THE EFFECT OF ELECTRIC ENERGY, HUMAN DEVELOPMENT INDEX, AND LABOR ON ECONOMIC GROWTH IN INDONESIA

Rangga Dzaki Saputra [1], Ririn Nopiah[2]
[1,2] Development Economics, Bengkulu University, Indonesia
Email: [1]ranggadzakisaputra@gmail.com, [2] ririn_nopiah@umb.ac.id

ABSTRACT
  Economic growth is one of the main indicators of a country's progress, therefore this study aims to analyze the effect of electrical energy, human development index (HDI), and labor on economic growth in Indonesia. The data used in this study are secondary data in the form of panel data obtained from the annual report of the Central Statistics Agency (BPS) from 2018 to 2022, consisting of 34 provinces in Indonesia. The dependent variable in this study is economic growth, while the independent variables are electrical energy distribution, human development index (HDI), and labor. To determine the effect of electrical energy, human development index (HDI), and labor on economic growth in Indonesia, this study uses the panel data regression analysis method. The results showed that the three variables studied, namely electrical energy, labor and HDI, had a significant effect on economic growth in Indonesia. The variables of electrical energy and labor have a positive and significant effect on economic growth in Indonesia. While the human development index (HDI) variable has a significant negative effect.
Keywords: Economic Growth, Electric Energy, Labor

1. Introduction

  One indicator of the success of a country's economic development is by measuring the country's economic growth. Economic growth measures the long-term ability of a country to provide goods and services to its population. (Nurdin & Fuady, 2021). Economic growth shows how economic activity will increase people's income over a certain period of time. One measure of economic growth is the Gross Domestic Product (GDP), which is the added value obtained from economic production activities. (Amdan & Sanjani, 2023).
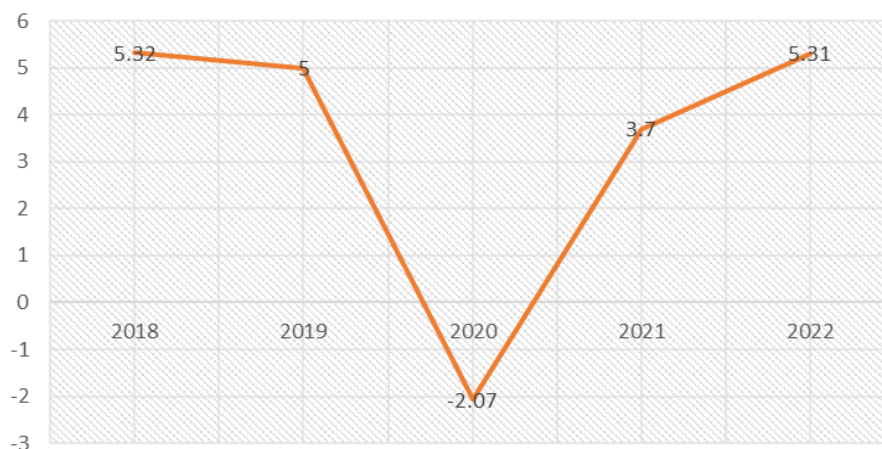

Figure.1. Indonesia's Economic Growth Rate 2018-2022
Source: BPS, data processed (2023)

The figure above shows the percentage of economic growth in Indonesia for 5 years from 2018-2022. The Central Bureau of Statistics (2023) reported that Indonesia's economic growth in 2019 decreased by 5 percent compared to the previous year. In 2020 Indonesia experienced a drastic contraction of -2.07 percent due to the impact of the covid-19 pandemic. This impact resulted in a decrease in community productivity. However, in 2021 & 2022 Indonesia's economic growth began to recover by reaching 3.7 percent and increasing to 5.31 percent.

