Analysis of the Influence of Port Performance, Palm Oil Exports and Infrastructure on Economic Growth of Aceh Singkil

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Abstract
This study aims to analyze the influence of port performance, palm oil exports, and logistics infrastructure on economic growth in Aceh Singkil Regency. Although the area has great potential in the oil palm plantation sector and is supported by the presence of a port, its economic growth has not reached its optimal level due to limited infrastructure and logistics efficiency. This study uses a Vector Autoregression (VAR) approach with five endogenous variables, namely Gross Regional Domestic Product (GDP), Port Performance Index (IKP), Palm Oil Export Value (NES), Palm Oil Export Permit Volume (VIES), and Logistics Infrastructure Index (IIL), with an observation period of 2015–2024. The results showed that most variables had the greatest contribution to their own historical value, but there was a significant interaction between them. VIES made a dominant contribution to NES of 81.31%, showing the strong relationship between licensing regulations and export realization. GDP was significantly influenced by IIL with a contribution of 18.02%, indicating the importance of logistics infrastructure in encouraging regional economic growth. In addition, IIL is also influenced by IKP, which reflects the close relationship between port feasibility and logistics efficiency. These findings underscore the importance of strengthening logistics infrastructure and optimizing port functions as a regional economic development strategy based on commodity excellence. Investment in the logistics sector and transportation systems is a crucial factor in increasing export competitiveness and supporting inclusive and sustainable economic growth.

Keywords: Economic Growth, Palm Oil Exports, Ports, Logistics, VAR, Aceh Singkil

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Introduction

Aceh Singkil Regency is one of the 18 districts in Aceh Province, which is located at the southern tip of Aceh Province on the island of Sumatra, which blooms from South Aceh Regency, and part of its area is in the Gunung Leuser National Park area. This district was formed in 1999, namely with the issuance of Law No. 14 of 1999 dated April 27, 1999. The geographical location of Aceh Singkil Regency is at the position of 2002'-2027'30" North Latitude and 97004'-97045'00" East Longitude. Gross Regional Domestic Product per capita is the result of sharing between GDP and the total population, while Regional Income per capita is obtained from the revenue of the division between the Net Regional Domestic Product (PDRN) on the cost of factors of production (GDP that has been deducted from depreciation and indirect taxes) and the population, Throughout the period 2009 – 2011, the GDP per capita and regional income per capita of Aceh Singkil Regency on the basis of the prevailing price showed a fairly high growth, However, when viewed based on constant prices, the growth rate is relatively low, even in 2009 the growth of per capita income in Aceh Singkil Regency experienced positive growth to 1.82 percent, in 2010 the growth of per capita income increased to 2.29 percent and in 2011 continued to increase to 2.68 percent. The improvement in per capita income on a constant price basis gives a good indication for the economy of Aceh Singkil Regency which means that at least the community can still adjust to the increase in prices with the increase in income (Kurniawan, 2016).

Local economic growth is a key benchmark in seeing the progress of a region. In Aceh Singkil Regency, economic growth inequality is in the spotlight, especially in the development of vital sectors such as ports, palm oil exports, and logistics infrastructure. Despite having a strategic location with great marine and agricultural potential, this area still faces obstacles in improving port efficiency, palm oil supply chains, and logistics facilities. Even though it has ports and mainstay commodities such as palm oil, its economic growth has not reached its maximum potential. In fact, about 72% of economic activity here rests on the agricultural and plantation sectors, including palm oil, but its economic value is not optimal due to a lack of infrastructure support. The problem of economic growth can be seen as a macroeconomic problem in the long run. From one period to another the ability of a country to produce goods and services will increase. This increased ability is due to the fact that production factors will always experience an increase in quantity and quality. Investment will increase the number of capital goods. The technology used is evolving. In addition, the workforce increases as a result of population development, and work experience and education add to their skills (Nasution & Yusuf, 2018).

Unfortunately, the performance of the port of Aceh Singkil is still not optimal and optimal. This shows that there is a gap between the potential of existing resources and the economic growth that is realized, so a comprehensive solution is needed from various aspects. To overcome this, we need to understand in depth how various factors are interrelated, especially the performance of port infrastructure, the dynamics of palm oil exports, and the logistics system that supports economic activities in the region. Although economic growth is an important benchmark for prosperity in Indonesia, the path to progress is often hampered by complex challenges (Rakhman et al., 2020).

