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# Modelling the Relationship between Rice Price, Rice Production, Exchange Rate, and Rice Import in Indonesia

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ABSTRACT

Rice is a strategic food commodity for Indonesia with 95% of the population relying on it as their staple. However, Indonesia still imports rice to fulfil its domestic rice needs. Dependence on imports is neither good for the short term nor the long term. The purpose of this study is to see the relationship among rice price, rice production, and exchange rate to the Indonesia's rice import. The data used is time series data with monthly frequency from January 2019 to December 2023 taken from ITC Trade Map, Central Statistic Agency, and Bank Indonesia. The analysis method uses a Vector Error Correction Model (VECM) approach that can provide short-term and long-term information through several tests. The results demonstrate that, in the long run, the exchange rate and rice production have a negative influence on rice imports. While in the short term, the variables that affect rice imports are the import variable itself, the price of rice in the previous 2 periods, as well as rice production in the preceding period. The significant influence of rice production requires the government to consider the stock and the volume of imports to maintain balance. Exchange rate, rice price, and rice production variables respond relatively quick to rice imports. The rice import variable has a large role in affecting future imports, followed by the exchange rate, and rice production which has a growing influence on each period.

## INTRODUCTION

Rice is a strategic food commodity with an important role in the diet of the Indonesian population. In addition to being the primary source of sustenance for over 95% of the population, it also plays a pivotal role in providing employment and income for 21 million rural farming households (Ilham et al., 2023). However, in conjunction with population growth and the emergence of increasingly complex global challenges, the availability of rice at the national level is becoming increasingly threatened. One of the

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challenges that has a detrimental impact on rice production is the El Niño and La Niña phenomena (Kinose et al., 2020; Dhamira & Irham, 2020; Ramadhan, 2024). It is therefore imperative that Indonesia maintains food security for its entire population in terms of accessibility, quality and sustainability. As set forth in Law No. 18/2012 on food, the fundamental concept of food security is comprised of two key elements: (1) accessibility to food, and (2) the availability of food that is adequate, safe, and nutritious. It thus falls upon the government to ensure the adequate and affordable availability of rice, a strategic food commodity, for all Indonesians.

The availability of rice in the domestic market depends on a country's ability to sustainably produce or supply its needs. However, data from the Central Statistics Agency (BPS) shows that, in the last six years (2018 - 2023), national rice production has decreased significantly. In 2018, rice production was able to reach 33,942 million tonnes and continued to decline to 31,101 million tonnes in 2023. The decline in rice production is partly due to the decreasing rice harvest area, namely in 2018 the total harvest area of 11,377 thousand hectares decreased to 10,213 thousand hectares in 2023. This condition indicates that rice food security in Indonesia is increasingly vulnerable.

The rice self-sufficiency programme is one of the efforts made by the government to balance the rice production and consumption in Indonesia (Kementan, 2022). However, despite Indonesia's efforts to achieve rice self-sufficiency, the imports have continued to occur in recent years. According to the International Trade Centre (2024), Indonesia's rice imports have increased and even jumped from 2.2 million tonnes in 2018 to 3 million tonnes in 2023. This gap between the self-sufficiency target and the reality of increasing imports indicates the complex challenges that need to be addressed in the rice farming sector. The increase in rice imports in Indonesia aims to fulfil national needs due to the lack of domestic rice supply, while also aims to suppress price increases due to the high demand for rice.

Domestic rice prices fluctuate every year. In 2018, the average domestic rice price was IDR 12,054/ Kg, then decreased in 2021 to IDR 10,394/Kg. In 2023 the price of domestic rice increased to IDR 13,458/ Kg due to decrease in rice production. The cause of the increase in Indonesia's domestic rice price in 2023 is also due to the increase in world rice prices, which in 2021 was 110.2 USD/ ton, rising to 132 USD/ton in 2023 (Food and Agriculture Organization, 2025).