The Indonesian government has made various efforts to increase economic growth. One of these efforts is to improve infrastructure, including electricity infrastructure. (Rediansyah et al., 2023) With the development and advancement of technology today, it is undeniable that electricity has become a primary need in supporting people's lives so that the government always ensures the availability, quality and sustainability of this electrical energy. However, electricity distribution is still uneven in Indonesia (Rezagama & Hadiwidodo, 2016) In some remote areas, there are still many people who do not have access to electricity. This causes low productivity of people in the area and hampers economic growth (Ministry of Energy and Mineral Resources, 2010) In the study of (Kamilla & Hutajulu, 2020; Prastika, 2023; Purim & Krismanti, 2021; Rediansyah et al., 2023; Salahuddin et al., 2018) shows that electrical energy has a positive and significant effect because electrical energy can increase productivity and efficiency in the production process, which in turn will encourage the country's economic growth. Whereas in the study (Riana, 2014) electricity did not have a significant effect because of the unevenness of electricity infrastructure.

Another indicator that can also affect economic growth is the Human Development Index (HDI). Increasing the Human Development Index (HDI) through education and health aims to improve people's welfare and economic growth. The HDI itself consists of three basic dimensions used to measure success in efforts to develop the quality of human life, namely longevity and healthy living, knowledge, and decent living standards. (Nisa & Rafikasari, 2022; Theophilia & Wijaya, 2023).. In the study of (Istianto et al., 2021; Olivia Theophilia & Riko Setya Wijaya, 2023; Taqi et al., 2021) HDI has a significant and positive effect on economic growth because an increase in HDI indicates an increase in the quality of human resources, such as education and health, which can increase productivity and innovation in a country's economy. However, in the study of (Ishak et al., 2020; Muqorrobin & Soejoto, 2017) HDI has a negative effect on economic growth due to low HDI, resulting from a lack of educational participation and high school dropout rates.

In addition to electrical energy and the human development index, indicators that can affect economic growth are labor. Labor is one of the inputs in driving the productivity of a region's economic growth. (Astawan, 2015) A larger number of workers will increase the amount of productive labor, the greater the productive labor, the greater the output produced. The theory is in line with studies from (Astawan, 2015; Nurul Fitriani, 2018; Shahid & Ali Khan, 2020; Tasrif et al., 2019; Vernanda et al., 2023) in contrast to the results of the study (Prameswari et al., 2021) where labor has a negative effect on economic growth due to the level of technology used, and external factors are more dominant.

Based on the study gap, description and problems, the purpose of this study is to analyze the effect of electrical energy, human development index (HDI), and labor on economic growth in Indonesia .

2. Literature Review

Economic Growth is a sustainable change in a country's economic situation towards better conditions. So that the development of economic activity that causes an increase in goods and services produced by the community and an increase in people's prosperity is called economic growth. (Dwi Putri et al., 2020; Subekti, 2023).. Economic growth is one of the main

indicators of a country's progress. In Indonesia, economic growth is influenced by various factors, including electrical energy, the Human Development Index (HDI), and labor.

The first indicator that can affect economic growth is electrical energy. Electrical energy is everything related to electric power generation, electric power distribution, electric power transmission, substations, or other electrical instruments that are useful for supporting economic development. (Rediansyah et al., 2023). In the study (Kamilla & Hutajulu, 2020; Prastika, 2023; Purim & Krismanti, 2021; Rediansyah et al., 2023; Salahuddin et al., 2018) shows that electrical energy has a positive and significant effect on economic growth in Indonesia, while in the study (Riana, 2014) electricity does not have a significant effect because of the uneven electricity infrastructure in Papua.

In addition, the human development index can also affect the level of economic growth. A high human development index indicates that people have a better quality of life. This can increase productivity and drive economic growth. In studies (Istianto et al., 2021; Olivia Theophilia & Riko Setya Wijaya, 2023; Taqi et al., 2021) HDI has a significant and positive effect on economic growth in Indonesia However, in studies (Ishak et al., 2020; Muqorrobin & Soejoto, 2017) HDI has a negative effect on economic growth in Makassar and East Java provinces.

