



The Effect of the Exploration and Exploitation of Oil and Gas on Indonesian Economic Growth

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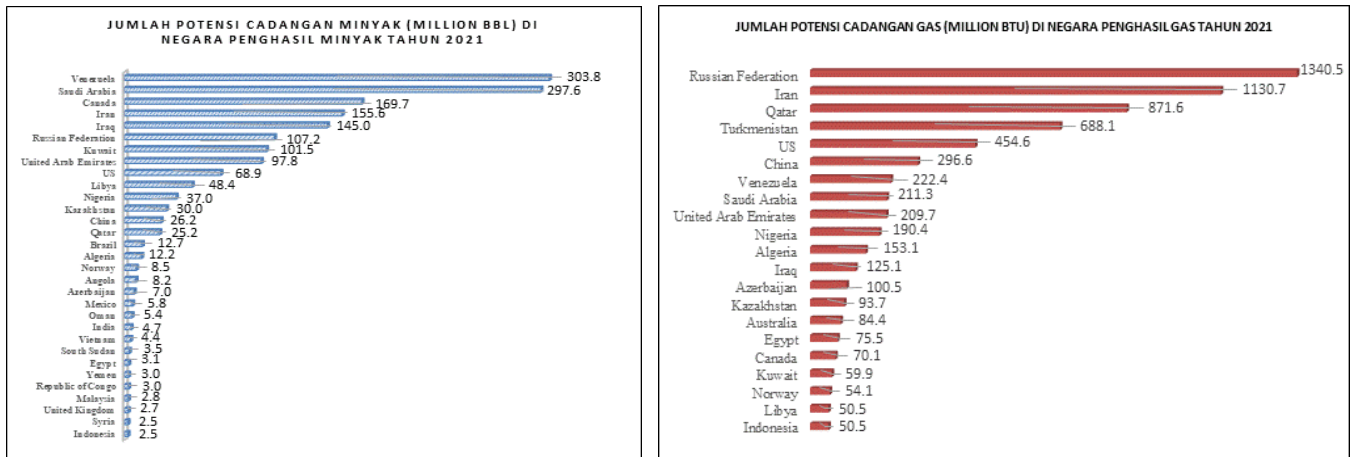
Abstract

The era of globalization and accelerated economic growth, as well as various kinds of industrial and technological transformations, are currently causing or triggering very concrete environmental problems, one of which is in terms of the growth in consumption of non-renewable energy, namely oil and natural gas. Oil and gas reserves are part of the socio-economic problems in Indonesia. It is known that oil and gas reserves are spread throughout almost all aspects of Indonesia. However, the utilization of the potential reserves of oil and natural gas resources in Indonesia is still not fully optimized. So that the potential for oil and gas reserves in Indonesia still does not fully have a more significant impact on Indonesia's economic growth. This study examines the influence of oil and gas exploration and exploitation in Indonesia on economic growth in Indonesia. This study used data on Indonesia's GDP and Exploitation and Exploitation of Indonesian Oil and Gas in a time series (1996-2021). In analyzing the data, this study used multiple linear regression. The results showed that the exploration and exploitation of oil and gas have a positive and significant effect on economic growth in Indonesia. It is hoped that this study can serve as an impetus for the government in making regulations and regulations directly related to exploration and exploitation activities both upstream and downstream of oil and gas and as encouragement and motivation for governments directly involved with upstream and downstream oil and gas activities. In addition, to issue policies in the form of continuing to prioritize technological development innovations, especially in the oil and gas sector. It is also hoped that the production results obtained from oil and natural gas exploration and exploitation activities can be more optimal and impact national energy security, state revenues, and Indonesia's economic growth.

