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ANALYSIS OF THE INFLUENCE OF REGIONAL CAPITAL EXPENDITURE, INVESTMENT PRIVATE ENTERPRISE, LABOR AND SPECIAL ALLOCATION FUNDSON THE ECONOMIC GROWTH OF ACEH PROVINCE

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Abstract

This study aims to analyze the effect of capital expenditure on regional economic growth in Aceh Province by considering control variables and the Special Autonomy Fund (DOKA) as a moderating variable. The control variables include the Open Unemployment Rate (TPT), Labor Force Participation Rate (TPAK), Human Development Index (HDI), and investment. This study employs panel data covering 23 regencies/cities over the period 2016–2025. The analytical method used is panel data regression with a Fixed Effect Model (FEM), selected based on the Chow test and Hausman test. Estimation is conducted using robust standard errors (White cross-section) to address potential heteroskedasticity and autocorrelation issues. The results indicate that capital expenditure has a positive and significant effect on economic growth. The HDI and investment variables also show positive and significant effects, while TPT and TPAK are not statistically significant. DOKA has a positive effect on economic growth; however, the interaction between capital expenditure and DOKA shows a significant negative effect, indicating that DOKA tends to weaken the effectiveness of capital expenditure. These findings highlight the importance of improving fiscal governance quality so that capital expenditure and DOKA can be more effective in promoting regional economic growth.

Keywords *: Capital Expenditure, Economic Growth, DOKA, Panel Data, FEM, Aceh*

INTRODUCTION

Regional economic growth is a key indicator of development success, reflecting a region's ability to sustainably improve community welfare. From a modern development economics perspective, economic growth is no longer solely determined by the availability of natural resources, but is strongly influenced by the quality of human resources, labor market dynamics, investment levels, and the effectiveness of local government fiscal policies. Within the *grand theory of* economic growth, both the neoclassical Solow theory (1956) and the endogenous growth theory developed by Romer (1986) and Lucas (1988) emphasize that the accumulation of physical and human capital is a key factor in driving long-term economic growth. Therefore, understanding the determinants of economic growth is crucial, particularly for regions with unique fiscal characteristics such as Aceh Province.

Economic growth in Aceh Province has tended to fluctuate and does not fully reflect its fiscal potential. As a region with special autonomy status, Aceh receives a relatively large annual Special Autonomy Fund allocation, which should accelerate economic development through increased public spending. However, the reality is that this substantial budget allocation has not yet fully generated stable and sustainable economic growth. This situation indicates structural problems in the regional economy, both in terms of fiscal policy effectiveness, human resource quality, and real sector dynamics. To provide an empirical picture of these conditions, the following presents data on economic growth in Aceh Province over the last ten years.

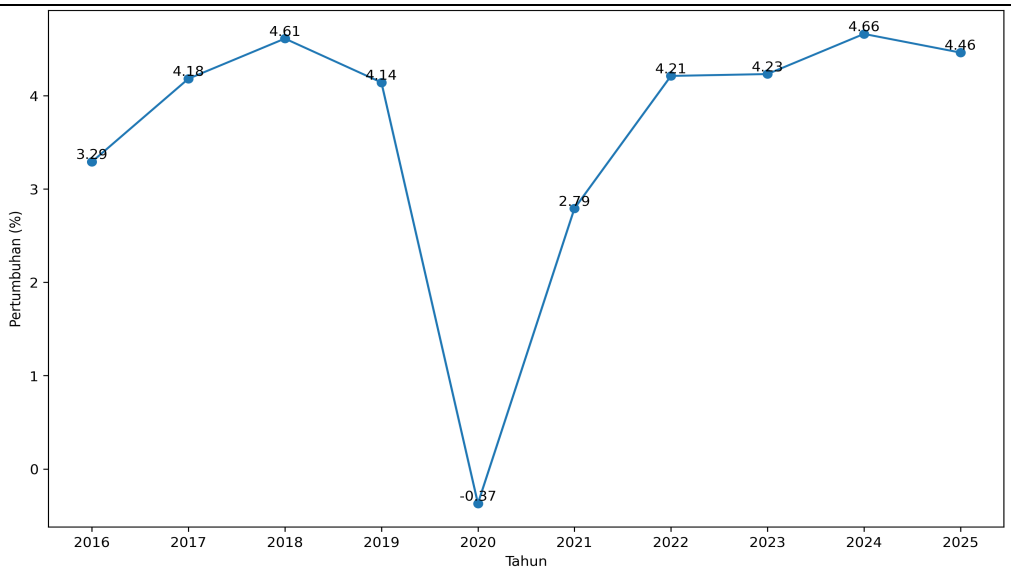


Figure 1.1 1of Economic Growth in Aceh Province 2016–2025

To provide an empirical overview, Figure 1.1 shows that economic growth in Aceh Province during the 2016–2025 period tended to fluctuate. In 2016–2018, growth increased from 3.29 percent to 4.61 percent, reflecting an expansion in economic activity, primarily driven by the agriculture, construction, and local government spending sectors. However, in 2019, growth began to slow to 4.14 percent due to the weakening oil and gas sector and limited regional economic diversification. The deepest contraction occurred in 2020, at -0.37 percent, due to the COVID-19 pandemic, which suppressed economic activity, including consumption, investment, and public mobility. After that, the economy began to recover in 2021 by 2.79 percent and continued to increase, reaching 4.66 percent in 2024. However, this growth is still moderate and has not yet shown strong acceleration. In 2025, growth slows slightly to 4.46 percent, indicating that Aceh's economic recovery still faces structural constraints, such as dependence on the primary sector, suboptimal productive investment, and limited labor absorption. This situation demonstrates that despite the region's relatively large fiscal capacity, its effectiveness in driving sustainable economic growth remains suboptimal.

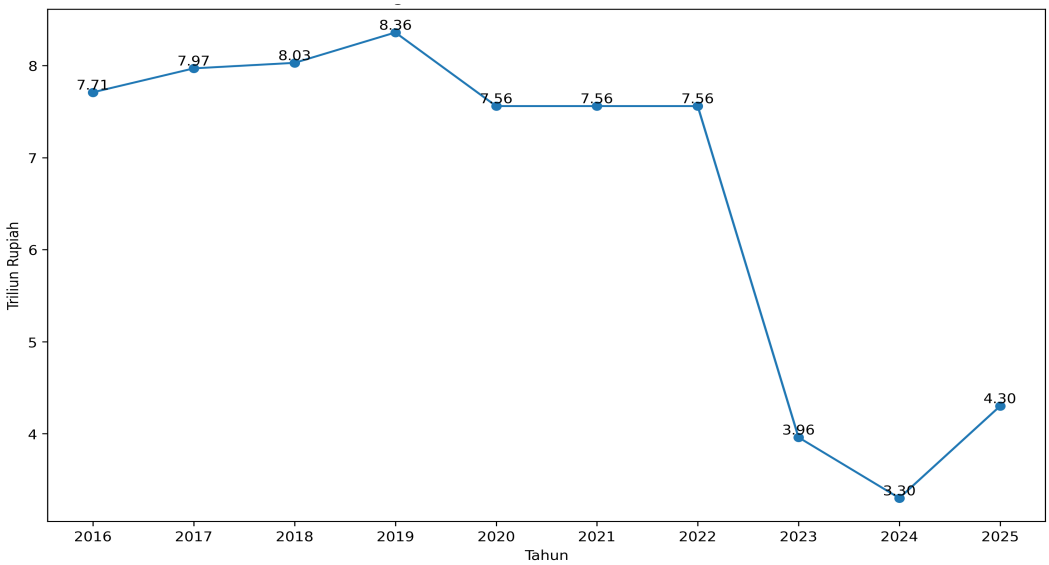


Figure 2 Development of Regional Gross Domestic Product (GRDP) at Current Prices in Aceh Province 2016-2025
Source: BPS Aceh Province 2025

Based on Figure 1.2, the per capita GRDP of Aceh Province during the 2016–2025 period shows a consistent increasing trend, from 26,852 thousand rupiah in 2016 to 45,770 thousand rupiah in 2025. This increase reflects an increase in economic value per individual and an improvement in aggregate economic performance. However, this increase does not always align with the fluctuating dynamics of economic growth. GRDP per capita continued to increase even during periods of economic contraction, such as 2020, suggesting that this indicator better reflects long-term trends than short-term economic conditions. Critically, this can be influenced by inflation, changes in economic structure, and increases in nominal output, which may not necessarily translate into improvements in real welfare.