Labor is an important resource in economic development, and workers who work and generate income will contribute to the economy because they will consume by buying goods and services. (koyongian et al., 2019)The study of (Astawan, 2015; Nurul Fitriani, 2018; Shahid & Ali Khan, 2020; Tasrif et al., 2019; Vernanda et al., 2023) shows that labor has a positive and significant effect on economic growth in Indonesia in contrast to the results of the study of (Prameswari et al., 2019). (Prameswari et al., 2021) where labor has a negative effect on economic growth in the province of East Java.

3. Research Methods

This study uses secondary data in the form of panel data. The dependent variable is Economic Growth and the independent variables are electrical energy distribution, human development index (HDI), and labor obtained from the Indonesian Central Bureau of Statistics (BPS). The type of data used is panel data with the analysis year 2018-2022 and the unit of analysis 34 provinces in Indonesia. In this study, the panel data regression analysis method was used to determine the effect of electrical energy, human development index (HDI), and labor on economic growth in Indonesia. The REM, FEM, CEM Model Test is used to select the most appropriate regression model and produce more accurate conclusions about the relationship between variables and then this study uses the t test, f test, and simultaneous R square test to test the hypothesis The model parameters used in this study are as follows:

$$PE_{it} = \beta_0 + \beta_1 EL_{it} + \beta_2 IPM_{it} + \beta_3 TK_{it} + e_{it}$$

Description:
PE : Economic Growth (Billion Rupiah) EL: Electric Energy (Gwh)
HDI : Human Development Index (%)
TK : Labor (%)
e : Error Term
It : Panel

Furthermore, the hypothesis testing carried out is :
The t-test : Used to test hypotheses about the effect of individual independent variables on the dependent variable. The t-test produces a t-statistic and p-value. If the p-value $< \alpha$ (significance level), then the null hypothesis is rejected and the alternative hypothesis is accepted.

F test : Used to test the hypothesis simultaneously about the effect of all independent variables on the dependent variable. The F test produces an F-statistic value and p-value. If the p-value $< \alpha$, then the null hypothesis is rejected and the alternative hypothesis is accepted.

Simultaneous R-Square Test : Used to test how large a proportion of the variation in the dependent variable is explained by all the independent variables. The R-Square value indicates the goodness of fit of the model.

In addition, the classic assumption test is also carried out :

Multicollinearity : There is no strong linear relationship between independent variables. The multicollinearity test can be done by looking at the VIF (Variance Inflation Factor) value. If the VIF value is greater than 10 or the tolerance value is low, then there is multicollinearity.

Normality : To determine whether the data in the linear regression model is normally distributed or not. If the Jarque-Bera value is more than 0.05 then the data is normally distributed.

4.   Research Findings and Discussion

4.1 Descriptive Statistics

In this study, economic growth is the dependent variable while the variables of electrical energy, labor and human development index are the independent variables. The following are the results of statistical description testing on these variables.

Table 1. Results of Descriptive Statistics

Variables	N		Max	Mean		Std. Deviation
Economic Growth	170	0.24	17.55	2.9416	4.15617	
Electrical Energy	170	183.32	56226.11	7408.6279	12349.00709	
Labor	170	15.89	70.43	40.8294	10.42098	
HDI	170	0.47	81.65	70.6968	6.64684	

Economic growth variables, from these data it can be described that the minimum value is 0.24 while the maximum value is 17.55 and the average value of the economic growth variable is 2.9416 with a standard deviation of 4.15617. The electrical energy variable, from the data it can be described that the minimum value is 183.32 while the maximum value is 56226.11 and the average value of the electrical energy variable is 7408.6279 with a standard deviation of 12349.00709. The labor variable, from the data, it can be described that the minimum value is 15.89 while the maximum value is 70.43 and the average value of the labor variable is 40.8294 with a standard deviation of 10.42098. HDI variable, from the data it can be described that the minimum value is 0.47 while the maximum value is 81.65 and the average value of the HDI variable is 70.6968 with a standard deviation of 6.64684Source: Data processed by the author, 2024

4.2 Model Estimation Test Results

In the regression model estimation method using panel data can be done through three approaches, namely the *Common Effect Model*, *Fixed Effect Model* (FEM), and *Random Effect Model* (REM). To choose the most appropriate model, there are several tests that can be carried out, namely the Chow test, Lagrange Multiplier , and Hausman.