Keywords: GDP, exploration, exploitation, oil, gas, economic growth

1. Introduction

The era of globalization and accelerated economic growth, as well as various kinds of industrial and technological transformations, are currently causing or triggering environmental problems that are so concrete, both in terms of population growth and consumption of non-renewable energy (Maryam, Mittal, & Sharma, 2017) thus it can particularly negative effects on the decline in environmental quality that causes global climate change. Various sectors in the aspect of the large-scale economy, natural resources, especially energy, are needed to be able to meet various consumption needs or in various aspects of production to support the economy. One of these energy sources is the result of oil and gas exploration and exploitation. Oil and gas reserves are part of the focus of socio-economic problems in the world, which until now have become one of the factors that strengthen inter-state linkages.

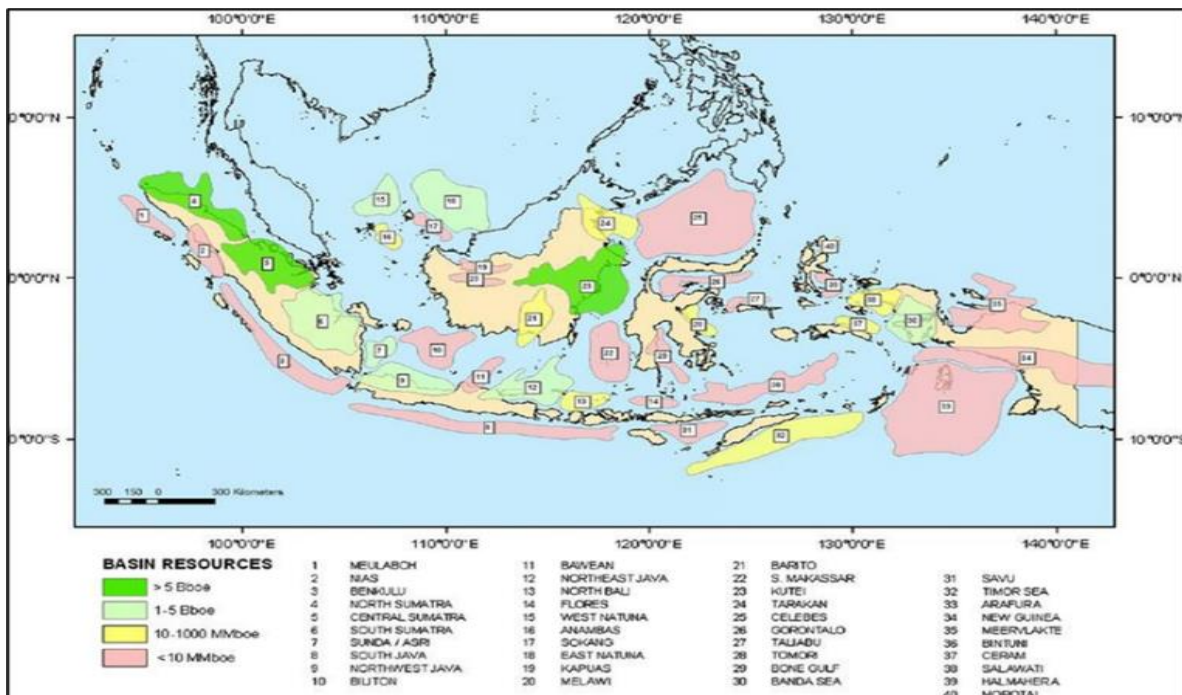


Source: Statistical Review of World Energy (2021)

Figure 1: Total Potential Oil and Gas Reserves in Oil and Gas Producing Countries in 2021

Figure 1 showed that countries with abundant oil and gas reserves tend to be developing countries. These developing countries tend to feel the curse of the abundant oil and gas mineral resource reserves themselves, such as corruption, lack of transparency to the public, lack of accountability, institutions, and bad government governance. Several recent studies have identified a strong link to oil and gas multinational companies as the source of the resource curse. This shows that some impacts and influences create a phenomenon platform as a curse for countries that have abundant reserves of natural oil and gas resources (Adams, Adams, Ullah, & Ullah, 2019).

In the current era of globalization, we hope that multinational companies as actors in exploring and exploiting oil and natural gas can carry out ethical and good practices and provide flexibility for countries producing oil and natural gas reserves in terms of independent management of mineral resources, as well as benefits that can be felt from a wealth of mineral resources (Adams, Adams, Ullah, & Ullah, 2019).