Overall, these conditions indicate that the development challenges in Aceh Province lie not only in the magnitude of fiscal capacity, but also in the effectiveness of economic development management. Although Aceh receives a relatively large allocation of fiscal funds, including the Special Autonomy Fund, the resulting economic growth tends to be moderate and fluctuating (BPS Aceh Province, 2025). Furthermore, limited economic diversification, dependence on the primary sector, and suboptimal effectiveness of development spending also contribute to obstacles. Furthermore, the relatively equitable distribution of income does not fully reflect a high level of welfare (BPS Aceh, 2024). To strengthen the argument regarding the large fiscal capacity of the region, the following presents the development of the Special Autonomy Fund of Aceh Province in recent years.

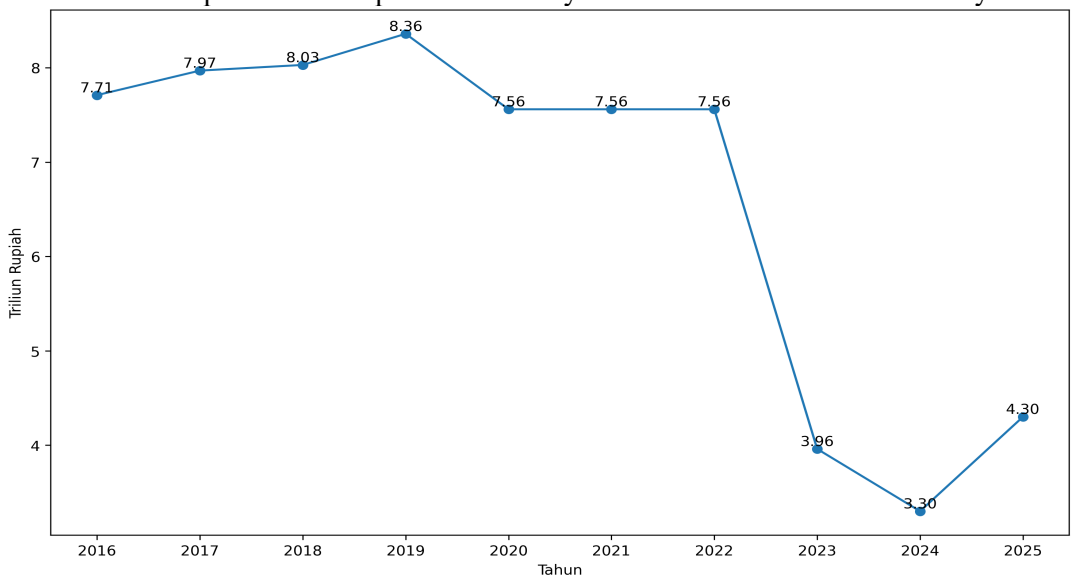


Figure 3 Development of Aceh Special Autonomy Fund (2016-2025)

Source: BPS Aceh 2025

Based on Figure 1.3, the Special Autonomy Fund (DOKA) of Aceh Province during the 2016–2025 period shows a fluctuating pattern, with an increase in the initial period, stagnation in 2020–2022, and a decrease in 2023–2024 before increasing again in 2025. This pattern reflects the dynamics of regional fiscal capacity which is not completely stable. When linked to economic growth, fluctuations in the DOKA (National Development Planning Agency) show a less than linear relationship. Despite relatively large funding allocations, Aceh's economic growth remains moderate, indicating that the problem lies not only in the size of the funds but also in the effectiveness of their management and allocation in stimulating economic activity. In the regional fiscal structure, in addition to the DOKA (Regional Original Revenue), economic development is also supported by various funding sources, such as General Transfer Funds, Regional Original Revenue, and regional spending within the Regional Budget (APBD). One crucial component is **capital expenditure** , which plays a strategic role in increasing economic capacity through the development of infrastructure and public facilities. Conceptually, capital expenditure is government spending to acquire fixed assets that provide long-term benefits (Government Regulation of the Republic of Indonesia Number 12 of 2019). From a growth theory perspective, this role aligns with neoclassical theory, which emphasizes the importance of physical capital accumulation in increasing output (Solow, 1956), as well as the Keynesian approach, which views government spending as a driver of aggregate demand and economic growth (Keynes, 1936).

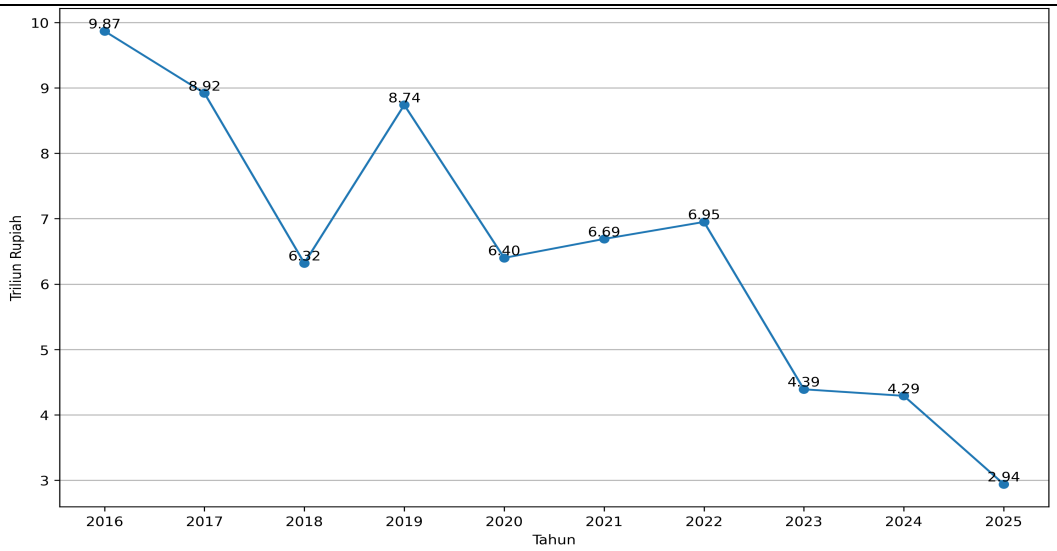


Figure 4 Development of Capital Expenditure of Aceh Province 2016-2025
Source: DJPK Kemenkue, 2025

Based on Figure 1.4, capital expenditure in Aceh Province during the 2016–2025 period shows a fluctuating pattern with a downward trend, especially after 2020 until it reaches its lowest point in 2025. This condition indicates fiscal pressure and potential problems in the effectiveness of planning and allocation of productive expenditure. Capital expenditures encompass government spending on long-term assets such as infrastructure, public facilities, and economic infrastructure. Although capital expenditures remained relatively high in 2020, economic growth contracted, only to rebound in 2021, when capital expenditures did not experience a significant increase. This indicates a disconnect between capital expenditures and economic growth performance.

