

Determinants of the Influence of Foreign Direct Investment and the Human Development Index on Gross Regional Domestic Product in North Sumatra Province

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Abstract

This study aims to examine whether Foreign Direct Investment (FDI) and the Human Development Index (HDI) have a significant effect on Gross Regional Domestic Product (GRDP) in North Sumatra Province. The data used in this study consist of secondary time-series data published by the Central Statistics Agency of North Sumatra Province covering the period from 2015 to 2024. This research employs a multiple linear regression analysis method to investigate the effects of the independent variables on the dependent variable, both simultaneously and partially. The independent variables analyzed in this study are Foreign Direct Investment (FDI) as X_1 and the Human Development Index (HDI) as X_2 , while Gross Regional Domestic Product (GRDP) serves as the dependent variable (Y). The findings reveal that, simultaneously, both independent variables exert a positive and statistically significant effect on Gross Regional Domestic Product. Partially, the Human Development Index has a positive and statistically significant effect on Gross Regional Domestic Product, whereas Foreign Direct Investment demonstrates a positive but statistically insignificant effect on Gross Regional Domestic Product. Based on these findings, this study is expected to provide a valuable reference for the government in formulating future policies aimed at accelerating regional economic development, particularly in North Sumatra Province. Furthermore, the results of this study are expected to serve as a reference for future researchers in developing and expanding research related to regional economic growth, investment, and human development.

Keywords: Gross Regional Domestic Product (GRDP), Foreign Direct Investment (FDI), Human Development Index (HDI).

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Introduction

The structure of the Gross Regional Domestic Product (GRDP) in North Sumatra Province has continued to experience fluctuations over the past decade. Various important issues and challenges still influence the growth rate of the Gross Regional Domestic Product (GRDP). As one of the provinces with the largest economies outside Java Island, North Sumatra Province is not exempt from these challenges. One of the most prominent issues is that the economy of North Sumatra Province still relies heavily on plantation, agricultural, and trade commodities, or the primary sector. In efforts to enhance Indonesia's economic development and its relationship with the GRDP structure, economic transformation in North Sumatra Province is required to develop other potential sectors, particularly modern manufacturing industries and service sectors. Such efforts are expected to contribute to sustainable regional development. Dependence on commodities in the primary sector causes the growth of North Sumatra Province's GRDP to be highly dependent on the performance of those sectors. A decline in commodity prices in the market may hinder the growth of the GRDP structure and slow economic growth. Therefore, to address this issue, investment in other sectors, such as manufacturing and more modern service industries, is necessary. Another factor that requires attention in improving the GRDP of North Sumatra Province is the mismatch between the labor qualifications demanded by industries and the capacities of the available human resources within society. This situation is not necessarily caused by the low quality of human resources. Based on trends in the Human Development Index (HDI) of North Sumatra Province, a stable increase in HDI values has occurred over time. However, improvements in these assessment results do not always correspond to the competencies required by existing industries. Consequently, the level of human development in North Sumatra Province has not yet made an optimal contribution to the economic structure and its relationship with GRDP growth.

Another factor influencing the GRDP structure in the economic dynamics of North Sumatra Province is the existence of economic disparities among sectors. Primary sectors continue to serve as the main pillars of the economy in North Sumatra Province, while other sectors tend to grow at a relatively slower pace. In addition, disparities in regional development also affect the GRDP structure. According to Rahmad Sembiring, community welfare resulting from regional economic growth is achieved through the optimal utilization of regional potential by both the government and society. Under current conditions, regional development accompanied by high levels of economic activity is concentrated mainly in urban areas, while other regions, particularly remote areas, remain considerably underdeveloped. This situation results in uneven contributions to the formation of the GRDP structure. The value added generated by regional products also affects GRDP. In North Sumatra Province, one of the challenges in the industrial sector is that economic activities remain heavily focused on the production of raw materials rather than finished goods. Consequently, the economic value chain that is created remains limited, and the growth of the manufacturing sector in supporting GRDP is also constrained. In fact, this sector has the potential to become an important source for enhancing the GRDP structure and increasing the value added of local products. The economy of North Sumatra Province is also influenced by national and global economic conditions. These influences arise through the dynamics of investment and international trade. If global economic conditions become unstable, this may affect the growth rate of GRDP in North Sumatra Province and may also reduce the inflow of foreign investment as well as the volume of exports.

The dynamics of GRDP values in North Sumatra Province during the period 2015–2024 are presented in the table below.