Source: Special Task Force for Upstream Oil and Gas Business Activities in Indonesia (2021).

Figure 2: Map of Indonesia's 2021 Active Oil and Gas Working Areas

Indonesia is also an exporter of energy resources to various destination countries to increase economic growth, which has an effect, especially in the industrial development sector in the ASEAN region (Sihombing, 2021). Besides that, Indonesia is also a developing country with abundant mineral resources, one of which is the potential reserves of oil and gas resources which can be seen in Figure 1. Oil and natural gas reserves are known to be spread in almost all parts of Indonesia. These conditions are predicted to contribute largely contributed to the significant acquisition of Indonesia's Gross domestic product (GDP) as well as the large benefits of obtaining corporate social responsibility (CSR) funds that will be received by the community around the Oil and Gas Work Area from the exploitation of oil

and natural gas, both onshore CAs (mainland) and offshore WK (offshore). However, the utilization of the potential reserves of oil and natural gas resources in Indonesia is still not fully optimized, so that the potential reserves of oil and natural gas in Indonesia still do not fully have a significant impact on Indonesia's economic growth (Pratama, 2016).

A study conducted by Syahnur and Diantimala (2021) stated, various aspects of the economy, such as economic inequality, environmental damage, and potential conflicts in terms of obtaining natural resources, especially illegal mining of gold and other mineral resources, conflicts also occur between land owners, workers, and from the government and investors. This means that the abundant resources in Indonesia are still unable to directly impact the welfare of the local community, even though some parties get high incomes from the exploitation of energy sources.

2. Literature Review

The economic development of a country can be measured by economic growth, which shows the growth in the production of goods and services in an economic area within a certain time interval. The industrial sector requires energy to produce goods and services. Energy sources currently widely used is energy from the oil and gas sector. In several industries, it appears that the oil and gas sector is not only used as an energy source but also as a basic material and supporting material. Fuel oil and natural gas are the main drivers for transportation and mobilization. Explanation and understanding of how economic growth can be affected by the oil and gas sector can be explained through the growth theory developed by Solow (1974). According to Solow, traditionally, economic growth is influenced by three factors: capital (land and equipment), people (labor), and technology. Solow assumes that the variables that affect the level of economic growth are sustainable (Pusat Data dan Teknologi Informasi Kementerian Energi dan Sumber Daya Mineral, 2016).

Sustainable development provides assumptions regarding the continuous availability of resources or materials. If the ecology is not maintained, environmental destruction will occur. Then, on the contrary, there will be the destruction of natural resources. Under these conditions, indeed, sustainable development cannot occur in the future. More specifically, research on sustainable development associated with energy, especially that derived from fossil fuels, plays an important role in determining productivity Garg et. Al in (Pusat Data dan Teknologi Informasi Kementerian Energi dan Sumber Daya Mineral, 2016).

Exploitation activities are part of upstream oil and gas activities carried out to extract crude oil and condensate from reservoirs in the earth's bowels to the earth's surface until the completion of the process of selling oil and natural gas to buyers (Priwataningsih & Masykur, 2012). The overall exploitation of oil and gas mining includes the main and supporting activities, namely the acquisition of oil and gas reserves as well as finalizing the completion and construction of wells, construction of facilities for transporting crude oil, condensate and gas produced, storage and processing/refining in the field operations including the processing of natural gas which is converted into liquefied gas, known as liquid natural gas (LNG) up to sales to buyers.

3. Materials and Methods

3.1. Materials

This research was conducted in Indonesia using Gross Domestic Product (GDP) as the Dependent Variable. Oil and Gas Exploration and Exploitation as Independent Variables. The data was secondary in a time series from 1996-2021 (26 years). The data used was data on Indonesia's oil production for 1996-2021, data on Indonesia's natural gas production for 1996-2021, and data on Indonesia's gross domestic product (GDP) for 1996-2021.

