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# The Autoregressive Distributed Lag Method in Predicting Aceh's Economy Post-Special Autonomy Fund

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ABSTRACT

Economic growth is a process that reflects the dynamic aspects of an economy that describes the movement of the economy from time to time. Economic growth is one indicator of the success of the implementation of development that can be used as a macro benchmark and can be reflected in changes in Gross Regional Domestic Product (GRDP) in an economy. area. This study was conducted to determine the effect of the Revenue Sharing Fund (DBH) and the Additional Revenue Sharing Fund (TDBH) of oil and gas on the Acehnese economy after the Special Autonomy Fund (SAF) ended from an Islamic economic perspective. The type of research used in this research is quantitative. The method used in this study is the Autoregressive Distributed Lag (ARDL) model. The data used in this study is secondary data sourced from related agencies. The results of this study using the ARDL model show that partially the oil and gas DBH has a negative and significant effect, while the oil and gas TDBH has a positive and significant impact on the Acehnese economy after the SAF ends.

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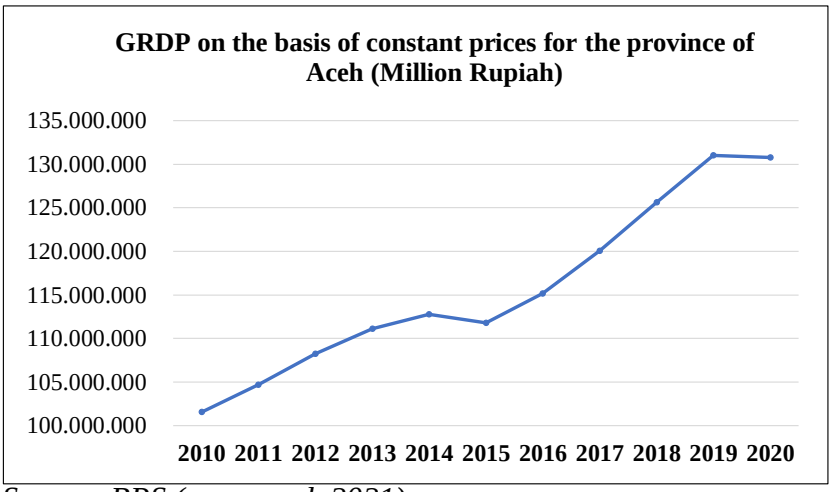
## 1. INTRODUCTION

Economic growth is a process that reflects the dynamic aspects of an economy that describes the movement of the economy from time to time. One of the main forces influencing economic growth is the factor of production, which shows the ups and downs of the rate of economic growth as a consequence of changes in the factors of production. Many factors that affect economic growth can be in the form of economic and non-economic factors. Economic factors that affect economic growth include natural resources, capital accumulation, organization, technological progress, division of labor, and scale of production. Meanwhile, non-economic factors that affect economic growth include social factors, qualitative human resources factors, and political and administrative factors (Susanti et al., 2017).

Economic growth is one indicator of the success of development implementation that can be used as a macro benchmark and can be reflected in changes in Gross Regional Domestic Product (GRDP) in a region. GRDP is defined as the amount of added value generated by all business units in a region or as the total value of final goods and services produced by all economic units in a region. The higher the economic growth of an area, the higher the economic activity of the area. Regional economic growth is expressed as GRDP growth at constant prices. An illustration of the rate of increase in GRDP in Aceh Province which is calculated on the basis of 2010 constant prices in Aceh Province for the period 2010 to 2020 is shown in the Figure 1.

SAF are funds allocated to finance the implementation of special autonomy in a region. Based on Article 179 paragraph (2) of Law No. 11 of 2006 concerning the Government of Aceh, SAF is a source of revenue for the Government of Aceh to finance development,