Although rice imports can help maintain price stability and domestic supply, especially when domestic production is unable to meet national needs, dependence on rice imports must be minimised. According to Kurniawan et al. (2019), production policies are better to stabilize domestic rice prices and fulfil rice availability compared to import policies. This dependence on imports is not only creates competition with domestic rice, but can also disrupt the welfare of local farmers and long-term food security. Continuous rice imports will threaten the sustainability of the domestic agricultural sector. Farmers as producers will face price competition against the lower prices of imported rice, which will certainly harm and reduce farmers' welfare (Yasinta et al., 2025). In addition, Indonesia's rice trade balance will also be disrupted (Badi'ah et al., 2023). Therefore, a deeper understanding of the factors that influence rice imports in Indonesia is needed. Previous studies have addressed the influence of rice prices, production, and exchange rates on imports. The research conducted by Suryana (2014); Kurniawan *et al.* (2019); Akbar et al. (2023); dan Dinar et al (2023) is limited in that it focuses exclusively on the examination of influencing factors. Consequently, these studies are unable to differentiate between the short and long term. The existing research examining the short- and long-term relationships between rice prices, rice production, exchange rates and Indonesia's rice imports remains limited. This study aims to address this gap in the literature by investigating these relationships over both the short and long term. The findings of this study are expected to provide a more nuanced understanding of the complex dynamics between rice prices, rice production, exchange rates and rice imports in Indonesia. Additionally, the study will offer insights that can inform more effective policy recommendations for maintaining national food security in a sustainable manner.

## METHODS

The data employed in this study are secondary data in the form of time series data. The data frequency is monthly, with a data length spanning from January 2019 (2019:M1) to December 2023 (2023:M12). The time period under consideration was selected on the basis of a significant increase in Indonesian rice imports, as well as a considerable rise in rice prices in 2023 compared to 2019 to 2022. The decision to employ monthly data is driven by the objective of enhancing the quality of the data set, thereby facilitating a more accurate representation of the actual situation.

**Table 1.** Average rice prices, exchange rates, and Indonesia's rice production and imports

| Years | Rice Imports (Ton) | Rice Production (Ton) | Rice Price (Rp/Kg) | Exchange Rate (Rp/USD) |
|---|---|---|---|---|
| **2019** | 444,509 | 31,313,034 | 12,091 | 14,218 |
| **2020** | 371,833 | 31,496,747 | 12,261 | 14,655 |
| **2021** | 407,741 | 31,356,017 | 10,395 | 14,380 |
| **2022** | 429,207 | 31,540,522 | 10,656 | 14,924 |
| **2023** | 3,062,858 | 31,101,285 | 12,466 | 15,313 |

Source : Data processed (2024)

**Table 2.**Variables, data units, and sources

| Variable | Data Unit | Source |
|---|---|---|
| Rice Imports (HS 1006:Rice) | Tons | International Trade Centre (ITC) Trade Map |
| Rice Production | Tons | Central Statistic Agency |
| Rice Price | Rp/Kg | Central Statistic Agency |
| Exchange Rate | IDR/USD | Bank Indonesia |

Source : Data processed (2024)

This is because, as posited by Firdaus (2020), the longer the data series, the more robust the Vector Error Correction Model (VECM) analysis. The following section will provide an overview of rice imports, rice production, Indonesian rice prices, and exchange rates.

An examination in Table 1 reveals a substantial increase in rice imports and prices in 2023, with a notable shift from 400,000 to 3 million tonnes of rice imports per year. Concurrently, Indonesia's rice production experienced a decline in comparison to the subsequent year. The data for this study are sourced from reliable and reputable sources, and the specific data sources and variables utilized are outlined on Table 2.

The data for this study has been sourced from reliable and independent sources, thus ensuring the ability to describe the variables to be processed. In the course of the analysis, the variables pertaining to rice import, rice production, rice price and exchange rate were transformed into natural logarithms (Ln). This study employs an econometric analysis approach, specifically the Vector Autoregressive (VAR)/Vector Error Correction Model (VECM) technique. The initial stage of this study is to ascertain whether the data can be utilised for VAR/VECM analysis by conducting a unit root test which serves to guarantee that the data is stationary. The subsequent stage is to ascertain the optimal lag by employing a number of criteria, including the Akaike Information Criterion (AIC). The next stage is the stage of conducting the VAR stationarity test with the aim of examining the stability of VAR. This test is applied to confirm if the outcomes of the Impulse Response Function (IRF) analysis obtained are correct. The VAR stability test is carried out by measuring the roots of the polynomial function. The results of all roots of the polynomial function must be at a value less than 1 if you want the VAR model to be stable. If all the root values of the polynomial function are less than 1, it is certain that the Impulse Response Function (IRF) results are correct or valid (Firdaus, 2020). Sims in 1980 was the first to use the Vector Autoregression (VAR) method (Firdaus, 2020). VAR in its application is often used to examine several objectives, namely: 1) Forecasting analyses future trends using past data; 2) Impulse Response Function (IRF) examines the response caused by a change or shock to a variable in the present to the future; 3) Forecast Error Variance Decomposition (FEVD) identifies the contribution of each variable to other variables in the form of percentage; 4) Granger Causality determines the causal connections between variables. Vector Error Correction Model (VECM) according to Gujarati & Porter (2009) is a model derived from a restricted form of VAR. Restriction is used because the data applied at the level stage is not stationary, but has cointegration between variables. Models that have cointegration can perform long-term analysis. Here is the VECM model in general form (Firdaus, 2020).