Table 1. Gross Regional Domestic Product of North Sumatra Province up to 2024

No.	Year	GRDP
1	2015	440.956
2	2016	463.775
3	2017	487.531
4	2018	512.763
5	2019	539.514
6	2020	533.746
7	2021	547.652
8	2022	573.529
9	2023	602.236
10	2024	632.535

Another challenge is the change in economic dynamics following the COVID-19 pandemic. The COVID-19 pandemic had a significant impact on altering the GRDP structure and economic activities. As a result of this event, certain sectors experienced a decline in activity, while others recovered more quickly and even achieved higher growth rates. This occurred due to the acceleration of economic digitalization across various sectors as they sought to survive during the pandemic period. The economic sectors that experienced significant pressure during the COVID-19 pandemic included the transportation and storage sector, the hospitality services sector, the services sector, the trade sector, and the export sector. On the other hand, several sectors recovered more rapidly and even expanded, such as the communication sector, the health sector, the insurance sector, and the digital economy technology sector. To optimize the growth of these sectors, digital transformation is required to enhance GRDP and accelerate regional development. Another challenge in digital transformation for supporting economic development is the relatively low level of innovation capability and information technology (IT) expertise. At present, many business actors have not yet fully adapted to the digital era. Consequently, this condition may reduce their competitiveness compared to industrial sectors that have already adopted advanced technologies. To address this issue, government intervention is needed to strengthen collaboration among educational institutions, government agencies, and industries, as well as to promote research, development, and innovation activities as part of the digital transformation process. The implementation of digital transformation must also be pursued evenly across all regions to prevent disparities in the distribution and adoption of digital transformation throughout the province.

Investment plays a significant role in boosting the Gross Regional Domestic Product (GRDP) growth of North Sumatra Province. However, the distribution of investment across the province remains uneven, tending to concentrate in regions that serve as economic and industrial hubs; this has resulted in an unbalanced impact on the province's GRDP structure. Meanwhile, local governments are working to improve regional access and infrastructure in various areas, yet existing limitations in infrastructure connectivity dampen investor interest in certain regions.

One component of investment that has a significant proportion is foreign investment, or Foreign Direct Investment (FDI). Although it serves as one of the driving forces of the economy in North Sumatra Province, FDI has not yet been able to fully transform the existing GRDP structure. This is because the GRDP remains dominated by primary sectors, such as agriculture, plantations, and trade, while manufacturing industries and more modern service sectors contribute relatively less to GRDP and have not developed significantly. As a result, the

economic structure of North Sumatra Province tends to progress at a relatively slow pace. Therefore, a greater role from the government is expected in promoting substantial economic transformation, as foreign direct investment is fundamentally assumed to generate economic value added and contribute to the advancement of regional industrialization.

Foreign direct investment in North Sumatra Province has not yet been evenly distributed across various economic sectors. The majority of foreign investment remains concentrated in sectors such as plantation product processing, plantations, natural resource-based industries, and several other specific sectors. The limited range of sectors that attract foreign investors has resulted in a low level of investment diversification, thereby hindering the optimal development of other potential sectors. In particular, industries that focus on modern technology and advanced industrial activities have not yet become primary targets for foreign investors.

GRDP is also highly vulnerable to external factors, particularly those arising from developments in the global economy. A global economic crisis can reduce the inflow of foreign direct investment, and when this occurs, the production activities of businesses tend to slow down. Furthermore, business expansion may be constrained due to suboptimal revenue generation. In addition, the interest of foreign investors is strongly influenced by uncertainties in global economic conditions as well as fluctuations in commodity prices, which tend to be unstable.

Foreign investment in North Sumatra Province has yet to fully maximize the economic growth of MSMEs. This is because local companies engaging in MSME activities are not yet directly integrated with foreign investors in efforts to develop the regional economy. Consequently, this situation can result in limited knowledge and technology transfer to local micro, small, and medium-sized enterprises.

The capacity of human resources available in the region is also a matter of concern for foreign investors. In general, there is often a mismatch between the quality of human resources available in the region and the labor demands of foreign investors due to the need for specific specialized skills. This gap between industrial requirements and the availability of qualified labor results in an uneven distribution of labor productivity, thereby preventing economic productivity growth in the region from reaching its optimal level.

The development of the economic structure in regions such as North Sumatra Province can also be influenced by the level of the Human Development Index (HDI) within society. However, under current conditions, improvements in HDI have not yet been able to optimally enhance GRDP in North Sumatra Province. One contributing factor is that the concentration of the labor force remains centered in traditional primary sectors, which generally exhibit lower productivity levels. This condition also indicates that the availability of high-quality human resources has not yet been widely distributed across modern manufacturing and service sectors. Consequently, the process of economic transformation tends to progress more slowly, despite improvements in the quality of human resources as reflected in HDI assessments.

The Human Development Index (HDI) in North Sumatra Province also exhibits disparities among regencies and municipalities. Major urban areas tend to have higher HDI levels than other regions, resulting in a greater concentration of labor in more modern sectors. In contrast, the labor force in other regions remains largely concentrated in primary sectors.

The factors contributing to these regional HDI disparities include differences in the distribution of access to education and healthcare services across regions, which ultimately lead to variations in the quality of the workforce.

The availability of a high-quality workforce is not always sufficient to attract foreign investors. Other factors, such as government regulations, market potential, and infrastructure, remain important considerations in foreign direct investment decisions within a region. In addition, investors also assess whether the available workforce possesses the specific competencies required by their industries, which are not always directly associated with general improvements in the quality of human resources within society.