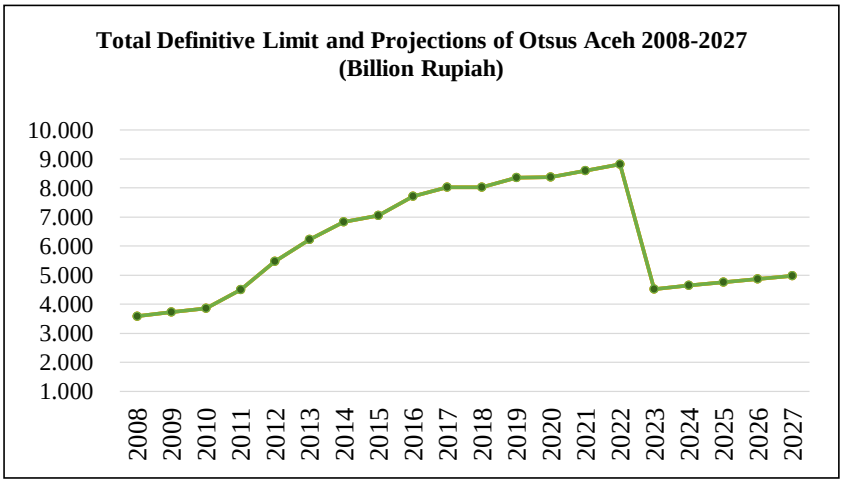
particularly infrastructure development and maintenance, economic empowerment of the population, poverty alleviation, as well as financing for education, society and health.




*Source: BPS (processed, 2021).*

**Figure 1.** GRDP on the basis of constant prices for the province of Aceh for the 2010-2020 period.

Local governments at the district/city level are given broad authority to carry out all public tasks in planning, implementing, monitoring, monitoring and evaluating laws that regulate the importance of community empowerment to enable broad welfare improvements. The following is the total definitive ceiling and projected SAF for Aceh in 2008-2027.

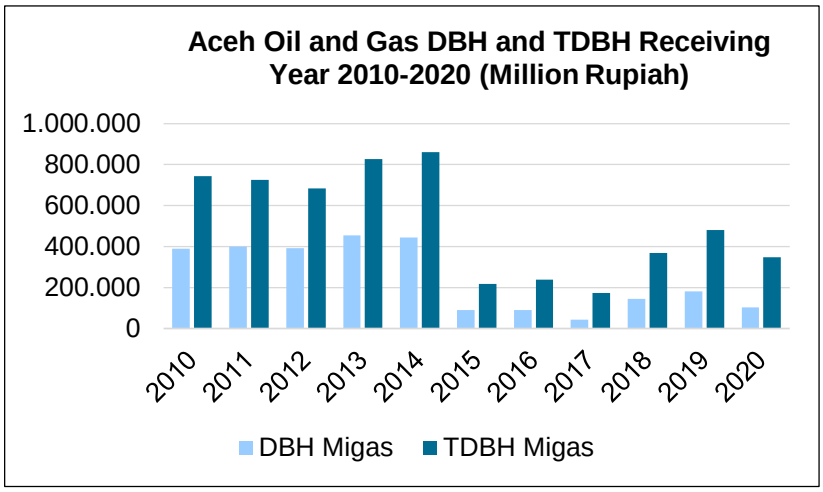



*Source: Bappeda (processed, 2021).*

**Figure 2.** Total Definitive Upper Limit and Projection of Aceh Special Autonomy in 2008-2027.

In addition to receiving SAF, Aceh with its specificity as regulated in Law No. 11 of 2006 concerning the Government of Aceh also receives oil and gas DBH and TDBH. Oil and gas DBH are funds originating from state revenues originating from oil and gas mining natural resources from the relevant regency/city and provincial area after deducting the components of taxes and other levies (Ministry of Finance of the Republic of Indonesia, 2008). Meanwhile, oil and gas TDBH is an additional revenue-sharing fund given to the Aceh Province based on the law regulated in Article 181 paragraph (3) letters a and b number 11 of 2006 concerning the Aceh Government. Oil and gas TDBH are not accepted by other provinces except Papua and West Papua. Thus, for the results of oil and gas mining within the territory of Aceh's

authority, in addition to receiving oil and gas DBH in the same amount as other oil and gas-producing provinces, they also receive oil and gas TDBH. The following are oil and gas DBH and TDBH receipts for the Aceh Province obtained over a period of 11 years from 2010-2020.




*Source: Bappeda (processed, 2021).*

**Figure 3**. Aceh Province Oil and Gas DBH and TDBH Revenue 2010-2020.

Currently, both the oil and gas DBH and TDBH are not reliable because they are very small. Aceh has experienced the heyday of oil and gas production from 1976 to the 2000s when the liquefied natural gas refinery PT. Arun. The Arun refinery processed natural gas supplied by Mobil Oil at that time. Finally, Mobil Oil changed its name to Exxon Mobil and ended the Arun field contract in 2018. Unfortunately, the heyday of Aceh's oil and gas sector cannot be enjoyed by the Acehnese people because there is no law that regulates it. All agricultural products in the regions are taken to the center, then distributed to local governments in very small amounts. At that time, Aceh received less than 1% per year if it was calculated from the oil and gas produced by Aceh. Aceh only receives development funds under a "financial balance" scheme. With this scheme, it is clear that Aceh always receives a very small amount every year, because the concept of distributing funds under a balancing scheme is based on population. Aceh, which at that time (under 2006) had a population of more than 3 million people, would always receive very little development funds from the Central Government.

