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# PANEL DATA MODELING OF THE POOR POPULATION IN EAST NUSA TENGGARA: THE ROLE OF HUMAN DEVELOPMENT INDEX AND GROSS REGIONAL DOMESTIC PRODUCT

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**Abstract:** Poverty is a multidimensional issue encompassing economic, social, and human development aspects. This study aims to analyze the influence of the Human Development Index (HDI) and Gross Regional Domestic Product (GRDP) growth on poverty levels in the regencies and municipalities of East Nusa Tenggara Province during the 2022–2024 period using panel data regression analysis. Three estimation models were applied, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The best model was selected through the Chow, Hausman, and Lagrangian Multiplier tests using RStudio software. The results indicate that the Random Effect Model (REM) is the most appropriate. The estimation results show an $R^2$ value of 0.0077 with a p-value of 0.782. The HDI variable has a negative effect on the number of poor people, with a coefficient of -0.157196, implying that an increase in HDI tends to reduce poverty levels. Conversely, GRDP growth has a positive effect with a coefficient of 0.089908, indicating that an increase in GRDP is followed by a rise in the number of poor people. These findings suggest that improvements in human development and economic growth alone are not sufficient to reduce poverty without inclusive and equitable policies. Therefore, poverty alleviation strategies in East Nusa Tenggara should consider other factors such as income inequality, labor productivity, and regional development equity to ensure that economic progress benefits low-income communities.

## 1. INTRODUCTION

Poverty is a persistent problem faced by Indonesia and other developing countries. Poverty is complex and multidimensional problem, making it as country development priority [1]. Currently, poverty is not only about income, but also about the inability to access basic needs such as education, health, and social protection which are key components of human development [2]. Human development encompasses improvements in education and health, which serve as bridges to improving the quality of life, thereby helping reduce poverty [2]. Improvements in education and health do not only improve the quality of life but also providing greater economic opportunities, leading to poverty reduction [3].

The Human Development Index (HDI) has gradually shown an updward trend over the years, reaching 75,02 in 2024 [4]. Improvements in standards of living and knowledge are the main drivers of the increase across all dimensions of the HDI. Over 2020-2024


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period, Indonesia's HDI increased by an average of 0,75 percent annually [4]. Enhancements in the quality of human resources can boost productivity and innovation, which in turn promote economic growth and increase the Gross Regional Domestic Product (GRDP). A higher GRDP leads to greater regional government revenues, which can then be allocated to improve educational and healthcare facilities, as well as infrastructure contributing to further HDI growth. While GRDP is often viewed as an indicator of economic progress, HDI offers a broader perspective by taking social and human aspects into account. Together, HDI and GRDP provide a comprehensive picture of regional development [5]. Increases in both HDI and GRDP can create better conditions for communities to improve their quality of life and reduce poverty [6].

Poverty is a concept comprised of five indicators: poverty itself, disability, vulnerability to emergencies, embeddedness, and isolation, both geographically and sociologically. Panel regression is a highly appropriate method for analyzing poverty data issues because it integrates two types of data: cross-sectional and time-series data. Thus, the integration of these two data sets can structure individual diversity and provide more detailed and comprehensive information, both on the relationships between variables and their development over a specific period.

A previous study conducted by [7] about rice production result model in Central Sulawesi used Fixed Effect Model (FEM). The result indicated the positive relationship by showing positive coefficient on Fixed Effect Model (FEM). The panel data regression model was carried out by using Fixed Effect Model (FEM). There were three variables obtained in the test and only one of them has a partial influence. Another study conducted by [8] examined the modelling and identification of factors influencing poverty in Aceh province over 2016-2020 period. This study found that panel data regression model with fixed effect model was the most appreprate model for poverty data in Aceh. Human Development Index (HDI), total population, and population growth rate with a high R-squared value of 97,14% were the factors that influenced poverty. Moreover, revealed that the most suitable model to describe causal relationship among variables was the panel data regression model with fixed effects. Budinirmala also stated that the economic growth rate and HDI were the most significant factors influencing the percentage of poor population in Bali province [9].