Table 2. Chow Test Results

Effect Test	Statistic	d. f.	Prob.
Cross-section F	0.160120	(4, 1 6 2)	0.9581
Cross-section Chi-squere	0.670786	4	0.9549

Source: Data processed by the author, 2024

Based on the test results, it can be seen that the *chow* test has a *chi-square* probability result greater than 0.05 (prob. 0.9549> 0.05) so that it can be said that the best model test is the *Common Effect Model.*

Table 3. Lagrange Multiplier Test Results

	Cross-section	Test Hypothesis Time	Both
Breusch-Pagan	1.938147	302.3780	304.3162
	(0.1639)	(0.0000)	(0.0000)

Source: Data processed by the author, 2024

Based on the results of the Lagrange multiplier test conducted, the *Breusch-Pagan* value <0.05. Thus, the right model to use is the *Random Effect Model.*

Table 4. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Random Cross-section	0.640481	3	0.8871

Source: Data processed by the author, 2024

Based on the table above, the tests that have been carried out produce a *Cross Section Random* probability value > 0.05. Thus, the appropriate model to use is the *Random Effect Model*. After the *Chow*, *Lagrange Multiplier*, and *Hausman* tests were conducted, it was found that the *Random Effect Model was* chosen to be the most appropriate model.

4.3 Classical Assumption Test Results

In this study, the classic assumption test used is the multicollinearity test, and the normality test only because the data used in this study is panel data with the Random Effect Model approach.

Table 4.5. Multicollinearity Test Results

Electrical Energy	Labor	HDI
1.000000	0.030192	0.042484
0.030192	1.000000	0.022421
0.042484	0.022421	1.000000

Source: Data processed by the author, 2024

The multicollinearity test is conducted to test whether there is a correlation between independent variables or independent variables in the regression model. The correlation coefficient of electrical energy, labor, HDI must be <0.85, so based on table 4.5 all independent variables pass the multicollinearity test.

Table 4.6. Normality Test Results

Mean	-4.15e-16
Median	-0.161201
Maximum	6.758899
Minimum	-5.149291
Std. Dev.	1.643297
Skewness	0.499591
Kurtosis	7.677912
Jarque-Bera	162.0753
Probability	0.000000

Source: Data processed by the author, 2024

It can be seen in the figure where the value of *Jarque-Bera* is 162.07> 0.05, so it can be concluded that the data is normally distributed (passes normality).

4.4 Panel Data Regression Analysis Results

The panel data regression model is a regression model used to determine the effect of one or more predictor variables on a response variable with a data structure in the form of panel data.

Table 7. Results of Panel Data Regression Analysis Using *Random Effect Models*

Variables	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	**1.834551**	1.392069	1.317859	**0.1894**
Electrical Energy	**0.000297**	1.09E-05	27.10667	**0.0000**
Labor	**0.043410**	0.013302	3.263400	**0.0013**
HDI	**-0.040514**	0.019900	-2.035919	**0.0433**
R Squared	**0.843669**		*Mean Dependent Var*	2.941588
Adj.R-S	0.840843		*S.D. Dependent Var*	4.156166
F-statistic	298.6156		*Durbin-Watson stat*	2.122590
Prob(F-statistic)	**0.000000**			

Source: Data processed by the author, 2024

1. Partial Test (t-Statistic)

Based on the regression results from table 4.5 above, electrical energy has a significant positive effect with a probability value of 0.0000. The coefficient value of 0.000297, shows that when electrical energy increases by 1 gigawatt (Gwh), it will cause an increase in economic growth of 0.0297%.

Then the labor variable has a significant positive effect with a probability of 0.0013. The coefficient value of 0.04 shows that every increase in labor by 1 percent will cause an increase in economic growth by 4% in Indonesia.

HDI has a negative and significant effect with a probability of 0.0433 on the decline in economic growth. The coefficient value of -0.040514, shows that every 1 percent increase in HDI will cause a 4% decrease in economic growth in Indonesia.