The enactment of law number 11 of 2006 concerning the Government of Aceh, Aceh was given the right to manage oil and gas mining within Aceh's jurisdiction from land to 12 nautical miles. To facilitate this management, the Government and the Government of Aceh formed the Aceh Oil and Gas Management Agency (BPMA) as an agency that autonomously manages oil and gas fields in Aceh, starting from survey, exploration, exploitation and production. When compared nationally, BPMA is the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas) at the center. SKK oil and gas is an agency that manages upstream oil and gas nationally. After the birth of BPMA, SKK oil and gas manages the national upstream oil and gas minus Aceh, and the upstream oil and gas in Aceh is managed by BPMA. Perhaps it can be said that BPMA is a miniature of the oil and gas SKK at the center.

The problem is that after the end of SAF receipts in 2027, starting from 2028 Aceh will no longer receive SAF from the Central Government, this means that the sources of funds for Aceh's development will be drastically reduced. If Aceh does not have other sources of funds, it will be difficult for Aceh to finance its development. Therefore, Aceh must optimize the oil and gas DBH and TDBH from Aceh's oil and gas mining production.

## 2. METHODS

### 2.1. Economic growth

Economic growth is one indicator of the success of economic development. Welfare and economic development are determined by the growth rate represented by changes in national production. Changes in output in an economy is a short-term economic analysis (Ma'ruf et al., 2008). According to Adam Smith, the government has three main functions to support the economy, namely: (1) maintaining national security and defense, (2) administering the judicial system, and (3) providing goods that are not produced by the private sector, infrastructure and public facilities. The government needs a budget to carry out its functions properly, and the mechanism for implementing the budget is implemented through fiscal policy. Fiscal policy reflects the size, growth rate and budget structure of the government adopted by a country.

Gross domestic product growth can be used as a measuring tool to see the structure of the economy. According to Arifin & Gina (2009), the indicators used to measure a country's economic growth are based on the level of gross domestic product (GDP). There are several reasons to use GDP as a measure of economic growth, namely:

a. GDP is calculated based on the total added value generated by all productive activities in the economy. This increase in GDP reflects an increase in wages for the factors of production used in the production process.
b. GDP is calculated based on the concept of circulation flow, in particular how to calculate GDP, including the value of the product produced during a certain period. This calculation does not include calculations for the previous period. Using the flow concept in GDP calculations allows this year's output to be compared with the previous year.
c. The boundary of the area where GDP is calculated is the country (domestic economy). This helps to measure the extent to which the government's economic policies are being implemented as well as to stimulate economic activity in the country.

### 2.2. SAF

Suparmoko (2002) states that, “Special autonomy is a special authority given to regions in regulating and managing regional interests based on people's aspirations. With the enactment of autonomy, the regional government at the Regency/City level is given broad authority in carrying out all government affairs, starting from planning, implementation, supervision, control and evaluation. The autonomy law underscores the importance of community empowerment to ensure that broad welfare improvements fulfill special autonomy (Yuwono, 2005).

This SAF was first received by Aceh in 2008 after the promulgation of Law No. 11 of 2006 concerning the Government of Aceh in 2006. As regulated in Law No. 11 of 2006 Article 183 concerning the Government of Aceh, which regulates finances, regulates SAF with details as follows:

a. SAF represents and transfers the central government to the Aceh government.
b. Intended to finance development, in particular:
    1) Development and maintenance of infrastructure,
    2) Community economic empowerment,
    3) Poverty alleviation,
    4) Education, social and health funding.
c. SAF is valid for a period of 20 years, with details:
    1) The first year up to the 15th year the amount is equivalent to 2% of the ceiling of the National General Allocation Fund (DAU),
    2) The 16th to 20th years is equivalent to 1% of the National General Allocation Fund (DAU) ceiling.
d. This development regulation applies in the Aceh region in accordance with the boundaries of the Aceh Province as determined by the provisions of laws and regulations.

e. The development agenda as outlined in the Aceh Province Development Program, starting from the districts/cities in Aceh, shows a balanced development between districts/cities.
f. Management SAF is administered to the provincial government of Aceh.

