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The Moderating Role of Foreign Investment in the Relationship between Economic Growth Determinants in Sumatra Island

Aisar Riski Baizura, T. Zulham and Vivi Silvia*

Department of Economics, Faculty of Economics and Business, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia

* Correspondence: vivisilvia@usk.ac.id

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Abstract

Economic growth in Sumatra Island still faces structural challenges, especially related to the high level of open unemployment, the quality of human development, and the effectiveness of local government spending. On the other hand, the role of foreign investment in strengthening the relationship between these factors and economic growth has not yet shown empirical consistency, so it is important to study it more deeply. This study aims to evaluate the effect of open unemployment rate, Human Development Index (HDI), and government expenditure on economic growth in Sumatra Island, by including foreign investment as a moderating variable. This study uses panel data from ten provinces for the period 2011-2024 and is analyzed using the Fixed Effect Model (FEM) and Moderated Regression Analysis (MRA). The results show that the open unemployment rate has a significant negative effect on economic growth, while the Human Development Index (HDI) has no statistical effect. Government spending has a significant negative effect, indicating that the effectiveness of regional spending is not yet optimal in driving economic growth. In the moderation test, foreign investment was proven to strengthen the effect of government spending on economic growth, but it was not able to significantly moderate the effect of unemployment and HDI. These findings confirm that foreign investment is more effective when accompanied by good fiscal governance and human resource readiness. This study recommends optimizing the quality of public spending, implementing productive job creation programs, and synergizing foreign investment with regional human resource capacity development to promote inclusive and sustainable economic growth.

Introduction

Economic growth is a fundamental indicator for assessing the dynamics of development in a region, especially in developing countries such as Indonesia, which still faces structural challenges and regional disparities [1–3]. Regional economic performance not only illustrates the productive capacity of an area, but also reflects the effectiveness of development policies, the quality of human resources, and the government's ability to manage the budget efficiently [4,5]. From a development economics perspective, equitable growth is a crucial issue, given that disparities in access to infrastructure, quality of labor, and ability to attract both domestic and foreign investment remain significant obstacles for a number of regions [6].

Theoretically, this study is based on classical, neoclassical, and endogenous economic growth theoretical frameworks. The Harrod-Domar model emphasises the role of capital accumulation and investment as the main drivers of economic growth [7], while the Solow-Swan model expands the analysis to include the role of labour and technological progress in explaining regional differences in growth rates [8]. Furthermore, the endogenous growth theory developed by Romer and Lucas places the quality of human capital, innovation, and knowledge spillovers as internal determinants of long-term economic growth. In the context of fiscal policy, the

Keynesian approach views government spending as an important instrument to boost aggregate demand and economic activity, especially in regions that still face limited production capacity [9].

A number of previous studies have shown mixed empirical results regarding the relationship between the open unemployment rate, Human Development Index, and government spending on economic growth. research by Irawan & Khoirudin [10], Prabowo et al. [11], and Halia et al. [12] found that the open unemployment rate has no significant effect on economic growth, while Amalia & Miranti [13] showed a positive and significant effect. Regarding the Human Development Index (HDI), research by Fadillah et al. [14], Prabowo et al. [11], and Irawan & Khoirudin [10] found no significant effect on economic growth, while research by Awaluddin et al. [15], and Elistia & Syahzuni [16] showed a significant positive effect. Meanwhile, Salfina et al. [17] and Onifade et al. [18] found that government spending has a significant negative effect on economic growth, while AG et al. [19], Ashari & Siwi [20], Wu et al. [21], and Chandana et al. [22] found a positive and significant effect.

Furthermore, previous studies have generally analysed the effect of each variable separately and have not explicitly linked the differences in empirical results to the role of foreign investment in strengthening or weakening the relationship between the fundamental variables of economic growth. Thus, this study not only re-examines the existing empirical relationships, but also offers a different approach by placing foreign investment as a moderating variable within the framework of regional economic growth analysis.