3.2. Methods

This study uses a quantitative descriptive data analysis approach. The analysis used is multiple linear regression analysis. The multiple regression analysis models in time-series form can be written as follows:

$$Y_t = \alpha + \beta_1 X_{1t} + \beta_2 X_{2t} + \dots + \beta_n X_t + \varepsilon_t \quad (1)$$

In this study, there are differences in units and quantities between the independent variable and the dependent variable, so they must be written in logarithmic form so that the equation can be written as follows:

$$\text{LogPDBI}_t = \alpha + \beta_1 \text{LogOILI}_t + \beta_2 \text{LogGASI}_t + \varepsilon_t \quad (2)$$

Where:

PDBI : Indonesia's gross domestic product

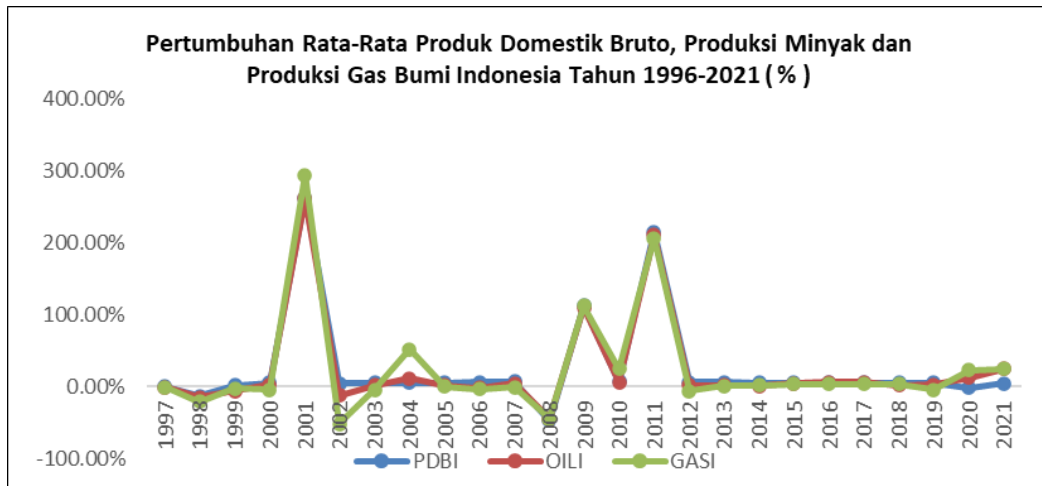
OILI : Indonesia's oil production

GASI : Indonesia's natural gas production

- α : Constant
- β : Regression coefficient
- e : Error term
- t : Indicates time series (1996-2021)

4. Results and Discussion

Indonesia's oil and gas production has a positive average growth rate. We can observe the relationship from the average positive growth rate more clearly based on Figure 3 below.



Source: Statistics Indonesia, (2022) (Data processed).

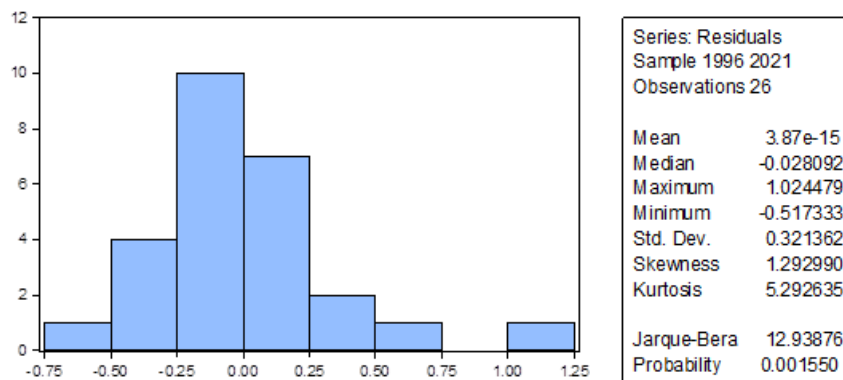
Figure 3: Average Growth of Indonesia's Gross Domestic Product, Oil Production and Natural Gas Production, 1996-2021 (%)