$$\Delta y_t = \alpha_{0x} + \alpha_{1x}t + \Pi_x y_{t-1} + \sum_{i=1}^{k-1} r_{ix}\Delta_{yt} + \varepsilon_t$$

Description:

$y_t$ =Vector with dynamix variables

$\alpha_{0x}$ =Vector with dynamic variables

$\alpha_{1x}$ =Vector Intercept

t =Time Trends

$\Pi_x$ =$\alpha_x\beta'$ where b' contains the long run cointegration equation

$y_{t-1}$ =In– level variables

$\Gamma_k$ =Regression coefficient matrix

k-1 =VECM order of VAR

$\varepsilon_t$ =error team

The results obtained by the VAR model are considered complicated and difficult to interpret. This difficulty can be addressed by using impulse response which helps clarify the interpretation of the coefficient value on the variable in the VAR model (Enders, 1995). The endogenous variable response to a particular shock can be identified by using the Impulse Response Function (IRF) method. The shock of the variable in the i-th period does not only affect the variable in the i-th variable but is transmitted to all other endogenous variables through a dynamic structure or lag structure in VECM. IRF is able to measure the response of a shock to a variable in the future (Firdaus, 2020)

Forecast Error Variance Decomposition (FEVD) is a dynamic description method in VAR/VECM analysis that examines changes in a variable as described by the error variance influenced by or composed of other variables. This method can illustrate how much these variables affect other variables over a long period of time. FEDV in other words is able to describe how much the contribution of each independent variable in influencing the dependent variable (Firdaus, 2020).

## RESULTS AND DISCUSSION

### Stationary Test

Stationary testing was conducted on the four variables used:the amount of rice imports (LNIM), exchange rate (LNEX), rice production (LNPB), and rice price (LNHB). The stationary test assessment is seen from the ADF Statistic results that are higher than the Mc-Kinnon critical value at the 1 percent, 5 percent, and 10 percent levels. All variables are tested based on the level and first-difference to determine the stationarity of the data. At the level form, all variables have a p -value of more than 0.05, indicating that the data is not stationary. So testing is carried out at the

**Table 3.** Stationary test result

| Varia-bles | *Differ-ence* | *ADF Statistic* | Trendless Intercept 1% | 5% | 10% | *P-Value* | Conclusion |
|---|---|---|---|---|---|---|---|
| LNIM | Level | 0.59996 | -3.55502 | -2.9155 | -2.5956 | 0.9885 | Non-Stationary |
| | 1st | -7.80789 | -3.55502 | -2.9155 | -2.5956 | 0.0000 | Stationer |
| LNEX | Level | -1.26934 | -3.55039 | -2.9135 | -2.5945 | 0.6379 | Non-Stationary |
| | 1st | -8.44786 | -3.55039 | -2.9135 | -2.5945 | 0.0000 | Stationer |
| LNPB | Level | -2.30675 | -3.57131 | -2.9224 | -2.5992 | 0.1740 | Non-Stationary |
| | 1st | -7.49968 | -3.57444 | -2.9238 | -2.5999 | 0.0000 | Stationer |
| LNHB | Level | -0.36180 | -3.54609 | -2.9117 | -2.5936 | 0.9084 | Non-Stationary |
| | 1st | -6.46682 | -3.54820 | -2.9126 | -2.5940 | 0.0000 | Stationer |

Source : Data processed (2024)

first-difference level, which results in a p-were stationary at the first difference level value of less than 0.05, indicating that all variables are stationary at the first-difference level. If the data has been stationary, it is said that the data has stabilised and there is no sharp increase and decrease (Sinambela et al. 2023). Research conducted by Muhlis & Nababan (2021) also found that all variables, namely the price of rice at the trader level, the price of premium rice at the farmer level, the price of medium quality rice at the farmer level, and the price of other quality rice, were stationary at the first difference level.