The novelty of this study lies in the application of three panel data regression estimation approaches Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) simultaneously to determine the most appropriate model for analyzing the influence of the Human Development Index (HDI) and Gross Regional Domestic Product (GRDP) growth on poverty in East Nusa Tenggara Province. This approach differs from previous studies that generally employed only a single estimation model, thus providing a more comprehensive understanding of poverty dynamics in a region with unique geographical and socio-economic characteristics such as East Nusa Tenggara. Those previous studies applied only one single estimation approach namely Fixed Effect Model. Therefore this study aims to build a panel data model of the HDI and GRDP growth towards the number of poor people in cities of East Nusa Tenggara province by applying three estimation models which are Common Effect Model, Fixed Effect Model, and Random Effects Model in which Chow Test, Hausman Test and Lagrangian Multiplier Test will be used to choose the best model.


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## 2. LITERATURE REVIEW

### 2.1. Panel Data Regression Analysis

One of the advancemant in multiple linear regression analysis is panel data regression analysis [10]. The distinction lies primarily in the type of research data utilized. Panel data refers to a combination of observational data from several cross-sectional units observed over a specific sequence of time periods [10]. Panel data regression is an analytical method used to model the relationship between dependent variable and one or more independent variables in form of panel data [11]. The panel data regression has several advantages in which the larger data volume leads to more comprehensive and information results which cannot be captured using only cross-sectional or time-series data alone.

### 2.2. Common Effect Model

Common Effect Model is the simplest way of panel data approach [11]. It is assumed that there is no difference in the intercepts and regression slope values which give best results based on the difference accross individuals and periods of time. The parameter estimation method in the Common Effect Model used the Ordinary Least Squares (OLS) technique. Generally, according to [12], the equation for the Common Effect Model is generally written as follows:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + u_{it} \quad (1)$$

with following notes,

$Y_{it}$ : Dependent variable for individual unit i and at time t
$\beta_1$ : Constant
$\beta_2$ : Coefficient of the second independent variable $X_{2it}$
$\beta_3$ : Coefficient of the third independent variable $X_{3it}$
$X_{2it}$ : Second independent variable for individual over time i and t
$X_{3it}$ : Third independent variable for individual over time i and t
$u_{it}$ : Error term (residual) for individual i and at time t

### 2.3. Fixed Effect Model

Fixed Effect Model is a panel data estimation method utilizing dummy variable to capture the differences of desired intercepts. In the Fixed Effect Model, it is assumed that intercepts vary across cross-sectional units and over time, while the slope coefficients remain constant [12]. Thus, dummy variables are employed to account for these intercept differences. The estimation technique commonly used in the fixed effect model is the Least Square Dummy Variable (LSDV). LSDV is a regression model that applies Ordinary Least Squares (OLS) estimation with dummy variables [13]. The panel data regression model, under the assumption of varying intercepts across observational units (individuals) and time periods, but with constant slopes across units, can be represented as follows:

a. Variation in intercepts across individuals:

$$Y_{it} = \propto_1 + \propto_2 D_{2i} + \propto_3 D_{3i} + \propto_4 D_{4i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + u_{it} \quad (2)$$

b. Variation in intercepts across time:

$$Y_{it} = \lambda_0 + \lambda_1 D_{1i} + \lambda_2 D_{2i} + \lambda_3 D_{3i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + u_{it} \quad (3)$$


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c. Variation in intercepts across individuals and time:

$$Y_{it} = \propto_1 + \propto_2 D_{2i} + \propto_3 D_{3i} + \lambda_0 + \lambda_1 D_{1i} + \lambda_2 D_{2i} + \lambda_3 D_{3i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + u_{it} \quad (4)$$

In which:

$\propto_i$ : Constant/coefficient for each individual *i*
$\lambda_t$ : Contant/coefficient of common time effect *t*