Nationally, Indonesia's economic growth dynamics in the 2011-2024 period show quite sharp fluctuations [23]. As illustrated in Figure 1, Sumatra Island has consistently been on a moderate growth path compared to other strategic regions such as Java and Sulawesi. Although at the beginning of the observation period, Sumatra's economic growth moved steadily at around 4-5 percent, a sharp contraction occurred in 2020 as a result of the COVID-19 pandemic [24–26]. Post-pandemic economic recovery has been gradual from 2021 to 2024, although it has not yet fully reached the high growth rates seen in regions with more established industrial structures and technology- and manufacturing-based economies [27].

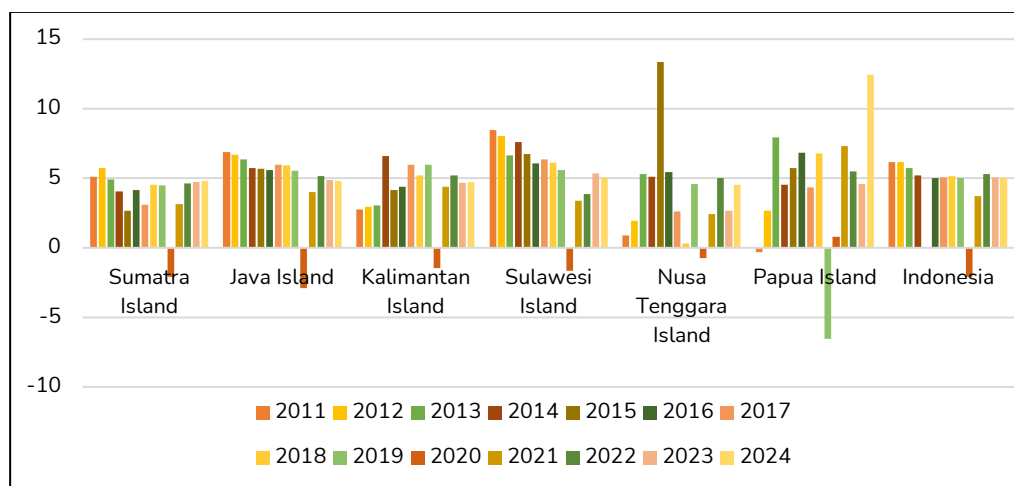


Figure 1. Average economic growth between islands in Indonesia from 2011 to 2024 in Percent (Source: Statistics Indonesia [28]).

Differences in economic structure between regions also affect the speed of recovery [29,30]. Java, as a center of manufacturing and services, recovered more quickly, while regions such as Papua experienced sharp volatility due to their dependence on the extractive sector [31]. This phenomenon confirms that regional economic growth is greatly influenced by the quality of

human resources, government spending patterns, and investment absorption capacity, including foreign investment [27].

The focus of the study then shifted to Sumatra as the second most strategic region after Java in terms of its contribution to the national economy [32]. As shown in Figure 2, economic growth among provinces in Sumatra during the 2022-2024 period was not homogeneous. The provinces of North Sumatra, West Sumatra, Jambi, and South Sumatra showed stable performance above the regional average, reflecting a more diversified economic structure and better ability to attract investment [33]. In contrast, Aceh and Riau tended to have lower growth levels, indicating structural challenges such as dependence on the primary sector, the quality of fiscal institutions, and the suboptimal implementation of development policies.

