THE INFLUENCE OF RICE PRODUCTION, INTERNATIONAL RICE PRICES, POPULATION, AND GROSS DOMESTIC PRODUCT (GDP) ON INDONESIA'S RICE IMPORTS

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Abstract

Trading activities hold a crucial position in a nation's economy, particularly as a means of fostering diplomatic relations between countries. In the context of strategic commodities such as rice, although production has increased, this growth has not yet fully kept pace with national consumption levels, which are largely driven by the household and industrial sectors. This study aims to examine the impact of rice production, international rice prices, population size, and Gross Domestic Product (GDP) on the volume of rice imports in Indonesia during the period from 1993 to 2023, both in the short and long term. A quantitative approach was employed, utilizing annual time series secondary data over a span of 31 years. Data analysis was conducted using multiple linear regression (OLS) and the Error Correction Model (ECM). The ECM estimation results indicate that all the variables studied tend to move toward a common equilibrium in the long run, suggesting cointegration. The analysis also shows that in the short term, rice production, international rice prices, population, and GDP do not have a significant effect on rice import volumes. However, in the long term, rice production and international rice prices have a positive and significant effect on import volumes, while GDP has a negative and significant effect. On the other hand, population has a positive but statistically insignificant impact on rice imports in Indonesia during the study period. These findings suggest that optimizing domestic rice production and managing international price fluctuations are critical strategies for sustainably controlling rice import volumes. Moreover, stable economic growth significantly contributes to reducing long-term dependency on rice imports.

Keywords: Rice imports, Production, International Rice Prices, Population, Gross Domestic Product (GDP)

INTRODUCTION

The rise and fall of rice imports in Indonesia are influenced by various interrelated factors, especially trade policies that support or limit imports, such as tariffs, quotas, and other regulations that greatly affect the amount of rice imports. Then,Fluctuations in rice prices in the international market can affect the decision to import, and cheaper prices in the international market can encourage increased imports. Then, when local rice prices are higher, there is a tendency to import cheaper rice to maintain domestic price stability (Rosmeli, 2020).

Table 1. Rice Imports by Main Country of Origin2019-2023 (Thousand Tons)

No	Country of Origin	2019	2020	2021	2022	2023
1	Thailand	53,278.00	88,593.1	69,360.0	80,182.5	1,381,921.2
2	Vietnames E	33,133.10	88,716.4	65,692.9	81,828.0	1,147,705.3
3	Pakistan	182,564.90	110,516.5	52,479.0	84,407.0	309,309.7
4	Myanmar	166,700.60	57,841.4	3,790.0	3,830.0	141,204.0
5	India	7,973.30	10,594.4	215,386.5	178,533.6	69,715.7
6	Japan	90.00	0.3	230.3	56.1	61.5
7	China	24.30	23.8	42.6	6.0	7.0
8	Other	744.60	0.3	760.1	364.1	12,933.3
	Total	444,508.80	356,286.2	407,741.4	429,207.3	3,062,857.6

Source: Central Bureau of Statistics, 2024

Table 1 shows rice imports by main country of origin in 2019-2023. Rice imports from main countries of origin fluctuated in 2019-2023. Rice imports from India decreased significantly in 2023. However, rice imports increased significantly in Vietnam, Thailand, Pakistan, Myanmar, Japan, China, and others in 2023. These data show that Indonesia still depends on rice imports from several developing countries. In 2023, the largest amount of rice came from Thailand, with a volume of 1,381,921.2 thousand tons, accounting for 45.12 percent of total rice imports that year.

Table 2. Data on the World's Five Largest Rice Producers in 2023 (Million Tons)

No	Country	Rice Production
1	China	145.9
2	India	132.0
3	Bangladesh	36.3
4	Indonesia	34.0
5	Vietnamese	27.0

Source: United States Department of Agriculture (USDA), 2024

Table 2 is data on the world's five largest rice producers in 2023. In Table 2,rice conditions in Indonesia compared to other countriesIn terms of rice production, Indonesia is one of the five largest rice producers in the world in 2023 after China and India. Rice production has increased from year to year. This increase in production is estimated to occur due to an increase in the harvest area.

