PANEL DATA ANALYSIS OF FACTORS AFFECTING ECONOMIC GROWTH IN INDONESIA

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Abstract

Economic growth is widely regarded as a key indicator of a country's overall development. This study investigates the factors influencing economic growth in Indonesia during the 2020–2024 period, where growth is proxied by Gross Regional Domestic Product (GRDP) at constant 2010 prices. The analysis employs panel data regression by incorporating several explanatory variables, including the open unemployment rate, poverty rate, Human Development Index, labor force participation rate, exports, investment, minimum wage, and population growth. Model selection was conducted using the Chow test and the Hausman test, both of which indicated that the Fixed Effect Model (FEM) is the most appropriate estimation method. The results of the partial (t-test) reveal that exports and the minimum wage have a statistically significant effect on economic growth, while the remaining variables do not show significant effects. The coefficient of determination (R^2) reaches 59.87 percent, indicating that the independent variables collectively explain a substantial portion of the variation in economic growth. Furthermore, the adjusted R^2 value of 49.39 percent suggests that the model has a reasonably strong explanatory power. Overall, the findings emphasize the importance of strengthening export performance and implementing effective minimum wage policies to support economic growth in Indonesia.

Keywords: Economic growth, panel data regression, fixed effect model, exports, minimum wage, Indonesia

1. INTRODUCTION

In 2020, Indonesia's economy experienced a contraction of 2.07 percent (BPS, 2025). The decline in economic growth in 2020 was attributable to the COVID-19 pandemic. To control the spread of the virus, the government implemented Large-Scale Social Restrictions under Government Regulation No. 21 of 2020 (Suryandari, 2021). These measures disrupted business activities, particularly in sectors reliant on physical presence, such as retail, hospitality, and entertainment, resulting in widespread layoffs. In April 2020, approximately 1.5 million workers were furloughed or dismissed (Fahrika & Roy, 2020).

The labor market deterioration was reflected in a declining Labor Force Participation Rate and rising unemployment. According to Statistics Indonesia (BPS), the unemployment rate increased from 4.94 percent in February 2020 to 7.07 percent in August 2020, which subsequently contributed to a rise in poverty to around 28 million people in September 2020. Wage dynamics also shifted during the pandemic, as rising living costs and increased workloads in essential sectors led to upward wage pressures. Efficiency wage theory suggests that wages tend to adjust in line with productivity and work intensity (Heldini, 2021).

The pandemic further affected human development outcomes, with Indonesia's Human Development Index (HDI) declining to 72.29 in 2021. This slowdown was mainly driven by a reduction in the standard of living component, while health and education indicators continued to improve at a slower pace (Nurfilah & Satiti, 2022). In addition, economic conditions weakened due to declining exports and domestic investment amid global uncertainty and mobility restrictions. Reduced trade and investment activities limited production and employment opportunities, thereby weakening household purchasing power (Nugroho, 2017).

Economic growth showed signs of recovery in 2021 at 3.7 percent, increased to 5.31 percent in 2022, and then slightly moderated to 5.05 percent in 2023 and 5.03 percent in 2024 (BPS, 2025). This indicates that the recovery remained uneven. These fluctuations highlight the continued influence of various socio-economic factors, including unemployment, poverty, labor force participation, human development, exports, investment, minimum wages, and population growth.

Given the multidimensional nature of these factors, this study examines the determinants of economic growth in Indonesia using panel data regression, an approach that allows for the simultaneous consideration of regional heterogeneity and temporal dynamics in economic relationships (Bajrami et al., 2024). The analysis covers 34 provinces over the 2020–2024 period. Panel data regression is implemented using the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), with model selection conducted through the Chow, Hausman, and Lagrange Multiplier tests (Gujarati, 2004). This methodological framework is expected to provide robust empirical evidence on the factors influencing regional economic growth in Indonesia.

2. METHODOLOGY

This study adopts a quantitative research design and utilizes panel data regression to examine the determinants of economic growth. Panel data are employed as they integrate cross-sectional observations across provinces with time-series data over multiple periods, thereby providing a more comprehensive analytical framework. The dataset comprises 34 provinces in Indonesia observed from 2020 to 2024. Data processing and estimation were conducted using EViews software. The variables included in this study are summarized in Table 1.