By examining the challenges that exist within the GRDP structure of North Sumatra Province, foreign direct investment and the Human Development Index (HDI) emerge as important factors. Foreign investment inflows are expected to promote economic growth as well as regional development. This process should be accompanied by improvements in the quality of human resources within society. An increase in HDI contributes to the development of a more skilled and productive workforce, which is expected to further stimulate economic growth in North Sumatra Province.

In this study, the researcher identifies several issues, including the uneven distribution of foreign direct investment across various economic sectors that influence GRDP in North Sumatra Province, as well as the uneven improvement in the Human Development Index (HDI), which also affects GRDP in the province. This research is developed with reference to previous studies. According to Ngabiyanto (2024), foreign direct investment has a positive and significant partial effect on GRDP, while HDI and other variables do not have a statistically significant partial effect on GRDP. According to Atha Adinata (2023), both HDI and investment have significant partial effects on GRDP, and simultaneously, investment and HDI exert a significant influence on GRDP. In another study, Berlian (2026) found that foreign direct investment does not have a significant partial effect on GRDP, although it has a positive impact. However, when considered simultaneously with other variables, foreign direct investment has a positive effect on GRDP. According to Yerima (2019), HDI, investment, and other variables simultaneously have a positive and significant effect on GRDP. Furthermore, both HDI and investment individually have positive and significant effects on GRDP. The findings of Silaban (2022) also indicate that HDI and foreign direct investment have positive and significant effects on GRDP.

Literature Review

Gross Regional Domestic Product (GRDP)

According to Widodo (2006), Gross Regional Domestic Product (GRDP) is essentially the total value added generated by all economic units within a region. GRDP at current prices reflects the value added of goods and services calculated using the prevailing prices in each year, whereas GRDP at constant prices reflects the value added of goods and services calculated based on prices from a specific base year. GRDP at current prices can be used to observe changes in the economic structure, while GRDP at constant prices is used to measure real economic growth from year to year.

There are three approaches that can be used to calculate GRDP, each of which is described as follows:

a. Production Approach

Under the production approach, GRDP is the total value added of goods and services produced by various production units within a region over a specific period, usually one year. Value added is obtained by subtracting intermediate inputs from total output.

b. Income Approach

Under the income approach, GRDP is the total compensation received by the factors of production that participate in the production process within a region during a specific period, usually one year. The compensation to factors of production includes wages and salaries (compensation for labor), land rent (compensation for land), interest on capital (compensation for capital), and profits (compensation for entrepreneurship), all measured before the deduction of income taxes and other direct taxes.

c. Expenditure Approach

Under the expenditure approach, GRDP consists of all components of final demand, including household consumption expenditure, expenditure by non-profit institutions serving households, government consumption expenditure, gross fixed capital formation, changes in inventories, and net exports (Widodo, 2006).

To assess the level of GRDP, several indicators can be used, including:

a. Per Capita Income

Per capita income refers to the average income earned by the population of a country or region during a specific period. It is calculated by dividing national or regional income by the total population. An increase in per capita income compared to previous periods generally indicates an improvement in economic performance.

b. Labor Force and Unemployment

The labor force consists of individuals who engage in productive activities to generate goods or services for their own needs or for society. Unemployment, on the other hand, refers to individuals who are willing and able to work but are unable to obtain employment. A region is generally considered to have a stronger economic performance when the number of employed individuals exceeds the number of unemployed individuals.

c. Community Welfare

Community welfare is an important indicator used to evaluate the level of economic development and GRDP performance. Community welfare can be observed through declining poverty levels and increasing purchasing power. It is also characterized by higher per capita income and the ability of individuals to meet their basic needs and improve their standard of living (Lincoln Arsyad, 2015).

Foreign Direct Investment (FDI)

Foreign Direct Investment (FDI) refers to investments undertaken by foreign capital owners within a host country to obtain profits from the business activities carried out. Foreign investment may take the form of direct investment (Foreign Direct Investment) or portfolio investment through the purchase of shares in domestic companies. The benefits of foreign investment include the utilization of natural resources, increased employment opportunities, the creation of added value, higher government revenues from taxation, and the transfer of technology (Irawan Suparmoko, 2002).

Based on Law Number 1 of 1967 and Law Number 11 of 1970 concerning Investment and Foreign Loans, foreign direct investment is defined as:

1. Foreign exchange instruments that do not constitute part of Indonesia's foreign exchange reserves and, with the approval of the Government of Indonesia, are used to finance business enterprises.
2. Capital goods for business operations, including inventions owned by foreign nationals and materials imported into the territory of Indonesia, provided that such goods are not financed through Indonesia's foreign exchange reserves.
3. A portion of company profits that, under the provisions of the law, may be transferred abroad but is instead utilized to finance business activities within Indonesia.

According to Anoraga (1994), foreign investment consists of two types:

- Portfolio Investment

Portfolio investment refers to the purchase of financial instruments in capital markets, such as stocks and bonds. Since the funds generated from this type of investment are often used to repay debt or strengthen a company's capital structure, they do not necessarily contribute to technology transfer or the creation of new employment opportunities.

