




Human Capital and FDI Effects on Regional Economic Growth: An ECM Approach

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Abstract. The present research aims to examine the effect of human resource quality, as demonstrated by the average years of schooling (RLS), and the influence of foreign capital, quantified by Foreign Direct Investment (FDI), on economic growth in South Sulawesi Province in Indonesia. The analysis utilizes the Error Correction Model (ECM) methodology to elucidate both short-term and long-term correlations among variables. The estimation results demonstrate that RLS exerts a positive and statistically significant influence on economic growth in both the short and long term, underlining the essential role of education in increasing productivity and fostering sustainable development. In contrast, FDI shows a positive but statistically insignificant correlation in both the short and long terms, indicating that foreign capital inflows have not yet effectively contributed to regional economic expansion. These findings emphasize the necessity for development plans that focus on developing human capital and optimizing foreign direct investment through improved infrastructure, regulatory frameworks, and closer connections with productive sectors.

Keywords: Human Capital, FDI, Economic Growth, ECM, Economics

1 Introduction

“Economic growth refers to the rise in the total value of goods and services generated within an economic system over a specific period, typically assessed using indicators such as Gross Domestic Product (GDP)” [1]. However, economic growth does not always reflect people's lives as a whole, because it does not pay attention to how wealth is distributed, the impact on the environment, or the quality of government institutions [2]. “Some of the important factors that accelerate economic growth in major countries include international trade, energy use, capital, labor, human resource development, and foreign direct investment, all of which have a positive impact in the long term” [3]. The existence of innovation, improved education, and foreign investment also greatly help increase economic growth, while high unemployment, inflation, or inefficient government spending can actually hinder this growth.

The theory of endogenous economic growth emphasizes the role of factors originating from the economy, such as innovation, knowledge gathering, investment in education, and public policy, as the main drivers of long-term economic growth. In contrast to neoclassical theories that consider technological advances as external

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M. Nohong et al. (eds.), *Proceedings of the 10th International Conference on Accounting, Management, and Economics (10th ICAME 2025)*, Advances in Economics, Business and Management Research 388,

https://doi.org/10.2991/978-94-6239-709-5_40

factors, this theory explains why countries that invest more in education, technology, and innovation tend to experience faster economic growth. However, empirically, strong evidence supporting this theory is still limited, and some endogenous models face challenges in explaining the dynamics of real economic growth in different countries. Overall, endogenous growth theory opens up new insights into the sources of growth economy by emphasizing the importance of internal factors as well as policies that encourage innovation and knowledge gathering [4].

“One of the key determinants of economic growth is the quality of human resources within a region. The average years of schooling is among the primary indicators used to measure human capital quality. Several studies have demonstrated a link between the average years of schooling and economic growth, although the magnitude and direction of this relationship may differ depending on regional contexts and other supporting factors. In the Special Region of Yogyakarta, the average years of schooling has been found to have a positive and significant impact on economic growth, suggesting that educational improvement can foster regional development [5]. Conversely, in Sampang Regency, a negative and significant relationship was identified, implying that the effect of education on economic growth may vary according to local conditions [6]. Generally, the positive impact of schooling on economic growth becomes stronger when a region attains a higher stage of development or experiences improvements in institutional quality and the education system [7].”

In addition to human resource quality, external factors such as Foreign Direct Investment (FDI) also serve as important drivers of economic growth, primarily through mechanisms like technology transfer, job creation, and the expansion of regional production capacity. “FDI plays a vital role in enhancing economic growth by contributing to capital accumulation and facilitating the diffusion of advanced technologies to host economies” [8]. Empirical studies conducted in Indonesia reveal that FDI exerts a positive and significant influence on economic growth, both at the provincial and sectoral levels, particularly within the manufacturing, mining, real estate, and hospitality industries.

Globally, FDI has also been shown to drive economic growth, especially in developing countries, with a greater effect than in developed countries [9]. However, the benefits of FDI are not always evenly distributed; Its positive influence is greatly influenced by the quality of institutions, political stability, and supportive government policies [10]. In addition, the effect of FDI can decrease if there is excessive dependence or if the FDI receiving sector becomes less productive, as seen in the agricultural sector in some cases [8]. FDI can also have a spillover effect in the form of workforce upskilling and innovation, but the end result is highly dependent on the readiness of the local economy and the quality of human resources. Thus, FDI can be a key driver of economic growth if supported by the right policies, good governance, and local capacity building.