Port development is currently the main issue in encouraging the competitiveness of the national and regional economy. A port according to Law Number 17 of 2008 concerning Shipping is a place consisting of land and/or waters with certain boundaries as a place for government activities and business activities that are used as a place for ships to dock, board and unload goods, in the form of terminals and ship berths equipped with shipping safety and security facilities and port supporting activities as well as as a place of transfer intra-mode of transportation. Ports can also support the local and national economies, encourage industrial development, provide jobs – both directly and indirectly – for local residents, and generate

income for local governments (Mandasari et al., 2017). The role of ports is vital in supporting trade activities, reducing logistics costs, and smoothing supply chains. Thus, the port serves as a driver of economic growth. In this study, port performance assessed using the Port Performance Index (IKP) is one of the main variables. When ports operate optimally, logistics efficiency increases and the distribution of goods becomes faster, which ultimately has a positive impact on local economic growth.(Syabri & Widyanarko, 2017). According to (Dhista Ayunia et al., 2020) Improving port performance has proven to make a great contribution to regional economic development, especially in export-dependent regions. The port performance indicators include loading and unloading speed, completeness of facilities, and the length of the ship's waiting time.

Palm oil is one of the mainstay commodities in Aceh Singkil Regency, so its exports are one of the focuses in this study. The value and volume of palm oil export permits show the regional economic potential that can boost people's income. positive relationship between palm oil exports and economic growth, although the impact is strongly influenced by trade and downstream policies. In addition, the volume of export permits reflects government regulations that also determine the realization of exports (Pasaribu et al., 2021). Unfortunately, in Aceh, the low port activity shows that the use of export permits is not optimal (Revika Nurpitaloka, 2022).

Export activities are a trading system by exporting goods from within the country and out of the country by complying with applicable regulations. Exports are the total goods and services sold by one country to another, including goods, insurance, and services in a given year (et al., 2018). Palm oil exports and the volume of export permits reflect the direct contribution of this commodity to regional foreign exchange earnings. Below is table data showing the variables of palm oil exports and the volume of export permits, especially for Aceh Singkil Regency.

Table 1. Palm Oil Exports & Volume of Export Permits Aceh Singkil 2015-2024

Year	Palm Oil Export Value (Billion IDR)	Permission Volume Palm Oil Exports (Tons)
2015	450	320.000
2016	460	330.000
2017	470	335.000
2018	480	340.000
2019	490	345.000
2020	480	350.000
2021	500	355.000
2022	510	360.000
2023	520	365.000
2024	530	370.000

Source : https://disbun.acehprov.go.id

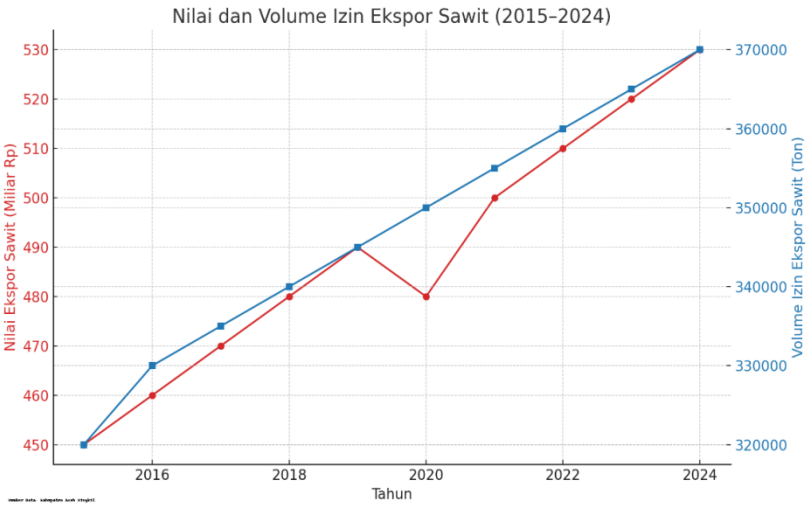

Figure 1. Aceh palm oil exports and export permit volume 2015-2024

This graph shows the trend in the value and volume of palm oil export permits from 2015 to 2024. During this period, there was a considerable increase in both value and export volume. The value of exports, which is calculated in billions of rupiah, continues to experience stable growth, indicating that market demand for this commodity continues to increase. Meanwhile, the volume of export permits (in tonnes) also followed the same trend, although there were some fluctuations in certain years. This proves that the palm oil industry remains resilient in the face of various challenges and continues to grow until 2024, showing the great potential that is still open in this sector. This data is sourced from Aceh Singkil Regency, providing clear insights into market dynamics over the past almost 10 years. With the successful control of export and import policies, the economy will have a long-term positive impact. For example, the creation of new jobs, the strengthening of the economic structure, and eventually the economy will develop to a new level. However, if it is the opposite, there will be many negative impacts borne by the economy, such as high dependence on imports, declining competitiveness of domestic businesses in the international arena, and negative consumerism(Nasution et al., 2024).