Besides capital expenditure, another factor that influences economic growth is the quality of human resources, as reflected in the Human Development Index (HDI), which measures the dimensions of health, education, and a decent standard of living (BPS, 2025). From *a grand theory perspective* , particularly Becker's (1964) *human capital theory* and Romer's (1986) and Lucas' (1988) endogenous growth theory, human resource quality is a key factor in increasing productivity and long-term economic growth. Investments in education and health will increase an individual's ability to generate economic output, so theoretically, an increase in the HDI should contribute positively to economic growth.

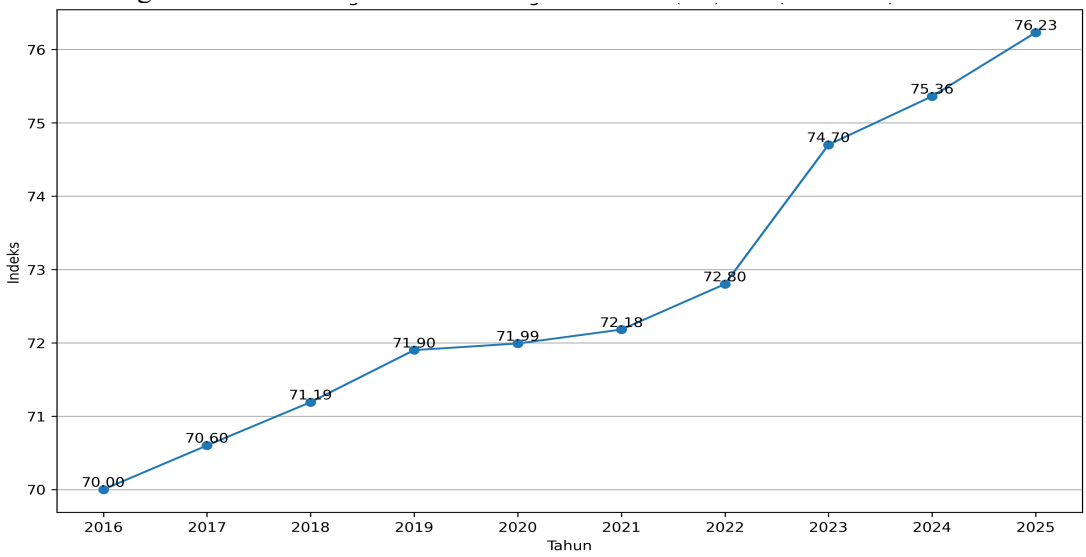


Figure 5Development of the Human Development Index (HDI) 2016-2025
Source: BPS Aceh Province 2025

Based on Figure 1.5, the Human Development Index (HDI) of Aceh Province during the 2016–2025 period shows a consistent upward trend, from 70.00 to 76.23. This increase reflects continuous improvements in the quality of human resources, particularly in education, health, and the community's standard of living. However, increases in the HDI are not always accompanied by stable economic growth. In certain periods, such as 2020, the HDI continued to increase despite economic contraction. This indicates that improvements in human resource quality have not fully stimulated economic activity in the short term, so the relationship between the HDI and economic growth is not always direct and linear. Theoretically, an increase in the HDI should boost labor productivity and economic output. However, in the Aceh context, this is influenced by various factors, such as limited job opportunities commensurate with the quality of the workforce, the dominance of the primary sector, and the suboptimal utilization of human resources in the productive sector. In addition to capital expenditure and human resource quality, as reflected in the Human Development Index (HDI), regional economic growth is also influenced by investment, both from Foreign Direct Investment (FDI) and Domestic Direct Investment (DDI). Investment plays a strategic role in increasing production capacity, creating jobs, and stimulating economic activity across various sectors. Therefore, investment is a crucial determinant of sustainable economic growth in a region.

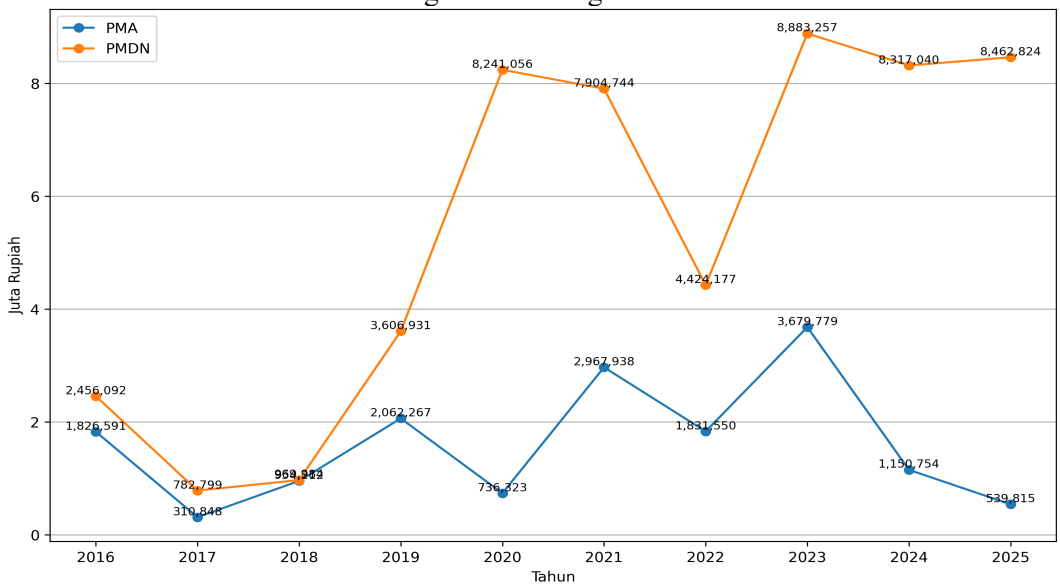


Figure 6 Development of PMA and PMDN in Aceh Province 2016-2025

Source: Ministry of Investment and Development 2025

Based on Figure 1.6, the investment structure in Aceh Province for the 2016–2025 period is dominated by Domestic Direct Investment (PMDN), which tends to be high and increasing, while Foreign Direct Investment (PMA) is relatively low and fluctuating. The dominance of PMDN indicates that investment is largely supported by domestic capacity, while the low level of PMA indicates limited attractiveness for foreign investment, which is influenced by infrastructure, regulations, and an economic structure that is still based on the primary sector. However, increased investment, particularly domestic direct investment (PMDN), is not always accompanied by consistent economic growth. In certain periods, such as 2020–2021, domestic investment was relatively high, but economic growth did not increase proportionally. This indicates that the relationship between investment and economic growth is not direct and linear, but rather influenced by the quality of the investment, the target sector, and the regional economy's ability to absorb the investment.

Theoretically, FDI has the potential to boost technology transfer and productivity, but its contribution in Aceh remains limited. This situation highlights a *research gap* , namely the mismatch between increased investment and suboptimal economic growth. Therefore, in this study, investment (domestic investment and foreign investment) is positioned as a control variable to avoid bias in the analysis of the effect of capital expenditure on economic growth. Besides investment, the labor force also plays a crucial role. Labor is proxied by the Labor Force Participation Rate (LFPR), which is the percentage of the working-age population that is economically active (Central Bureau of Statistics, 2025). In neoclassical theory, labor is the primary factor of production, alongside capital (Mankiw, 2019). However, the fluctuating dynamics of the LFPR in Aceh indicate that labor potential has not been fully utilized optimally, creating *a research gap* regarding the labor force's contribution to regional economic growth.