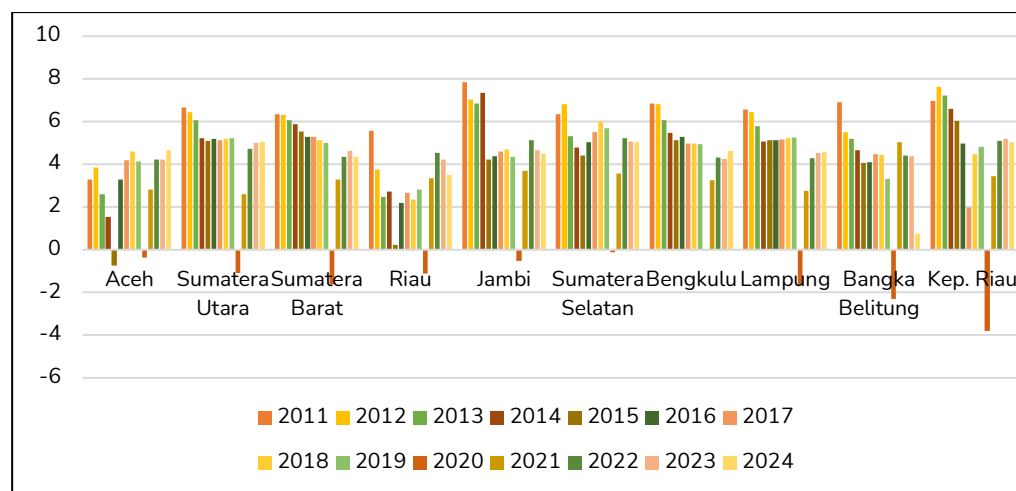


Figure 2. Interprovincial Economic Growth in Sumatra 2011-2024 in Percent (Source: Statistics Indonesia [28]).

This gap shows that increased government spending does not automatically lead to accelerated economic growth, especially if the composition of spending is not directed towards long-term productive sectors such as infrastructure, education, and health [34]. In addition, foreign investment flows, which are the engine of modern growth, have not been evenly distributed across all provinces due to limitations in supporting infrastructure, bureaucracy, and the readiness of local resources [35].

The Human Development Index (HDI) also plays a central role in promoting sustainable growth [2,36,37]. Provinces with higher HDI scores tend to have more dynamic economic activity and are more adaptive to changes in the global market structure [38–40]. However, there are regions that have relatively good HDI but suboptimal economic growth, indicating the presence of external factors such as dependence on primary commodities and suboptimal regional industrial competitiveness [38–40].

In addition, the open unemployment rate is an important variable in observing the effectiveness of economic growth. Growth that is unable to adequately absorb labor has the potential to cause jobless growth, which has an impact on increasing social inequality and people's purchasing power. This condition is still evident in a number of areas in Sumatra, especially in the post-pandemic recovery phase [41].

Based on these conditions, this study aims to analyze the effect of open unemployment, Human Development Index, and government spending on economic growth in Sumatra, as well as to assess the role of foreign investment as a moderating variable. The theoretical framework of this study is based on the Harrod-Domar model, Solow-Swan model, and endogenous growth theory, which emphasizes the role of capital accumulation, labor, technology, and human

resource quality in driving long-term economic growth [9,42]. The Keynesian approach also serves as the empirical basis for evaluating the effectiveness of government spending as a fiscal instrument to drive aggregate demand [42].

By utilizing provincial panel data for the period 2011-2024, this study is expected to contribute to the development of regional development economics literature in Indonesia and produce evidence-based policy recommendations. The results of this study are expected to provide direction for the formulation of more effective development policies, oriented towards improving the quality of human resources, strengthening fiscal effectiveness, and optimizing foreign investment as a catalyst for inclusive and sustainable economic growth on the island of Sumatra [43].

Academically, this study makes a new contribution by examining the role of foreign investment as a moderating variable in the relationship between open unemployment rates, human development quality, and government spending on economic growth in Sumatra using panel data from 2011 to 2024. This approach has not been widely used in Indonesian regional studies, thus offering a more comprehensive empirical perspective on the dynamics of regional development based on the interaction of labor factors, human capital quality, regional fiscal policy, and foreign capital flows [44]

Materials and Methods

Conceptual Framework and Research Hypotheses

The conceptual framework of this study is based on classical, neoclassical, and endogenous economic growth theories that emphasise the role of the labour market, the quality of human capital, and fiscal policy in driving regional economic growth. The open unemployment rate reflects the efficiency of the labour market and the capacity to absorb labour, the Human Development Index represents the quality of human capital, while government spending illustrates the role of regional fiscal policy in encouraging economic activity.

In addition, foreign investment is positioned as a moderating variable that theoretically has the potential to strengthen or weaken the influence of these variables on economic growth. Foreign investment flows serve not only as a source of additional capital, but also as a channel for technology transfer, productivity improvement, and strengthening regional economic capacity. Thus, the relationship between the open unemployment rate, the Human Development Index, and government spending on economic growth is expected to be conditional on the presence and intensity of foreign investment.

Figure 3 shows that the open unemployment rate, Human Development Index, and government spending have a direct effect on economic growth. Furthermore, foreign investment acts as a moderating variable that affects the strength of the relationship between each independent variable and regional economic growth.