The research procedure is carried out through the following steps:

a. Presenting descriptive statistics to examine the general characteristics of the data.
b. Estimating panel data regression models using the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM).
c. Determining the most appropriate panel data model through a series of model selection tests.

d. Assessing the selected model by applying classical assumption diagnostics.
e. Testing the statistical significance of the estimated parameters using both the F-test (simultaneous) and t-test (partial).
f. Re-estimating the model to obtain the best-fitting regression equation.
g. Evaluating model goodness-of-fit using the coefficient of determination.
h. Interpreting the estimation results and drawing conclusions based on the overall analysis.

Table 1. Description of Research Variables

Variable	Symbol	Unit of Measurement
Economic Growth (*Proxied by GRDP Growth at Constant Prices, 2010*)	Y	Percent (%)
Open Unemployment Rate	X_1	Percent (%)
Poverty Rate	X_2	Percent (%)
Human Development Index	X_3	Index (0-1)
Labor Force Participation Rate	X_4	Percent (%)
Exports	X_5	Million USD
Domestic Investment	X_6	Billion Rupiah
Minimum Wage	X_7	Rupiah
Population Growth Rate	X_8	Percent (%)

Source: Statistics Indonesia (BPS) (2020-2024)

3. FINDINGS AND DISCUSSION

This section presents the empirical findings derived from panel data analysis. Several estimation models are employed, namely CEM, FEM, and REM, after which the most appropriate model is selected based on established criteria (Abdullah et al., 2022). Diagnostic tests are then conducted to examine normality, multicollinearity, heteroskedasticity, and autocorrelation. In addition, both simultaneous and partial significance tests are performed, after which the explanatory power of the model is evaluated using the coefficient of determination and the estimated results are subsequently interpreted.

3.1 Descriptive Statistic

Table 2 presents the descriptive statistics of the variables employed in this study. The table reports the average (mean), maximum, and minimum values for the dependent variable and all independent variables, providing an overview of the data distribution and variability across observations.

Table 2. Descriptive Statistic

Variable	Average	Maximum	Minimum
Y	3.946	22.940	-9.340
X_1	4.992	10.015	1.830
X_2	10.188	27.120	3.900
X_3	72.232	83.080	60.440
X_4	68.941	78.990	62.525
X_5	6,949.594	38,547	32.900
X_6	17,041.042	128,402.100	252.900
X_7	2,806,728.035	5,067,381	1,704,608
X_8	1.421	4.130	0.310

Source: Authors' estimation results

As shown in Table 2, the variables demonstrate diverse ranges of values, indicating variation across observations. This variation suggests that the dataset contains sufficient information for further empirical investigation.

3.2 Model Estimation and Selection

The most appropriate panel data model is selected by comparing three alternative specifications, namely the CEM, FEM, and REM. Model selection is conducted using the Chow test, Hausman test, and Lagrange Multiplier test to identify the model that best fits the data.

3.2.1 Chow Test

The Chow test is used to compare the CEM and the FEM. The results show a p-value of 0.000, which is below 0.05, indicating that the FEM is more appropriate than the CEM.

3.2.2 Hausman Test

The Hausman test is applied to compare the FEM and the REM. The test produces a p-value of 0.000, suggesting that the FEM is preferred over the REM.

3.2.3 Lagrange Multiplier Test

The Lagrange Multiplier test is not performed in this study because both the Chow and Hausman test results consistently indicate that the FEM is the most appropriate model.

3.3 Classical Assumption Tests

Classical assumption tests are conducted to evaluate the validity of the FEM, which has been selected as the best estimation model. These tests include normality, multicollinearity, heteroskedasticity, and autocorrelation tests. In panel data regression, potential violations of these assumptions may arise, therefore, diagnostic testing is required to ensure the reliability of the estimation results.

3.3.1 Normality Test (Jarque–Bera Test)

Residual normality is assessed using the Jarque–Bera (JB) statistic. The test yields a JB value of 60.276, which exceeds the corresponding chi-square critical value of 5.99, indicating that the residuals deviate from normality. Nevertheless, since normality is not a strict assumption under the Fixed Effect Model, this deviation does not compromise the validity of the estimated model.