Figure 3 above shows a significant and close relationship between the three variables: the economic growth variable, the oil production variable, and the natural gas production variable in 1996 - 2021. We can see this and prove it by the same trend towards the growth direction of the three variables in question from 1996-2021. This means that the positive growth rate indicates that the results of oil and gas exploration and exploitation positively influence and impact Indonesia's economic growth. Of course, the positive impact is primarily for the state revenue sector and community revenue around the oil and gas working area through corporate social responsibility (CSR) funds and the construction of social facilities, which have a direct positive influence on sustainability in social and economic values (Pusat Data dan Teknologi Informasi Kementerian Energi dan Sumber Daya Mineral, 2016).

4.1 Model Testing

4.1.1 Classic Assumption Test

a) Normality Test



Source: Results of Eviews processing (2022)

Figure 4: Normality Test Results

The graphic image showed that the normality test was carried out using the Jarque-Bera test method. The probability value was 0.0015, and in this condition, the results of the analysis explain that the probability value was greater than the α value, which is 0.05, which means that the data obtained and used in the research analysis is not normally distributed.

b) Multi collinearity Test**Table 1:** Multi collinearity Test Results

Variance Inflation Factors			
Date: 12/13/22		Time: 15:49	
Sample: 1996 2021			
Include observations: 26			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LogOILI	0.097555	5162.673	1.055499
LogGASI	0.402844	20682.72	1.055499
C	91.12373	21105.91	NA

Source: Results of Eviews processing (2022)

The table above showed that the results of calculating the centered VIF value of the LogOILI and LogGASI variables was less than 10 (< 10). This means that in the multi collinearity test on the independent variables in this study.

c) Heteroskedasticity Test**Table 2:** Heteroscedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.274992	Prob. F(2,23)	0.2985
Obs*R-squared	2.594897	Prob. Chi-Square(2)	0.2732
Scaled explained SS	4.358359	Prob. Chi-Square(2)	0.1131

Source: Results of Eviews processing (2022)

The table above showed that the heteroscedasticity test used was the application of the Breuch-Pagan-Godfrey test method, which shows the probability value (Prob. Chi-Square 2) was 0.2732 or greater than the constant value α (0.05). So it can be concluded that in this study, there was no heteroscedasticity problem.

d) Autocorrelation Test**Table 3:** Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	4.270520	Prob. F(2,21)	0.0278
Obs*R-squared	7.517239	Prob. Chi-Square(2)	0.0233

Source: Results of Eviews processing (2022)

In the table above, it can be seen that for testing the autocorrelation test used was the application of the Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) Test method, which shows that for a probability value of 0.00233 it is smaller than the α value with a level of 5% (0.05), so it can be concluded that there is an autocorrelation problem.

Because two assumption tests were not met, a settlement was carried out using the first different transformation method. In order to obtain a model for multiple linear regression, namely as follows:

$$\rho \text{LogPDBI}_{t-1} = \alpha + \rho\beta_1 \text{LogOILI}_{t-1} + \rho\beta_2 \text{LogGASI}_{t-1} + \varepsilon_t \tag{3}$$