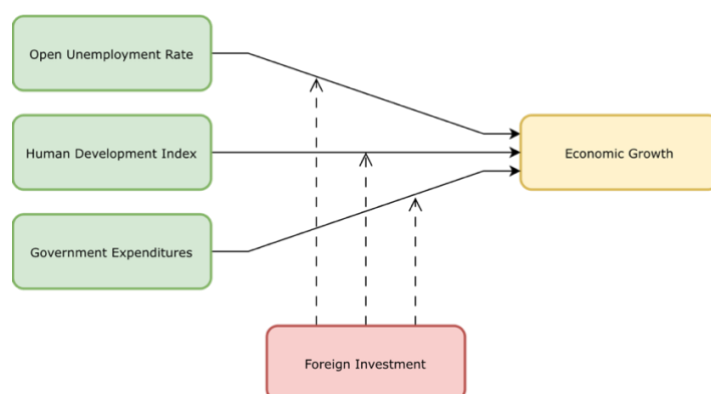


Figure 3. Research conceptual framework.

Based on this conceptual framework, the research hypothesis is formulated as follows:

H₁ : The Open Unemployment Rate (OPT) has a negative effect on economic growth on the island of Sumatra.

H₂ : Human Development Index (HDI) has a positive effect on economic growth on the island of Sumatra.

H₃ : Government Expenditure has a positive effect on economic growth in Sumatera Island.

H₄ : Foreign Investment moderates the effect of Open Unemployment Rate on economic growth in Sumatera Island.

This study uses a quantitative approach by utilizing secondary data in the form of panel data covering ten provinces on the island of Sumatra during the period 2011-2024. The data was obtained from official sources, namely the Central Statistics Agency (BPS) and the Directorate General of Fiscal Balance (DJP) [45]. The observation period was chosen based on the availability of consistent data and to capture economic dynamics before, during, and after the COVID-19 pandemic, so that the research results could comprehensively describe the structural conditions of the economy.

The unit of analysis in this study is the province (cross-section = 10) with a time dimension of 14 years (time series = 2011-2024). The variables studied include the open unemployment rate, human development index, government expenditure, and foreign investment as moderating variables, while the dependent variable is regional economic growth as measured by the growth rate of Regional Gross Domestic Product (RGDP) at constant prices (ADHK). These variables refer to classical and modern economic growth theories and various empirical studies that emphasize the role of labor, human resource quality, public spending, and international capital flows on regional economic output.

Table 1. Operational definition of variables.

Status	Variable (Symbol)	Description	Measurement Unit	Data Source
Dependent	Economic Growth (PE)	ADHK GRDP growth rate.	Percent	Statistics Indonesia
Independent	Open Unemployment Rate (TPT)	Percentage of the labor force that is unemployed.	Percent	Statistics Indonesia
	Human Development Index (HDI)	Education, health, and standard of living composite.	Index (0-100)	Statistics Indonesia
	Government Expenditures (G)	Total realized local government spending.	Billion Rupiah	Directorate General of Taxes.
Moderation	Foreign Investment (PMA)	Realization of Foreign Direct Investment.	Billion Rupiah	Statistics Indonesia

Methods

The empirical model in this study was estimated using panel data regression with the Fixed Effect Model (FEM) and Random Effect Model (REM) approaches. The selection of the best model was carried out through the Chow test and Hausman test to determine whether the fixed effect or random effect was more appropriate to use. Next, classical assumptions were tested, including multicollinearity and heteroscedasticity tests to ensure valid and unbiased estimates. To test the moderating role of foreign investment, Moderated Regression Analysis (MRA) was used by including the interaction between the main variable and the moderating variable in the model.

Mathematically, the basic research model is formulated as follows [46]:

$$PE_{it} = \alpha + \beta_1 TPT_{it} + \beta_2 IPM_{it} + \beta_3 G_{it} + \varepsilon_{it} \quad (1)$$

To test the moderating effect of foreign investment, the model was developed into [47]:

$$PE_{it} = \alpha + \beta_1 TPT_{it} + \beta_2 IPM_{it} + \beta_3 G_{it} + \beta_4 (TPT \times PMA_{it}) + \beta_5 (IPM \times PMA_{it}) + \beta_6 (G \times PMA_{it}) + \varepsilon_{it} \quad (2)$$

Where PE is economic growth, α is a constant, β 1,2,3, ... are constants, TPT is the open unemployment rate, HDI is the human development index, G is government expenditure, FDI is foreign investment, i is province/region, t is time period, ε is the error term.

