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Analysis of Poverty and Unemployment on Human Development Index in West Kalimantan in 2020-2022

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ABSTRACT

The Human Development Index (HDI) is built through a three-dimensional approach, namely knowledge, decent living standards, and longevity and healthy living. In the longevity and healthy life dimension, life expectancy at birth is the benchmark, and the expected years of schooling and average years of schooling are indicators used in the knowledge dimension. Meanwhile, a decent standard of living as measured by annual capita expenditure is an indicator in the HDI. West Kalimantan's HDI in 2020 to 2021 experienced a fairly low increase, then in 2021 to 2022, West Kalimantan's HDI experienced a very significant increase and even occupied the first position of the highest HDI increase in Kalimantan Island. The increase in West Kalimantan's HDI every year is influenced by a number of variables that affect HDI. The objective of this research is to examine the influence of poverty and unemployment on the Human Development Index (HDI) by analyzing the outcomes derived from the most effective panel data regression model. This study involves several phases, including data input, conducting multicollinearity tests, analyzing using panel data regression models, finding the best model with the Chow test, Hausman test, and Lagrange Multiplier test, as well as classical assumption tests, and output interpretation. The factors considered in this research comprise HDI (Y), poverty (X_1), and unemployment (X_2) in West Kalimantan. The examination indicates that the Fixed Effect Model (FEM) stands out as the most effective model, demonstrating an adjusted R-squared value of 99.14% where the variables of poverty (X_1) and unemployment (X_2) have a significant influence on HDI (Y).

Keywords: Panel Data Regression, CEM, FEM, REM, HDI.

INTRODUCTION

The Human Development Index (HDI) is a metric employed to evaluate the progress of a specific geographical area's development (Hidayat et al., 2018). The goal of improving the HDI is to enhance human well-being by achieving a population with an acceptable level of living. The HDI is based on three dimensions: the dimension of long and healthy life, the dimension of knowledge, and the dimension of a decent standard of living (BPS Kalbar, 2023). Life expectancy at birth is the benchmark for the HDI in the dimension of long and healthy life. The expectation of years of schooling and mean years of schooling are indicators used in the dimension of knowledge. The dimension of a decent standard of living is assessed through per capita expenditure per year (BPS Kalbar, 2023).

Data for the HDI for Kalimantan Island from 2020 to 2022 is provided in Table 1 as follows:

Table 1. HDI Increase Table for Kalimantan Island in the Years 2020-2022

Province	**Human Development Index (HDI)**			**Increase in HDI**	
	2020	**2021**	**2022**	**2020-2021**	**2021-2022**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
East Kalimantan	76.24	76.88	77.44	0.64	0.56
Central Kalimantan	71.05	71.25	71.63	0.2	0.38
West Kalimantan	67.66	67.90	68.63	0.24	0.73
North Kalimantan	70.63	71.19	71.83	0.56	0.64
South Kalimantan	70.91	71.28	71.84	0.37	0.56

Source: Central Statistics Agency of Kalimantan Island (2020 – 2022).

Based on Table 1, the HDI for West Kalimantan Province in 2022 is 68.63 points. This figure places West Kalimantan Province at a medium level. From Table 1, it is also evident that the rise in the ranking of the HDI for West Kalimantan Province is the second-lowest compared to all provinces in the Kalimantan region. Thus, among all provinces in Kalimantan, West Kalimantan experienced a relatively low increase in the HDI from 2020 to 2021. Subsequently, West Kalimantan Province experienced a significant increase in HDI from 2021 to 2022 by 0.73 points, which is the highest increase in HDI in Kalimantan Island in 2022.

According to the Central Statistics Agency of West Kalimantan Province (2022), the HDI for West Kalimantan fluctuates positively. This is attributed to the continuous increase in the HDI for West Kalimantan every year, influenced by several variables affecting the HDI. Hence, employing a panel data regression approach becomes necessary to identify the variables that impact the Human Development Index (HDI).

Hidayat et al., (2018) conducted a panel data regression analysis on the HDI of East Java from 2006 to 2015. The study found that variables such as regional per capita expenditure, the percentage of per capita expenditure in the food category, the teacher-student ratio, and the number of health facilities had a significant impact on the HDI. Conversely, the variable that did not have a significant influence on the HDI was the literacy rate.

Based on the outlined facts, this research attempts to analyze the influence of poverty and unemployment on the HDI in West Kalimantan using panel data regression analysis.

