Jurnal Ekonomi Pembangunan*, 19(1), pp. 51–60. doi: 10.29259/jep.v19i2.13826.
- Roodman, David (2009) 'How to do Xtabond2: An Introduction to Difference and System GMM in Stata', *The Stata Journal*, 9(1), pp. 86–136. doi: 10.1177/1536867X0900900106.
- Sahoo, P. and Dash, R. K. (2009) 'Infrastructure development and economic growth in India', *Journal of the Asia Pacific Economy*, 14(4), pp. 351–365. doi: 10.1080/13547860903169340.
- Saputra, Z., Sartiyah, S. and Seftarita, C. (2022) 'The Impact of Tourism on Economic Growth: Evidence from Aceh Province, Indonesia', *International Journal of Global Optimization and Its Application*, 1(3), pp. 223–228. doi: 10.56225/ijgoia.v1i3.74.
- Sasongko, H. and Wibowo, P. (2022) 'GOVERNMENT SPENDING AND REGIONAL ECONOMIC GROWTH: THE MEDIATING EFFECT OF HUMAN DEVELOPMENT INDEX', *Jurnal Ekonomi Bisnis dan Kewirausahaan*, 11, p. 230. doi: 10.26418/jebik.v11i2.52229.
- Sethi, Narayan et al. (2024) 'Health Expenditure and Economic Growth Nexus: Empirical Evidence from South Asian Countries', *Global Business Review*, 25(2_suppl), pp. S229–S243. doi: 10.1177/0972150920963069.
- Shapkova Kocavska, K. (2023) 'PUBLIC EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH: EVIDENCE FROM NORTH MACEDONIA', *Journal of Liberty and International Affairs, Institute for Research and European Studies - Bitola*, 9, pp. 22–34. doi: 10.47305/JLIA2391022shk.
- Sima, M., Liang, P. and Qingjie, Z. (2023) 'The impact of fiscal decentralization on economic growth: A comparative analysis of selected African and OECD countries', *Heliyon*, 9(9). doi: 10.1016/j.heliyon.2023.e19520.
- Sofilda, E., Zilal Hamzah, M. and Kusairi, S. (2023) 'Analysis of fiscal decentralisation, human development, and regional economic growth in indonesia', *Cogent Economics & Finance*, 11(1), p. 2220520. doi: 10.1080/23322039.2023.2220520.
- Soleman, R. et al. (2022) 'The Effect of HDI and Macroeconomic Variables on Economic Growth in Indonesia 2015-2020', *Jurnal Ilmu Ekonomi Terapan*, 7(1), pp. 63–74. doi: 10.20473/jiet.v7i1.34641.
- Sulaiman, N., Muhamad Bustaman, N. F. and Tang, C. F. (2024) 'Economic growth and female labour force participation in an ageing society: evidence from Southeast Asia', *Applied Economics*, 56(37), pp. 4481–4491. doi: 10.1080/00036846.2023.2212964.
- Suparman, S. and Muzakir, M. (2023) 'Regional inequality, human capital, unemployment, and economic growth in Indonesia: Panel regression approach', *Cogent Economics & Finance*, 11(2), p. 2251803. doi: 10.1080/23322039.2023.2251803.
- Syadullah, M. and Setyawan, D. (2021) 'The Impact of Infrastructure Spending on Economic Growth: A Case Study of Indonesia', *Communications - Scientific letters of the University of*

- Zilina, 23, pp. A184–A192. doi: 10.26552/com.C.2021.3.A184-A192.
- Statistics Indonesia. (2022). *Indonesian Sustainable Development Goals Indicators*.
- Statistics Indonesia. (2023). *Indonesian Sustainable Development Goals Indicators*.
- Sun, M., Yan, S., Cao, T., & Zhang, J. (2024). The impact of COVID-19 pandemic on the world's major economies: based on a multi-country and multi-sector CGE model. *Frontiers in Public Health*, 12. <https://doi.org/10.3389/fpubh.2024.1338677>
- Takyi, P. O. *et al.* (2023) 'Economic activities' response to the COVID-19 pandemic in developing countries', *Scientific African*, 20, p. e01642. doi: <https://doi.org/10.1016/j.sciaf.2023.e01642>.
- Tassinari, M. (2023a) 'Productivity, equity, and sustainability: A trilemma for contemporary human development?', *International Review of Applied Economics*, 37(5), pp. 575–606. doi: 10.1080/02692171.2023.2240255.
- Timilsina, G., Stern, D. I. and Das, D. K. (2024) 'Physical infrastructure and economic growth', *Applied Economics*, 56(18), pp. 2142–2157. doi: 10.1080/00036846.2023.2184461.
- Trinh, L. (2025) 'The impact of education expenditure on economic growth in the Southeast Asia region', *Knowledge and Performance Management*, 9, pp. 148–159. doi: 10.21511/kpm.09(1).2025.11.
- Tong, K. (2024). Urbanization moderates the transitional linkages between energy resource use, greenhouse gas emissions, socio-economic and human development: insights from subnational analyses in China. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2024.143776>
- Tulus Rahayu, N. and Muharam, H. (2021) *The Impact of The Covid-19 Pandemic on Provincial Economic Performance In Indonesia Article Information, Management Analysis Journal*. Available at: <http://maj.unnes.ac.id>.
- Wadipalapa, R., Katharina, R., Nainggolan, P., Aminah, S., Apriani, T., Ma'rifah, D., & Anisah, A. (2024). An Ambitious Artificial Intelligence Policy in a Decentralised Governance System: Evidence From Indonesia. *Journal of Current Southeast Asian Affairs*, 43, 65–93. <https://doi.org/10.1177/18681034231226393>
- Wafit Hidayah and Happy Febrina Hariyani (2024) 'The Role Of Education For Economic Growth In Indonesia', *Journal of Business, Finance, and Economics (JBFE)*, 5(1), pp. 246–258. doi: 10.32585/jbfe.v5i1.5185.
- Zamir, S., Abbasi, B., Yu, L., Sohail, A., & Yang, C. (2023). Transformative role of educational funding in shaping national development across SAARC countries in the 21st century: A panel NARDL approach. *Heliyon*, 9. <https://doi.org/10.1016/j.heliyon.2023.e20417>
- Zhao, T., & Shah, S. A. A. (2024). Green Energy, Economic Growth, and Innovation for Sustainable Development in OECD Countries. *Sustainability*. <https://doi.org/10.3390/su162210113>