International Journal for Advanced Research

Journal homepage: https://journal.outlinepublisher.com/index.php/ijar

Research Article

Impact of Human Development Index (HDI) and Labor Participation on Poverty in North Sumatra Province for the Period 2010-2023

Tasya G Sianturi [1]* , Graciela Br Sembiring [2], Syaqinah Ujung [3], Melody Sitorus [4]

[1,2,3,4] State University of Medan, Indonesia

*Correspondence: E-mail: gracielabrsembiring@mhs.unimed.ac.id

Keywords:

Human Development Index,
Labor Participation,
Poverty,
North Sumatra,
Linear Regression,

Abstract

Poverty is a multidimensional issue that is still a serious challenge in development in North Sumatra Province. This study aims to analyze the effect of the Human Development Index (HDI) and Labor Participation on the poverty rate during the period 2010–2023. HDI is used as an indicator of quality of life through the dimensions of education, health, and standard of living, while Labor Participation reflects the involvement of the working-age population in economic activities. Secondary data used were obtained from the Central Statistics Agency (BPS). The analysis was carried out using multiple linear regression with the Ordinary Least Squares (OLS) approach and supported by classical assumption tests such as normality, multicollinearity, autocorrelation, and heteroscedasticity. The results of the study indicate that HDI has a negative and significant effect on the poverty rate, while labor participation does not have a significant effect partially. However, simultaneously, both variables jointly affect poverty in North Sumatra. This finding emphasizes the importance of inclusive human development policies and the creation of quality jobs to accelerate poverty alleviation.

Introduction

Poverty is still a crucial issue in development in North Sumatra Province. Although various poverty alleviation programs have been created by the government, the results have not fully touched the root of the poverty problem. Poverty is not only triggered by income factors, but also by limited community access to education, health, and decent work.

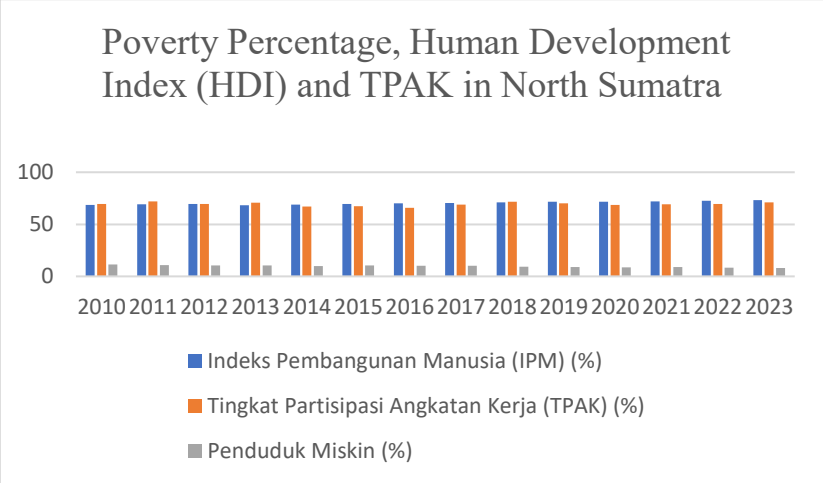
Poverty is also inseparable from the dynamics of regional development that is not evenly distributed. The social and economic disparities that still occur in various districts/cities in North Sumatra indicate that development policies are not entirely inclusive. Sari et al. (2025) explained that one of the main obstacles in poverty alleviation is the suboptimal integration between social and economic policies, so that even though physical development continues, it has not had much direct impact on the welfare of poor community groups.

The Human Development Index (HDI) is used as an important indicator to assess the quality of life of a community, including aspects of education, health, and purchasing power. A high HDI indicates an increase in the basic ability of the community to live a productive life. Research by Manuhuttu and Hartadi (2022)

states that increasing the HDI significantly reduces poverty rates because people become more educated, healthier, and able to access better employment opportunities. Read the journal.