METHODOLOGY

This research employs a quantitative approach, namely panel data regression analysis. The identification of the optimal model is established through a sequence of assessments, such as the Chow, Hausman, and Lagrange Multiplier tests. Subsequently, to identify all significant variables influencing the HDI, parameter estimation tests, including simultaneous tests, partial tests, and classical assumption tests, are conducted (Hidayat et al., 2018).

Panel Data Regression

Panel data refer to a blend of cross-sectional and time-series data that increases the number of observations, i.e., degrees of freedom, to generate better output estimates (Silalahi et al., 2014). The equation for the panel data model itself can be written as Equation (1) as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \ldots + \varepsilon_{it};\ i = 1, 2, \ldots, N\ and\ t = 1, 2, \ldots, T \tag{1}$$

In Equation (1), β_0 is the parameter for the 0-th variable, β_1 is the parameter for the X_1 variable, X_{it} is the independent variable for individual i at time t, ε_{it} is the individual error component for individual i in year t, N is the number of observations, and T is the number of time periods.

Several approaches are used to estimate model parameters using panel data, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM).

Common Effect Model (CEM)

CEM is a technique that combines time series data with cross-sectional data without considering the dimensions between individuals and time because the behavior of data between individuals is assumed to be the same over time periods (Lestari & Setyawan, 2017). The equation for the CEM method can be written as follows (Silalahi et al., 2014):

$$Y_{it} = \alpha + \beta_j X_{it}^{j} + \varepsilon_{it} \tag{2}$$

In Equation (2), Y_{it} is the dependent variable for individual i at time t, X_{it}^{j} is the independent variable for individual j at time t, i is the cross-sectional unit count of N, j is the time series unit count of T, ε_{it} is the individual error component for individual i in year t, α is intercept, and β_j is the parameter for the variable j.

Fixed Effect Model (FEM)

FEM is a model used to address the shortcomings of the CEM model because the intercept produced in the CEM model does not change between individuals and over time. Despite having the same regression coefficients, the FEM model indicates that there is a constant difference between objects (Silalahi et al., 2014).

The FEM assumes that although intercepts between objects vary, intercepts over time remain constant. Additionally, the FEM approach assumes that slopes between objects and over time are the same (Silalahi et al., 2014), requiring the addition of a generalization, namely dummy variables used to explain variations in parameter values over time and across cross-sectional units (Nuryanto & Pambuko, 2018). FEM can be formulated as follows:

$$Y_{it} = \alpha_i + \beta_j X_{it}^{j} + \sum_{i=2}^{n} \alpha_i D_i + \varepsilon_{it} \tag{3}$$

In Equation (3), β_j is the parameter for the variable j, X_{it}^{j} is the independent variable for individual j at time t, D_i is a dummy variable, ε_{it} is the individual error component for individual i in year t, α_i is the intercept for individual i, and Y_{it} is the dependent variable for individual i at time t.

Random Effect Model (REM)

The REM is highly necessary when estimating panel data where residuals may be correlated between individuals and over time. REM also assumes that the individual effects on cross-sectional and time series units, which are random variables, are included in the Ordinary Least Squares (OLS) model as errors, making the model efficient (Nuryanto & Pambuko, 2018). Therefore, the term "error component model" is commonly used for this model (Srihardianti & Prahutama, 2016), given by Equation (4) (Silalahi et al., 2014):

$$Y_{it} = \alpha + \beta_j X_{it}^j + \varepsilon_{it} \, ; \, \varepsilon_{it} = u_i + V_t + W_{it} \tag{4}$$

In Equation (3), β_j is the parameter for the variable j, X_{it}^j is the independent variable for individual j at time t, ε_{it} is the individual error component for individual i in year t, α_i is the intercept for individual i, u_i is the cross-sectional error component, V_t is the time series error component, W_{it} is a composite error component, and Y_{it} is the dependent variable for individual i at time t.

Selection of the Best Model Estimation

The process of choosing panel data regression models is undertaken to ascertain the model that will be employed. This model selection can be accomplished through various tests, such as the Chow test, Hausman test, and Lagrange Multiplier test (Muda et al., 2019).

The Chow test functions to ascertain whether FEM or CEM is the best method for predicting panel data models. In the Chow test, the following hypotheses are present (Sugiantari & Budiantara, 2013):

H_0: There is a common effect

H_1: There is a fixed effect

with the criterion that H_0 is accepted if the cross-section F statistic's probability value > the significance level (0.05).