In addition to demand factors, logistics infrastructure support also plays an important role in driving economic growth. Adequate transportation networks and supporting facilities as reflected in the Logistics Infrastructure Index (IIL) can reduce shipping costs and speed up distribution, making local products more competitive in the global market. Investment in logistics is able to increase economic efficiency and support long-term growth. Instead (Arvis et al., 2023). He warned that a poor logistics infrastructure index could actually hinder regional economic development. Unfortunately, in Aceh Singkil, the condition of roads and logistics networks still needs a lot of improvement in order to support trade activities optimally.

Literature Review

The economy in Aceh Singkil Regency grows thanks to a number of important factors, especially port performance, the size of palm oil exports, and the quality of logistics infrastructure. In this section, we will examine the various supporting theories that form the basis of the analysis. By examining the relationship between these variables, we can gain a more complete understanding of the role of these three factors in driving regional economic progress.

Economic growth theory as the main foundation. This theory states that the economic progress of a region is influenced by various elements, such as investment, the availability of natural resources, and the quality of infrastructure. Especially for Aceh Singkil, the role of ports and palm oil exports are two key components, areas with adequate infrastructure and easy access to international markets generally have faster economic growth (Hamid, 2025). Economic growth means the development of activities in the economy that cause the goods and services produced in society to increase and the prosperity of society to increase. The problem of economic growth can be seen as a macroeconomic problem in the long run. From one period to another the ability of a country to produce goods and services will increase. This increased ability is due to the fact that production factors will always experience an increase in quantity and quality(Nasution & Yusuf, 2018).

A good logistics system not only reduces transportation costs but also speeds up delivery times, a key factor that also determines the competitiveness of products in the global arena. In the context of Aceh Singkil, the smooth export of palm oil as a leading commodity is highly dependent on port performance and adequate logistics infrastructure support (Ahmad & Karadas, 2021). The quality of a port can be judged from various factors, such as the speed of operation, the length of time the ship is docked, and the ability to load and unload goods (Yangailo, 2024). An efficient port is able to encourage economic growth in a region by smoothing the distribution of goods and reducing logistics costs. This is very important for Aceh Singkil Regency, which relies on the export of commodities such as palm oil. As an archipelagic country, logistics activities in Indonesia have a very important and strategic role in the flow of goods that are not only to meet the basic needs of the community, but also as a way to deliver agricultural, mining and industrial products so that they can be used and marketed, both domestically and abroad. The importance of this role of logistics has in fact not been supported by an adequate national logistics system. Indonesia's logistics system has not been able to play a role as it should. This is evidenced by the logistical problems that occur such as the scarcity of goods in several regions, high logistics costs, price fluctuations and price disparities between regions for several types of goods (Sudrajat et al., 2024). Logistics problems are very complex from several factors such as the diversity of commodities, the area and geographical conditions, the condition of infrastructure and superstructure, and the number of parties involved in the logistics system (a number of ministries/institutions and agencies at the central level, local governments, state-owned enterprises, private companies, and others) (Budisiswanto et al., 2024).

Oil palm is a plantation crop that has experienced quite rapid production growth compared to other plantation crops in Indonesia Palm oil produced in Indonesia is mostly consumed domestically as a raw material in the manufacture of cooking oil, oleochemicals, soap, margarine, and most others are exported in the form of palm oil or Crude Palm Oil (CPO) and palm kernel oil (PKO). Of the total oil palm produced. The increase in commodity exports is inseparable from the increasing level of productivity, the increase in oil palm production can be caused by several factors, including the efficiency and availability of harvested land, low production costs, promising domestic and international markets, and government policies that encourage the development of the palm oil industry. The countries that are the main destinations for Indonesia's CPO and PKO exports are China, India, Pakistan, the Netherlands, Malaysia, and Singapore. This commodity makes a great contribution to regional income and opens up many jobs. Not only that, the high demand for palm oil exports also shows how much this product is in demand in the global market (Ermawati & Septia, 2013).