**Optimum Lag Test**

The optimum lag test in VAR/VECM aims to determine the optimum lag length to capture the past effects of variables on the response variable. The test criteria are seen from the LR, FPE, AIC, SC, and HQ values which have the

**Table 4.** Optimum lag test result

| Lag | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|
| 0 | NA | 1.78e-08 | -6.491400 | -6.344067* | -6.434579 |
| 1 | 17.22448 | 2.27e-08 | -6.250327 | -5.513666 | -5.966226 |
| **2** | **58.46442*** | **1.13e-08*** | **-6.956944*** | **-5.630954** | **-6.445562*** |
| 3 | 10.01113 | 1.65e-08 | -6.608525 | -4.693207 | -5.869862 |
| 4 | 22.59154 | 1.70e-08 | -6.626515 | -4.121868 | -5.660571 |
| 5 | 9.792475 | 2.49e-08 | -6.330664 | -3.236688 | -5.137439 |

Source : Data processed (2024)

Description: (LR) Sequential Modified LR Test Statistic, (FPE) Final Prediction Error, (AIC) Akaike Information Cri formation Criterion, (HQ) Hannan-Quinn Information Criterion.

smallest absolute value and are marked with asterisks (*). The test outcome shows that the optimum lag length used in the research model is lag 2 (Table 4). In another study, it was also obtained that the optimum lag length used was lag 2 which discussed the chilli market in Tasikmalaya City. (Hidayat, Sukmaya, & Heryadi, 2022) and rice price integration in North Sumatra (Yanti, Asaad, & Sibuea, 2020).

**Cointegration Test**

Cointegration testing is conducted to determine the long-term relationship between variables in the model. The decision is based on the trace statistic and the maximum eigenvalue which has a value higher than the critical value which indicates the occurrence of cointegration. The test results (Table 5; Table 6) show that all variables have trace statistic and max-eigenvalue values higher than the critical value with a p-value of less than 0.005. This means that there is long-term cointegration between the exchange rate, rice production, and rice price with the amount of rice imports. However, in the short term, it is still undetermined, so further testing is needed. If the results show the existence of cointegration, then the appropriate model for subsequent analysis is the Vector Error Correction Model (VECM).

**Granger Causality Test**

Granger causality test is used to identify the reciprocal relationship between variables. The test results show that there is no two-way relationship but one-way or independent on some variables. In the variable exchange rate and the amount of rice imports, there is a one-way relationship, namely the amount of rice imports affects the

**Table 5.** Cointegration test results (Trace)

| Hypothesis | Eigenvalue | Trace Statistic | Critical Value 0.05 | p-value |
|---|---|---|---|---|
| None | 0.495511 | 102.9381 | 47.85613 | 0.0000 |
| At most 1 | 0.415638 | 64.62239 | 29.79707 | 0.0000 |
| At most 2 | 0.348481 | 34.53722 | 15.49471 | 0.0000 |
| At most 3 | 0.171623 | 10.54407 | 3.841465 | 0.0012 |

Source: Data processed (2024)

**Table 6.** Cointegration test results (Maximum Eigenvalue)

| Hypothesis | Eigenvalue | Max-Eigen Statistic | Critical Value 0.05 | p-value |
|---|---|---|---|---|
| None | 0.495511 | 38.31566 | 27.58434 | 0.0014 |
| At most 1 | 0.415638 | 30.08517 | 21.13162 | 0.0021 |
| At most 2 | 0.348481 | 23.99315 | 14.26460 | 0.0011 |
| At most 3 | 0.171623 | 10.54407 | 3.841465 | 0.0012 |

Source: Data processed (2024)

**Table 7.** Granger causality test results

| Null Hyphothesis | Obs | F-Statistic | Probability |
|---|---|---|---|
| LNEX does not Granger Cause LNIM | 58 | **4.89607** | **0.0112*** |
| LNIM does not Granger Cause LNEX | | 0.70187 | 0.5002 |
| LNHB does not Granger Cause LNIM | 58 | **2.84852** | **0.0668*** |
| LNIM does not Granger Cause LNHB | | 1.47616 | 0.2378 |
| LNPB does not Granger Cause LNIM | 58 | 1.32838 | 0.2736 |
| LNIM does not Granger Cause LNPB | | 0.60062 | 0.5522 |
| LNHB does not Granger Cause LNEX | 58 | 1.23203 | 0.2999 |
| LNEX does not Granger Cause LNHB | | **2.84222** | **0.0672*** |
| LNPB does not Granger Cause LNEX | 58 | 1.90362 | 0.1591 |
| LNEX does not Granger Cause LNPB | | 0.87011 | 0.4248 |
| LNPB does not Granger Cause LNHB | 58 | 0.41305 | 0.6637 |
| LNHB does not Granger Cause LNPB | | 0.31563 | 0.7307 |