The Hausman test functions to ascertain whether FEM or REM is the best method in estimating panel regression models. In the Hausman test, the following hypotheses are present (Sugiantari & Budiantara, 2013):

H_0: There is a random effect

H_1: There is a fixed effect

With the criterion that H_0 is accepted if the statistical probability value > the significance level (0.05).

The Lagrange Multiplier test functions to ascertain whether CEM or REM is the best method in predicting panel data models. The hypothesis for this test is (Muda et al., 2019):

H_0: There is a common effect

H_1: There is a random effect

With the criterion that H_0 is accepted if the LM value < the corresponding chi-square table value.

Significance Test of Parameters

The goal of conducting a significance test on parameters is to assess the significance of the regression coefficients obtained (Alviani et al., 2021). A regression coefficient is regarded as significant if the statistically calculated value is zero. When the regression coefficient is not zero, it can be inferred that the independent variable lacks substantial evidence to impact the dependent variable (Apriliawan & Yasin, 2013). Thus, simultaneous and partial tests are needed to examine all the regression coefficient values (Firman Alamsyah et al., 2022).

The simultaneous test is conducted to assess the impact of all independent variables on the dependent variable based on the hypothesis:

H_0: Lacks a significant simultaneous impact

H_1: Possesses a noteworthy simultaneous impact

With the critical region being H_0 rejected if $F_{calculated}$ > F table or (Prob(F-statistic)) < 0.05 (significance), so that the independent variables collectively affect the dependent variable, and vice versa (Muda et al., 2019).

The purpose of the partial test is to measure the level of significance of each independent variable in its relationship with the dependent variable using the hypothesis:

H_0: $\beta_j = 0$ (not significantly influential)

H_1: $\beta_j \neq 0$ (significantly influential)

With the critical region being H_0 rejected if $[t_{calculated}] > t_{table}$ ($t_{(\alpha, (n-K-1))}$) or the statistical probability value of t < 0.05 (significance), indicating an individual influence of independent variables on the dependent variable, and vice versa (Nuryanto & Pambuko, 2018).

Coefficient of Determination

The coefficient of determination (R^2) is an indicator that shows the extent of the change level due to the influence of other factors. Its purpose is to determine the percentage correlation between two variables, namely the independent variable and the dependent variable, and to determine the extent to which changes in the independent variable can accurately account for the variation in the dependent variable. R^2 has values ranging from zero to one (Silalahi et al., 2014).

Classical Assumption Test

When conducting panel data regression analysis, classical assumption tests must be satisfied, which include assumptions that the residuals are identical, independent, and normally distributed. If a model meets these assumptions, then it will meet the criteria of being the Best, Linear, Unbiased, and Estimator (BLUE), making it an excellent panel data regression model. Classical assumption tests used include multicollinearity test, normality test, and heteroskedasticity test (Silalahi et al., 2014), while autocorrelation test is only used for time series data and not for panel data (Ningrum et al., 2020).

The normality test functions to ascertain whether the dependent and/or independent variables are normally distributed by observing the normal probability plot using the Jarque-Bera test. Data follows a normal distribution if the probability value is > 0.05 (significance), and vice versa (Silalahi et al., 2014).

The multicollinearity test is an analysis that examines the Variance Inflation Factor (VIP) to determine the relationships or correlations among independent variables (Ningrum et al., 2020; Srihardianti & Prahutama, 2016). If the VIP value is equal to or greater than 10, then the data used exhibits symptoms of multicollinearity (Silalahi et al., 2014).

The heteroskedasticity test is conducted to determine whether there is a significant difference in the variance of residuals between each observation in the regression model, using the Park test as a reference. If the probability value is < 0.05 (significance), it indicates the presence of heteroskedasticity issues in the data (Silalahi et al., 2014).

Human Development Index (HDI)

The Human Development Index (HDI) can depict the indices of health, education, and economics, which represent the basic capabilities of humans in expanding their choices (BPS, 2017). The extent of the population involved in the development process is indicated by the number of the workforce and the unemployment rate. In this context, both unemployment and the labor force are components of the population that can drive the economic process, indicating that the dynamics of the development process should encompass the entire workforce. Thus, a large labor force can become a burden for the development of the economic index (Muslim, M. R., 2014).

According to the Central Statistics Agency of West Kalimantan Province (2023), from an economic perspective, poverty is defined as the inability to meet basic needs for both food and non-food items. These needs are quantified in the form of expenditures, such as spending on education, health, and others, thus becoming a burden for the development of the HDI itself.