- Direct Investment

Direct investment involves establishing, purchasing, or acquiring business enterprises in another country. Foreign direct investment (FDI) provides a more sustainable source of economic growth through the transfer of technology, managerial expertise, and the creation of employment opportunities.

In understanding foreign direct investment, several economic theories are relevant, including the neoclassical theory. As discussed by M. Sornarajah (2010), based on the theory proposed by Roy Harrod (1939), investment including foreign direct investment plays a crucial role in a country's economic growth. Within the context of FDI, this theory explains how foreign investment can significantly influence the economic development of the host country. Foreign

investment can contribute to increased production capacity, improved infrastructure, and the creation of employment opportunities. These factors, in turn, promote greater economic stability and growth.

Furthermore, a country's ability to demonstrate strong and stable growth potential enhances its attractiveness to foreign investors, which may subsequently encourage additional inflows of foreign direct investment.

Human Development Index (HDI)

In the study conducted by Lumban Toruan and Hidayat (2014), the Human Development Index (HDI) is defined as a measure of human development achievement based on several fundamental components of people's quality of life. HDI is able to reflect societal welfare through various dimensions. A low HDI level may lead to low labor productivity among the population. Reduced productivity subsequently results in lower income generation, which ultimately affects the overall income level of society. According to the study by Laode (2020), the Human Development Index is a composite indicator that can describe the progress of human development in a measurable and representative manner. The HDI was first introduced in 1990 by the United Nations Development Programme. It serves as a measurement tool for assessing the quality of human development, both in terms of its impact on physical aspects of human life, such as welfare and health, and on non-physical aspects, such as intellectual development. In the study conducted by Siska Yanti Maratade et al. (2016), it is explained that, in understanding the Human Development Index, two important indicators are:

1. Life Expectancy Rate (LER)
2. Average Literacy Rate (ALR)

Furthermore, several key policy measures have been identified to improve the quality of human life across sectors, including:

1. Improving Physical Human Quality (Individual Physical Quality)

This includes physical and mental well-being, motivation, and the fulfillment of basic needs such as adequate nutrition, clothing, housing, and a healthy living environment.

2. Enhancing Skills Development

This involves improving the skills of productive human resources and promoting a more equitable distribution of skilled labor across regions.

3. Strengthening Human Resources in Science and Technology

This includes increasing the capacity of human resources in the mastery of science and technology while maintaining an environmentally sustainable perspective.

4. Improving Institutions and the Rule of Law

This covers the strengthening of institutions, legal instruments, law enforcement personnel, and legal certainty.

According to Mulyadi (2014), from a sectoral perspective, the implementation of these policies is carried out through various development sectors, particularly the education, health, and social welfare sectors.

Research Methodology

This study employs a quantitative research approach. Quantitative data are data presented in numerical form or data that can be quantified into numbers (Sugiyono, 2015). The rationale for using a quantitative approach is that the data analyzed consist of macroeconomic statistical figures that require mathematical and statistical calculations to examine causal relationships among variables. This approach is considered appropriate for the objectives of the study, which aim to measure both the partial and simultaneous effects of Foreign Direct Investment (FDI) and the Human Development Index (HDI) as independent variables, and Gross Regional Domestic Product (GRDP) as the dependent variable. According to Suhendi et al. (2025), quantitative data-based research requires the formulation of hypotheses. A hypothesis is a preliminary assumption or tentative proposition regarding a fact or truth that requires testing to

determine its relationship with data collection methods and analytical procedures. The hypotheses proposed in this study state that the independent variables, namely FDI and HDI, have a significant effect on GRDP, both simultaneously and partially. This study utilizes secondary data published by the Statistics Indonesia of North Sumatra Province, consisting of time-series data covering the period from 2015 to 2024. The research was conducted through data processing using multiple linear regression analysis, with statistical computations performed using the SPSS software application.

Multiple linear regression analysis is used to measure the strength of the relationship and the direction of the influence of independent variables on a dependent variable. This analysis is conducted to determine the effects of the variables both simultaneously (collectively) and partially (individually). In conducting this analysis, several stages are involved, including the Classical Assumption Tests, the Coefficient of Determination Test, and the Partial and Simultaneous Significance Tests. The first stage that must be completed before proceeding to subsequent tests is the Classical Assumption Testing. The Classical Assumption Tests consist of four sub-tests, namely the normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test.

Classical Assumption Tests

The first stage of testing that must be conducted in research employing multiple linear regression analysis is the Classical Assumption Testing, which consists of several tests, including the following:

Normality Test

To determine whether the data for each variable both independent and dependent are normally distributed, a data normality test is conducted (Ghozali, cited in Sumantri et al., 2018; Tanujaya, 2020). The Kolmogorov-Smirnov (K-S) value serves as the benchmark for this assessment. The Kolmogorov-Smirnov test evaluates residual normality using the non-parametric Kolmogorov-Smirnov (K-S) statistical test (Darmadi, 2013). In this analysis, the data are considered normally distributed if the Asymp. Sig. (2-tailed) value exceeds 0.05 and the Normal P-P Plot shows the distribution clustered around the diagonal line.