This approach uses two main approaches, namely Fixed Effect Model (FEM) and Moderated Regression Analysis (MRA) [39,48]. Fixed Effect Model is used to accommodate unobserved heterogeneity among provinces in Sumatera Island, such as differences in institutional characteristics, economic structure, and regional fiscal capacity that are relatively constant over time. By controlling for province-specific effects, the FEM is able to produce more consistent and unbiased parameter estimates in the context of regional labelled data.

Furthermore, Moderated Regression Analysis (MRA) is used to examine the role of foreign investment as a moderating variable in the relationship between the open unemployment rate, Human Development Index, and government spending on economic growth. This approach allows identification of whether the presence of foreign investment strengthens or weakens the influence of independent variables on economic growth. The use of MRA is considered to be in accordance with the research objectives that not only test the direct effect, but also the interaction dynamics between variables in the framework of regional economic growth [39,49].

The selection of panel data regression models in this study was carried out through the Chow test and the Hausman test to determine the most suitable estimation approach between the Common Effect Model, Fixed Effect Model, and Random Effect Model [49,50]. The Chow test is used to test the existence of individual effects among provinces, while the Hausman test aims to assess the consistency of the estimator between the fixed effects and random effects models. The results of both tests indicate that the FEM is the most appropriate approach to use in this study.

Likewise, the classical assumption test focused on multicollinearity and heteroscedasticity tests. The multicollinearity test is conducted to ensure that there is no high correlation between independent variables that can disrupt the stability of the estimation, while the heteroscedasticity test is used to ensure constant error variance. The residual normality test is not performed explicitly given the nature of panel data with a relatively large number of observations, where parameter estimates have fulfilled the principle of asymptotic normality.

Results and Discussion

Descriptive Statistics

Table 2 presents descriptive statistics of research variables consisting of economic growth, open unemployment rate, Human Development Index (HDI), government spending, and Foreign Direct Investment (FDI) in ten provinces on the island of Sumatra during the period 2011-2024. The average economic growth was recorded at 4.31 percent with fairly high fluctuations, reflecting the dynamics of post-pandemic recovery. The average unemployment rate reached 5.49 percent, indicating challenges in the capacity to absorb labor in the region. The average HDI of 70.27 indicates a relatively moderate distribution of human resource quality with disparities between provinces. Meanwhile, the average government and foreign direct investment (FDI) expenditures were Rp23.55 trillion and Rp6.94 trillion, respectively, indicating considerable fiscal variation and differences in the ability to attract foreign investment between regions. Overall, the data shows the heterogeneity of the economic structure underlying the use of the panel data model to capture differences in characteristics between provinces.

In addition to the average value, Table 2 shows that economic growth among provinces in Sumatra Island has a wide variation with a minimum value of -3.80 percent and a maximum of

7.86 percent and a standard deviation of 2.09 percent which reflects fluctuations in regional economic growth. The open unemployment rate also shows significant variation with a range of 2.60 - 10.34 percent and a standard deviation of 1.57 percent, while the Human Development Index has a wide range of values from 20.01 to 77.97 with a standard deviation of 5.04 indicating disparities in the quality of human resources between provinces. The variables of government expenditure and Foreign Direct Investment (FDI) show the highest level of data dispersion reflected by the difference in minimum and maximum values and large standard deviations, indicating the existence of inequality in fiscal capacity and the ability to attract foreign investment between regions and supporting the use of a panel data regression approach with fixed effects in subsequent analyses.

Table 2. Descriptive statistics.