There are several factors that determine the existence of rice imports in Indonesia such as production, international rice prices, population, and Gross Domestic Product (GDP). The first factor that determines the existence of rice imports in Indonesia is production. Almost 97 percent of the Indonesian population consumes rice as a staple food. This shows that Indonesia is very dependent on rice and one of the causes of rice imports from Indonesia is its rice production.(Pamungkas et al., 2023).

No	Year	Rice Production
		Table 3.Rice Production in Indonesia 1993 – 2023 (Million Tons)
1	1993	44.70
2	1994	45.10
3	1995	45.30
4	1996	31.70
5	1997	56.54
6	1998	49.23
7	1999	50.86
8	2000	51.88
9	2001	50.46
10	2002	51.49
11	2003	52.13
12	2004	54.09
13	2005	54.15
14	2006	54.45
15	2007	57.15
16	2008	59.32
17	2009	64.39
18	2010	66.46
19	2011	65.75
20	2012	69.05
21	2013	71.29
22	2014	70.83
23	2015	75.40
24	2016	79.14
25	2017	81.38
26	2018	59.20
27	2019	54.60
28	2020	54.64
29	2021	54.41
30	2022	54.74
31	2023	53.98

Source: Central Bureau of Statistics 2024

Domestic rice production has decreased, causing rice prices to potentially rise due to rising imports. Low production has resulted in reduced agricultural land ((Puspitasari et al., 2018). The meaning of this statement is that one of the causes of the rice stock shortage is because production in the region is decreasing. This is caused by the lack of paddy field area, due to the conversion of agricultural land to build housing, offices, and large companies (Azzahra et al, 2021). The amount of rice production has continued to increase and decrease in the last five years, making Indonesia need to import rice from neighboring countries.(Anggraini et al., 2021).

Not only rice production and consumption affect rice imports in Indonesia, but there is also a government policy on minimum rice reserves that can affect imports if rice reserves do not reach the minimum amount. It should be noted that Indonesia's

minimum rice stock is 20 percent of national rice needs.(Arifin, 2021). The second factor that determines the existence of rice imports in Indonesia is the international price of rice.

Table 4. International Rice Prices 1993 – 2023 (USD/Ton)

No	Year	Rice Price
1	1993	270.74
2	1994	260.88
3	1995	300.00
4	1996	340.62
5	1997	252.50
6	1998	127.00
7	1999	228.00
8	2000	262.20
9	2001	296.28
10	2002	302.20
11	2003	302.32
12	2004	330.58
13	2005	363.63
14	2006	450.00
15	2007	489.00
16	2008	575.00
17	2009	580.00
18	2010	568.80
19	2011	516.80
20	2012	542.00
21	2013	564.20
22	2014	450.00
23	2015	420.00
24	2016	369.00
25	2017	377.00
26	2018	421.00
27	2019	432.00
28	2020	450.00
29	2021	451.00
30	2022	620.00
31	2023	644.00

Source: Central Bureau of Statistics 1993–2023

Population of Indonesia in 1993-2023. In 1993-2023, BPS noted that the population increased significantly each year.The increase in population each year is due to several main factors. The first factor is a high birth rate, which is when the number of births exceeds the number of deaths. This is due to advances in health, nutrition, sanitation, and access to medical care, which have resulted in reduced mortality rates, especially infant and child mortality. This has contributed to increased life expectancy and population growth. Improvements in living standards, including health, nutrition,

and working conditions, have resulted in increased life expectancy. As a result, opeople live longer, which will eventually increase the population (Akasumbawa and Wibowo, 2021). The second factor is in-migration (immigration) which can increase the population in a country or region. People move to areas that offer better economic opportunities, security, or better living conditions.(Suartha and Murjana Yasa, 2017).

Although population growth will increase demand for rice, increased domestic productivity will not meet demand.(Sari, 2014). Economic, social, and political instability can occur if the amount of rice available is less than needed. The very large role of rice in the Indonesian economy makes government intervention in the economy very important.(Suandari and Ayuningsasi, 2017). Therefore, Indonesia must import rice from other rice producing countries.

Domestic rice production itself is very important to avoid the high risk of price instability and rice supply from the world market, and Indonesia continues to strive to increase domestic rice production and manage rice stocks to stabilize prices.(Anggraini et al., 2021). However, it is also not recommended for the government to continue importing rice. Innovation is needed to solve the problem of domestic food needs (Sariagi, 2021).