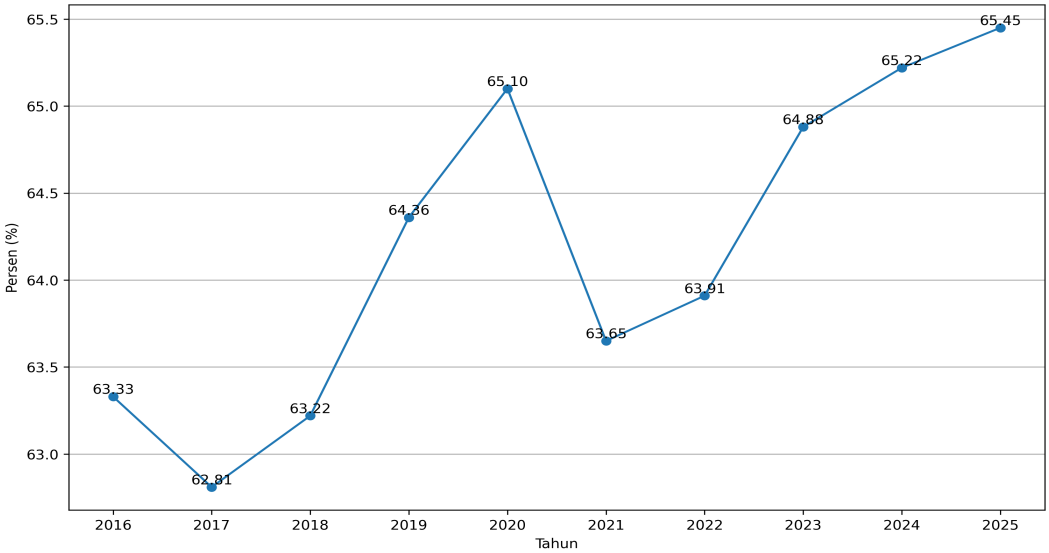


Figure 7Development of the Labor Force Participation Rate (TPAK) in Aceh Province (2016-2025)
Source: BPS Aceh Province 2025

Based on Figure 1.7, the Labor Force Participation Rate (LFPR) in Aceh Province for the 2016–2025 period shows a long-term upward trend, albeit with fluctuations, particularly a decline in 2021 due to the impact of the pandemic. The increase in LFPR reflects the greater involvement of the working-age population in economic activities, but is not always accompanied by stable economic growth. In some periods, the increase in the TPAK (Intermediate Employment Ratio) did not align with economic growth, indicating that labor absorption had not yet fully occurred in productive sectors. This suggests that a high labor force does not necessarily reflect increased productivity, as it is still influenced by labor quality, the structure of the employment market, and the dominance of the informal sector. Therefore, in this study, TPAK is positioned as a control variable to assess the effect of labor force participation on economic growth. Thus, *a research gap exists* , namely a mismatch between increased labor force participation and unstable economic growth performance in Aceh Province.

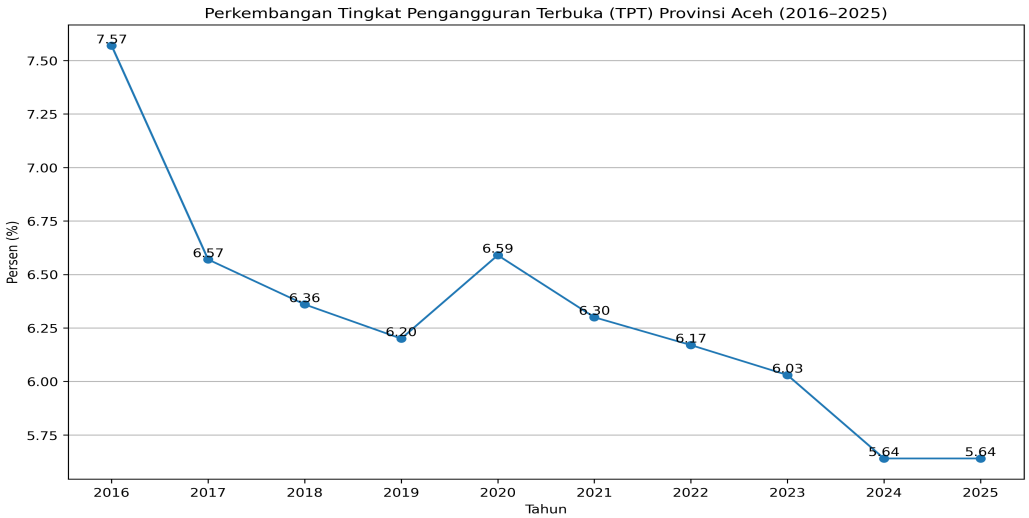


Figure 8 Development of the Open Unemployment Rate (TPT) Aceh Province (2016-2025)

Source: BPS Aceh Province 2025

Based on Figure 1.8, the Open Unemployment Rate (TPT) in Aceh Province during the 2016–2025 period shows a downward trend, from 7.57 percent to 5.64 percent, despite a slight increase in 2020 due to the COVID-19

pandemic. This decline reflects a quantitative improvement in labor absorption. However, the decline in unemployment is not always accompanied by a steady increase in economic growth. In some periods, despite a decline in the unemployment rate, economic growth remains volatile. This indicates that labor absorption has not yet fully occurred in the productive sector, which is capable of optimally driving economic output. Critically, this situation indicates that the decline in unemployment is likely to occur in the informal sector or low-productivity jobs, as well as the phenomenon of *underemployment* . From Okun's law perspective, a decline in unemployment should increase economic output, but in the Aceh context, this relationship appears inconsistent due to structural factors such as low productivity and a mismatch in workforce skills. Therefore, in this study, the unemployment rate is positioned as a control variable to control the effect of labor market imbalances on economic growth. Thus, *a research gap exists* , namely a mismatch between the declining unemployment rate and unstable economic growth in Aceh Province.

Empirically, the effect of capital expenditure on economic growth shows mixed results and is heavily influenced by the quality of allocation, implementation effectiveness, and institutional conditions. Several studies demonstrate a positive impact of capital expenditure on economic growth through increased productivity, connectivity, and multiplier effects (Esquivias and Harianto, 2020; Sahoo et al., 2021; Mensah et al., 2022; Jalles et al., 2024; Mbanda and Bonga-Bonga, 2024). However, other findings show inconsistent results due to inefficiency, weak governance, and misdirected allocation (Al Mamun et al., 2021; Nguyen and Bui, 2022; Sugiyarto et al., 2025; Setiawan, 2023). This confirms that the relationship between capital expenditure and economic growth is not always linear. Furthermore, the quality of human resources, as reflected in the HDI, theoretically contributes to economic growth by increasing labor productivity (Hanushek and Woessmann, 2020; Gupta et al., 2021; Rahman and Nasir, 2022). However, in some contexts, this influence is suboptimal due to limitations in economic structures and institutions (Alvarado et al., 2020; Kim, 2021). Therefore, the HDI is positioned as a control variable. Investment, both PMA and PMDN, also plays an important role in driving economic growth through capital accumulation and technology transfer (Fazaalloh et al., 2024; Li and Tanna, 2021; Nguyen and Nguyen, 2022; Rahman et al., 2021; Kurniawan and Managi, 2023).