Source: Data processed (2024)
Notes: Statistical value *** = significant at 1% level, ** = significant at 5% level, * = significant at 10% level

exchange rate. This is evidenced by the f-statistic value of 4.89607 which is higher than the t-table of 1.67252 at the 10 percent level. The rice price variable and the amount of rice imports also have a one-way relationship, where the amount of rice imports affects the price of rice with an f-statistic value of 2.84852. In addition, there is also a one-way relationship between the exchange rate and rice price variables, where the price of rice affects the exchange rate with an f-statistic value of 2.84222. However, the exchange rate does not affect the price of rice, in accordance with research by (Nizar & Abbas, 2019; Anam et al. 2021), who reported that

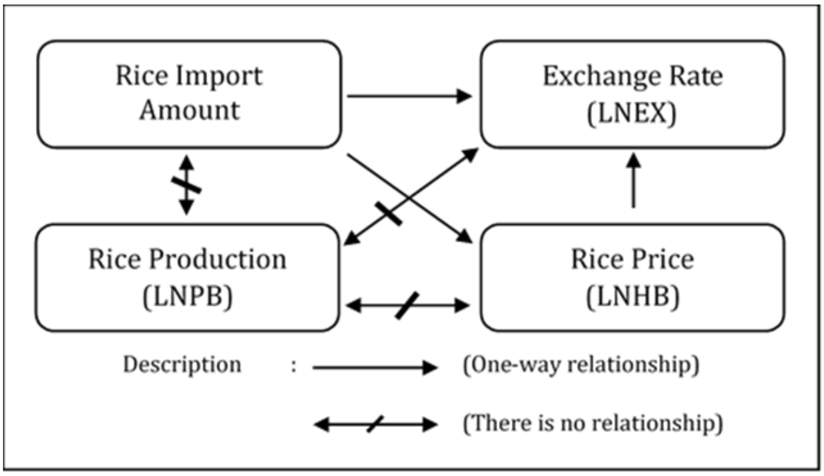


**Figure 1**. Granger Causality Test Relationship
Source : Data processed (2024)

the rupiah exchange rate has no significant effect on retail rice prices . Figure 1 shows the different directional relationships between the variables. The variables between rice production and the amount of imports, exchange rates, and rice prices do not have a two-way relationship, and vice versa. If there is a change in rice production, it will not be responded to by changes in the amount of imports, exchange rates, and rice prices. Vice versa, if there is a change in the amount of imports, exchange rates, and rice prices, rice production will not respond to these changes.

**Vector Error Correction Model (VECM) Estimation Results**

The integration relationship between rice imports, exchange rates, rice production, and rice prices is further analysed using the VECM model selected from the results of previous tests. The results of the VECM estimation test shows that the variables are integrated in the long term and short term. The long-term estimation results (Table 8) show that there is one relationship between rice imports, exchange rates, and rice production that is significant at the 1 percent and 10 percent levels. This significant result is evidenced by the t-statistic values of the exchange rate (3.39689) and rice production (1.92632), which are each more than the t-table value. The amount of rice imports is negatively affected by changes in the exchange rate at the 1 percent level, which means that a 10 percent exchange rate increase will reduce the amount of rice imports by 2.64 percent. An increase in the exchange rate in June 2023 from 14,885 USD to 15,007 USD decreases rice imports from 253,954 tonnes to 212,805 tonnes. Research results from Ratih Kumala Sari, (2014); Paipan & Abrar, (2020) also shows that in the long run the exchange rate has a negative effect on the amount of rice imports. The strengthening of the rupiah exchange rate against the USD causes the volume of rice imports to decrease, because if the rupiah exchange rate strengthens, it makes people flock to buy as many imported goods as possible. (Nizar & Abbas, 2019).