Increasing the HDI is not just about increasing the numerical value, but also concerns the distribution of equitable human resource development. Febrianti (2024) highlighted that unbalanced human development between regions is an obstacle to poverty alleviation efforts. When high HDI is only concentrated in certain areas, other areas continue to experience stagnation in their human development. This has an impact on welfare inequality and the continuation of the poverty cycle.

In addition, the level of work participation reflects the extent to which people are involved in productive economic activities. The greater the number of working-age population absorbed into the labor market, the greater the opportunity to increase income and welfare. Romadhona et al. (2023) stated that high work participation contributes to poverty reduction, but only if accompanied by adequate job quality. Without high work productivity, increasing work participation will not have a significant impact on poverty reduction.



Source: BPS North Sumatra

Figure 1
Poverty Percentage, Human Development Index (HDI) and TPAK in North Sumatra

The graph above shows the development of the Human Development Index (HDI), Labor Force Participation Rate (TPAK), and the percentage of poor people in North Sumatra Province during the period 2010 to 2023. In general, there is an increasing trend in the HDI and TPAK, as well as a decrease in the poverty rate. In 2010, the HDI of North Sumatra was around 69% and has consistently increased every year to reach around 74% in 2023. This increase reflects improvements in the aspects of education, health, and people's living standards.

The Labor Force Participation Rate (LFPR) in 2010 was around 68%, then increased slowly to around 70.5% in 2023. This shows that more and more working-age people are involved in economic activities, both formal and informal. Meanwhile, the percentage of poor people has decreased significantly. In 2010, the poverty rate in North Sumatra was still around 12%, but has decreased gradually to reach around 8% in 2023. This decrease is a positive indicator of the success of poverty alleviation programs and improving community welfare. This graph shows that the increase in the HDI and LFPR in North Sumatra is correlated with the decrease in poverty rates, which is a reflection of the progress of social and economic development in the region over the past decade.

According to research conducted by Hidayat (2023), related to the influence of HDI and labor on poverty in North Sumatra Province. The regression results show a correlation between HDI and labor on poverty, although the coefficient of determination shows that most of the variation in poverty is influenced by other variables that are not studied. This study conducted by Matondang (2023), uses a panel data regression model to analyze the effect of the Labor Force Participation Rate (TPAK) and HDI on poverty in North Sumatra Province. The results show that HDI has a negative and significant effect on poverty, while TPAK has no significant effect. The Random Effect Model (REM) was chosen as the best model in this study. According to Sari et al. (2025), this study analyzes the effect of HDI and Open Unemployment Rate (TPT) on poverty in

North Sumatra Province. The results of the analysis show that HDI has a negative and significant effect on poverty, while TPT has a positive and significant effect. This study aims to analyze the role of the Human Development Index (HDI) and Labor Participation in reducing poverty levels in North Sumatra Province for the period 2010-2023. By understanding the relationship between these two variables and poverty, this study is expected to provide deeper insights into human resource development strategies and increasing job access that can be applied to accelerate poverty alleviation.

Hypotheses Development

Economic growth is often considered a major factor in poverty reduction. The trickle-down theory states that when the economy grows, its benefits will be felt by all levels of society, including the poor. However, empirical research shows mixed results. A study by Alamsyah and Armelly (2024) found that economic growth had a negative but insignificant effect on poverty rates in provinces on Sumatra Island during the period 2013–2022. This suggests that economic growth alone may not be enough to significantly reduce poverty without equitable distribution.

Based on this, the following hypothesis is proposed:

H1: Economic growth has a negative but insignificant effect on the poverty rate in North Sumatra Province.

High unemployment rates directly contribute to increased poverty, as individuals without jobs do not have the income to meet basic needs. Research by Saputra et al. (2023) in West Sumatra Province shows that unemployment has a positive and significant effect on poverty rates, both in the short and long term. Likewise, a study by Alamsyah and Armelly (2024) found that unemployment rates have a positive and significant effect on poverty in provinces on the island of Sumatra.

Therefore, the following hypothesis is proposed:

H2: The unemployment rate has a positive and significant effect on the poverty rate in North Sumatra Province.