RESULTS AND DISCUSSION

This research uses secondary data from 14 regencies and cities in West Kalimantan obtained from the Central Statistics Agency of West Kalimantan Province for the period of 2020-2022. The variables used involve poverty parameters (X_1) and unemployment (X_2) as independent variables, and HDI (Y) as the dependent variable.

Multicollinearity Test

Table 2. Results of Multicollinearity Test

Independent Variables	VIF
(1)	**(2)**
X_1	1.4070
X_2	1.4070

Based on Table 2, there is no sign of multicollinearity among the independent variables in the regression model, given that the VIF values for each variable are below 10, specifically at 1.4070.

Selection of the Best Model Estimation

Chow Test

Table 3. Chow Test Result

Effect Test	Statistic	d.f	Probability
(1)	**(2)**	**(3)**	**(4)**
Cross-section F	138.2592	(13.26)	0.0000
Cross-section Chi-square	178.5145	13	0.0000

Based on Table 3, the Chow test results indicate a statistical F probability value of 0.0000 < the significance level (alpha), which is 0.05. Therefore, the null hypothesis (H_0) is rejected, suggesting that the CEM model is not suitable for estimating the panel data regression model.

Next, to determine which approach is better between FEM and REM, a Hausman test is conducted.

Hausman Test

Table 4. Hausman Test Results

Test Summary	Chi-sq Statistic	Chi-Sq.d.f	Probability
(1)	**(2)**	**(3)**	**(4)**
Cross-Section Random	21.7345	2	0.0000

By using the Chow and Hausman tests, it can be stated that FEM is better than CEM and REM, as shown in Table 4. The Hausman test results indicate a chi-square statistical probability value of 0.0000 < the significance level (alpha), which is 0.05. Thus, H_0 is rejected. Therefore, it can be concluded that the REM is not suitable for estimating the panel data regression model.

Table 5. FEM Estimation Results

Variables	Coefficient	Std.Error	t-Statistic	Prob.
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Intercept	75.7662	1.6195	46.7839	0
X_1	-0.894	0.2473	-3.6154	0.0013
X_2	-0.2594	0.1084	-2.3934	0.0242
Fixed Effect (Cross)				
Sambas	-0.6633			
Bengkayang	-0.8829			
Landak	0.9838			
Mempawah	-2.9593			
Sanggau	-4.5161			
Ketapang	2.4354			
Sintang	0.5265			
Kapuas Hulu	-0.9192			
Sekadau	-4.6574			
Melawi	1.5189			
Kayong Utara	-3.3972			
Kubu Raya	-1.7697			
Pontianak	11.275			
Singkawang	3.0253			

Based on Table 5, the estimation results of FEM parameters are as follows.

$$\hat{Y}_{it} = 75.7662\alpha - 0.8940X_1 - 0.2594X_2 \quad (5)$$

Based on the model in Equation (5), it can be explained that for every decrease of 1 point in the poverty variable (X_1), assuming the unemployment variable (X_2) is constant, the HDI (Y) value will increase by 0.8940 points. For every decrease of 1 point in the unemployment variable (X_2), assuming the poverty variable (X_1) is constant, the HDI value will increase by 0.2594 points. The intercept (constant) represents the average HDI value when both poverty (X_1) and unemployment (X_2) variables are constant, and it is equal to 75.7662.

In addition to the overall model, individual models were also obtained for each regency and city in West Kalimantan Province. In FEM, there are variations across each region, resulting in specific HDI models for each regency and city.