The rice production variable has a negative effect on the amount of rice imports at the 10 percent level. If there is an increase in rice production by 10 percent, it will reduce the amount of

**Table 8.** VECM Long-Term Estimation Results

| Cointegration Equation | CPO Price Variable | | | | |
|---|---|---|---|---|---|
| | LNIM(-1) | LNEX(-1) | LNHB(-1) | LNPB(-1) | C |
| Cointegration | 1,000000 | -26.49602 | -3.959586 | -1.367728 | 300.6878 |
| | | (7.80008) | (2.68218) | (0.71002) | |
| | | [-3.39689]*** | [-1.47626] | [-1.92632]* | |

Source: Data processed (2024)

Notes: Numbers in [ ] are statistical values *** = significant at 1% level, ** = significant at 5% level, and * = significant at 10% level.

rice imports by 0.36 percent. In contrast, the price of rice and the amount of rice imports do not have a long-term relationship because they have a t-statistic value less than the t-table. Therefore, changes in rice prices do not affect the amount of rice imported.

The short-term results from the VECM estimation show that there are three variables that have a significant influence on the amount of rice imports (Table 9). First, the variable of the amount of rice imports is negatively influenced by its past values specifically at the 2nd lag. This is indicated by the t-statistic value of 1.98641 which is higher than the t-table of 1.67252 at a significant level of 10percent. In this case, it is said that if there is a 10percent increase in the amount of rice imports in the previous 2 periods, it will result in a decrease in the amount of rice imports in the current period by 2.39 percent. The negative effect given by the amount of rice imports on itself is also the same as the results of research by (Rai & Wibowo, 2020). In the short term, the current rice import volume is negatively affected by the previous rice import volume due to the accumulation of rice stocks. If in the previous two periods the government has imported a certain amount of rice, the current rice stock may still be sufficient. Therefore, the government reduced the amount of rice imports from other countries. Besides being influenced by itself, the amount of rice imports is also negatively affected by the price of rice in the previous 2 periods with a t-statistic value of 1.73946 which is higher than the t-table value at the 10percent level. The effect of the price of rice has a huge impact on changes in the imports level at this time. This is because if there is a 10percent increase in the price of rice in the previous 2 periods, it will reduce the amount of imports by 63.48 percent in the current period. This result is in line with research by (Paipan & Abrar, 2020) and (Onu et al. 2017) where domestic rice prices have a significant positive effect on rice imports. The reason is that despite the decline in rice prices, the government still imports with the aim of creating excess supply. This excess supply can cause domestic rice prices to fall. However, in another study, Rai & Wibowo (2020) inversely stated that the domestic rice price in the previous period had a positive influence on the volume of Indonesian rice imports. This is because if the domestic rice price increases, the demand for imported rice is higher as the government tries to maintain the stability of domestic rice prices.

The last variable, rice production, also has a significant effect on changes in the amount of rice imports at a previous period lag. The obtained t -statistic value of 2.52768 is higher than the t-table at the 1percent level. The effect is also negative, which means that every 10 percent increase in rice production in the previous period will reduce the amount of imports by 6.21 percent in the current period. If the government is able to increase domestic rice production, it will certainly make

**Table 9.** VECM Short-Term Estimation Results

| Error Correction | D(LNIM) | |
|---|---|---|
| | Coefficient | t-statistic |
| CointEq1 | -0.335197 | [-3.25433]*** |
| D(LNIM(-1)) | 0.028102 | [ 0.23304] |
| D(LNIM(-2)) | -0.239692 | [-1.98641]* |
| D(LNEX(-1)) | 0.704687 | [ 0.15611] |
| D(LNEX(-2)) | -4.602497 | [-1.02962] |
| D(LNHB(-1)) | 2.925059 | [ 0.81156] |
| D(LNHB(-2)) | -6.348663 | [-1.73946]* |
| D(LNPB(-1)) | -0.621800 | [-2.52768]** |
| D(LNPB(-2)) | -0.118670 | [-0.43391] |
| C | 0.066622 | [ 0.81125] |

Source: Primary data analysis (2023)
Notes: Statistical value *** = significant at 1% level, ** = significant at 5% level,
* = significant at 10% level.