### 2.4. Random Effect Model

The estimation method for panel data regression in the Random Effect Model uses the Generalized Least Squares (GLS) approach [14]. Mathematically, according to [12], the Random Effect Model can be expressed as follows:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + w_{it} \quad (5)$$

with following notes:

$$w_{it} = u_{it} - \varepsilon_i \quad (6)$$

$\varepsilon_i$ : The residual/error term for i-th unit

## 3. METHODOLOGY

This study employs variables consisting of the Human Development Index (HDI), Gross Regional Domestic Product (GRDP), and the Number of Poor Population in the regencies and municipalities of East Nusa Tenggara Province during the 2022–2024 period. The study utilizes data from 22 regencies/municipalities for the years 2022, 2023, and 2024, with an equal number of observations for each regency/municipality per year. The data used in this study were obtained from publications of Statistics Indonesia (BPS) and downloaded on June 18, 2025. The explanation of the variables used in this study is as follows:

1. Dependent Variable (Y): Number of Poor Population
   *Definition*: The number of individuals whose average monthly per capita expenditure is below the Poverty Line (PL) established by Statistics Indonesia (BPS). *Unit*: Persons (number of individuals), often expressed in thousand persons for easier interpretation. *Data Source*: Statistics Indonesia (BPS) by regency/municipality (https://ntt.bps.go.id/id/statistics-table/2/MzUjMg==/jumlah-penduduk-miskin-menurut%20kabupaten-kota.html). *Notation:* $Y_{it}$: the number of poor people in regency/municipality i in year t.
2. Independent Variable ($X_1$): Human Development Index (HDI)
   *Definition*: A composite index encompassing three fundamental dimensions of human development used as indicators: (i) health: longevity, (ii) education: knowledge, and (iii) economy: decent standard of living. Scale: 0–100 (a higher value indicates a higher level of human development). Data Source: Statistics Indonesia (BPS) by regency/municipality (https://ntt.bps.go.id/id/statistics-table/2/NDYjMg==/-metode-baru-indeks-pembangunan-manusia-ipm-menurut-kabupaten-kota.html). Notation: $X_{1it}$: the level of human development in regency/municipality i in year t.
3. Independent Variable ($X_2$): Gross Regional Domestic Product Growth (GRDP Growth)
   *Definition*: The percentage growth in the gross value added of all economic activities produced by production units within a specific region over one year compared to the previous year. Unit: Percent (%). Type: Refers to growth rate, not total or per capita,


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since this study analyzes the effect of economic dynamics (rather than income level) on poverty. Data Source: Statistics Indonesia (BPS) – Annual GRDP Growth at Constant Prices by Regency/Municipality in East Nusa Tenggara Province (https://ntt.bps.go.id/id/statistics table/3/WnpCcmNtcE1ibkF5VjFSelJHMUVhRE52WjNWSVp6MDkjMw==/laju-pertumbuhan-produk-domestik-regional-bruto-atas-dasar-harga-konstan-2010---menurut-kabupaten-kota-di-provinsi-nusa-tenggara-timur--persen---2022.html?year=2022). Notation: $X_{2it}$: annual GRDP growth at constant prices in regency/municipality i in year t. Data analysis was performed using RStudio statistical software. The analysis steps include:

1) Descriptive tests to describe the data.
2) Classical assumption tests (multicollinearity, heteroscedasticity, autocorrelation, and residual normality) are performed in accordance with the nature of panel data.
3) The panel regression model estimation is based on the results of the best model selection test. To determine the most appropriate model, the following series of tests are used:
    a) Chow test: comparing CEM with FEM.
    b) Hausman test: comparing FEM with REM.
    c) Lagrange Multiplier (LM) Breusch-Pagan test: comparing CEM with REM.
4) Interpretation of regression coefficients to determine the effect of independent variables on the dependent variable.

## 4. RESULTS AND DISCUSSION

### 4.1. Summary Data

Summary of research variable data can be seen in Table 1 as follows.