Status	PE (Percent)	TPT (Percent)	HDI (Index)	G (Billion)	PMA (Billion)
Mean	4.310000	5.486929	70.27257	23551.91	6935.528
Median	4.710000	5.315000	70.70000	21478.36	1997.241
Max.	7.860000	10.34000	77.97000	60909.21	40889.66
Min.	-3.800000	2.600000	20.01000	4407.850	171.0150
Std. Dev.	2.091942	1.568651	5.041742	13432.03	9064.993
Skewness	-1.477708	0.836205	-7.089793	0.731611	1.775178
Kurtosis	5.475720	3.661890	71.79816	2.829401	5.794494
Obs.	140	140	140	140	140

Panel Model Selection

Table 3 shows the results of model estimation selection through Chow and Hausman tests. In Model 1, both Chow and Hausman tests produced a probability value of 0.0000, which is below the 5 percent significance level. This indicates that the fixed effect model (FEM) is more appropriate than the common effect or random effect models in analyzing the effect of independent variables on economic growth in Sumatra. Similar results were also found in Model 2, which included PMA interaction as a moderating variable. The Chow test produced a probability value of 0.0000, while the Hausman test showed a value of 0.0002, thus reaffirming that FEM is the most appropriate approach. This decision is economically consistent given that interprovincial characteristics tend to have well-observed structural differences in terms of fiscal capacity, industrialization level, and institutional quality. Thus, the panel regression analysis in this study uses the FEM approach to obtain more consistent estimates in capturing interprovincial heterogeneity in Sumatra.

Table 3. Chow and Hausman test results.

Model	Test	Effect Test- Cross-section	Stat.	d.f.	Prob.	Conclusion
Model 1	Chow	F	7.048028	(10,126)	0.0000	FEM
		Chi-square	62.199225	10	0.0000	
	Hausman	random	24.741163	3	0.0000	FEM
Model 2	Chow	F	9.817871	(10,122)	0.0000	FEM
		Chi-square	82.658589	10	0.0000	
	Hausman	random	28.488046	7	0.0002	FEM

Classical Assumption Tests

Based on Table 4, the correlation values between independent variables are below 0.90, indicating that there is no indication of serious multicollinearity in the model. Although some interactions with foreign investment have relatively higher correlations, the values are still at an econometrically acceptable level.

Table 4. Multicollinearity test results.

	TPT	HDI	G	PMA	TPT X PMA	HDI X PMA	G X PMA
TPT	1	-	-	-	-	-	-
HDI	0.0880	1	-	-	-	-	-
G	0.2230	-0.0279	1	-	-	-	-
INV	0.0847	0.0800	0.4028	1	-	-	-
TPT X PMA	0.2856	0.1218	0.3482	0.9405	1	-	-
HDI X PMA	0.0933	0.2236	0.3765	0.9873	0.9342	1	-
G X PMA	-0.0031	-0.0249	0.6455	0.8926	0.7833	0.8631	1

The heteroscedasticity test in Table 5 shows that most variables have probability values above 0.05, indicating that there are no significant heteroscedasticity issues. This condition reinforces the validity of the model and ensures that the residual variance is constant so that the estimation results can be interpreted more reliably.

Table 5. Heteroscedasticity test results.

Model	Variable	Coef.	Std. Er.	t-stat.	Prob.
Model 1	C	-0.777415	1.708656	-0.454986	0.6499
	TPT	0.350823	0.104890	3.344673	0.0011
	HDI	-0.013187	0.020739	-0.635869	0.5260
	G	3.94E-05	1.62E-05	2.433961	0.0163
Model 2	C	-2.838641	4.259378	-0.666445	0.5064
	TPT	0.356755	0.136813	2.607618	0.0503
	HDI	0.016937	0.061349	0.276078	0.7830
	G	0.0000265	0.0000243	1.087182	0.2791
	PMA	0.000108	0.000214	0.504072	0.6151
	TPT X PMA	0.00000413	0.00000980	0.421429	0.6742
	HDI X PMA	-0.00000146	0.00000279	-0.523750	0.6014
	G X PMA	0.000000000107	0.00000000133	0.080079	0.9363

The Results of Panel Data Regression (Model 1)

The results of the Fixed Effect panel model estimation in Table 6 show that the open unemployment rate has a negative and significant effect on economic growth in the provinces of Sumatra, indicating that an increase in unemployment has an impact on hampering production capacity and reducing people's purchasing power. Meanwhile, the Human Development Index (HDI) variable does not show a significant effect on economic growth, reflecting that improvements in human quality in this region have not been fully converted into optimal economic productivity in the short term. On the other hand, government spending was found to have a negative and significant effect on economic growth, suggesting the potential inefficiency of regional spending structures that are still dominated by non-productive spending and have not been fully directed towards boosting long-term economic drivers.