South Sulawesi (South Sulawesi) is included in the group of provinces with optimal economic growth in Indonesia, along with several other provinces such as East Java and Bali [11]. South Sulawesi's growth in recent years has shown quite good performance and is often above the average of Indonesia's national economy. Leading sectors such as agriculture, forestry, fisheries, construction, trade, financial services,

education, and health are the main engines of economic growth in the province, while other sectors such as manufacturing and transportation still have the potential to be further developed [12]. In addition, South Sulawesi plays a role as a growth center in the Eastern Region of Indonesia, where its economic growth has a significant spillover effect to neighboring provinces. Factors such as household consumption, private investment, exports, and government spending have been proven to contribute positively to the economic growth of this region [13].

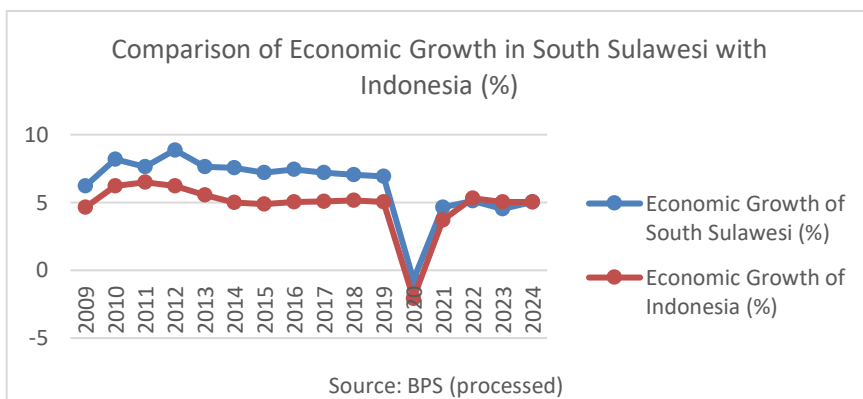


Fig 1. Comparison of South Sulawesi's Economic Growth with Indonesia

Fig 1. shows a comparison of economic growth between South Sulawesi Province and Indonesia nationally during the period 2009 to 2024. In general, South Sulawesi's economic growth has consistently been above the national average until 2019, which shows that the province has a relatively better economic performance compared to the national aggregate. South Sulawesi's highest growth peak was recorded in 2012 at 8.87%, while Indonesia only grew 6.23% in the same year. However, the COVID-19 pandemic in 2020 caused a contraction in economic growth at both levels, with South Sulawesi experiencing negative growth of -0.71%.

Despite this, economic recovery has been seen since 2021, albeit at a more moderate pace. In recent years (2022–2024), South Sulawesi's economic growth has begun to approach and even slightly below the national level, such as in 2023 and 2024 where both recorded almost balanced figures (around 5%). This indicates that although South Sulawesi had excelled in regional economic performance, post-pandemic structural challenges and a slowdown in leading sectors may also have affected the regional economic momentum. Therefore, efforts are needed to strengthen productive and innovative sectors to maintain inclusive and sustainable growth momentum.