**Table 1.** Descriptive Statistics of Research Data

| Variables | Average | Median | Minimum Value | Maximum Value |
|---|---|---|---|---|
| Y | 51,52 | 41,55 | 18,01 | 120,45 |
| $X_1$ | 65,67 | 65,19 | 57,90 | 81,08 |
| $X_2$ | 3,42 | 3,37 | 1,73 | 4,93 |

*Source: The result of analysis (2025)*

According to Table 1, it can be seen that the average number of poor people is 51,52 thousand individuals across the regencies/municipalities in East Nusa Tenggara province. The highest number of poor people was recorded in Timor Tengah Selatan regency which is 120,45 thousand individuals in 2022, while the lowest was in Nagekeo regency with 18,01 thousand individuals in 2022. The Human Development Index variable ($X_1$) has an average value of 65,67 during the 2022-2024 period across regencies/municipalities in East Nusa Tenggara province. Additionally, the GRDP growth variable ($X_2$) has an average value of 3,42 percent during the 2022-2024 period across regencies/municipalities in East Nusa Tenggara province.

### 4.2. Common Effect Model

The common effect model method is a simple panel regression method for estimating parameters by combining time series and cross-section data without considering differences between time and individuals [15]. The behavior of data between spaces in the CEM method is assumed to be the same in various periods. The parameter estimation results of the CEM model, obtained using RStudio software, can be seen in Table 2 as follows:


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**Table 2.** Parameter Estimation in The Common Effect

| Variable | Estimation | Std Error | *t* Value | P value |
|---|---|---|---|---|
| Intercept | 84,90389 | 54,48136 | 1,5584 | 0,1241 |
| $X_1$ | -0,75623 | 0,86156 | -0,8777 | 0,3834 |
| $X_2$ | 4,75669 | 5,98685 | 0,7945 | 0,4299 |
| **R-Squared** | 0,017037 | | | |
| **Ad. R-suared** | 0,014168 | | | |
| **p-value** | 0,58199 | | | |

*Source: The result of analysis (2025)*

Based on Table 2, the panel data regression equation for the Common Effect Model (CEM) is as follows:

$$Y_{it} = 84{,}90389 - 0{,}75623X_{1it} + 4{,}75669X_{2it}$$

The CEM model shows an $R^2$ value of 0,017 with a p-value of 0,582 (> 0,05), indicating that the HDI and GRDP variables jointly have no significant effect on poverty when it is assumed that all regions have the same characteristics. In other words, differences between districts and over time are not accounted for in this model, making the results general and weak.

### 4.3. Fixed Effect Model

The FEM estimation method uses dummy variable estimates to capture the intercept differences between variables simultaneously. This model assumes a constant regression coefficient (slope) across variables and across time. The estimation result of FEM was obtained by utilizing RStudio software which can be seen in the following Table 3:

**Table 3.** Parameter Estimation in The Fixed Effect Model

| Variables | Estimation | Std. Error | t Value | p Value |
|---|---|---|---|---|
| $X_1$ | -0,144549 | 0,243369 | -0,5939 | 0,5557 |
| $X_2$ | 0,074371 | 0,385544 | 0,1929 | 0,8480 |
| **R-Squared** | 0,0096341 | | | |
| **Adj. R-Squared** | -0,53271 | | | |
| **p-value** | 0,81604 | | | |

*Source: The result of analysis (2025)*

Based on Table 3, the panel data regression model equation for Fixed Effect Model is as follows:

$$Y_{it} = -0{,}144549X_{1it} + 0{,}074371X_{2it}$$

The FEM model, which accounts for differences in characteristics between districts, shows similar results. The $R^2$ value of 0,0096 and a p-value of 0,816 indicate that the HDI and GRDP variables do not have a significant effect on poverty after considering individual effects. The variation in poverty levels across regions is not strongly explained by these two variables.

### 4.4. Random Effect Model

Random effects models estimate panel data with residual probability. Each relates to time and individuals, assuming each subject has a different intercept. GLS technique can be employed in REM estimation and slope $\alpha$ is seen as random variable besides residual component $u_{it}$. The REM estimation can be obtained by utilizing RStudio software which can be seen in the following Table 4:


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**Table 4.** Parameter Estimation in The Random Effect Model

| Variables | Estimation | Std. Error | z Value | p Value |
|---|---|---|---|---|
| Intercept | 61,535457 | 15,936798 | 3,8612 | 0,0001128 |
| $X_1$ | -0,157196 | 0,237341 | -0,6623 | 0,5077634 |
| $X_2$ | 0,089908 | 0,378802 | 0,2373 | 0,8123860 |
| **R-Squared** | 0,0077429 | | | |
| **Adj. R-Squared** | -0,023757 | | | |
| **p-value** | 0,78207 | | | |