HDI, which includes aspects of education, health, and decent living standards, is an important indicator in measuring human welfare. A study by Purba et al. (2024) showed that HDI has a negative and significant effect on poverty in North Sumatra Province, which means that an increase in HDI contributes to a decrease in poverty rates. In addition, research by Alamsyah and Armelly (2024) also found that HDI has a negative and significant effect on poverty rates in provinces on the island of Sumatra.

Based on these findings, the following hypothesis is proposed:

H3: The Human Development Index (HDI) has a negative and significant effect on the poverty rate in North Sumatra Province.

Method

This study uses a quantitative approach with a causal-comparative research type to determine the effect of independent variables on dependent variables. The data used are annual secondary data from 2010 to 2023, obtained from the official publication of the Central Statistics Agency (BPS) of North Sumatra Province.

The variables used in this study include:

1. Dependent variable:Poverty rate (%)
2. Independent variables:Human Development Index (HDI) and Labor Force Participation Rate (TPAK)

Data analysis was performed using multiple linear regression models. To ensure the validity of the model, several classical assumption tests were performed, namely:

1. Normality Test:using the One-Sample Kolmogorov-Smirnov Test.
2. Multicollinearity Test:by looking at the Variance Inflation Factor (VIF) and Tolerance values.
3. Autocorrelation Test:using Durbin-Watson values.
4. Heteroscedasticity Test:through residual analysis (Glejser test).

After the model is declared to have passed the classical assumption test, it is continued with:

1. Partial Test (t-test):to determine the influence of each independent variable on poverty.
2. Simultaneous Test (F-test):to see the influence of HDI and work participation together on poverty.
3. Coefficient of Determination (R^2):to see how much variation in poverty can be explained by the HDI and work participation variables.

Results And Discussion

Result

1. Classical Assumption Test

The Classical Assumption Test is a series of statistical tests conducted to ensure that the regression model built meets certain requirements so that the analysis results produced can be interpreted properly and the estimation results are accurate.

a. Normality Test

This test is carried out to ensure that the regression model applied meets the requirements, so that the results obtained can be considered legitimate and valid.

Table 1
One-Sample Kolmogorov-Smirnov Test

N		14
Normal Parametersa,b	Mean	9.7371
	Std. Deviation	.99245
Most Extreme Differences	Absolute	.187
	Positive	.127
	Negative	-.187
Test Statistics		.187
Asymp. Sig. (2-tailed)		.200c,d

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Based on the Kolmogorov Normality test output above, the sig. result is 0.200 > 0.050. So it can be concluded that the data in this research is normally distributed (passed the test).

b. Multicollinearity Test

This test is designed to see if there is a high correlation between independent variables, which can affect the stability of the model.

Table 2
Multicollinearity Test

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	46,574	5,054		9.216	.000		
	IPM	-.447	.048	-.926	-9.249	.000	.998	1.002
	Work Participation	-.079	.056	-.141	-1.408	.187	.998	1.002

a. Dependent Variable: Poverty

The results of the analysis show that the Tolerance value for the Human Development Index (HDI) and Work Participation variables is 0.998 > 0.1, while the VIF is 1.002 < 10, so it can be said that there is no multicollinearity problem in this model.

c. Autocorrelation Test

Table 3
Autocorrelation Test

Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.943a	.890	.870	.35803	1,715

a. Predictors: (Constant), Work Participation, HDI
b. Dependent Variable: Poverty

Based on the results of the autocorrelation test with Durbin-Watson of 1.715 and comparing it with the lower limit value (dL = 1.08) and the upper limit (dU = 1.54) at n = 14 and k = 2, it is known that the DW value is between dU and 4 − dU. Thus, it can be concluded that there is no autocorrelation in the regression model, so that the model meets the classical assumptions related to residual autocorrelation.

d. Heteroscedasticity Test

This test is designed to evaluate whether there are consistent differences in residual variance across levels of the independent variable.

Table 4
Heteroscedasticity Test

Coefficientsa

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6,739	2.315		2,910	.014
	IPM	-.022	.022	-.221	-.987	.345
	Work Participation	-.071	.026	-.622	-2,771	.018

a. Dependent Variable: ABS_RES

The results show the sig. value for the Human Development Index (HDI) variable is 0.345 and for Work Participation is 0.018, both are higher than 0.05. This means that there are no signs of heteroscedasticity in the model, so the assumption of homoscedasticity has been met.