These points mean that since Aceh received SAF for the first time in 2008, from 2008 to 2022, for fifteen years Aceh received SAF of 2% of the National DAU ceiling. Meanwhile, from 2023 to 2027, for the next five years, Aceh will only receive 1% of SAF from the National DAU ceiling. Meanwhile, since 2028, Aceh will no longer receive the source of SAF from the Central Government, this means that the source of funds for Aceh's development will be drastically reduced.

### 2.2. Oil and Gas Revenue Sharing Fund and Additional Oil and Gas Revenue Sharing Fund

Revenue Sharing Fund (DBH) for oil and gas SDA is a fund originating from state revenues sourced from natural resources of oil and gas mining from the regency/city and provincial area concerned after deducting the components of taxes and other levies (Ministry of Finance of the Republic of Indonesia, 2008).

Clause 1 Verse (15) Aceh Qanun No. 2 of 2008 states that the Additional Oil and Gas Revenue Sharing Fund (TDBH) is a fund sourced from APBN revenues which is part of the Aceh Government's revenue. Thus, oil and gas TDBH is one of the regional revenues transferred by the central government to oil and gas producing regions in the context of implementing regional autonomy and fiscal decentralization, as well as a form of central and regional fiscal balance.

### 2.3. Allocation of Oil and Gas DBH and TDBH in terms of Islamic Economics

In general, a Muslim will always perform worship to Allah SWT in every move he takes. They are only active in order to gain the pleasure of Allah. As in managing these oil and gas DBH and TDBH funds, of course, they must be managed fairly in taking rights resulting from oil and gas mining. Because Islam places it in the concept of ownership and management of natural resources. Islam not only recognizes private property, but also ensures the widest and equitable distribution of wealth through religious institutions and prescribed moral warnings. Islam clearly establishes the correct concept of ownership.

### 2.4. Research Methods

This research was obtained based on data obtained from related agencies, namely the Central Statistics Agency (BPS), the Aceh Oil Management Agency (BPMA) and the Regional Development Planning Agency (Bappeda). The results obtained from these agencies are quantitative because they are real data and data with a very high approach. This study aims to see the effect of oil and gas DBH and TDBH on the economy in Aceh Province after the end of SAF using the period from 2010-2020.

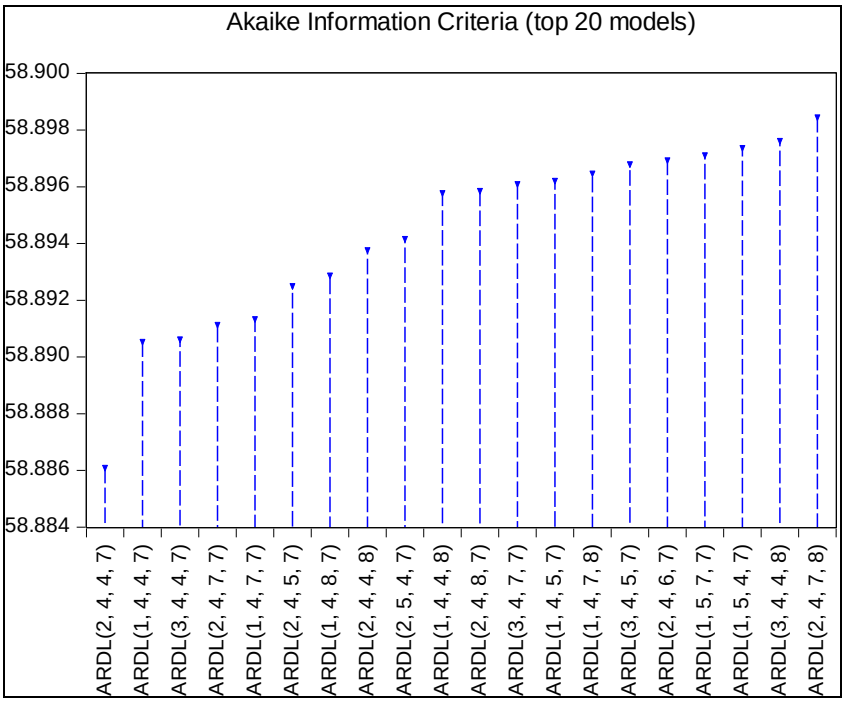
The type of data in this study uses time series data. Time series data is a type of data consisting of variables that are collected chronologically over a certain period of time. Sources of data used in this study is secondary data. The data in this study displays figures such as the number of economic growth rates in Aceh Province in a given year and the amount of oil and gas DBH and TDBH received by Aceh. The sources of these data are obtained from the Central Statistics Agency (BPS), the Aceh Oil and Gas Management Agency (BPMA) and the Regional Development Planning Agency (Bappeda).