*Source: The result of analysis (2025)*

According to Table 4, the panel data regression model equation for Random Effect Model is as follows:

$$Y_{it} = 61{,}535457 - 0{,}157196X_{1it} + 0{,}089908X_{2it}$$

The (REM) assumes that individual effects are random. The estimation results show an $R^2$ value of 0.0077 with a p-value of 0.782. The coefficients of HDI and GRDP are also not significant. This indicates that although there are differences among regencies, the influence of these two variables on poverty is not strong enough to be considered statistically significant.

### 4.5. Model Selection for Panel Data Regression

Statistical considerations were taken into account in this study for model selection. Three methods were employed to determine the most appropriate panel data model, namely the Chow test, Hausman test, and Lagrangian Multiplier test.

#### 4.5.1. Chow Test

The Chow test aims to determine the appropriate model to be used between the CEM and FEM, based on the following hypothesis test:
$H_0$: $\beta_{0i} = \beta_{01} = \cdots = \beta_{0n} = 0$ (CEM was selected as the preferred model)
$H_1$: There are at least 1 $\beta_{0i} \neq 0$ (FEM was selected as the preferred model) with $i = 1, 2. \ldots . n$

If the $p$ value < 0,05 (significant), the Fixed Effect Model (FEM) is selected. Conversely, if the $p$ value > 0,05 (not significant), the Common Effect Model (CEM) is chosen. The results of the Chow test analysis are presented in Table 5 below.

**Table 5.** The Result of Chow Test

| Effect Test | Statistic | p value |
|---|---|---|
| Cross-section F | 2586,3 | $2{,}2 \times 10^{-16}$ |

*Source: The result of analysis (2025)*

Based on Table 5, the F statistic value is 2586,3 with a p value of $2{,}2 \times 10^{-16}$ (< 0,05), indicating that the null hypothesis $H_0$ is rejected and the alternative hypothesis $H_1$ is accepted. These estimation results confirm that the appropriate model is the Fixed Effect Model (FEM). Subsequently, the Hausman test can be conducted.

#### 4.5.2. Hausman Test

The Hausman test is used to determine the appropriate model between the Fixed Effect Model (FEM) and the Random Effect Model (REM), based on the following hypothesis testing:

$H_0 : corr\ (X_{it}, \varepsilon_{it}) = 0$ (REM is selected as the appropriate model)


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$H_1 : corr\ (X_{it}, \varepsilon_{it}) \neq 0$ (FEM is selected as the appropriate model)

The Hausman test can be conducted by examining the p-value. If the $p$ value < 0,05 (significant), the Fixed Effect Model (FEM) is selected. Meanwhile, if the $p$ value > 0,05 (not significant), the Random Effect Model (REM) is chosen. The result of Hausman Test are presented in Table 6 below.

**Table 6.** The Result of Hausman Test

| Test Summary | Chi-square Statistic | Chi-square df | p Value |
|---|---|---|---|
| Random Period | 0,059205 | 2 | 0,9708 |

*Source: The result of analysis (2025)*

The chi-square statictic obtained from the calculation and presented in Table 6 is 0,059205, with a p-value of 0,9708 > 0,05. Therefore, the null hypothesis $H_0$ is accepted, indicating that the Random Effect Model (REM) is more appropriate than the Fixed Effect Model (FEM). Based on the Hausman test, REM is provisionally selected as the preferred model. Subsequently, the Lagrangian Multiplier (LM) test is conducted to determine the final choice between the REM and CEM.

### 4.5.3. Lagrangian Multiplier Test

The Lagrangian Multiplier (LM) test is specifically used in the context of panel data regression to determine whether the Random Effect Model (REM) is more appropriate than the Common Effect Model (CEM), based on the following hypothesis testing:

$H_0 : corr\ (X_{it}, \varepsilon_{it}) = 0$ (CEM is selected as the appropriate model)
$H_1 : corr\ (X_{it}, \varepsilon_{it}) \neq 0$ (REM is selected as the appropriate model)

The Lagrangian Multiplier can be conducted by considering the p value. If the $p$ value < 0,05 (significant), REM will be selected. Conversely, if the $p$ value > 0,05 (not significant), CEM is selected. The result of Lagrangian Multiplier test are presented in Table 7 below.