Overall, this model is able to adequately explain the dynamics of regional economic growth, as indicated by an adjusted R-squared value of 0.37. These findings confirm that labor market variables, human resource quality, and fiscal effectiveness play an important role in explaining variations in economic growth between provinces on the island of Sumatra. Thus, policies to reduce unemployment through the creation of productive jobs, optimization of government spending quality, and strengthening of human capital are strategic factors that need to be reinforced to promote more inclusive and sustainable economic growth in this region.

Table 6. Panel data regression results for Model 1.

Variable	Coef.	Std. Er.	t-stat.	Prob.
C	12.42685	2.689971	4.619699	0.0000
TPT	-0.978868	0.165131	-5.927841	0.0000
HDI	0.015170	0.032650	0.464618	0.6430
G	-0.000162	2.55E-05	-6.356894	0.0007

R-squared	0.428954
Adjusted R-squared	0.370036
F-statistic	7.280590
Prob(F-statistic)	0.000000

The Results of Panel Data Regression (Model 2)

The moderation model in Table 7 shows an increase in model capability with an Adjusted R-squared of 0.52, indicating that the presence of foreign investment increases the model's explanatory power regarding economic growth. The interaction between HDI and foreign investment has a positive and significant effect ($p < 0.001$), indicating that foreign investment can strengthen the contribution of human development to economic performance when accompanied by technology absorption, workforce training, or knowledge transfer. Conversely, the interaction between the open unemployment rate and government spending with foreign investment is not significant, indicating that foreign capital flows do not directly compensate for the negative impact of unemployment or increase the effectiveness of government spending in the short term.

In general, these findings confirm that although foreign investment plays an important role, its effectiveness is highly dependent on the readiness of human resources and the quality of local institutions. Thus, development strategies in Sumatra need to emphasize improving the quality of the workforce, improving fiscal governance, and strengthening the attractiveness of investment directed at productive sectors.

Table 7. Moderated regression analysis results for Model 2.

Variable	Coef.	Std. Er.	t-stat.	Prob.
C	39.00333	5.850502	6.666663	0.0000
TPT	-0.950693	0.187920	-5.059030	0.0000
HDI	-0.372375	0.084267	-4.418998	0.0000
G	-0.000117	0.0000334	-3.494193	0.0007
PMA	-0.001484	0.000295	-5.036847	0.0000
TPT X PMA	-0.0000206	0.0000135	-1.532701	0.1279
HDI X PMA	0.0000194	0.00000384	5.060033	0.0000
G X PMA	0.00000000473	0.00000000183	2.588174	0.0108
R-squared	0.5748858	F-statistic	9.703719	
Adjusted R-squared	0.515617	Prob(F-statistic)	0.000000	

Discussion

The discussion of the results of this study is linked to the empirical findings reviewed in the introduction, particularly the research that shows the inconsistent influence of the open unemployment rate, Human Development Index, and government spending on economic growth. The findings of this study indicate that the open unemployment rate has a negative and significant effect on economic growth in the provinces of Sumatra. These results reinforce the classical and neoclassical theoretical framework that emphasizes the importance of labor factors in shaping economic output, where an increase in unemployment reflects idle resources that reduce productivity and the aggregate economic capacity of the region [51,52]. These findings are in line with empirical literature such as Amalia & Miranti [13] and Halia et al. [12], which found that an increase in unemployment has an impact on weakening regional performance due to a decline in purchasing power and household consumption. Thus, increasing employment opportunities through regional industrialization policies, accelerating investment, and strengthening labor-intensive sectors are strategic priorities in driving economic growth acceleration in Sumatra.

On the other hand, the Human Development Index (HDI) does not show a significant effect on economic growth in the short term. Although in theory the endogenous growth model (Romer & Lucas) emphasizes the quality of human resources as the main driver of productivity, these

findings indicate that the increase in HDI in Sumatra has not been fully converted into strong economic output. This may be influenced by a mismatch in labor quality, limited job absorption, and a regional economic structure that is still supported by primary commodities [10]. These findings are consistent with studies by Prabowo et al. [11] and Fadillah et al. [14], which state that the effect of HDI on growth is not always significant in regions with slow economic transformation, but differ from studies that emphasize a strong positive relationship between human quality and economic output in developed industrial regions.