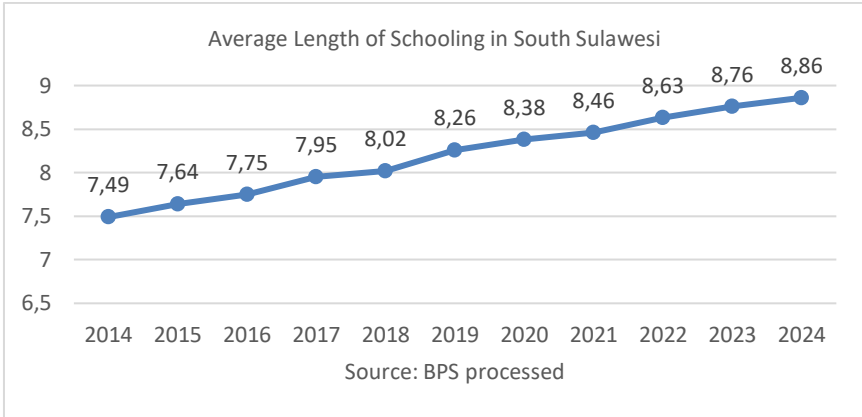


Fig 2. Average length of school in South Sulawesi

Fig 2. shows the average development of the length of residential schooling in South Sulawesi Province during the period 2014–2024. The data shows a consistent upward trend, from 7.49 years in 2014 to 8.86 years in 2024. This shows that the level of educational participation of the people of South Sulawesi has gradually improved in the last decade. The increase in average length of school reflects the wider public access to formal education services, both at the primary and secondary levels. A significant increase was seen in the 2017–2019 period, where this indicator rose from 7.95 to 8.26 years, which may be related to local and national government programs in expanding access and compulsory learning. However, the achievement of 8.86 years is still relatively low when compared to the standard of upper secondary education (12 years), so the quality of human resources in South Sulawesi still needs to be improved. Thus, despite positive progress, the challenge of improving the quality of education remains on the strategic agenda of human development in this region.

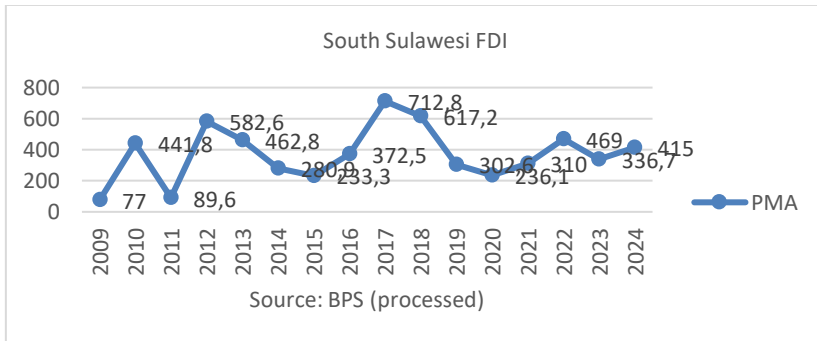


Fig 3. Foreign Investment in South Sulawesi

Fig 3. The above shows significant fluctuations in the value of FDI in South Sulawesi from 2009 to 2024. The value of FDI had jumped sharply from Rp77 billion in 2009 to a peak of Rp712.8 billion in 2017, reflecting the increasing interest of foreign

investors in the region's economic potential. However, this chart also shows a striking pattern of ups and downs, such as a drastic decline to Rp233.3 billion in 2016, as well as a decline again after 2018. In recent years, the value of FDI has been relatively lower and has not returned to its previous highs. This instability indicates that the sustainability of FDI flows still faces challenges, both in terms of the investment climate and external factors such as global economic turmoil. When the value of FDI decreases, its contribution to regional economic growth also weakens. Therefore, to maintain a solid economic growth rate, South Sulawesi needs to strengthen investment promotion strategies, improve the business climate, and ensure political and legal stability to make it more attractive to foreign investors. Based on the background of the problem and the data that has been previously explained, this article will further discuss and analyze the quality of human resources and the contribution of foreign capital to Economic Growth in South Sulawesi Province in the short and long term.

2 Literature Review

Economic growth continues to be understood as a dynamic process that reflects the interaction of multiple macroeconomic forces. Recent works underline that long-term expansion is not merely driven by capital accumulation but also by structural changes that contribute to productive capacity [1] [2]. "The theoretical discussion over the past several decades also suggests that modern growth patterns cannot be detached from endogenous elements, particularly knowledge and learning, which allow productivity to evolve internally rather than relying solely on external inputs" [4]. Consequently, differences in educational attainment and human capital formation have become central explanations for regional disparities in income and economic performance.

Empirical studies in the Indonesian context confirm that human resource quality remains a decisive factor shaping productive outcomes. Research investigating human development indicators, especially education-related dimensions, reveals a consistent positive association with economic performance across various provinces [5] [6]. "At the global level, some studies argue that the number of years spent in school does not always translate directly into actual learning, which implies that improved quality of education may generate stronger long-run effects than mere enrollment expansion" [7]. Therefore, measuring education through average years of schooling provides an important proxy for capturing the stock of skills that contribute to long-term productivity growth.