**Table 7.** The Result of Lagrangian Multiplier Test

| Test Summary | Chi-square Statistic | Chi-square df | p Value |
|---|---|---|---|
| Individual Effect | 65,15 | 1 | $6{,}94 \times 10^{-16}$ |

*Source: The result of analysis (2025)*

Based on Table 7, the result of Lagrangian Multiplier test for individual effect shows a Chi-square statistic of 65,15 with p-value of p $6{,}94 \times 10^{-16}$. Since the $p$-value is less than or equal to 0,05, the alternative hypothesis ($H_1$) is accepted. This indicates that the Random Effect Model (REM) is more appropriate than the Common Effect Model (CEM). Therefore, the REM is selected as the final model to be employed for prediction.

## 4.6. Classical Assumption Testing in Panel Data Regression

### 4.6.1. Heteroskedasticity Test

The results of the heteroskedasticity test obtained using RStudio software are as follows.

**Table 8.** Studentized Breusch-Pagan Test

| Data | BP | df | p-value |
|---|---|---|---|
| Model_REM | 3,1335 | 2 | 0,2087 |

*Source: The result of analysis (2025)*


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Based on Table 8, the Breusch–Pagan test results show a p-value of 0,2087 (> 0,05), indicating that there is no heteroskedasticity. This means that the residual variances across observations are homogeneous, and thus the model satisfies the assumption of equal variance.

### 4.6.2. Autocorrelation Test

The results of the autocorrelation test obtained using RStudio software are as follows.

**Table 9.** Breusch-Godfrey/Wooldridge Test for Serial Correlation in Panel Models

| Data | Chisq | Df | p-Value | Alternative Hypothesis |
|---|---|---|---|---|
| Y ~ X1 + X2 | 5,7108 | 3 | 0,1266 | serial correlation in idiosyncratic errors |

*Source: The result of analysis (2025)*

Based on Table 9, the Wooldridge test produced a p-value of 0,1266 (> 0,05), indicating that there is no serial autocorrelation in the panel data. The assumption of no autocorrelation is met, meaning that the errors across periods are not correlated.

### 4.6.3. Cross-Sectional Dependence Test

The results of the cross-sectional dependence (CD) test obtained using RStudio software are as follows.

**Table 10.** Pesaran CD Test for Cross-Sectional Dependence in Panels

| Data | z | p-value | Alternative Hypothesis |
|---|---|---|---|
| Y ~ X1 + X2 | 2,2441 | 0,02483 | cross-sectional dependence |

*Source: The result of analysis (2025)*

Based on Table 10, the Pesaran CD test produced a p-value of 0,02483 (< 0,05), indicating the presence of cross-sectional dependence among regencies/municipalities. This suggests that there may be interregional linkages in socioeconomic factors influencing poverty.

### 4.6.4. Two-Ways Fixed Effect Model

The results of the two-ways test obtained using RStudio software are as follows.

**Table 11.** Estimation Results of Two-Ways Effects Within Model

| Variable | Coefficient (Estimate) | Std. Error | t-value | p-value |
|---|---|---|---|---|
| $X_1$ (HDI) | -0,257601 | 1,048046 | -0,2458 | 0,8071 |
| $X_2$ (GRDP) | 0,050497 | 0,383021 | 0,1318 | 0,8958 |
| **R-Squared** | 0,0021 | | | |
| **Adjusted R-Squared** | -0,6215 | | | |
| **F-statistic** | 0,0428 (df = 2, 40) | | | |
| **Prob (F-statistic)** | 0,9582 | | | |
| **p-value** | 0,95815 | | | |

*Source: The result of analysis (2025)*

Based on Table 11, the Two-Ways Fixed Effect (TWFE) model, which includes both individual and time effects, shows an $R^2$ value of 0,002 and a p-value of 0,958. These results indicate that the time effect (2022–2024) is not significant in influencing poverty levels in East Nusa Tenggara. Changes in conditions across years do not have a meaningful impact compared to variations among regencies.