e) **First Different Normality Test**

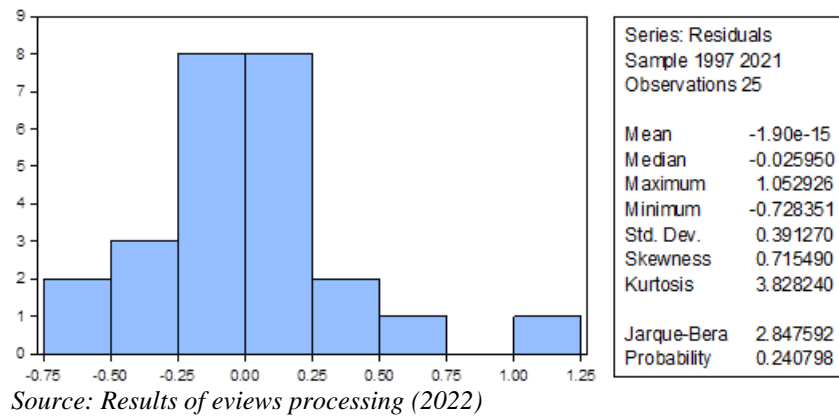


Figure 5: First Different Normality Test Results

In the graphic image and table above, it can be seen that for the normality test after the technique is carried out, the first difference method by sticking to the Jarque-Bera test method. The probability value is 0.240, and in this condition, the results of the analysis explain that the probability value was greater than the α value, which was 0.05, which means that the data obtained and used in the research analysis was normally distributed.

f) **First Different Multi collinearity Test**

Table 4: First Different Multi collinearity Test Results

Variance Inflation Factors			
Date: 12/13/22		Time: 18:27	
Sample: 1996 2021			
Include observations: 25			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Log_FD_OILI	1.074386	5078.325	1.143904
Log_FD_GASI	0.523101	2410.410	1.143904
C	33.44500	5006.457	NA

Source: Results of Eviews processing (2022)

The table above shows the results of calculating the correlation value between LogFDOILI and LogFDGASI at a VIF value smaller than 10 (< 10). This means that in the multicollinearity test on the independent variables in this study.

g) **First Different Heteroscedasticity Test**

Table 5: First Different Heteroscedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.072350	Prob. F(2,23)	0.1498
Obs*R-squared	3.963231	Prob. Chi-Square(2)	0.1378
Scaled explained SS	4.340113	Prob. Chi-Square(2)	0.1142

Source: Results of Eviews processing (2022)

The table above shows that the heteroscedasticity test used was the application of the Breuch-Pagan-Godfrey test method, which shows the probability value (Prob. Chi-Square 2) was 0.1378 or greater than the constant value α (0.05). So, it can be concluded that in this study, there was no heteroscedasticity problem.

h) First Different Autocorrelation Test

Table 16: First Different Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.264527	Prob. F(2,21)	0.3040
Obs*R-squared	2.806435	Prob. Chi-Square(2)	0.2458

Source: Results of Eviews processing (2022)

In the table above, it can be seen that for testing the autocorrelation test used was the application of the Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) Test method, which shows that the probability value of 0.2458 was greater than the α value with a level of 5% (0.05), so it can be concluded that there is no autocorrelation problem.

4.1.2 Hypothesis Test

Table 7: Estimation Results of Multiple Linear Regression Models

Dependent Variable: Log_FD_PDBI				
Method: Least Squares				
Data: 12/13/2022 Time: 18:32				
Sample: 1996 2021				
Included Observations: 25 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Log_FD_OILI	-4.318921	1.036526	-4.166728	0.0004
Log_FD_GASI	1.701681	0.723257	2.352802	0.0280
C	20.44854	5.783165	3.535873	0.0019
R-squared	0.453243	Mean dependent var		5.621105
Adjusted R-squared	0.403538	S.D dependent var		0.529150
S.E. of regression	0.408668	Akaike info criterion		1.160338
Sum squared resid	3.674205	Schwarz criterion		1.306603
Log likelihood	-11.50423	Hannan-Quinn criter		1.200906
F-statistic	9.118642	Durbin-Watson stat		1.322192
Prob(F-statistic)	0.001305			

Source: Results of Eviews processing (2022)

In the table above, we can interpret the data processing results using multiple linear regression to explain that the results of oil and gas exploration characterized by oil production and natural gas production in Indonesia have a significant influence on Indonesia's economic growth. The proof of this can, of course, be seen in the probability value achieved below 0.05 (> 0.05), both constants with a probability value of 0.0019 (> 0.05), the variable Log_FD_OILI (production results from petroleum exploration and exploitation) with a value probability of 0.0004 (> 0.05) and the variable Log_FD_GASI (production results from natural gas exploration and exploitation) with a probability value of 0.0280 (> 0.05).