2. Regression Test

This analysis was conducted to determine how much influence the Human Development Index (HDI) and Labor Participation as independent variables have on Structural Poverty as the dependent variable.

Table 5
Regression Test

Coefficientsa

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	4.391	11,948		.368	.718		
	IPM	-.002	.002	-.287	-1.201	.247	1,000	1,000

	Work Participation	-.037	.173	-.052	-.215	.832	1,000	1,000

a. Dependent Variable: ABS_RES

The resulting regression equation:

Y= 4.391 - 0.002X1 - 0.037X2

The regression equation can be explained as follows:

a) The constant value (B0) = 4.391 means that without the Human Development Index (HDI) and Work Participation that influence Learning Interest, the Poverty output value (Y) is 4.391 units.
b) The value of B1 = -0.002 means that if the variable X1 (HDI) increases by one unit, then Y (Poverty) will decrease by 0.002.
c) The value of B2 = -0.037 means that if the variable X2 (Work Participation) increases by one unit, then Y (Poverty) will decrease by 0.037.

3. Hypothesis Testing

The t-test is used to determine the effect of each independent variable on the variation of the dependent variable at a certain level of significance (alpha). The statistical t-test is conducted to test the hypothesis partially between variables where to determine the effect between the independent variable and the dependent variable is seen by comparing the t-table value with the calculated t. In this case, the t-table is obtained by calculating the df value and the calculated t is obtained from the table of multiple regression estimation results that have been carried out previously.

Decision making criteria can be done by:

The calculated t value < t table means H0 is accepted and H1 is rejected.

The calculated t value > t table means H0 is rejected and H1 is accepted.

With the number$n$= 14 and$k$= 2, the ttable value is obtained: 2.17881

a. Partial Test (t-Test)

Table 6
Partial Test (t-Test)

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	46,574	5,054		9.216	.000
	IPM	-.447	.048	-.926	-9.249	.000
	Work Participation	-.079	.056	-.141	-1.408	.187

a. Dependent Variable: Poverty

The Human Development Index (HDI) variable has a tcount value of -0.926. At a significance level of α = 0.05, a ttable value of 2.17881 is obtained. Thus, the absolute value of tcount < ttable (-9.249 > 2.17881) and a significance value of 0.000 < 0.05, meaning Ha is accepted. The Human Development Index (HDI) variable has a significant influence on Structural Poverty in North Sumatra Province.

The Work Participation variable has a tcount value of -1.408. At a significant level of α = 0.05, the ttable value is 2.17881. Thus, the absolute value of tcount> ttable (-1.408 <2.17881), and the significance value of 0.187> 0.05, meaning that Ha is rejected. The Work Participation variable does not have a significant effect on Structural Poverty in North Sumatra Province.

b. Simultaneous Test (F Test)

The F test is a statistical test used in regression analysis to determine whether the overall regression model is significant, or in other words, whether the independent variables together have an effect on the dependent variable.

Simultaneous Hypothesis Design (F Test) in decision making:

If Fcount < Ftable or P value (significance value) > 0.05 then H0 is accepted (Ha is rejected)

If Fcount > Ftable or P value (significance value) < 0.05 then Ha is accepted (H0 is rejected)

Table 7
Simultaneous Test (F Test)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,394	2	5,697	44.444	.000b
	Residual	1,410	11	.128		
	Total	12,804	13			

a. Dependent Variable: Poverty
b. Predictors: (Constant), Work Participation, HDI

From the table above, it can be seen that the Fcount value of the Human Development Index (X1) and Work Participation (X2) variables simultaneously have an effect on Poverty (Y) of 44.444. While Ftable is 3.98. This means that Fcount> Ftable. Significance value 0.000 <0.05. Thus, it can be said that Ha is accepted, Fcount value = 44.444> Ftable = 3.98 and significance value 0.000 <0.05, which means that there is a simultaneous influence between the Human Development Index (X1) and Work Participation (X2) simultaneously affecting Structural Poverty (Y) in North Sumatra Province.

c. Coefficient of Determination (R^2)

The R Square test or coefficient of determination is used to determine the extent to which the contribution of independent variables in the regression model is able to explain the variation of the dependent variable. This test will also show the percentage of influence given by the independent variable (X) simultaneously to the dependent variable (Y). In this case, the coefficient of determination is able to explain the accuracy of the determination of independent variables simultaneously to the dependent variable.