Government spending was found to have a negative and significant effect on economic growth, indicating inefficiency in the structure of public spending. This phenomenon shows that the allocation of government spending in the provinces of Sumatra has not been fully directed towards productive sectors such as infrastructure, education, and health, but rather tends to be dominated by routine and administrative spending. This finding reinforces the studies by Onifade et al. [18] and Salfina et al. [17], which show that fiscal effectiveness is a major determinant of the success of government spending in promoting growth. These results also confirm the Keynesian view that fiscal stimulus is only effective when efficiently directed to sectors that drive the economy.

Furthermore, the role of foreign investment as a moderating variable shows interesting findings. Foreign direct investment (FDI) can strengthen the influence of human development and government spending on economic growth, but it is not effective in moderating the relationship between open unemployment and growth. This means that the inflow of foreign capital can be a catalyst for increasing production capacity and technology transfer, especially in regions with adequate human resources and fiscal facilitation. However, without a sufficiently adaptive labor market, investment flows are unable to optimally absorb local labor and thus do not contribute directly to reducing unemployment. These findings are in line with the global literature on foreign capital effectiveness, which states that the benefits of FDI depend on the readiness of local institutions and regional economic capacity.

Overall, the results of this study confirm that economic growth in Sumatra is influenced by labor market dynamics, the quality of human development, the effectiveness of public spending, and the capacity of regions to optimize foreign investment flows. Therefore, regional development policies need to be directed at strengthening the quality of the workforce, improving fiscal efficiency, and creating a conducive investment climate, particularly through regulatory simplification, improving the quality of human resources, and industrialization based on local potential. This approach is expected to promote more inclusive and sustainable economic growth and reduce disparities between provinces on the island of Sumatra.

Conclusions

This study analyzes the effect of open unemployment, Human Development Index, and government spending on economic growth in Sumatra during the period 2011-2024 and assesses the role of investment as a moderating variable. The results show that open unemployment has a negative and significant effect on economic growth, confirming that labor market inefficiency remains a structural obstacle to regional output growth. Meanwhile, the Human Development Index does not have a significant effect on economic growth, indicating that improvements in the quality of education, health, and living standards have not been fully converted into increased economic productivity in the region. In addition, government spending actually shows a significant negative effect, indicating the need to improve the effectiveness of fiscal policy and the quality of public spending.

Moderate analysis shows that foreign investment can strengthen the relationship between macroeconomic variables and economic growth, confirming its role in promoting capital accumulation and regional economic integration. However, these investment resources have not

been able to fully offset the negative impact of unemployment, so labor market reforms and improvements in human resource capacity are needed as strategic measures to maximize the benefits of foreign capital flows.

This study provides empirical contributions to the regional economics literature by utilizing the latest provincial panel data. However, this study has limitations in terms of the scope of observation and variables used, so further research is recommended to expand the dataset to include the district/city level and integrate institutional indicators and public expenditure quality. Advanced econometric approaches such as spatial panel regression are also recommended to capture interregional linkages. Overall, these findings underscore the importance of improving the quality of government spending, labor reform, and optimizing foreign investment to promote inclusive and sustainable economic growth in Sumatra.

Based on the empirical findings of this study, policy implications that can be formulated for local governments and related stakeholders are directed at improving the quality of public spending, strengthening labour market conditions, and optimising the role of foreign investment in driving regional economic growth. Local governments are advised to reorganise the composition of public expenditure by increasing allocations to long-term productive expenditure, especially in the economic infrastructure, education and health sectors, accompanied by strengthening expenditure performance evaluation mechanisms to ensure the effectiveness and efficiency of budget use. Furthermore, efforts to reduce the open unemployment rate need to focus on developing labour-intensive sectors and improving the quality of human resources through skills enhancement programmes that are aligned with industry needs at the regional level. In the context of foreign investment, improving the investment climate is crucial, among others through simplifying licensing procedures, increasing regulatory capacity, and strengthening the readiness of local labour, so that foreign investment can function as a supporting factor that strengthens the effectiveness of government spending and encourages more inclusive and sustainable economic growth in Sumatra Island.

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