3.3.2 Multicollinearity Test (Pearson Correlation Test)

The presence of multicollinearity is evaluated by examining Pearson correlation coefficients among the independent variables. The results show that all pairwise correlation values are below 0.85, suggesting that multicollinearity is not a concern in the model.

3.3.3 Heteroskedasticity Test (Glejser Test)

Heteroskedasticity is examined using the Glejser test. The obtained p-values for all independent variables exceed the 5 percent significance level, indicating that the residuals exhibit constant variance and that heteroskedasticity is not present.

3.3.4 Autocorrelation Test (Durbin–Watson Test)

Autocorrelation was examined using the Durbin–Watson statistic. Values ranging between −2 and 2 indicate the absence of autocorrelation. The estimated Durbin–Watson statistic is 1.704, which lies within the acceptable range, suggesting that the model does not suffer from autocorrelation.

3.4 Parameter Significance Tests

This study evaluates the statistical significance of the estimated parameters to assess the relationship between the dependent variable and the explanatory variables.

3.4.1 Simultaneous Significance Test (F-test)

The joint significance of the independent variables is examined using the F-test. The estimated F-statistic is 5.234, which exceeds the critical value of 1.53, with a corresponding p-value of 0.000. These results indicate that the independent variables collectively exert a statistically significant influence on the dependent variable at the 5 percent significance level.

3.4.2 Partial Significance Test (t-test)

Individual effects are tested for statistical significance using the t-test, with decisions made according to p-values at the 5 percent threshold. A detailed summary of the t-test results for all independent variables are presented in Table 3.

Table 3. t-Test Result

Variable	t-Statistic	p-value	Remarks
X_1	-0.242	0.809	Not Significant
X_2	-0.720	0.473	Not Significant
X_3	-1.302	0.195	Not Significant

Variable	t-Statistic	p-value	Remarks
X_4	1.964	0.052	Not Significant
X_5	6.078	0.000***	Significant
X_6	-0.249	0.804	Not Significant
X_7	2.011	0.046**	Significant
X_8	-1.974	0.051	Not Significant

Source: Authors' estimation results using EViews
Notes: *** significant at 1% level, ** significant at 5% level

Based on the results of the partial significance test (t-test), it can be concluded only variables exports (X_5) and the minimum wage (X_7) have a statistically significant effect on the dependent variable. Meanwhile, the remaining independent variables do not show a significant partial effect.

3.5 Best Model Specification

The panel data regression analysis involving eight independent variables indicates that not all explanatory variables have a statistically significant effect on economic growth. The results of the partial significance test (t-test) reveal that only exports (X_5) and the minimum wage (X_7) have a statistically significant impact on economic growth. Based on these findings, the model is re-estimated by including only the significant independent variables in order to obtain a more parsimonious, efficient, and explanatory regression model. The results of the best model specification are presented in Table 4.

Table 4. Best Model

Variable	Coefficient	Std.Error	t-Statistic	p-value
C	-21.13922	4.331	-4.881	0.000***
X_5	0.000648	0.000	6.135	0.000***
X_7	7.33×10^{-6}	$1{,}56 \times 10^{-6}$	4.695	0.000***
$R^2 = 0.598712$				
$Adjusted\ R^2 = 0.493898$				

Source: Authors' estimation results using EViews
Notes: *** significant at 1% level, ** significant at 5% level

The best model is estimated using the FEM and incorporates only the statistically significant independent variables. The estimated regression equation is expressed as follows.

$$\hat{Y}_{it} = (-21.13922 + \delta_i) + 0.000648X_{5it} + 7.33 \times 10^{-6}X_{7it}$$

Based on the estimation results reported in Table 4, the constant term is −21.13922 and is statistically significant at the 1 percent level. This indicates that when all

explanatory variables are held constant at zero, economic growth is expected to decrease by 21.13922 percent.