Furthermore, fiscal transfers such as the Special Autonomy Fund (DOKA) play a role in increasing regional fiscal capacity and driving economic development (Rodríguez-Pose and Ezcurra, 2020; Boadway and Shah, 2021; Martínez-Vázquez et al., 2022). However, their effectiveness is highly dependent on the quality of institutions, governance, and the effectiveness of regional budget management (Rodríguez-Pose and Garcilazo, 2021; Arham, 2022). Therefore, in this study, DOKA is positioned not only as an independent variable but also as a moderating variable interacting with capital expenditure to determine whether the fund's presence can strengthen or weaken the influence of capital expenditure on regional economic growth.

The novelty of this research lies in its more focused, integrative, and contextual approach to analyzing regional economic growth in Aceh Province, with capital expenditure as the primary variable. Unlike previous studies, which generally examined various determinants of economic growth partially or placed key variables in relatively equal positions, this study explicitly constructs a hierarchical and structured analytical framework. Furthermore, another important novelty in this study is the inclusion of the Special Autonomy Fund (DOKA) as a moderating variable, rather than simply as an independent or dummy variable, as is often done in previous studies. With this approach, the study not only examines the direct effect of DOKA on economic growth but also examines how DOKA interacts with capital expenditures in influencing regional economic growth. This is relevant given that Aceh Province has unique fiscal characteristics as a special autonomy region with a relatively large allocation of funds, making the potential interaction of fiscal policies an important aspect that requires more in-depth analysis.

LITERATURE REVIEW

A review of previous research serves as an important foundation for building empirical arguments for a study. By reviewing various previous studies, patterns of relationships between variables, consistency and inconsistencies in research results, and relevant research gaps for further development can be identified. Several studies have shown that government capital spending has a positive impact on economic growth. Calderón et al. (2022) found that public investment in infrastructure contributes significantly to economic growth by increasing productivity and efficiency. This finding is supported by Abiad et al. (2020), who showed that infrastructure spending has a significant *multiplier effect* in stimulating economic activity, particularly in developing countries. Furthermore, Égert et al. (2021) emphasized that high-quality public spending can sustainably increase economic output. However, several studies have shown conflicting results. Al Mamun et al. (2021) found that public spending does not always have a positive impact when faced with governance issues such as corruption and bureaucratic inefficiency. Furthermore, Setiawan (2023) in the Aceh context showed that large capital spending has not been able to fully stimulate economic growth

due to less productive budget allocation. These findings suggest that the effect of capital spending on economic growth is not always linear, but is highly dependent on the effectiveness of budget management. In the context of human development, several studies have shown that the Human Development Index (HDI) has a positive influence on economic growth. Hanushek and Woessmann (2020) found that educational quality has a significant impact on economic growth through increased labor productivity. Gupta et al. (2021) also showed that improving the quality of human resources contributes to increased economic output. Furthermore, Rahman and Nasir (2022) found that the HDI has a positive influence on economic growth through increased efficiency and innovation. However, other empirical results show that this relationship is not always consistent. Alvarado et al. (2020) found that improving the quality of human resources does not always lead to economic growth if it is not accompanied by a supportive economic structure. Kim (2021) also showed that the impact of the HDI on economic growth can weaken if the labor market is unable to optimally absorb the workforce. This suggests that the quality of human resources needs to be supported by conducive economic conditions to impact economic growth.

Research on investment, both Foreign Direct Investment (FDI) and Domestic Direct Investment (DDI), also shows mixed results. Nguyen and Nguyen (2022) found that foreign investment has a positive impact on economic growth through technology transfer and increased productivity. Li and Tanna (2021) showed that domestic investment plays a crucial role in strengthening local economic sectors and driving economic growth. Furthermore, Shahbaz et al. (2022) found that investment contributes significantly to economic growth, particularly in developing countries. However, several studies have shown conflicting results. Alfaro et al. (2004) found that the impact of foreign investment is highly dependent on the investment's destination sector, with investment in the extractive sector having a smaller impact on economic growth. Furthermore, recent research shows that investments lacking strong linkages to local sectors (*weak linkages*) tend to have a limited impact on regional economic growth. This suggests that investment effectiveness is determined not only by the size of the investment but also by its quality and structure.

From a labor perspective, increasing labor force participation is theoretically expected to boost economic growth. Altuzarra et al. (2021) show that increased labor force participation has a positive impact on economic growth, especially if the workforce is absorbed in the productive sector. Sulaiman and Abdul-Rahim (2022) also found that the workforce contributes significantly to economic growth through increased productivity. Furthermore, Osei and Kim (2023) emphasized that matching labor skills with labor market needs is a crucial factor in increasing economic growth. However, several studies have shown conflicting results. Bloom et al. (2011) showed that increasing the labor force does not always have a positive impact on economic growth if it is not accompanied by the creation of productive jobs. Furthermore, the dominance of the informal sector limits the labor force's contribution to economic growth. This suggests that labor quality is a crucial factor in determining its contribution to economic growth.

On the other hand, the unemployment rate is also closely related to economic growth. Ball et al. (2019) found that rising unemployment significantly reduces economic output, in line with Okun's Law. Moosa (2020) also showed that the negative relationship between unemployment and economic growth remains relevant across various country contexts. Furthermore, several studies suggest that a decrease in unemployment can boost economic activity by increasing employment. However, other empirical results indicate that this relationship is not always consistent. Lee et al. (2020) found that a decrease in unemployment is not always followed by increased economic growth, especially in developing countries. This is due to the phenomenon of *underemployment* and low labor productivity. Thus, the unemployment rate reflects not only the number of unemployed workers but also the quality of available jobs.

In the context of fiscal decentralization, the Special Autonomy Fund (DOKA), as a form of fiscal transfer, has the potential to boost regional economic growth. Rodríguez-Pose and Ezcurra (2020) found that fiscal transfers can boost regional economic growth if supported by good governance. Martínez-Vázquez et al. (2022) also showed that fiscal transfers can enhance economic development through improved infrastructure and public services. Furthermore, several studies have shown that regional transfer funds play a significant role in reducing development disparities. However, several studies have shown conflicting results. Fiscal transfers are not always effective in driving economic growth if not accompanied by efficient management and targeted allocation. In the Aceh context, although the DOKA provides substantial fiscal capacity, the resulting economic growth tends to be moderate, indicating challenges in the effective management of these funds.

Based on these various empirical findings, it can be concluded that capital expenditure, HDI, investment, labor, unemployment, and regional fiscal capacity play a significant role in influencing economic growth. However, the relationship between these variables is not always linear and consistent; instead, it is heavily influenced by structural factors, policy quality, and regional characteristics. Thus, there are *research gaps* that form the basis of this study. First, there are still inconsistencies in research results regarding the effect of capital expenditure on economic

growth. Second, increasing the HDI does not always optimally drive economic growth. Third, the effectiveness of investment, labor, and unemployment is highly dependent on regional economic structure. Fourth, the role of the Special Autonomy Fund as a specific fiscal instrument has not been widely analyzed in an integrated model. Therefore, this study aims to address this gap by analyzing the impact of capital expenditure on regional economic growth, incorporating the Human Development Index (HDI), investment, labor force, and unemployment rate as control variables, and the Special Autonomy Fund as a dummy variable in the context of Aceh Province. This approach is expected to provide a more comprehensive and relevant empirical contribution to the development of regional development policies.