Multicollinearity Test

This test aims to determine whether there is a correlation among independent variables in the regression model. The test is conducted by examining the Tolerance and VIF (Variance Inflation Factor) values. If the Tolerance value is greater than 0.10 and the VIF is less than 10, the model is considered free from multicollinearity.

Heteroskedasticity Test

This test is used to determine whether a model exhibits symptoms of heteroskedasticity. It is conducted by observing patterns in a scatter plot; if the data forms a distinct pattern such as a wavy shape or a pattern that widens and narrows then the data fails the heteroskedasticity test (Ghozali, 2006).

Autocorrelation Test

This test aims to determine whether there is a correlation between the disturbance error in a given period and the error in the preceding period. Based on the approach by Santoso Singgih (cited in Amimah, 2022), the autocorrelation test is considered to have passed if the Durbin-Watson value falls between -2 and 2.

this test, the hypotheses are formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

In the regression model, economic growth is represented by the constant term, the coefficients of X_1 and X_2 , and the error term.

Hypothesis Testing

Hypothesis testing involves several procedures: the coefficient of determination test, the t-test (or partial test), and the F-test (or simultaneous test). The coefficient of determination test measures the extent to which the model can explain the variation in the dependent variable. The partial t-test is designed to determine whether each independent variable (X) individually influences the dependent variable (Y). Meanwhile, the simultaneous F-test aims to determine whether the independent variables (X), when considered collectively, influence the dependent variable (Y). The criteria for these tests require that the calculated t-value exceeds the t-table value with a significance level below 5% (0.05); similarly, for the simultaneous F-test, the calculated F-value must exceed the F-table value with a significance level below 5%.

Results

Statistik Deskriptif.

Table 2. Statistik Deskriptif

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
PMA	10	580,40	1721,70	1158,2600	332,60032
IPM	10	69,51	75,76	72,5860	2,25575
PDRB	10	440956,00	632535,00	533423,7000	59944,86268
Valid N (listwise)	10				

The descriptive statistical data above indicate the following:

- Foreign Direct Investment (FDI) consists of 10 observations, with values ranging from a minimum of 580.40 to a maximum of 1,721.70. The variable has a mean value of 1,158.26 and a standard deviation of 332.60032.
- The Human Development Index (HDI) variable consists of 10 observations, with values ranging from a minimum of 69.51 to a maximum of 75.76. The variable has a mean value of 72.586 and a standard deviation of 2.25575.
- The Gross Regional Domestic Product (GRDP) variable consists of 10 observations, with values ranging from a minimum of 440,956 to a maximum of 632,535. The variable has a mean value of 533,423.7 and a standard deviation of 59,944.86268.

Normality Test

Table 3. Normality Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		10
Normal Parameters ^{a,b}	Mean	,0000000
	Std. Deviation	16253,99875189
Most Extreme Differences	Absolute	,129
	Positive	,129
	Negative	-,082
Test Statistic		,129
Asymp. Sig. (2-tailed) ^c		,200 ^d
Monte Carlo Sig. (2-tailed) ^e Sig.		,914
99% Confidence Interval		Lower Bound ,907
		Upper Bound ,921

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.
- e. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 743671174.

As part of the Classical Assumption Tests, a normality test was conducted. Based on the results of the One-Sample Kolmogorov–Smirnov (K–S) Test presented in the normality test table above, the Asymp. Sig. (2-tailed) value is 0.200, which is greater than 0.05. This result indicates that the data are normally distributed. Therefore, it can be concluded that the normality assumption has been satisfied.

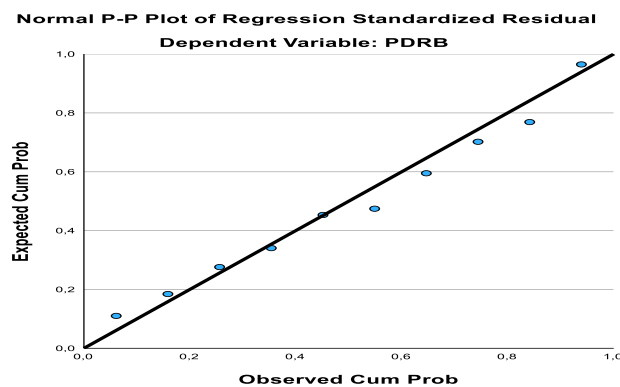


Figure 1. Normal P–P Plot Graph

Based on the observation of the Normal P–P Plot of Regression, the data points are distributed around the diagonal line, indicating that the data are normally distributed. The fulfillment of this assumption suggests that the normality requirement has been satisfied, allowing the hypothesis testing process to proceed to the subsequent stages of analysis.