1. Sambas Regency
   $$\hat{Y}_{sambas\ t} = -0.6633\alpha - 0.8940X_1 - 0.2594X_2$$
2. Bengkayang Regency
   $$\hat{Y}_{bengkayang\ t} = -0.8829\alpha - 0.8940X_1 - 0.2594X_2$$
3. Landak Regency
   $$\hat{Y}_{landak\ t} = 0.9838\alpha - 0.8940X_1 - 0.2594X_2$$
4. Mempawah Regency
   $$\hat{Y}_{mempawah\ t} = -2.9593\alpha - 0.8940X_1 - 0.2594X_2$$
5. Sanggau Regency
   $$\hat{Y}_{sanggau\ t} = -4.5161\alpha - 0.8940X_1 - 0.2594X_2$$
6. Ketapang Regency
   $$\hat{Y}_{ketapang\ t} = 2.4354\alpha - 0.8940X_1 - 0.2594X_2$$
7. Sintang Regency
   $$\hat{Y}_{sintang\ t} = 0.5265\alpha - 0.8940X_1 - 0.2594X_2$$
8. Kapuas Hulu Regency
   $$\hat{Y}_{kapuas\ hulu\ t} = -0.9192\alpha - 0.8940X_1 - 0.2594X_2$$
9. Sekadau Regency
   $$\hat{Y}_{sekadau\ t} = -4.6574\alpha - 0.8940X_1 - 0.2594X_2$$
10. Melawi Regency
   $$\hat{Y}_{melawi\ t} = 1.5189\alpha - 0.8940X_1 - 0.2594X_2$$
11. Kayong Utara Regency
   $$\hat{Y}_{kayong\ utara\ t} = -3.3971\alpha - 0.8940X_1 - 0.2594X_2$$
12. Kubu Raya Regency
   $$\hat{Y}_{kubu\ raya\ t} = -1.7697\alpha - 0.8940X_1 - 0.2594X_2$$
13. Pontianak City
   $$\hat{Y}_{pontianak\ city\ t} = 11.2750\alpha - 0.8940X_1 - 0.2594X_2$$
14. Singkawang City
   $$\hat{Y}_{singkawang\ city\ t} = 3.0253\alpha - 0.8940X_1 - 0.2594X_2$$

Significance Test of Parameters

The significance test of the parameter estimates from the best model, which is FEM, aims to determine whether the obtained regression coefficients are significant or not. Therefore, simultaneous (F) and partial (T) tests are conducted (Alviani et al., 2021).

Simultaneous Test (F-Test)

Table 6. Simultaneous Test Result

	F-Statistic	Prob.
	(1)	(2)
Value	316.5832	0.0000

Based on Table 6, from the results of the simultaneous test, the $f_{statistic}$ value is 316.5832, and the f_{table} value is 4.085. Since $f_{statistic} > f_{table}$ or because the p-value is 0.0000 < the significance level (alpha) of 0.05, H_0 is rejected. Therefore, it can be inferred that the independent variables exert a noteworthy impact on the dependent variable.

Partial Test (T-Test)

In Table 5, it can be observed that the statistical probability values (p-values) for the t-test of poverty (X_1) and unemployment (X_2) are 0.0013 and 0.0242, respectively. These values are smaller than the significance level (alpha) of 0.05. Therefore, H_0 is rejected, and it can be deduced that HDI (Y) is significantly influenced by both independent variables, namely poverty (X_1) and unemployment (X_2).

Coefficient of Determination

Table 7. Coefficient of Determination Test Results

F-Statistic	Value
(1)	(2)
R-square	0.9946
Adjusted R-square	0.9914
S.E. of regression	0.3662

Table 7 shows that the Adjusted R-square value is 0.9914 (99.14%), indicating that the model can explain the variability of poverty and unemployment in West Kalimantan Province, while 0.86% is accounted for by other variables that are not incorporated in the model.

Classical Assumption Test

Normality Test

Based on the analysis results, it is known that the Jarque-Bera statistical probability is 0.1486 > the significance level (alpha) of 0.05, meaning H_0 is accepted. Thus, it can be inferred that the residual data utilized in the panel data regression model adheres to a normal distribution.

Heteroscedasticity Test (Uji Park)

This study employs the Park test to examine heteroscedasticity in the model (Muda et al., 2019).

Table 8. Heteroscedasticity Test

Parameter	**P-Value**
(1)	**(2)**
Intercept	0.1175
X_1	0.1372
X_2	0.2850

Table 8 shows the p-values for each variable as 0.1175, 0.1372, and 0.2850 > the significance level (alpha) of 0.05. Therefore, H_0 is rejected, indicating that the variables used exhibit homoscedasticity or are free from heteroscedasticity.

CONCLUSION AND RECOMMENDATION

The research results indicate that the best model, after conducting the Chow and Hausman tests, is the Fixed Effects Model (FEM) with the highest adjusted R-square value. From 2020 to 2022, the HDI in West Kalimantan is significantly influenced by poverty and unemployment. This implies that the government and private sector need to collaborate to create more job opportunities, promote skill-based or expertise-based training, enhance the quality of the workforce, and open up employment opportunities so that people have income to meet their living needs. This, in turn, can reduce poverty and improve the HDI in West Kalimantan.

A limitation of this study is the constrained sample size and relatively limited number of observations. Hence, it is advisable for future research to incorporate additional variables that are believed to influence the HDI.

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