Framework of Thought and Conceptual Framework

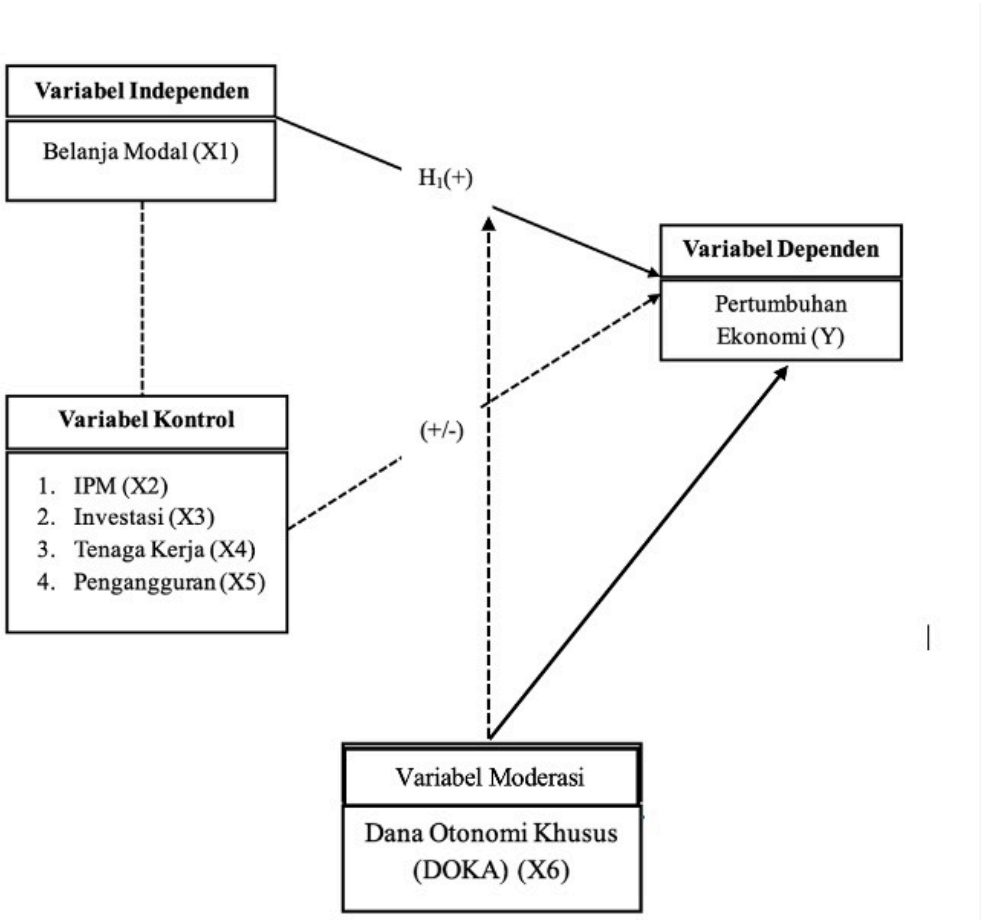


Figure 2 Research Conceptual Framework

Research Hypothesis

A research hypothesis is a tentative answer to the research problem formulation, the validity of which will be tested empirically through data analysis. The formulation of the hypothesis in this study is based on the research objectives, theoretical foundations, and relevant previous research findings. Therefore, the proposed hypothesis is systematically formulated, referring to the relationships between variables described in the conceptual framework, thus depicting the direction of the expected influence in this study.

Based on the research objectives that have been formulated, the hypothesis in this research is as follows:

H_1: Regional government capital expenditure has a positive impact on regional economic growth in Aceh Province.

H_2: Regional government capital expenditure has a significant effect on regional economic growth in Aceh Province after considering control variables, namely the Human Development Index (HDI), investment, labor, and unemployment rate.

H_3: The Special Autonomy Fund (DOKA) has an impact on regional economic growth in Aceh Province.

H_4: The Special Autonomy Fund (DOKA) moderates the influence of capital expenditure on regional economic growth in Aceh Province.

METHOD

Research Location and Object

This research was conducted in Aceh Province, a region in Indonesia with special autonomy status and distinct fiscal characteristics compared to other regions, primarily through the existence of the Special Autonomy Fund (DOKA). This location was chosen based on the consideration that Aceh Province has a relatively large fiscal capacity, yet its economic growth still exhibits a fluctuating pattern, making it interesting for empirical study. The research object in this study is all regencies and cities in Aceh Province, which are analyzed using a panel data framework (a combination of time series and cross-sectional data). By using all regencies/cities as the unit of analysis, this study is expected to capture variations in economic characteristics across regions more comprehensively.

Data Types and Sources

This research uses secondary data obtained from various official and trusted institutions. Secondary data was selected because it has a high level of validity and reliability and has been processed by authorized institutions, making it suitable for use in scientific analysis. The type of data used in this study is quantitative data in the form of numbers or figures that can be analyzed statistically. This data includes Gross Regional Domestic Product (GRDP), local government capital expenditure, the Human Development Index (HDI), investment consisting of Foreign Direct Investment (PMA) and Domestic Direct Investment (PMDN), the Labor Force Participation Rate (TPAK), the Open Unemployment Rate (TPT), and the Special Autonomy Fund (DOKA).

This study uses panel data, a combination of time series *and* cross-sectional data . The time series data covers a 10-year period, from 2016 to 2025, while the cross-sectional data covers 23 districts and cities in Aceh Province. The use of panel data in this study aims to analyze the effect of capital expenditure on regional economic growth by including control variables such as the Human Development Index (HDI), investment, labor, and unemployment rates, as well as the Special Autonomy Fund (DOKA) as a moderating variable. Through this approach, analysis can be conducted simultaneously across regions and over time, thus capturing differences in characteristics between regions and the dynamics of economic development within the study period, ultimately resulting in more accurate, efficient, and robust estimates compared to using a single data set.

The data sources in this study come from several official government institutions, namely the Central Statistics Agency (BPS), which provides data on GRDP, HDI, TPAK, and TPT; the Directorate General of Fiscal Balance of the Ministry of Finance, which provides data on capital expenditures and Special Autonomy Funds; and the Ministry of Investment/BKPM, which provides investment data in the form of PMA and PMDN. However, in practice, data availability for each variable is not always complete throughout the entire observation period. Therefore, this study uses a panel data approach adapted to data availability (unbalanced panel), allowing for analysis without compromising the validity of the results.

Data collection technique

The data collection technique in this study was conducted through the documentation method, namely collecting secondary data sourced from official publications of government agencies. The documentation method was used because the data required in this study is quantitative in the form of time series and cross-sections, which are readily available in statistical reports and official databases. Data collection was conducted by accessing and downloading data from various trusted sources, such as annual publications, statistical reports, and online databases provided by the Central Statistics Agency (BPS), the Directorate General of Fiscal Balance at the Ministry of Finance, and the Ministry of Investment/BKPM. The data collected included indicators of economic growth, capital expenditure, the Human Development Index, investment, labor, unemployment rates, and the Special Autonomy Fund.

Panel Data Regression Model

The analysis in this study uses panel data regression, an analysis method that combines cross-regional data (*cross-section*) and time *series data* in one estimation model. In this study, the *cross-section dimension* consists of 23 districts/cities in Aceh Province, while *the time series dimension* covers an annual period of 10 years, namely from 2016 to 2025. The use of panel data regression was chosen because this method is able to capture differences in characteristics between regions as well as the dynamics of change over time. Thus, this approach is considered appropriate for analyzing the effect of capital expenditure on regional economic growth by considering control variables and the Special Autonomy Fund as a moderating variable.

RESULTS AND DISCUSSION

Panel Data Model Selection

Chow Test

Table 1 Chow Test Results

Effects Test	Statistics	df	Prob.
Cross-section F	508.590426	(22,195)	0.0000
Cross-section Chi-square	915.066821	22	0.0000

Based on the results of the Chow test presented in Table 4.2, the probability value for the Cross-section F is 0.0000 and the Cross-section Chi-square is 0.0000. This probability value is smaller than the significance level used in this study, which is 0.05. Thus, the null hypothesis (H_0) stating that the Common Effect Model (CEM) is more appropriate to use is rejected, while the alternative hypothesis (H_1) is accepted.