domestic rice stocks maintained and sufficient, so as to reduce rice imports from outside. If production increases and the government still imports rice, there will be an increase in supply, which will result in a decrease in rice prices, to the detriment of farmers. (Paipan & Abrar, 2020). Conversely, if domestic rice production decreases, there will be inadequacy of domestic stocks, thus requiring the import of rice from other countries. In the actual data obtained, rice production increased from 1,594,609 tonnes to 3,289,263 in February 2018 (Central Statistic Agency, 2024). On the other hand, the amount of imports in the next period, which was March 2018, fell from 272,898 tonnes to 97,634 tonnes (International Trade Centre, 2024). In April 2023, rice production dropped from 5,134,806 tonnes to 3,659,422 tonnes Central Statistic Agency (2024) and corresponded with an increase in rice imports in May 2023, which improved from 88,434 tonnes to 253,954 tonnes (International Trade Centre, 2024). Research by Armaini & Gunawan (2016); Rai & Wibowo (2020); Dinar et al. (2023) also stated that rice production has a negative and significant effect on the volume of rice imports in the short term. Similarly, research from Revania (2014) on the corn commodity market that corn production in the short term significantly affects corn imports negatively.

The exchange rate variable in the short term is the only variable that does not have a significant effect on changes in the amount of rice imports in both lag 1 and lag 2. In line with research by Revania (2014); Estyawan & Yuliarmi (2024) that the exchange rate variable has no significant effect on Indonesia's rice imports.

**Impulse Response Function (IRF) Analysis Results**

IRF or Impulse Response Function analysis can see the effect of the level of shock given by a variable on other variables. IRF analysis is able to explain simply to overcome the complexity of interpretation of the results of the VAR / VECM method.

The period used in the IRF analysis is 35 months. Figure 2a identifies the response of the amount of rice imports with itself when there is a shock of 6.10 percent in the 1st period. Furthermore, the amount of rice imports began to give a decreasing response reaching 1.13 percent in the 4th period. Then it increased slightly in the 8th period by 2.18 percent and began to give a stable response to the shock of the amount of rice imports until the last period, namely the 35th period by 1.93 percent. The amount of rice imports to the shock itself still gives a positive response or above the 0 boundary line. A shock in exchange rate variable is responded by an increase in the amount of rice imports. Figure 2b shows the shape of the graph that increases from 0.00 percent in the first period to 2.84 percent in the 4th period. The response given to the exchange rate shocks began to stabilise when stepping into the 11th period at 2.27 percent until the 35th period at 2.23 percent. The response is also positive throughout the period. In contrast, the response of rice imports to the shocks from the price of rice gave a negative response (Figure 2c). In the 1st and 2nd periods, it still gives a positive response of 0.00 percent and 1.83 percent. However, from the 3rd to the last period, it started to give a negative response, which peaked in the 7th period at -0.20 percent. This is consistent with the results of the short-term VECM estimation that the price of rice has a negative effect on changes in the amount of rice imports.

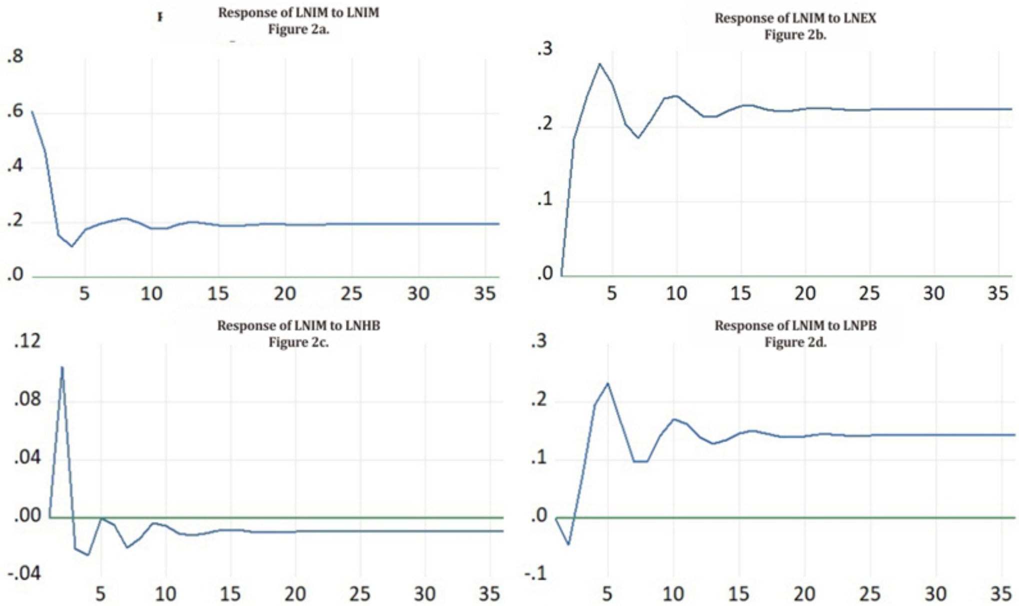


**Figure 2.** Impulse response function (IRF) analysis results
Source: Data processed (2024)

Regarding the shocks given by rice production to the amount of imports, the response is positive (Figure 2d). Only in the 2nd period does it give a negative response of -0.45 percent. Starting from 0.00 percent in the first period, the response rate peaked at 2.32 percent in the 5th period. A stable response is given when starting to step on the 9th period until the last period, which is 1.42 percent.