The role of foreign direct investment has also been widely explored in economic growth literature, yet empirical findings tend to vary substantially across countries and periods. While many studies point out that FDI inflows may stimulate technological diffusion, employment, and capital accumulation, their overall impact depends heavily on institutional quality, governance, and local absorptive capacity [9] [10]. "Evidence from Indonesian provinces also reveals that the influence of FDI differs across economic sectors, and inflows do not automatically guarantee a substantial growth effect when they are not linked to productive industrial activities" [8].

In the case of South Sulawesi, economic performance has historically been shaped by the structure of leading sectors and patterns of investment allocation, which in many cases are more closely related to domestic activities than to foreign capital [12] [13]. Considering such characteristics, the relative strength of human capital development and the limited role of FDI appear consistent with broader empirical findings showing that foreign capital tends to contribute more significantly when accompanied by adequate infrastructure, regulatory improvement, and integration with productive industries. Hence, regional growth in South Sulawesi remains strongly tied to internal factors, especially education-driven productivity enhancement.

3 Research methods

“This study employs a quantitative approach using secondary time-series data covering the period from 2009 to 2024. According to Sugiyono” [14], secondary data refers to information that has been previously collected, processed, and made available by other parties for subsequent use. The variables analyzed in this study consist of human resource quality, represented by the average years of schooling, foreign investment (PMA), and economic growth in South Sulawesi Province. All datasets were sourced from the official publications of the Central Statistics Agency (BPS) of South Sulawesi Province.

The choice of a dynamic analytical method, namely the Error Correction Model (ECM), is based on its capability to capture the short- and long-term dynamic relationships among economic variables. Model estimation was conducted using EViews software to ensure accurate and efficient data analysis.

3.1 Stationary test

“The unit root test is conducted to determine whether a data series exhibits stationarity. Stationarity is a crucial prerequisite in studies utilizing secondary or time-series data. The test originally developed by Dickey and Fuller, known as the Dickey-Fuller unit root test, serves as the foundation for identifying non-stationary variables. To enhance its accuracy, the Augmented Dickey-Fuller (ADF) test is commonly employed as an extension of the original method. In statistical terms, a time-series variable is considered stationary if its probability (p-value) is less than 0.05” [15]. This criterion ensures that the data used in the analysis do not produce misleading or spurious regression results due to non-stationarity.

3.2 Cointegration test

“In this study, the cointegration analysis was conducted using the Johansen Rank Test. This test is applied to determine whether a long-term equilibrium relationship (cointegration) exists among two or more variables that become stationary after their first differencing. The presence of cointegration indicates that although the individual variables are non-stationary, there exists a stationary linear combination of them, implying that the variables move together over the long run” [15].

3.3 Error Correction model (ECM)

“The Error Correction Model (ECM) method is applied because it allows the analysis of both short-term and long-term economic dynamics while testing the consistency of the empirical model with established economic theory. Moreover, the use of ECM in this study is justified by the nature of the data, which is time series and often non-stationary. Non-stationary data can lead to unreliable or spurious regression results if analyzed using conventional regression techniques” [16].

4 Results and discussion

4.1 Stationary test

Table 1. Stationary Test at the First Difference level

Group unit root test: Summary
Series: RLS, FDI, PDB ADHK

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.11807	0.0000	3	40
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.44251	0.0000	3	40
ADF - Fisher Chi-square	27.7318	0.0001	3	40
PP - Fisher Chi-square	41.6557	0.0000	3	42

“Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality”.

Table 1. above shows that the level of significance of the stationary group of the root test group on the observed variable as a whole, the variable is at the level of 1st Difference. Thus, the next cointegration test will be carried out.

4.2 Cointegration test

Table 2. Rank Test (Johansen)

Trend assumption: Linear deterministic trend
Series: RLS FDI PDB_ADHK

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.797227	38.63461	29.79707	0.0037
At most 1 *	0.594441	16.29522	15.49471	0.0378
At most 2	0.230070	3.660380	3.841466	0.0557