The analytical technique used to analyze the research data obtained is by using the Autoregressive Distributed Lag (ARDL) method. This method is used to estimate the effect of SAF, oil and gas DBH, and oil and gas TDBH on the economy in Aceh Province. To analyze this research, there are several analytical steps which include stationarity test, test,

determination of lag length, ARDL model test, cointegration Bound Testing and autocorrelation test.

## 3. RESULT AND DISCUSSION

Economic growth is the development of economic activity that leads to an increase in goods and services produced by the community and an increase in people's welfare (Sukirno, 2010). This economic growth can be seen from the level of Gross Regional Domestic Product (GRDP). Because in principle, economic growth can be understood as an increase in national income for goods and services produced within a year. The following are the results of tests that have been carried out using the Eviews software.




*Source: Eviews (processed, 2021).*

**Figure 4**. Optimum Lag Length Results.

### 3.1. Stationary Test

This stationary test is carried out to ensure that the data does not have a unit root so as not to produce spurious regression. This research will conduct a unit root test using Augmented Dickey-Fuller (ADF) which is processed using Eviews software.

**Table 1**. Unit Root Test Results.

| ADF | | | |
|---|---|---|---|
| **Variable** | ***P Value*** | **Critical Value α = 5%** | **Decision** |
| GRDP | 0.0123 | 0.05 | Stationary |
| SAF | 0.0000 | 0.05 | Stationary |
| DBH | 0.0003 | 0.05 | Stationary |
| TDBH | 0.0000 | 0.05 | Stationary |

*Source: Eviews (processed, 2021).*

Based on the table, it can be seen that the probability value of all variables is smaller than the critical value, so it can be concluded that the data is stationary. However, the variables of GRDP, DBH, and TDBH have been stated to be stationary at the level level,

while the SAF variable is stated to be stationary at the first difference level.

### 3.2. Lag Length Determination Test

This lag selection is carried out to find out which model is the best from the data in this study. The best lag selection is done by looking at the Akaike Information Criteria (AIC) value of which model produces the smallest value. The results of the optimum lag test can be seen in the Figure 4.

Based on the picture above, there are 20 models. However, the model that is suitable for the ARDL model in this study is ARDL (2,4,4,7) because it has a smaller AIC value compared to other ARDL models, which is 58,8861. So it can be concluded that the best model for logarithmic transformation data is the ARDL model (2,4,4,7).

ARDL estimation has the advantage of producing consistent estimates with good long-term coefficients regardless of whether the explanatory variables or regressors are I(0) or I(1). The following are the results of the estimation of the ARDL model parameter coefficients (2, 4, 4, 7) in this study which have been summarized in the Table 2.