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### 4.6.5. Multicollinearity Test

The results of the multicollinearity test obtained using RStudio software are as follows.

**Table 12.** VIF Value of the Multicollinearity Test

| Variable | VIF |
|---|---|
| $X_1$ (HDI) | 1,089226 |
| $X_2$ (GRDP) | 1,089226 |

*Source: The result of analysis (2025)*

Based on Table 12, the VIF values for the HDI and GRDP variables are both 1,089, which is well below the tolerance threshold of 10. Therefore, there is no multicollinearity, meaning that the two independent variables do not excessively influence each other.

### 4.6.6. Robust Standard Error

The results of the robust standard error test obtained using RStudio software are as follows.

**Table 13.** Cluster-Robust and Driscoll–Kraay

| Variable | Estimate | Std. Error | t value | P value |
|---|---|---|---|---|
| Intercept | 61,535457 | 18,851791 | 3,2642 | 0,001776** |
| $X_1$ (HDI) | -0,157196 | 0,293728 | -0,5352 | 0,594412 |
| $X_2$ (GRDP) | 0,089908 | 0,449215 | 0,2001 | 0,842011 |
| **Variable** | **Estimate** | **Std. Error** | **t value** | **P value** |
| Intercept | 61,535457 | 9,598564 | 6,4109 | 2.1e-08 *** |
| $X_1$ (HDI) | -0,157196 | 0,142498 | -1,1031 | 0,2742 |
| $X_2$ (GRDP) | 0,089908 | 0,056453 | 1,5926 | 0,1162 |

*Source: The result of analysis (2025)*

Based on Table 13, due to the presence of cross-sectional dependence, corrections were made using Cluster-Robust and Driscoll–Kraay Standard Errors. The results show that the coefficients of HDI and GRDP remain insignificant, indicating that even after correcting for assumption violations, there is no significant effect of HDI and GRDP on poverty.

### 4.7. Explanation of Interpretation

The results of this study indicate that during the period 2022–2024, increases in the Human Development Index (HDI) and Gross Regional Domestic Product (GRDP) have not significantly reduced poverty levels in East Nusa Tenggara Province. This condition suggests that improvements in human development and economic growth have not yet been fully inclusive for low-income groups. Substantively, these findings may be attributed to several factors:

1) Interregional disparities: Economic growth and HDI improvement may be concentrated in certain areas and not evenly distributed across all regencies/municipalities.
2) Regional economic structure: Most of the population still depends on subsistence agriculture with low productivity.
3) Unequal infrastructure and access to public services, causing development outcomes not to directly translate into poverty reduction.


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Therefore, more targeted policies are needed to ensure that economic growth and HDI improvement truly benefit low-income communities. Programs such as improving access to education, healthcare, and rural economic empowerment are essential in the context of regional development in East Nusa Tenggara.

## 5. CONCLUSION

The conclusion of this study is that Random Effect Model (REM) is the best model. The panel regression model can be expressed as follows:

$$Y_{it} = 61.535457 - 0.157196X_{1it} + 0.089908X_{2it}$$

The HDI has a direct negative effect on the number of poor people, with a coefficient of -0,157196. This implies that for every one unit increase in the Human Development Index, the number of poor people decreases by 0,157196, assuming other variables remain constant. Moreover, the GRDP) has a direct positive effect on the number of poor people with a coefficient of 0,089908. It means that for every one unit increase in GRDP growth, the number of poor people increases by 0,089908, assuming other variables remain constant.

Based on all model tests and classical assumption evaluations, the Random Effect Model is the best model for this data. However, the analysis results indicate that neither HDI nor GRDP has a significant effect on the poverty rate in East Nusa Tenggara during 2022–2024. Therefore, poverty alleviation efforts should consider other factors such as income inequality, labor productivity, and equitable regional development. Future studies may consider integrating additional socio-economic variables to provide deeper insights into the dynamics of poverty, as well as exploring alternative estimators within the REM methodology.

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