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

4.3 Error correction model (ECM)

Table 3. Long-Term ECM Estimation Results

Dependent Variable: PDB_ADHK					
Method: Least Squares					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-624157.6	23046.73	-27.08227	0.0000	
RLS	114035.4	2935.875	38.84203	0.0000	
FDI	14.74778	9.337466	1.579420	0.1383	
R-squared	0.991786	Mean dependent var		285689.1	
Adjusted R-squared	0.990522	S.D. dependent var		64769.35	
S.E. of regression	6305.629	Akaike info criterion		20.50363	
Sum squared resid	5.17E+08	Schwarz criterion		20.64849	
Log likelihood	-161.0291	Hannan-Quinn criter.		20.51105	
F-statistic	784.8044	Durbin-Watson stat		2.046593	
Prob(F-statistic)	0.000000				

Table 3. Presents the results of long-term Error Correction Model (ECM) estimates with the dependent variable of Gross Domestic Product (GDP) on a constant price basis. The results showed that the variable average length of school (RLS) had a positive and significant effect on GDP, with a coefficient of 114,035.4 and a probability value of 0.0000. This indicates that improving the quality of education in the long term can drive significant economic growth.

On the other hand, the Foreign Direct Investment (FDI) variable has a positive coefficient of 14.7478, but it is not statistically significant (p-value 0.1383), which shows that foreign investment has not made a real contribution to long-term economic growth in South Sulawesi. Thus, it can be concluded that education is the main determinant of long-term economic growth, while FDI is not optimal in providing sustainable effects.

Table 4. Short-Term ECM Estimation Results

Dependent Variable: D(PDB_ADHK)					
Method: Least Squares					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	

C	1409.245	3572.051	0.394520	0.7007
D(RLS)	105719.1	29364.70	3.600210	0.0042
D(FDI)	2.293781	6.741452	0.340250	0.7401
ECT(-1)	-0.907534	0.308136	-2.945240	0.0133
R-squared	0.583983	Mean dependent var		13039.58
Adjusted R-squared	0.470523	S.D. dependent var		8128.971
S.E. of regression	5915.058	Akaike info criterion		20.43157
Sum squared resid	3.85E+08	Schwarz criterion		20.62038
Log likelihood	-149.2368	Hannan-Quinn criter.		20.42956
F-statistic	5.147068	Durbin-Watson stat		1.770736
Prob(F-statistic)	0.018243			

The short-term ECM estimation results presented in Table 4 reveal that the variable representing the average years of schooling exerts a positive and significant influence on economic growth, “with a coefficient value of 1057.19 and a probability of 0.0042. This finding demonstrates that improvements in education directly contribute to GDP growth in the short run. Conversely, the Foreign Direct Investment (FDI) variable, although exhibiting a positive coefficient of 2.29, is statistically insignificant (p-value 0.7401), suggesting that its short-term contribution to economic growth remains limited. The error correction term (ECT-1) displays a significant negative coefficient of -0.9075 (p-value 0.0133), indicating the presence of a correction mechanism that adjusts approximately 90.75 percent toward long-run equilibrium in each period. Meanwhile, the R-squared value of 0.5839 implies that the model accounts for 58.39 percent of the variation in economic growth. Overall, these results reaffirm the critical role of education in promoting short-term economic expansion, while the impact of FDI remains marginal.

4.4 Classic assumption test

After estimating the ECM equation, to ensure that the model used meets certain conditions, so that the results of the analysis obtained are valid and the estimation model is not biased and consistent, a series of Classical Assumption Tests are carried out.

Normality test

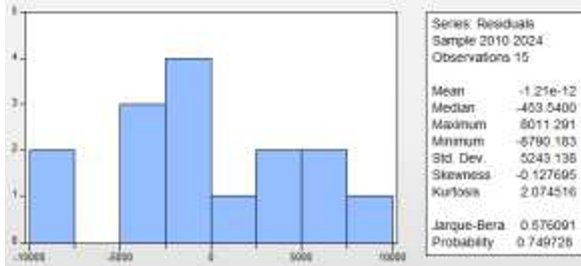


Fig 4. Normality Test Results

Based on Figure 4 above, it can be seen that the Probability Value is $0.7497 > \alpha 0.05$. This means that the model above passed the Normality Test, where the residual is considered to be distributed Normal.

Multicollinearity test

Table 5. Multicollinearity Test

Variance Inflation Factors			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	12759551	5.470269	NA
D(RLS)	8.62E+08	5.582147	1.323285
D(FDI)	45.44717	1.106658	1.096765
ECT(-1)	0.094948	1.362987	1.360339

Table 5. explained above that all variables have a Variance Inflation Factors (VIF) value of < 10 (Sig). This means that the model is free from Multicollinearity.