The export variable (X_5) has an estimated coefficient of 0.000648 and is significant at the 1 percent level, indicating a positive relationship between exports and economic growth. This result implies that a one million US dollar increase in exports is associated with an increase in economic growth of 0.000648 percent. From a theoretical standpoint, export expansion contributes to economic growth by broadening market access and increasing national income.

The minimum wage variable (X_7) has a coefficient of 7.33×10^{-6} and is significant at the 1 percent level, indicating that minimum wages have a positive and statistically significant effect on economic growth. Specifically, a one rupiah increase in the minimum wage is associated with an increase in economic growth of 7.33×10^{-6} percent. Theoretically, higher minimum wages may enhance household purchasing power, thereby stimulating economic activity.

The coefficient of determination (R^2) is 0.598712, indicating that 59.87 percent of the variation in economic growth can be explained by the independent variables included in the model. Furthermore, the adjusted R^2 value of 0.493898 suggests that, after adjusting for the number of explanatory variables, the model explains 49.39 percent of the variation in economic growth. The remaining 50.61 percent of the variation in economic growth is explained by other factors outside the model.

3.6 Model Application

Based on the best regression model identified in the previous subsection, the estimated results can be applied and interpreted for each cross-sectional unit. The intercept values for each province are calculated using EViews 12 software and are presented in the following Table 5.

As an illustration, the regression equation for Aceh Province is presented in the following equation.

$$\hat{Y}_{it} = -21.263182 + 0.000648X_{5it} + 7.33 \times 10^{-6}X_{7it}$$

Based on the estimated regression model for Aceh Province, the results can be interpreted as follows.

a. When the export and minimum wage variables are held at zero, economic growth in Aceh Province is predicted to decline by 21.263182 percent.
b. A one million US dollar increase in exports (X_5) is estimated to increase economic growth by 0.000648 percent, assuming that other independent variables remain constant.
c. A one rupiah increase in the minimum wage (X_7) is estimated to increase economic growth by 7.33×10^{-6} percent.

Table 5. Province Specific Intercepts from the Fixed Effect Model

i	Province	δ_i	i	Province	δ_i
1	Aceh	-0.123962	18	NTB	6.367230
2	Sumatera Utara	-1.481661	19	NTT	8.554137
3	Sumatera Barat	3.480209	20	Kalimantan Barat	4.768744
4	Riau	-10.15595	21	Kalimantan Tengah	-0.176076
5	Jambi	2.676018	22	Kalimantan Selatan	-4.742526
6	Sumatera Selatan	-2.618337	23	Kalimantan Timur	-14.53089
7	Bengkulu	7.284855	24	Kalimantan Utara	0.625360
8	Lampung	2.468882	25	Sulawesi Utara	-0.446293
9	Kep. Bangka Belitung	-2.450050	26	Sulawesi Tengah	3.750881
10	Kep. Riau	-9.135776	27	Sulawesi Selatan	-0.300141
11	DKI Jakarta	-17.01924	28	Sulawesi Tenggara	2.887326
12	Jawa Barat	-11.56384	29	Gorontalo	3.008886
13	Jawa Tengah	4.000781	30	Sulawesi Barat	3.036077
14	DI Yogyakarta	10.63517	31	Maluku	4.857624
15	Jawa Timur	-4.742149	32	Maluku Utara	11.42560
16	Banten	-2.485660	33	Papua Barat	1.125590
17	Bali	2.517048	34	Papua	-1.497863

Source: Authors' estimation results using EViews

4. CONCLUSION

The results indicate that the Fixed Effect Model provides the most appropriate specification for analyzing economic growth in Indonesia over the observation period, and the corresponding estimated regression equation is presented below.

$$\hat{Y}_{it} = (-21.13922 + \delta_i) + 0.000648X_{5it} + 7.33 \times 10^{-6}X_{7it}$$

Among all independent variables included, only two variables namely exports and the minimum wage, are found to have a statistically significant effect on economic growth in Indonesia. The coefficient of determination (R^2) shows that approximately 59.87 percent of the variation in economic growth is explained by the model, while the adjusted R^2 of 49.39 percent suggests a moderate explanatory capacity after accounting for the number of regressors. The remaining variation is likely attributable to other factors not included in the analysis.

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