2. Simultaneous Test (F Test)

The results of the panel data regression analysis in table 4.6, produce an F statistic value of 298.6156 with a *Prob (F-statistic)* value of 0.000000 <0.05. This

means that the variables of electrical energy, labor, and HDI affect economic growth in Indonesia simultaneously or together.

3. Determination Coefficient Test

The results of the regression analysis in table 4.6 show the coefficient of determination known through the value in *Adjusted R-Square*, which is 0.840843, which means that the independent variables of electrical energy, labor, and HDI affect the dependent variable, namely economic growth by 84%, while the other 16% is influenced by other variables not included in the research model.

4.5 Discussion

Based on the test results conducted by the author, it shows that the three variables studied, namely electrical energy, labor and HDI, have a significant effect on economic growth in Indonesia. The electrical energy variable has a positive and significant effect on economic growth in Indonesia, this is in line with the results of studies conducted by (Kamilla & Hutajulu, 2020; Prastika, 2023; Purim & Krismanti, 2021; Rediansyah et al., 2023; Salahuddin et al., 2018) which say that electrical energy has a positive and significant effect on economic growth because electrical energy plays a fundamental role in driving economic growth in Indonesia. access to electrical energy allows people to carry out various economic and social activities that require electricity, such as working, studying, and accessing information. This increases people's productivity and welfare, which in turn drives economic growth. the government needs to pay attention to the use of this electrical energy well Indonesia can utilize electrical energy as the main driver to achieve sustainable economic growth and improve the welfare of its people.

Labor variables also have a positive and significant effect on economic growth in Indonesia, this is in line with the results of studies from (Astawan, 2015; Nurul Fitriani, 2018; Shahid & Ali Khan, 2020; Tasrif et al, 2019; Vernanda et al., 2023) which says that labor has a positive and significant effect on economic growth in Indonesia because a skilled and competent workforce can produce more goods and services in less time. This increase in productivity will increase overall economic output. And the more people who work and have income, the purchasing power of the community will increase. This increase in purchasing power will expand the domestic market for domestically produced products and services.

In contrast to electrical energy and labor, the HDI variable has a negative and significant impact on economic growth in Indonesia, this is in line with the results of studies from (Ishak et al., 2020; Muqorrobin & M., 2020), 2020; Muqorrobin & Soejoto, 2017) HDI has a negative effect on economic growth. Although the human development index (HDI) is usually considered a positive indicator of a country's overall progress, there are certain circumstances where HDI can have an indirect negative impact on economic growth. this is due to skills mismatches and labor market imbalances, if the education system is not aligned with the skills required by the labor market, this can lead to skills mismatches. this can result in educated individuals who have difficulty finding suitable jobs, while companies face a shortage of qualified labor. So the government needs to take strategic steps to improve the quality and relevance of education and skills development, streamline bureaucratic processes, reduce unnecessary red tape, and expedite business approvals to create a more conducive environment for investment and entrepreneurship, strengthen the legal framework and institutions to ensure the protection of intellectual property rights for both domestic and foreign investors, which will boost trust and confidence in the business climate, link social security benefits to skills development and training programs, which will encourage individuals to continuously upgrade their skills and remain employable in a changing economy.

5. Conclusion

Based on the research results described above, it can be concluded that the three variables studied, namely electrical energy, labor, and the Human Development Index (HDI), have a significant effect simultaneously on economic growth in Indonesia. The positive and significant effect of the use of electrical energy and labor can be seen from their ability to increase productivity and efficiency in various production processes. The higher level of use of electrical energy and labor triggers an increase in production output, which in turn will boost the country's economic growth. On the other hand, the negative and significant effect of HDI indicates that aspects such as lack of participation in education, high dropout rates, as well as other issues related to health and accessibility of education in Indonesia may become obstacles in achieving optimal economic growth. Therefore, efforts to improve these aspects need further attention as part of a sustainable economic development strategy for Indonesia.

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