Multicollinearity Test

Table 4. Multicollinearity Test

Coefficients ^a		Collinearity Statistics	Collinearity Statistics
Model		Tolerance	VIF
1	(Constant)		
	PMA	,985	1,015
	IPM	,985	1,015

In the multicollinearity test, the results indicate that the Foreign Direct Investment (FDI) variable has a tolerance value of 0.985, which is greater than 0.10, and a Variance Inflation Factor (VIF) value of 1.015, which is less than 10. These results indicate that there is no multicollinearity in the FDI variable. Similarly, the Human Development Index (HDI) variable has a tolerance value of 0.985, which exceeds 0.10, and a VIF value of 1.015, which is below 10. Therefore, no multicollinearity is detected in the HDI variable. Based on these findings, it can be concluded that neither of the independent variables exhibits multicollinearity. Consequently, the regression model satisfies the multicollinearity assumption, and the analysis can proceed to the next stage of testing.

Heteroscedasticity Test

In the heteroscedasticity test, the results can be observed from the scatterplot shown below. The data points are evenly distributed both below and above the zero value on the Y-axis and do not form any specific pattern. Therefore, it can be concluded that there is no heteroscedasticity problem in this study.

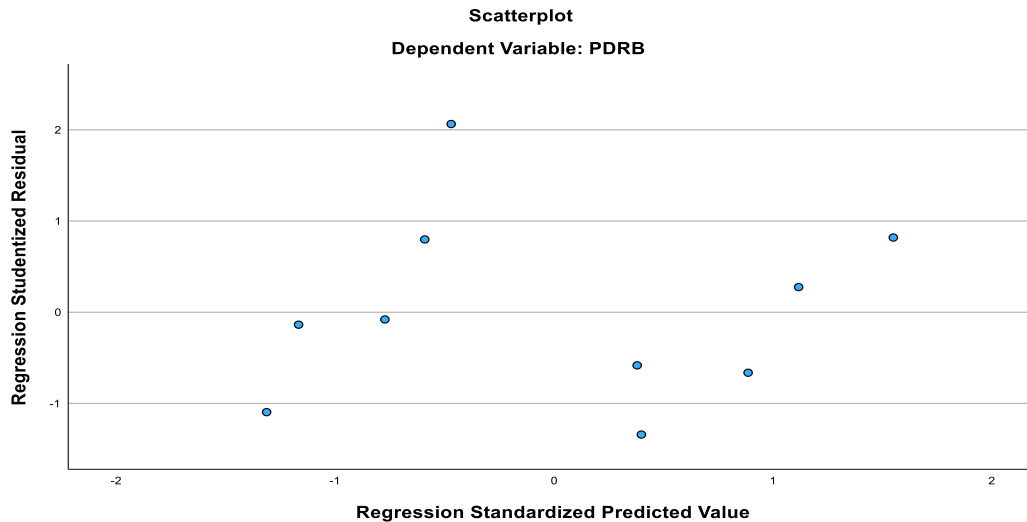


Figure 2. Heteroscedasticity Test Graph

Autocorrelation Test

Table 5. Autocorrelation Test

Model Summary ^b			
Change Statistics			
Model	df2	Sig. F Change	Durbin-Watson
1	7	<,001	1,870

In the autocorrelation test, the Durbin–Watson (DW) value obtained in this study is 1.870. Therefore, to determine whether autocorrelation occurs, the Santoso Singgih approach is applied, with the criterion that the DW value must be within the range of -2 to 2. Based on the test results, the DW value is within this range, or $-2 < 1.870 < 2$, indicating that there is no autocorrelation problem in this study. Based on the data processing results above, it can be concluded that the data collected by the researcher for the independent variables (X) and dependent variable (Y) have fulfilled the Classical Assumption Tests and are appropriate to be used for further analysis.

Multiple Linear Regression Analysis

The multiple linear regression analysis in this study is presented in the following table.

Table 6. Regression Analysis Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1312202,750	197788,100		-6,634	<,001
	PMA	16,854	18,609	,094	,906	,395
	IPM	25157,817	2743,751	,947	9,169	<,001

Based on the data table above, the regression equation for economic growth can be determined as follows:

$$Y = -1312202.75 + 16.854X_1 + 25157.817X_2 + \varepsilon$$

The multiple linear regression equation indicates that foreign direct investment has a coefficient reflecting a positive influence on GRDP, and the Human Development Index also has a coefficient reflecting a positive influence on GRDP. The significant influence of the independent variables (X) on the dependent variable (Y) whether assessed simultaneously or individually will be examined in the subsequent F-test and t-test.

Coefficient of Determination Test

Table 7. Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,963 ^a	,926	,905	18430,30222

The coefficient of determination test reveals an adjusted R-squared value of 0.905 (or 90.5%), indicating that the independent variables comprising Foreign Direct Investment and the Human Development Index exert a very strong influence on the dependent variable, Gross Regional Domestic Product (GRDP). The remaining 9.5% is attributable to other variables not examined in this study.

Simultaneous Significance Test (F-test)

The simultaneous significance test, or F-test, aims to determine the collective or simultaneous effect of variable X on variable Y. The results of the simultaneous significance test in this study are presented in the following table.