**Table 2**. Model Parameter Estimation.

| Variable | Coeffisient | Parameter | *P Value* |
|---|---|---|---|
| $LGRDP_{(t-1)}$ | $C_1$ | 0,987214 | 0,0000 |
| $LGRDP_{(t-2)}$ | $C_2$ | -0,118960 | 0,0638 |
| LSAF | $C_3$ | 17,79961 | 0,0031 |
| $LSAF_{(t-1)}$ | $C_4$ | -36,28132 | 0,0000 |
| $LSAF_{(t-2)}$ | $C_5$ | 22,60533 | 0,0071 |
| $LSAF_{(t-3)}$ | $C_6$ | 14,04166 | 0,0553 |
| $LSAF_{(t-4)}$ | $C_7$ | -17,94331 | 0,0045 |
| LDBH | $C_8$ | 59,07264 | 0,0000 |
| $LDBH_{(t-1)}$ | $C_9$ | -47,11216 | 0,0000 |
| $LDBH_{(t-2)}$ | $C_{10}$ | 7,441837 | 0,4847 |
| $LDBH_{(t-3)}$ | $C_{11}$ | -16,05051 | 0,1177 |
| $LDBH_{(t-4)}$ | $C_{12}$ | 21,88109 | 0,0066 |
| LTDBH | $C_{13}$ | -14,26435 | 0,4038 |
| $LTDBH_{(t-1)}$ | $C_{14}$ | 24,26159 | 0,1614 |
| $LTDBH_{(t-2)}$ | $C_{15}$ | -36,26845 | 0,0171 |
| $LTDBH_{(t-3)}$ | $C_{16}$ | -25,11032 | 0,0625 |
| $LTDBH_{(t-4)}$ | $C_{17}$ | 41,33606 | 0,0050 |
| $LTDBH_{(t-5)}$ | $C_{18}$ | -17,57825 | 0,2914 |
| $LTDBH_{(t-6)}$ | $C_{19}$ | 35,52693 | 0,0415 |
| $LTDBH_{(t-7)}$ | $C_{20}$ | -50,87773 | 0,0029 |
| C | $C_{21}$ | 1.378813 | 0.4041 |
| ***R Squared*** | 0,884084 | ***Akaike info criterion*** | 58,88688 |
| ***Adj R-Squared*** | 0,873780 | ***Schwarz criterion*** | 59,18612 |
| ***F Statistic*** | 85,80307 | ***Hannah-Quinn criter.*** | 59,00737 |
| ***Prob (F Stat)*** | 0,000000 | ***Durbin-Watson Stat*** | 2,070769 |

*Source: Eviews (processed, 2021).*

Based on the estimation results of the parameter coefficients from the ARDL (2, 4, 4, 7) model above, it can be concluded that GRDP has an effect on the current GRDP value. If the GRDP in the first period increases by 1%, the current GRDP value will increase by 98.72%. Furthermore, the SAF also has an influence on GRDP. If the SAF for the first period increases by 1%, the GRDP will increase by 36.28%. Likewise with the DBH variable, if the oil and gas DBH in the first period has increased by 1%, the current GRDP will increase by 47.11%.

### 3.3. Cointegration Test with Bound Test

This Bound Test is conducted to determine whether there is a long-term relationship between the variables studied. In this approach, cointegration can be seen from the value of F Statistics with a critical value that has been compiled by Pesaran (2001). The results of the Bound Test on the ARDL model (2, 4, 4, 7) with a significance level of 1%, 2.5%, 5% and 10% are shown in the Table 3.

**Table 3.** Bound Test Result.

| ***Test Statistic*** | ***Value*** | **K** |
|---|---|---|
| ***F Statistic*** | 5,680243 | 3 |
| ***Critical Value Bounds*** | | |
| ***Significance*** | **I0 *Bound*** | **I1 *Bounds*** |
| 10% | 2,72 | 3,77 |
| 5% | 3,23 | 4,35 |
| 2,5% | 3,69 | 4,89 |
| 1% | 4,29 | 5,61 |

*Source: Eviews (processed, 2021).*

The results of the cointegration test using the Bound Test approach in the table above show the F statistic of 5.680243. The F value of this statistic is greater than the upper bound value at a significance level of 5%, which is 4.35. After concluding that there is a long-term relationship between the variables, the next step is to determine the parameter coefficients for the long-term equation. Then the results of the long-term estimation can be presented in the Table 4.

**Table 4**. Long-Term Estimation Results.

| ***Variable*** | ***Coefficient*** | ***Std. Error*** | ***t-Statistic*** | ***Prob*** |
|---|---|---|---|---|
| **C** | 1.378813 | 1.65E+12 | 0,0000 | 0,0000 |
| **PDRB** | 0,118960 | 0,063866 | 1,862656 | 0,0638 |
| **SAF** | 17,94331 | 6,259693 | 2,866483 | 0,0045 |
| **DBH** | -21,88109 | 7,976776 | -2,743100 | 0,0066 |
| **TDBH** | 50,87773 | 16,92321 | 3,006387 | 0,0029 |

*Source: Eviews (processed, 2021).*

Based on the estimation results above, the interpretation of the long-term estimation results obtained is as follows.

1. For the SAF variable based on the estimation results carried out above, the coefficient value with a positive sign is 17.94331 with a probability value of 0.0045. Thus it can be concluded that the probability value on the SAF variable is smaller than the significant level = 0.05, which is 0.0045 <0.05. This means that the SAF variable has a positive and significant effect on the GRDP variable.