Indonesia's logistics facilities can be said to be far from capable. Compared to other countries, the quality and quality of logistics in Indonesia can be said to be very weak. One of the main factors causing Indonesia's weak logistics is the poor road conditions. With a very large area, for the smooth running of the community's economy, it must be accompanied by

adequate infrastructure development. Infrastructure plays an important role in determining the logistics performance of a country, many countries have made improvements and added logistics aspects in the development process. To achieve a better economic environment, the main branch of the logistics industry is transportation and storage, which requires infrastructure through air transportation, seaports, highways, railways, and information and communication technology. In addition to the fact that infrastructure quality is an important factor in logistics that attracts investors to develop economic activities, the poor quality of logistics infrastructure is one of the causes of high logistics costs and low availability, which is the biggest problem in the logistics sector(Fajar et al., 2023).

Research Methodology

3.1 VAR analysis model

The VAR model does not pay attention to the issue of the exogenicity of the variables used in the analysis. This makes it easier to provide empirical answers and evidence in long-term reciprocal relationships, where economic variables contribute to each other or are considered as endogenous variables as a whole (Rusiadi et al., 2018).
the whole is considered an endogenous variable (Rusiadi, 2014).

PDRBt = β10PDRBt-p + β11IKPt-p + β12NESt-p + β13VIESt-p + β14IILt-p+ et1
IKPt = β10PDRBt-p + β11IKPt-p + β12NESt-p + β13VIESt-p + β14IILt-p+ et1
Nest = β10PDRBt-p + β11IKPt-p + β12NESt-p + β13VIESt-p + β14IILt-p+ et1
VIESt = β10PDRBt-p + β11IKPt-p + β12NESt-p + β13VIESt-p + β14IILt-p+ et1
IILt = β10PDRBt-p + β11IKPt-p + β12NESt-p + β13VIESt-p + β14IILt-p+ et1

Where:

GDP = GDP
IKP = Port Performance Index
NES = Palm Oil Export Value
LIFE = Volume of Palm Oil Export Permits
IIL = Logistics Infrastructure Index
Et = Random shock (*Random disturbance*)
p = lag length

The Conceptual Framework of the VAR Model is as follows:

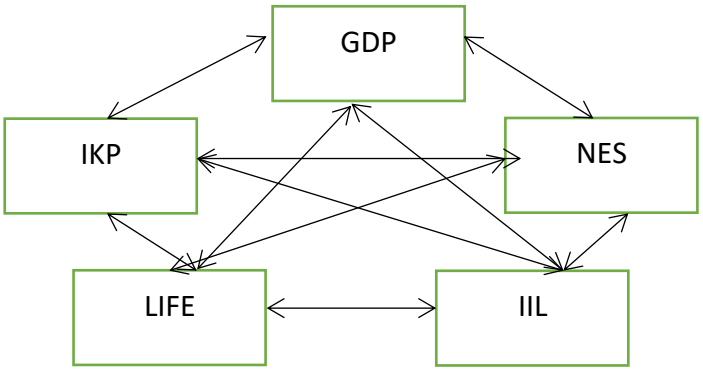

Figure 2. The Conceptual Framework of VAR

Vector Autoregression supported by *Impluse Response Funcation* (IRF) and *Forecast Error Variance Desomposition* (FEVD) are the data analysis models used. However, the following assumption tests are used: VAR Structure Lag Stability, Optimal Lag Determination, Stationarity, and Cointegration.

Results And Discussion

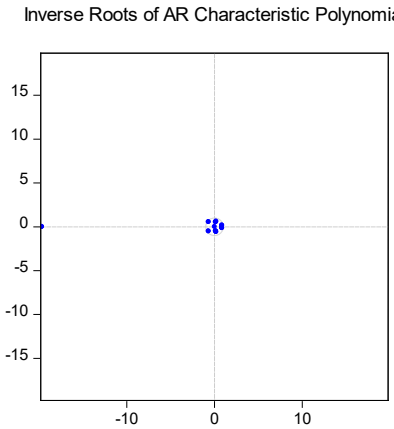

Figure 3. Roots Modulus Values

The above results show that the value of the roots modulus is below 1. Similarly, in the image above which illustrates that the root points are in a circular line. This shows that with the use of *Roots of Characteristic Polynomial* and *Inverse Roots of AR Characteristic Polynomia*, the model specification that is formed is stable. Thus, the lag stability test has been met, then the VAR analysis can be continued.