Table 8. Simultaneous Significance Test (F-test)

		ANOVA ^a				
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29962746773,261	2	14981373386,631	44,105	<,001 ^b
	Residual	2377732278,839	7	339676039,834		
	Total	32340479052,100	9			

a. Dependent Variable: PDRB

The F-test results show that the calculated F-value exceeds the F-table value ($44.105 > 4.757$), indicating that the independent variables comprising Foreign Direct Investment (FDI) and the Human Development Index (HDI) collectively exert a significant influence on the Gross Regional Domestic Product (GRDP). This finding is further supported by the F-test significance level of 0.001, which is below the 0.05 threshold. Additionally, the results demonstrate that the regression model possesses proven capability in explaining the relationship between the independent and dependent variables.

Partial Significance Test (t)

The following displays the results of the Partial Significance Test (t):

Table 9. Partial Significance Test (t)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	-1312202,750	197788,100		-6,634	<,001
	PMA	16,854	18,609	,094	,906	,395
	IPM	25157,817	2743,751	,947	9,169	<,001

The t-table value in this study is 2.44691. Based on the Partial Significance Test (t-test) results above, the influence of each independent variable can be explained individually (partially) as follows:

1. Regarding the influence of Foreign Direct Investment (FDI) on GRDP, the t-test analysis for the FDI variable yielded a t-value of 0.906 with a significance level of 0.395. Consequently, the calculated t-value is less than the t-table value ($0.906 < 2.44691$), and the significance value is greater than 0.05 ($0.395 > 0.05$). This indicates that FDI does not have a significant partial effect on GRDP in North Sumatra Province during the 2014–2025 period at a 95% confidence level.
2. Regarding the influence of the Human Development Index (HDI) on GRDP, the t-test analysis yielded a calculated t-value of 9.169 with a significance level of 0.001. Consequently, the calculated t-value is greater than the t-table value ($9.169 > 2.44691$), and the significance value is less than 0.05 ($0.001 < 0.05$). This indicates that the Human Development Index (HDI) has a significant partial effect on GRDP in North Sumatra Province during the 2010–2025 period at a 95% confidence level.

Discussion of Research Results

The Effect t of Foreign Direct Investment (FDI) on Gross Regional Domestic Product in North Sumatra Province

Based on the results of the partial significance test conducted previously, it was found that foreign direct investment has a positive but insignificant effect on GRDP in North Sumatra Province. This is indicated by the fact that the t-count value is lower than the t-table value ($0.906 < 2.44691$) with a significance level above 0.05 ($0.395 > 0.05$). Based on these test results, it can be concluded that the dynamics of foreign investment in North Sumatra Province do not have a significant influence on Gross Regional Domestic Product (GRDP).

The positive but insignificant effect of foreign direct investment (FDI) on the GRDP structure is mainly attributed to the fact that the economic impact generated by foreign investment cannot be fully observed in the early years. In the initial stages, foreign direct investment is generally more focused on industrial infrastructure development, as well as the planning and operational management stages of industrial activities. Therefore, the economic impact tends to be realized several years later, as investment that has not yet entered the full production stage is not yet optimal in contributing to GRDP. Furthermore, foreign direct investment in North Sumatra Province has not been evenly distributed across all economic sectors, resulting in its limited contribution to GRDP. FDI in North Sumatra Province remains largely concentrated in sectors such as plantations, manufacturing industries, and the energy sector. The uneven distribution of foreign investment has not yet generated a significant multiplier effect on the regional economy. Another factor contributing to the insignificant impact of foreign direct investment on GRDP is that a substantial portion of the profits or returns obtained by foreign investors is transferred back to their home countries. The use of imported raw materials in industrial activities and the involvement of foreign workers in certain industries may also affect the benefits received by the local economy. Therefore, although the amount of foreign capital inflows may be relatively large, it does not necessarily result in an optimal impact on local economic growth. GRDP in North Sumatra Province is not solely determined by the amount of foreign capital received. Other factors, such as domestic investment, household expenditure, government spending, export performance, and the quality of human resources, may also influence GRDP. As stated by Rahmad Sembiring et al. (2019), the improvement of regional economic development is not only driven by capital accumulation

but also by economic structure, productivity, human resource capacity, and the ability to utilize regional potential effectively.

Based on previous studies, Berlian (2026) found that Foreign Direct Investment (FDI) has a positive but insignificant effect on Gross Regional Domestic Product (GRDP), while simultaneously, FDI along with other variables has a significant effect on GRDP. This finding is consistent with the study conducted by Dewinta (2014), which stated that FDI does not have a significant effect on GRDP; however, simultaneously, FDI together with other variables has a positive and significant effect on GRDP.

The findings of Hapsari (2016) also support this result. The study concluded that there is no significant relationship between FDI and GRDP. Based on the analysis, it was demonstrated that FDI was unable to significantly increase regional economic growth because the Indonesian government prioritized strategic sectors to be managed through Domestic Investment (DI).