Hausman test

Table 2 Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. df	Prob.
Random cross-section	156.472932	7	0.0000

Based on the results of the Hausman test presented in Table 4.3, a probability value (Prob.) of 0.0000 was obtained with a Chi-Square value of 156.472932 at a degree of freedom (df) of 7. This probability value is smaller than the significance level used in this study, which is 0.05. Thus, the null hypothesis (H_0) which states that the Random Effect Model (REM) is more appropriate to use is rejected, while the alternative hypothesis (H_1) is accepted.

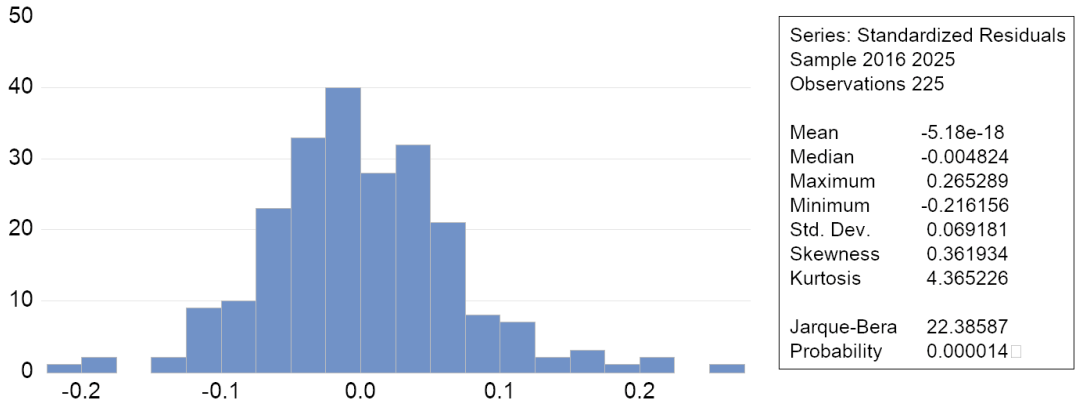
Multicollinearity Test

Table 3 Multicollinearity Test Results

Variables	LNBM	TPT	TPAK	HDI	LNINV	LNDOKA	LNBM x LNDOKA
LNBM	1,0000	0.1713	-0.176639	-0.318684	-0.134114	0.669352	0.906306
TPT	0.1713	1,0000	-0.618748	0.162504	0.244952	0.152602	0.177681
TPAK	-0.176639	-0.618748	1,00000	0.019111	-0.209786	-0.053767	-0.123564
HDI	-0.318684	0.162504	0.019111	1,00000	0.230096	-0.412704	-0.403621
LNINV	-0.134114	0.244952	0.230096	0.230096	1,00000	-0.221362	-0.198057
LNDOKA	-0.669352	0.152602	-0.412704	-0.412704	-0.221362	1,000,000	0.920076
LNBM x LNDOKA	-0.906306	0.177681	-0.403621	-0.403621	-0.198057	0.920076	1,000,000

Based on the test results, most of the independent variables showed correlation values below 0.80, indicating that there were no serious multicollinearity problems in the model. This indicates that each variable has relatively different information in explaining the variation in the dependent variable.

Normality Test (Optional)



The residuals in this model are not fully normally distributed, as indicated by the Jarque-Bera probability value of 0.000014, which is less than 0.05. This indicates a statistical deviation from the normal distribution.

Model Estimation Results

Table 4 FEM (Robust Standard Errors) Regression Estimation Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	1.631757	3.305283	0.493681	0.6334
LNBM	0.787060	0.222603	3.535707	0.0064
TPT	-0.002631	0.003105	-0.847455	0.4187
TPAK	-0.001434	0.002039	-0.703270	0.4997
HDI	0.075079	0.021674	3.464069	0.0071
LNINV	0.005131	0.002202	2.330585	0.0447
LNDOKA	0.832796	0.297196	2.802180	0.0206
LNBM×LNDOKA	-0.074854	0.022034	-3.397193	0.0079
Effects Specification				

Cross-section fixed (dummy variables)

Information	Mark	Information	Mark
R-squared	0.991755	Prob(F-statistic)	0.000000
Adjusted R-squared	0.990529	Durbin-Watson stat	1.017678
SE of regression	0.074147	Akaike info criterion	-2.241969
Sum squared residual	1.072066	Schwarz criterion	-1.786489
Log likelihood	282.2216	Hannan-Quinn criter.	-2.058136
F-statistic	808.7984		

Data Processing Results Source with Eviews (2026)

Regression Equation Model

Based on the results of panel data regression estimation using the Fixed Effect Model (FEM) approach with robust standard errors, the following equation model is obtained:

$$\text{LNPDRB}_{it} = 1.631757 + 0.787060\, LNBM_{it} - 0.002631\, TPT_{it} - 0.001434\, TPAK_{it} + 0.075079\, IPM_{it} + 0.005131\, LNINV_{it} + 0.832796\, LNDOKA_{it} - 0.074854\, (LNBM \times LNDOKA)_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.1)$$

Discussion

The Impact of Capital Expenditure on Economic Growth

The estimation results show that the capital expenditure (LNBM) variable has a coefficient of 0.787060 with a significance level of 0.0064, indicating a positive and significant effect on regional economic growth. The positive direction of the effect indicates that increased regional government capital expenditure can drive an increase in GRDP. Statistically, a probability value of less than 0.05 indicates that the effect is significant at the 95 percent confidence level. From an elasticity interpretation perspective, because the model uses a logarithmic form, the coefficient of 0.787060 can be interpreted as meaning that every 1 percent increase in capital spending will increase economic growth by 0.78 percent, all other things being equal. This indicates that capital spending plays a significant role as a fiscal instrument in driving regional economic activity. Theoretically, this finding aligns with endogenous growth theory, which emphasizes the importance of capital accumulation in increasing production capacity. Within the framework of regional economic development, government capital expenditure reflects public investment in infrastructure, such as roads, bridges, educational facilities, and health care, which directly and indirectly increase the productivity of production factors. Furthermore, Keynesian theory emphasizes that government spending has a multiplier effect on the economy, particularly in regions facing limited private investment. The results of this study are also consistent with various recent empirical studies in reputable international journals. A study by Nguyen et al. (2020) found that government infrastructure spending has a positive effect on regional economic growth in developing countries. Research by Aschauer (2019) shows that public investment in infrastructure increases private sector productivity.

The Role of Control Variables in the Model

Open Unemployment Rate (TPT)

The estimation results show that the open unemployment rate (TPT) variable has a coefficient of -0.002631 with a probability value of 0.4187, indicating a negative but insignificant effect on economic growth. This finding indicates that changes in unemployment rates between districts/cities in Aceh Province have not directly affected the dynamics of regional economic growth. In the context of Aceh, this condition can be explained by an economic structure still dominated by the informal sector and natural resource-based sectors. Much of the workforce is absorbed in low-productivity economic activities that are not optimally recorded in formal indicators. Furthermore, the phenomenon of skill mismatch between labor and market needs is also a factor causing unemployment to not directly impact economic output. Therefore, although unemployment theoretically influences growth, in the case of Aceh, this effect is insignificant in this model. The TPT variable is retained as a control to maintain estimation consistency.