Based on the estimation analysis of the F test method (structural change test) that the probability value of the F-statistic is 0.0013, which is less than 0.05, which means that simultaneously the production results from oil exploration and exploitation and production results from exploration and exploitation Natural gas has a significant impact on Indonesia's gross domestic product.

Meanwhile, in terms of estimation analysis on the T-test method (partial test), the results of the analysis can be explained in detail as follows:

- a. The constant coefficient value at 20.45 has a positive direction of influence, meaning that if the Log_FD_OILI variable (production results from petroleum exploration and exploitation) and the Log_FD_GASI variable (production results from natural gas exploration and exploitation) are considered fixed with the assumption *ceteris paribus* then the variable Log_FD_PDBI (gross domestic product) will increase by 20.45% unit;
- b. The coefficient value of the Log_FD_OILI variable was -4.31, which has a negative direction of influence. It can be interpreted that if the Log_FD_PDBI and Log_FD_GASI variables are considered fixed with the assumption of conditions *paribus*, an increase in Log_FD_OILI by one unit will reduce Log_FD_PDBI by 4.31 units. The probability value of production results from oil exploration and exploitation is below the value of α (0.05), so that production results from oil exploration and exploitation have a significant influence on Indonesia's gross domestic product.
- c. The coefficient value of the Log_FD_GASI variable is 1.70, which has a positive direction of influence, meaning that if the Log_FD_PDBI variable and the Log_FD_OILI variable were assumed to be fixed with the assumption of *ceteris paribus*, the increase would increase the Log_FD_PDBI variable by 1.170 units. The probability value of production results from natural gas exploration and exploitation is below the value of α (0.05), so production results from natural gas exploration and exploitation have a significant influence on Indonesia's gross domestic product.

While the estimation analysis on the coefficient of determination (R-Squared) can be explained that the results of the estimation analysis are that in the output results above, it can be seen that the R-Squared value was 0.453, meaning that 45.3% of the independent variable (production results from oil and gas exploration and exploitation) could explain the dependent variable (economic growth), the remaining 54.7% can be explained by other variables outside this model.

5. Conclusion

This study examines the analysis of the influence of the results of the exploration and exploitation of Indonesia's oil and gas resources on Indonesia's economic growth for 26 years, namely from 1996 to 2021. Based on the results of the research and discussion previously described, the conclusions that can be drawn from this study are as follows: 1) The results of Indonesian oil exploration and exploitation have a positive and significant impact on Indonesia's gross domestic product or economic growth. 2) The results of the exploration and exploitation of natural gas in Indonesia have a positive and significant impact on Indonesia's gross domestic product or economic growth.

The following are some suggestions that the author conveys based on some of the analyzes that have been described in this study, namely as follows:

1. The results of this study are expected to be input for the government so that every upstream and downstream oil and gas business activity can have a more optimal impact, especially on state revenues and the economy of local communities around the oil and gas working area.
2. The results of this research are expected to be an impetus for the government in making regulations and regulations directly related to exploration and exploitation activities both upstream and downstream of oil and gas so that they are better monitored and have a direct impact on the economy of the surrounding community.
3. The upstream and downstream oil and gas industrial activities are expected to be able to further stimulate the communities around the oil and gas working areas, to be more productive and creative in developing individual and group potentials and to create conditions that are mutually beneficial and have a direct impact between both parties, namely cooperation contract contractors (KKKS) who are appointed as operators in an oil and gas work area and the surrounding community who are around the oil and gas work area so that the workers used are productive local workers who are around the work area the oil and natural gas.
4. It is hoped that the results of this research can be an impetus and motivation for governments directly involved with upstream and downstream oil and gas activities to issue policies in the form of continuing to prioritize technological development innovations, especially in the oil and gas sector with the hope that production results will be obtained from these activities. Exploration and exploitation of oil and natural gas can be more optimal and can have a more significant impact on national energy security, state revenues, and Indonesia's economic growth.
5. For further research, it is possible to see the effect of the results of oil and gas exploration and exploitation on economic growth in oil and gas-producing areas.

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