**Forecast Error Variance Decomposition (FEVD) Analysis Result**

FEDV or Forecast Error Variance Decomposition analysis is used to identify the level of contribution made by each variable to the shocks caused by the main variable. The main variable in this study's FEDV analysis is the amount of rice imports over 35-months periods. Figure 3 in the first period shows that the formation of the amount of rice imports is 100 percent attributed to its own. Entering the 2nd period, the contribution made by the exchange rate was 5.33 percent, the price contributed 1.72 percent, rice production 0.32 percent, and the remaining amount of rice imports itself was 92.6 percent. The contributions made by the exchange rate, and rice production increased and tended to stabilise until the last period. From the 4th period, the exchange rate variable gave an influence of 20.22 percent to the 35th period of 40.52 percent. Similarly, the contribution of rice production variables to the amount of imports rose from 0.00percent in the 1st period to 16.73 percent in the 35th period. In contrast, the contribution of rice prices to the formation of rice import volumes shows a declining trend, decreasing from an initial 1.72%–1.40% in the 2nd to 4th periods, and continuing to fall to just 0.34% by the final period.

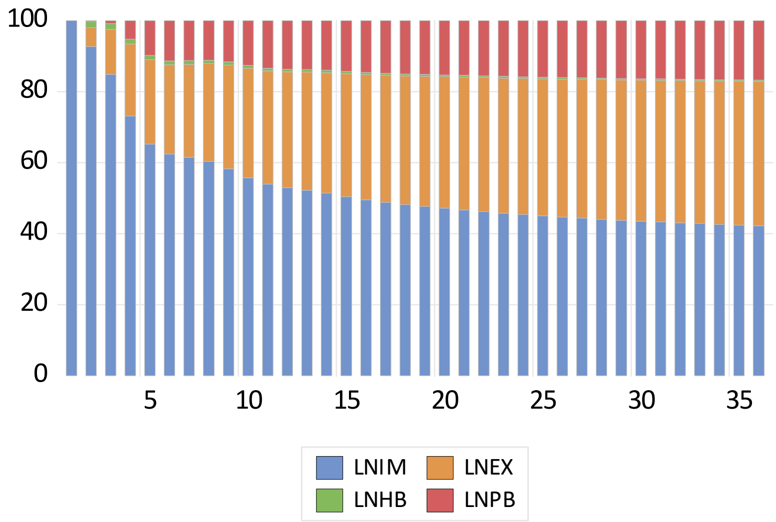


**Figure 3.** Forecast error variance decomposition (FEVD) analysis results
Source: Data processed (2024)

## CONLUSION AND SUGGESTION

This study finds that the variables that can significantly affect domestic rice imports in the short term are the import variable itself at lag-2, rice price at lag-2, rice production at lag-1 while the exchange rate variable has no significant effect. In the long run, the variables that have a significant effect on rice imports are the exchange rate and rice production while the price of rice is not proven to have a significant effect on rice imports. Given that rice production has an influence in the long term and short term, it is necessary to make efforts to maintain rice production by implementing several policies such as preventing land conversion by protecting potentially productive land, increasing productivity by using superior varieties and ensuring agricultural inputs such as fertilizers, pesticides and other inputs that support production.

Based on the Impulse Response Function results, the exchange rate, rice price, and rice production variables are relatively quickly responded by the rice import variable. The rapid responsiveness is due to rice as the main national food with a relative balance that occurs in the period of ten years and above with a long period of time. The FEVD results illustrate that the rice import variable itself has the largest proportion in influencing rice imports, followed by the exchange rate, and rice production which has a greater influence each period. In formulating policies to maintain food security, the government should consider rice prices and production levels as key benchmarks for determining the appropriate volume of rice imports. The government must regulate the volume of rice imports to maintain price stability while also strengthening domestic production. Import restrictions need to be maintained to avoid trade balance deficits and high dependence on international markets.

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