2. The oil and gas DBH variable obtains a negative coefficient value of -21.88109 with a probability value of 0.0066. Thus, it can be concluded that the probability value of the oil and gas DBH variable is smaller than the significant level = 0.05, which is 0.0066 <0.05. This means that the oil and gas DBH variable has a negative and significant effect on the GRDP variable.
3. The oil and gas TDBH variable has a positive coefficient value of 50.87773 with a probability value of 0.0029. Thus it can be concluded that the probability value of the oil and gas TDBH variable is smaller than the significant level = 0.05, which is 0.0029 <0.05. This means that the oil and gas TDBH variable has a positive and significant effect on the GRDP variable.

### 3.4. Autocorrelation Test

One method that can be used to detect autocorrelation problems is to use the Breusch-Godfrey method. The following Table 5are the results of the test.

**Table 5**. Autocorrelation Test Results

| ***P Value*** | **Critical Value α = 10%** | **Decision** |
|---|---|---|
| 0,4356 | 0,1 | No autocorrelation |

*Source: Eviews (processed, 2021).*

Based on Table 5, the autocorrelation test using the Breusch-Godfrey Test can be concluded that there is no autocorrelation because the results obtained indicate that the p-value of 0.4356 is stated to be greater than (0.4356> 0.1), which means H0 accepted and the conclusion is that there is no autocorrelation in the residuals.

### 3.5. Discussion

1. The Effect of the SAF on Economic Growth
   Based on the test results using the ARDL model analysis in this study, it shows that partially the SAFs have a positive and significant effect on economic growth. The effect is unidirectional (positive) indicating that every one percent increase in the SAF variable (X1) will result in an increase in economic growth (Y) of 17.94331. This means that the SAF has a positive and significant impact in the long term to increase economic growth in Aceh Province. Thus, it can be said that this is in accordance with the hypothesis in this study.
2. The Effect of Oil and Gas Revenue Sharing Funds on Economic Growth After the SAF Ends
   Based on the results of tests that have been carried out previously using ARDL analysis, it shows that the oil and gas DBH has a negative and insignificant effect on economic growth with the probability value on the oil and gas DBH variable which shows it is smaller than the significant level = 0.05, which is 0.0066 <0.05. Each increase in the oil and gas DBH variable increases by one percent, it results in a decrease in the economic growth variable by 21.88109. Thus, it can be concluded that the oil and gas DBH cannot be used as a fund to replace the SAF when the SAF expires.
3. The Effect of Additional Oil and Gas Revenue Sharing Funds on Economic Growth After the SAF Ends
   Oil and gas TDBH shows that oil and gas TDBH has a good effect in the long term on economic growth, according to the test results which show that oil and gas TDBH has a positive and significant effect on economic growth with the probability value of the oil and gas TDBH variable being smaller than the significant level = 0 .05, i.e. 0.0029<0.05. Each variable TDBH oil and gas increased by one percent, it resulted in an increase in the variable

economic growth of 0.0029. Thus, it can be concluded that the oil and gas TDBH can be used as a guide to replace the SAF when the SAF expires in 2027.

## 4. CONCLUSION

Based on the test results using the ARDL model analysis in this study, it shows that partially the SAF has a positive and significant effect on economic growth. Based on the test results using the ARDL model analysis in this study, it shows that partially the oil and gas DBH has a negative and significant effect on economic growth after the SAF ends. Based on the test results using the ARDL model analysis in this study, it shows that partially the oil and gas TDBH has a positive and significant effect on economic growth after the SAF ends. In sharia economics, allocating oil and gas DBH and TDBH is to control the use of wealth. DBH and TDBH of oil and gas should be managed fairly and distributed equally to those who have the right to use these funds based on the concept of ownership in Islam where natural resources must be used properly by humans. It is hoped that the Aceh Oil and Gas Management Agency (BPMA) will be able to further optimize and increase production of oil and gas fields currently operating in Aceh Province to be able to produce more oil and gas. And it is also hoped that BPMA will see opportunities for other oil and gas field locations that are possible to be used as new oil and gas fields, so that they can increase DBH and TDBH revenues from the oil and gas sector and also increase economic growth in Aceh Province. This research certainly has limitations in various aspects, including the lack of literacy regarding variables, the literacy obtained in this study only comes from the law and several studies that have been conducted previously. For researchers who want to develop this research, they can obtain more accurate results by adding the types of variables, increasing the sample by increasing the research period, and expanding the research subject.

## ACKNOWLEDGMENTS

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