Labor Force Participation Rate (LFPR)

The labor force participation rate (LFPR) variable has a coefficient of -0.001434 with a probability value of 0.4997, indicating a negative and insignificant effect on economic growth. This indicates that increasing labor force participation has not been able to directly increase regional economic output in Aceh Province. This situation reflects that high labor force participation is not always accompanied by increased productivity. In Aceh, the majority of the workforce remains in the informal sector, with low levels of efficiency and value-added. Furthermore, limited formal employment opportunities and low skill quality also prevent labor force participation from optimally contributing to economic growth. Therefore, the LFPR in this model serves more as a control variable, ensuring that estimates of the impact of capital expenditure are not biased by variations in labor force participation that do not optimally reflect economic productivity.

Human Development Index (HDI)

The Human Development Index (HDI) variable shows a coefficient of 0.075079 with a probability value of 0.0071, indicating a positive and significant effect on economic growth. This finding confirms that human resource quality is a crucial factor in driving regional economic activity. In the context of Aceh, the increase in the HDI reflects improvements in education, health, and the community's standard of living. This contributes to increased labor productivity and adaptability to economic change. However, challenges remain, including disparities in the quality of education and health across regions, as well as suboptimal absorption of highly educated workers. Therefore, although the HDI has a significant influence, its impact on economic growth still requires more integrated policy support. In this model, the HDI serves as a control variable, strengthening the validity of the analysis by considering the role of human quality in economic development.

Investment (LNINV)

The investment variable (LNINV) has a coefficient of 0.005131 with a probability value of 0.0447, indicating a positive and significant effect on economic growth, albeit a relatively small one. This indicates that investment contributes to increasing regional economic activity, but its influence is not yet dominant. In the context of Aceh Province, investment still faces various obstacles, such as limited infrastructure, inadequate regulations, and low investment attractiveness in some regions. Furthermore, investment tends to be concentrated in certain sectors and is not evenly distributed across regions. Dependence on government funding also means that the role of private investment has not yet developed optimally. Therefore, although investment has a positive effect, its impact on economic growth remains limited. In this model, the investment variable serves as a control to ensure that the influence of capital expenditure on economic growth is not mixed with the influence of private investment, resulting in more accurate and valid estimates.

The Role of Special Autonomy Funds (DOKA)
Direct Impact of DOKA on Economic Growth

The estimation results show that the Special Autonomy Fund (LNDOKA) variable has a coefficient of 0.832796 with a probability value of 0.0206, indicating a positive and significant effect on economic growth. This finding indicates that increasing DOKA contributes to increased regional economic activity in Aceh Province. Theoretically, these results align with the theory of fiscal decentralization, which states that fiscal transfers from the central government to regional governments can increase development capacity and stimulate economic growth (Oates, 1999). Within the framework of endogenous growth theory (Romer, 1990), government intervention through public spending, including fiscal transfers such as the DOKA, can increase capital accumulation and economic productivity in the long run. Several empirical studies in the past five years also support these findings. For example, a study by Nguyen and Anwar (2020) found that fiscal transfers have a positive impact on regional economic growth in developing countries. Furthermore, research by Gemmell et al. (2021) shows that government spending supported by fiscal transfers can increase economic output, especially when directed towards productive sectors. Another study by Martínez-Vázquez et al. (2021) confirms that effective fiscal decentralization can accelerate regional economic development. Furthermore, studies by Ahmad and Brosio (2022) and Rodríguez-Pose and Ezcurra (2023) show that fiscal transfers can reduce inter-regional disparities and boost economic growth if managed optimally.

The Moderating Role of DOKA on the Relationship between Capital Expenditure and Economic Growth

The estimation results show that the interaction variable between capital expenditure and DOKA (LNBM×LNDOKA) has a coefficient of -0.074854 with a probability value of 0.0079, indicating a negative and significant effect. This finding indicates that DOKA acts as a moderating variable that weakens the influence of capital expenditure on economic growth. Theoretically, these results can be explained through the perspective of public spending efficiency theory and the concept of fiscal illusion. According to this theory, large increases in funding sources, such as fiscal transfers, do not necessarily increase spending effectiveness if not accompanied by good governance (Musgrave, 1959; Buchanan, 1967). Within this framework, the availability of large funds can actually reduce fiscal discipline and the efficiency of budget allocation. These findings also align with a number of recent empirical studies. A study by Afonso and Jalles (2020) found that increased public spending does not always have a positive impact on growth if there is inefficiency in its management. Research by Liu et al. (2021) shows that large fiscal transfers can reduce the effectiveness of regional spending if not accompanied by good coordination. Furthermore, studies by Bose et al. (2022) and Kim and Dougherty (2023) revealed that overlapping programs (overlapping expenditure) and weak planning can lead to less productive government spending. Rodríguez-Pose and Garcilazo (2023) also emphasize that institutional quality is a key factor in determining the effectiveness of fiscal transfers on economic growth.

Model Strength (Goodness of Fit)

The strength of the model in this study can be seen from the coefficient of determination (R-squared) and the simultaneous test results (F-statistic) obtained from the Fixed Effect Model (FEM) estimation using the robust standard errors approach. Based on the estimation results, the R-squared value of 0.991755 and the adjusted R-squared of 0.990529 indicate that the model has a very high level of explanatory ability (See Table 4.7) for variations in the dependent variable, namely economic growth (GRDP). The R-squared value indicates that approximately 99.17 percent of the variation in economic growth between districts/cities in Aceh Province during the study period can be explained by the independent variables in the model, namely capital expenditure, TPT, TPAK, HDI, investment,

Special Autonomy Funds, and the interaction variable between capital expenditure and DOKA. Meanwhile, the remaining less than 1 percent is explained by other factors outside the model that are not included in this study. The high coefficient of determination indicates that the model used is highly capable of capturing the dynamics of regional economic growth. It also reflects the theoretical and empirical relevance of the variables selected in the study in explaining variations in PDRB in Aceh.

Furthermore, the F-test results show an F-statistic value of 808.7984 with a probability of 0.000000, indicating significance at a very high confidence level. These results indicate that all independent variables in the model simultaneously have a significant effect on economic growth. Thus, the model used is not only individually robust but also overall consistent in explaining the relationships between variables. In the context of this research, the high model power is also influenced by the use of a fixed effects model approach, which is able to capture the specific characteristics of each district/city in Aceh Province. Differences in geographic conditions, resources, and economic structures between regions can be accommodated through fixed effects, resulting in more accurate and representative estimates. Overall, the goodness of fit results indicate that the model used in this study has a very good level of reliability in explaining regional economic growth in Aceh Province. Therefore, the estimation results obtained can serve as a strong basis for drawing conclusions and formulating implications for regional development policies.

CONCLUSION

1. Capital expenditure has been proven to have a positive and significant impact on regional economic growth. This indicates that increased regional government capital spending can stimulate economic activity through infrastructure and public facility development. In the context of Aceh, capital expenditure plays a highly strategic role in supporting equitable development across regions.
2. The Special Autonomy Fund (DOKA) has a direct, positive and significant impact on economic growth. This demonstrates that DOKA has made a real contribution to increasing regional fiscal capacity and supporting development financing in Aceh.
3. The Special Autonomy Fund (DOKA) acts as a significant moderating variable with a negative direction in the relationship between capital expenditure and economic growth. This finding indicates that increasing DOKA actually weakens the effectiveness of capital expenditure, likely due to budget inefficiency, a lack of program synergy, and potential policy overlap.
4. Control variables show varying results. The HDI and investment have a positive and significant effect on economic growth, while the TPT and TPAK have no significant effect. This suggests that human resource quality and investment play a more dominant role than labor market dynamics in the Acehnese context.

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