The Effect of the Human Development Index (HDI) on Gross Regional Domestic Product (GRDP) in North Sumatra Province

Based on the test results above, the Human Development Index (HDI), which is one of the independent variables in this study, has a positive and significant effect on GRDP in North Sumatra Province. This is indicated by the fact that the t-count value is greater than the t-table value ($9.19 > 2.44691$) with a significance level of $0.001 < 0.05$. Based on these test results, it can be concluded that an increase in the Human Development Index (HDI) value contributes to an increase in the Gross Regional Domestic Product (GRDP) in North Sumatra Province.

The Human Development Index (HDI) can significantly support the improvement of GRDP in North Sumatra Province because improvements in human quality enable individuals to achieve a better standard of living by obtaining adequate sources of income that are in line with their capabilities. The enhancement of human resource quality, which is accompanied by an increase in the standard of living of society as one of the indicators of HDI improvement, can increase household expenditure or consumption. Household consumption is one of the components contributing to the formation of GRDP; therefore, an increase in HDI can lead to higher GRDP or have a positive effect on economic performance. An adequate level of HDI quality can encourage labor productivity, including improvements in workers' skills and competencies. Increased regional productivity contributes to a higher output of goods and services produced within a region; consequently, GRDP will increase. The improvement of HDI is closely related to the enhancement of education quality and health quality. The better the education system in improving human capacity, combined with more optimal healthcare functions to support public health, the higher the HDI level will become. An increase in the quality of education within a region will improve the availability of a skilled workforce. With improved skills, the adoption and operation of advanced industrial technologies can become more efficient, thereby generating greater added value for the regional economy. A high-quality workforce with adequate skills must also be supported by good health conditions. A healthy and skilled workforce can improve production efficiency due to higher levels of attendance and active participation in economic activities. In terms of its impact on GRDP, HDI is considered to have a more observable effect because when society possesses adequate skills and good health conditions, productivity improvements can occur more rapidly. Furthermore, increased income received by the community will stimulate consumption more quickly, which ultimately contributes to higher GRDP and more significant economic growth.

Consistent with previous research, Ariyadi (2025) posits that the Human Development Index (HDI) has a significant impact on Gross Regional Domestic Product (GRDP). This finding aligns with human capital theory, which asserts that the level of human development plays a crucial role in economic growth. Research by Pratiwi (2021) indicates that the HDI, along with other variables, exerts a significant simultaneous influence on GRDP; furthermore, GRDP is significantly influenced by the HDI on an individual basis, meaning that an increase in the HDI leads to a substantial rise in GRDP. These findings also align with the study by Mulyasari (2016), which revealed that the HDI has a positive and significant partial effect on

the GRDP of regencies and cities in Central Java, while also demonstrating that the HDI and other variables collectively exert a significant influence on GRDP.

The Effect of Foreign Direct Investment (FDI) and the Human Development Index (HDI) on GRDP in North Sumatra Province

The two independent variables simultaneously have a significant effect on GRDP in North Sumatra Province during the period of 2015–2024. The results of the simultaneous significance test (F-test) show that the F-count value is greater than the F-table value ($44.105 > 4.757$) with a significance level below 0.05 ($0.001 < 0.05$). Based on the coefficient of determination test, the adjusted R-square value obtained in this study is 90.5%, which indicates a very high explanatory capability. Therefore, it can be concluded that all variables tested have a strong ability to explain variations in GRDP. Consequently, the results of this study are considered robust and can serve as a reference for further research and practical implications.

This study demonstrates that an increase in foreign capital inflows, accompanied by a rise in the Human Development Index (HDI), can support the growth of the Gross Regional Domestic Product (GRDP) or economic growth in North Sumatra Province. In particular, improvements in workforce quality can boost industrial productivity; this, in turn, drives up the output of goods and services, thereby exerting a more significant direct impact on GRDP.

These findings align with previous research; Silaban (2022) revealed that Foreign Direct Investment (FDI), HDI, and other variables exert a simultaneous, positive, and significant influence. Similarly, Alexander (2019) found that HDI, investment, and other independent variables simultaneously have a significant effect on GRDP. Likewise, Ariyadi (2025) reported that HDI, investment, and other independent variables simultaneously exert a significant influence on GRDP.

Conclusion

This study demonstrates that foreign direct investment and the Human Development Index simultaneously influence the Gross Regional Domestic Product (GRDP) of North Sumatra Province, with a high adjusted R-squared value of 90.5%; this indicates that the independent variables tested are capable of strongly explaining the phenomenon of income inequality. Partial analysis results reveal that the Human Development Index has a significant impact on the GRDP of North Sumatra Province during the 2015–2024 period.

To support the optimization of the Gross Regional Domestic Product (GRDP) in North Sumatra, it is expected that the distribution of incoming foreign investment can be directed toward a wider range of sectors, rather than being overly concentrated in primary sectors. Efforts to enhance workforce quality thereby boosting productivity and fostering economic growth also continue to be pursued to achieve optimal and sustainable regional development.

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