Autocorrelation test

Table 6. Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.958555	Prob. F(2,9)	0.4194
Obs*R-squared	2.634089	Prob. Chi-Square(2)	0.2679

Table 6. above explains that the Prob. Chi-Square $0.2679 > \alpha 0.05$. This means that the model above is free from Autocorrelation.

Heterokedasticity test

Table 7. Heteroskedastic Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.665706	Prob. F(3,11)	0.2314
Obs*R-squared	4.685643	Prob. Chi-Square(3)	0.1963
Scaled explained SS	1.353801	Prob. Chi-Square(3)	0.7164

Table 7. above explains that the Prob. Chi-Square $0.7164 > \alpha 0.05$. This means that in the above model, there are no symptoms of Heteroscedasticity.

5 Discussion

The influence of human resources quality on economic growth. The estimation results indicate that the quality of human resources, as represented by the average years of schooling (RLS), has a positive and significant effect on economic growth in South Sulawesi, both in the short and long run. The relatively large RLS coefficient in the long-term model reinforces the notion that improvements in education substantially contribute to sustainable increases in economic output. Similarly, the short-term findings also highlight the direct role of education in stimulating GDP growth. These results align with human development theory [17], which underscores the pivotal role of education in enhancing labor productivity and economic competitiveness. Consistent with the study conducted by Ari, A [5] in the Special Region of Yogyakarta, this research confirms that the average years of schooling positively and significantly influences economic growth. The increase in average schooling duration reflects broader public access to formal education, thereby strengthening innovation capacity and economic efficiency. Nevertheless, ensuring that educational outcomes remain aligned with labor market needs remains a challenge to avoid job mismatches. Hence, improving human resource quality through education serves as a fundamental driver of economic growth in South Sulawesi.

The influence of foreign capital on economic growth. The estimation results reveal that Foreign Direct Investment (FDI) exhibits a positive yet statistically insignificant coefficient in both the short and long term with respect to South Sulawesi's economic growth. This finding suggests that inflows of foreign capital have not yet made a substantial contribution to regional output expansion. The results are consistent with studies conducted in Nigeria, where FDI similarly demonstrated a positive but insignificant impact on long-term economic growth, although in some instances, a bidirectional causal relationship between FDI and growth was observed [18]. Several factors may account for this outcome. First, most FDI inflows are concentrated in extractive or capital-intensive industries, limiting their effects on employment creation and local productivity. Second, inadequate infrastructure and the limited quality of human capital hinder effective technology transfer from foreign investors. Third, there is a potential for economic leakage, wherein profits are largely repatriated to parent companies abroad, diminishing the local multiplier effect. Therefore, although FDI possesses the potential to stimulate economic activity, without effective management and integration strategies, its contribution to South Sulawesi's economic growth remains suboptimal.

6 Conclusion

The results of this study demonstrate that human resource quality, measured through the average years of schooling, has a strong and statistically significant influence on economic growth in South Sulawesi. This finding indicates that improvements in educational attainment contribute directly to enhancing the region's economic performance. Human capital appears to function as a fundamental driver of productivity

and long-term development. In both the short and long run, the positive effect of human resource quality remains consistently significant. This suggests that investments in education not only generate immediate economic benefits but also create enduring impacts that strengthen the province's growth trajectory. The role of education in shaping skills, knowledge, and innovation capacity becomes increasingly critical in supporting sustainable regional development.

On the other hand, foreign direct investment (FDI) shows a positive yet statistically insignificant effect on economic growth in South Sulawesi. Although foreign capital inflows may offer potential economic advantages, such as technological transfer or job creation, these benefits have not translated into measurable growth impacts within the study period. This limited influence may reflect structural barriers, insufficient local absorptive capacity, or the concentration of FDI in sectors with weak linkages to the broader economy.

Overall, these findings underscore the importance of prioritizing human capital development as a key strategy for strengthening regional economic growth. At the same time, they highlight the need for policies aimed at enhancing the effectiveness of foreign investment through improving institutional quality, sectoral targeting, and local capacity so that FDI can contribute more substantially to long-term economic advancement in South Sulawesi.

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