Table 2. Lag 1 and Lag 2 Length Test Results

Vector Autoregression Estimates LAG 1	
Akaike information criterion	50.56016
Schwarz criterion	52.03054
Number of coefficients	30
Vector Autoregression Estimates LAG 2	
Akaike information criterion	48.97090
Schwarz criterion	51.62667
Number of coefficients	55

Source: Data analysis, Eviews 10

The Schwarz Criterion (SC) and the Akaike Information Criterion (AIC) are used to determine the optimal lag. This optimal lag has lower AIC and SC values than other lags. From the results of the lag determination in table 2 above, the AIC value at lag 2 (48.97090) is lower than lag 1 (50.56016) which shows that lag 2 is more optimal. Therefore, the analysis can be extended using lag 2. Next, analyzing the results of the VAR test is explained in the table as follows:

Table 3. VAR Analysis Results

Variable	Greatest Contribution I	Greatest Contribution II
LIFE (Volume of Palm Oil Export Permits)	LIVES (24.13%)	CPI (1.16%)
IIL (Logistics Infrastructure Index)	ILL (11.29%)	IKP (1.48%)
IKP (Port Performance Index)	CPI (15.84%)	ILL (1.63%)
NES (Palm Oil Export Value)	NES (100.3%)	LIFE (81.31%)
GDP	GDP (19.75%)	IIL (18.02%)

Source: Data analysis, Eviews 10

Based on the results of the contribution estimate, it can be seen that the volume of Palm Oil Export Permits (VIES) has a dominant influence on itself by 24.13%, and has a smaller influence on the Port Performance Index (IKP) of 1.16%. This indicates that changes in the volume of export permits are influenced more by the variables themselves than by other factors. Furthermore, the Logistics Infrastructure Index (IIL) received the largest contribution from the IKP at 11.29%, while the second largest contribution came from the ILL itself at 1.48%. This reflects the mutual relationship between logistics infrastructure and port performance in supporting logistics efficiency. Meanwhile, the Port Performance Index (IKP) was strongly influenced by itself at 15.84%, with the second contribution coming from ILL at 1.63%. This shows that improving port performance depends a lot on internal and logistical supporting factors. In the Palm Oil Export Value (NES) variable, the largest contribution came from VIES at 81.31%, which illustrates that the volume of export permits greatly determines the export value of palm oil commodities. The second contribution to NES comes from the NES itself at 10.31%, indicating a strong historical influence in palm oil export patterns. Finally, for GDP, the largest contribution actually comes from the variable itself at 19.75%, and the second largest contribution comes from IIL at 18.02%. This indicates that regional economic growth is largely determined by internal economic strength, but the role of logistics infrastructure is also the main driver of GDP growth.

In the table above, the discussion of the contribution of VAR analysis shows the largest contribution of one and two to a variable, which is then analyzed as follows:

1. Discussion of VAR analysis on the volume of palm oil export permits

   The largest contribution of variables that affect VIES is VIES itself the previous year and then IKP becomes the second largest contribution. Where it can be seen that with a fairly high level of palm oil production, it is not surprising that Indonesia is one of the largest palm oil producing countries in the world. Palm oil produced in Indonesia is mostly consumed domestically as a raw material in the manufacture of cooking oil, oleochemicals, soap, margarine, and most of others are exported in the form of palm oil or Crude Palm Oil (CPO) and palm kernel oil (PKO) (Ermawati & Septia, 2013). Higher international palm oil prices have resulted in an increase in the volume of palm oil exports from Indonesia. The relationship between international prices and export volumes is that if the commodity price in the global market or international prices is greater than in the domestic market, then the demand for Indonesian palm oil will increase so that the volume of palm oil exported is increasing or increasing. Rising prices in the international market can be an indication that this can be an export incentive for domestic CPO

entrepreneurs that can trigger an increase in domestic CPO production(Advent et al., 2021).