Table 8
Coefficient of Determination (R^2)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.943a	.890	.870	.35803

a. Predictors: (Constant), Work Participation, HDI

From the table above, it can be concluded that the R Square value is 0.890 or 89%. This means that the Human Development Index and Work Participation affect the Interest in Learning Economics Students. While the remaining 11% is influenced by other variables outside the model in this study.

Discussion

The results of this study indicate that the Human Development Index (HDI) variable has a negative and significant effect on the poverty rate in North Sumatra Province. This indicates that the higher the HDI value of a region, the lower the poverty rate. This finding is in line with the human capital theory which states that improving human quality—through education, health, and a decent standard of living—will increase productivity, competitiveness, and the ability of individuals to obtain jobs and income, so that they can escape

the poverty trap. This study is also supported by the results of a study by Manuhuttu and Hartadi (2022), which found that increasing the HDI significantly contributed to reducing poverty rates in various provinces in Indonesia.

Poverty reduction through increasing the HDI can be further explained through Amartya Sen's capability approach, which emphasizes that poverty is not just a matter of lack of income, but rather a limited ability to live a valuable life. In this context, people with better access to education and health services tend to have more decent life choices and economic opportunities. Therefore, increasing the HDI is not only a statistical indicator, but also reflects the success of inclusive and sustainable human development.
Meanwhile, the work participation variable in this study did not show a significant effect on poverty. Although in general work participation reflects the extent to which people are involved in economic activities, these results indicate that increasing the number of working people is not necessarily able to directly reduce poverty in North Sumatra. This may be due to the dominance of informal jobs or low wages that are unable to lift workers out of poverty. In line with the findings of Romadhona et al. (2023), it is stated that increasing work participation will only be effective in reducing poverty if it is followed by the creation of productive and economically viable jobs.

The findings also indicate challenges in the local labor market structure. Many people are working but remain in the poor category, known as the working poor. This situation shows that the quality of work needs to be a serious concern in the formulation of employment policies. Local governments need to ensure that the increase in the number of workers absorbed is also accompanied by improvements in wages, social security, and a safe working environment.

Simultaneously, the F-test results show that HDI and work participation together have a significant effect on poverty. Although partially work participation is not significant, in the context of the combined model, these two variables contribute to reducing poverty levels. This confirms that poverty alleviation cannot be done by relying on only one approach. A comprehensive and synergistic strategy is needed between improving the quality of human resources and providing access to productive employment.

In addition, the coefficient of determination (R^2) value of 89% indicates that the model used in this study is able to explain the variation of poverty in North Sumatra Province quite well. This means that the HDI and work participation are two important variables that are empirically closely related to the dynamics of poverty in the region, although there are still other factors that influence such as government spending, inflation, and income inequality that have not been included in the model.

Thus, the results of this study provide implications that human development policies and the expansion of quality employment opportunities must be the main focus of the poverty alleviation agenda in North Sumatra Province. Programs to improve access to education, health services, and job skills training will play a major role in strengthening the HDI.

Conclusion

Based on the results of the study, it can be concluded that the Human Development Index (HDI) has a negative and significant effect on the poverty rate in North Sumatra Province, which shows that improving the quality of education, health, and living standards can reduce poverty. Although partial labor participation does not have a significant effect, simultaneously together with the HDI it contributes to reducing poverty, indicating the importance of an integrated approach between human development and decent job creation. This finding emphasizes that poverty alleviation requires a strategy that focuses not only on the quantity of labor, but also on the quality of work and sustainable human development.

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