2. Discussion of VAR analysis on the Logistics Infrastructure Index

The largest variable contribution to IIL was the IIL itself the previous year and then IKP became the second largest contribution. Where Indonesia's broad conditions must be supported by an effective and efficient national transportation system. The opinion of Prof. Dr. Ing. Ir. Ahmad Munawar, M.Sc, is that what is meant by the implementation of effective transportation is the realization of user safety, high accessibility, integration, sufficient capacity, orderly and smooth, fast, easy to reach, punctual, comfortable, affordable rates, orderly, safe, and low pollution, while what is meant by the implementation of efficient transportation is the burden faced by the public for the implementation of low transportation and high utility in one unity.1 The implementation of an effective and efficient transportation system is expected to serve the transportation of goods and people between cities, regions, and inter-islands smoothly, quickly, safely, and cheaply. With better access productivity increases, so input costs decrease. Reduced input costs cause product prices to be more affordable. Consumers' purchasing power has increased, making demand increase, so demand flows are high. Increased demand will certainly result in profits for producers(Wirabrata & Silalahi, 2012).

3. Discussion of VAR analysis of Port Performance Index

The largest variable contribution to the IKP was the previous year's IKP, then ILL became the second contribution of the previous year. Performance is basically the results obtained by a person or institution in carrying out certain work. Performance is generally defined as the relationship between real and physical results (goods/services) and actual inputs, or in other words the comparison between output and input outputs (Nasir et al., 2012). The high number of passengers needs to be accompanied by an improvement in the performance of passenger service standards. This aims to increase passenger satisfaction with public services organized by the Aceh Provincial Government. Satisfaction is the level of feeling a person has after comparing perceived performance with expectations. If the performance is below expectations, then the customer, in this case the passenger, will be disappointed and dissatisfied. On the other hand, if the performance is in line with expectations, then passengers will be satisfied. While the performance exceeds expectations, passengers will be very satisfied. Satisfied passengers will be loyal to the service for longer, willing to recommend, say positive things, and be less sensitive to the price of the service (Najwan et al., 2024).

4. Discussion of VAR analysis on the Value of Palm Oil exports

The largest variable contribution to the NES was the previous year's NES then VIES became the second contribution of the previous year The main commodities produced from Indonesia are from agriculture and the results of plantations, for this reason it is very important for Indonesia because the role of both creates various jobs and creates export activities that can be carried out between countries and improve the economy. One of the best commodities in Indonesian plantations is oil palm. This commodity is believed to be the most produced commodity from Indonesia so that through this Indonesia is believed to be a country that contributes greatly to palm oil throughout the country. Indonesia has a very high amount of palm oil production and palm oil exports have also increased from year to year, so it is believed to be a country that produces palm oil on a large scale(Ruchban et al., 2025).

5. Discussion of VAR analysis on GDP

The largest variable contribution to GDP was GDP itself the previous year and then ILL became the second largest contribution. Positive economic growth is influenced by economic driving factors in the region. Where each region has characteristics of natural resources, human resources and related management policies. GDP growth cannot be separated from the role of each economic sector. The size of the income of each economic sector is the result of planning and growth in the area. The greater the contribution of each sector to regional GDP, the better economic growth will be. In his view, GDP is allocated on the basis of prevailing prices and on the basis of constant prices. GDP on the basis of prevailing prices is used to see the size and economic structure of a region, while on the basis of constant prices is used to measure economic growth because it is not affected by price changes. The increase in the value of GDP is inseparable from the contribution of seventeen business sectors. If the economic sectors owned by the region are managed properly and optimally, then the sector will make a good contribution to regional development, especially the West Coast Regency. If the economic sector develops well, it can become a base sector as well as a non-base sector in the region (Dwi Satria et al., 2023).

Conclusion

Based on the discussion in the previous chapter, the conclusions that the author can convey are as follows**:**

1. Through the analysis of the VAR model, the value of the roots modulus is below 1. Similarly, in the Figure above which illustrates that the root points are in a circular line. This shows that with the use of Roots of Characteristic Polynomial and Inverse Roots of AR Characteristic Polynomia, the model specification that is formed is stable.
2. The largest contribution of variables that affect VIES is VIES itself the previous year and then IKP becomes the second largest contribution.
3. The largest contribution of variables that affect IIL is IIL itself the previous year and then IKP becomes the second largest contribution.
4. The largest variable contribution that affects the IKP is the IKP itself the previous year and then the IIL becomes the second largest contribution.
5. The biggest contribution of the variables that influenced the NES was the NES itself the previous year and then VIES became the second largest contribution.
6. The largest contribution of variables that affect GDP is GDP itself the previous year and then ILL becomes the second largest contribution.

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