The next factor that determines the existence of rice imports in Indonesia is Gross Domestic Product (GDP). The size of rice production will affect the contribution of the agricultural sector to GDP. The greater the production, the greater the contribution of the agricultural sector. If Indonesia's GDP increases, economic growth will also increase, this is because economic growth can be seen from constant price GDP.

Table 5. GDP in Indonesia 1993 – 2023 (Trillion Rupiah)

No	Year	GDP
1	1993	959.8
2	1994	1,116.1
3	1995	1,243.7
4	1996	1,408.8
5	1997	1,605.3
6	1998	1,110.1
7	1999	1,352.2
8	2000	1,656.5
9	2001	1,711.4
10	2002	1,610.0
11	2003	1,786.7
12	2004	2,303.0
13	2005	2,729.7
14	2006	3,338.2
15	2007	3,957.4
16	2008	4,200.0
17	2009	5,613.4
18	2010	6,422.9
19	2011	6,840.3
20	2012	8,241.9

21	2013	9,084.0	472,660
22	2014	10,542.7	844,160
23	2015	11,540.8	861,600
24	2016	12,406.8	1,283,180
25	2017	13,588.8	305,270
26	2018	14,837.4	2,253,820
27	2019	15,833.9	444,510
28	2020	15,432.2	356,290
29	2021	16,970.8	407,740
30	2022	19,588.4	429,210
31	2023	20,892.4	3,062,860

Source: Central Bureau of Statistics 1993–2023

Along with GDP growth, if observed in 2018Indonesia imports quite a lot of rice, amounting to 2,253.82 thousand tons. This is to overcome the shortage of supply and stabilize prices in the market, but it also affects the results of local farmers due to the high import of rice in 2018. However, the positive side is that it can help stabilize prices and reduce the scarcity of rice production, which may face price competition with imported rice. Then, in 2019, there was a fairly extreme decline in rice imports in Indonesia, namely to 444.51 thousand tons. This decline was caused by several factors, including good domestic harvests and government policies to increase local production and reduce dependence on imports. The Indonesian government is also trying to achieve food self-sufficiency, especially in the rice sector, so that the country does not rely too much on imports from abroad (Ariska, 2021).

Therefore, the problem in this study is, actually Indonesia is an agricultural country rich in nature, which almost all sectors in Indonesia are agricultural sectors, so the need for rice production in Indonesia should be sufficient and does not require rice imports. However, every year the government continues to import rice from abroad. After observing, even though production in Indonesia is small or large, the government will continue to import rice from abroad to meet rice reserves.

Basically, rice imports are influenced by several factors such as rice production, international rice prices, population, GDP, and others. Seeing the large volume of Indonesian rice imports and Indonesia's status as an agricultural country which is a staple food requirement for the Indonesian people, researchers are interested in observing further the "Effect of Rice Production, International Rice Prices, Population, and GDP on Rice Imports in Indonesia".

RESEARCH METHODS

This study adopts a descriptive quantitative approach, which is considered relevant to the topic under investigation—namely, the impact of domestic rice production, global rice prices, population growth, and Gross Domestic Product (GDP) on the volume of rice imports in Indonesia during the period from 1993 to 2023. The geographical focus of the study is Indonesia as the research location. The main objective of this study is to evaluate how these economic variables influence the amount of rice imported into Indonesia over the specified time period.

The data used in this study are secondary data in the form of annual time series, comprising 31 observations from 1993 to 2023. The analysis was carried out using multiple linear regression techniques (Ordinary Least Squares/OLS) and the Error Correction Model (ECM). Since the data were found to be stationary at the first difference and exhibited long-run cointegration relationships among the variables, the Vector Error Correction Model (VECM) was selected as the most appropriate analytical method.

DATA AND DISCUSSION OF RESEARCH RESULTS
Research Results and Discussion
Descriptive Statistical Analysis

Table 6. Descriptive Statistics

Variables	N	Mean	Minimum	Maximum	Std. Deviation
Rice Import (Y)	31	6.69	3.19	13.44	1.79
Rice Production (X1)	31	4.03	3.45	4.39	0.19
International Rice Price (X2)	31	5.94	4.84	6.46	0.36
Population (X3)	31	19.27	19.07	19.44	0.11
GDP (X4)	31	8.39	6.86	9.94	1.03

Source: Appendix 2 in the author's thesis

Stationarity Test Results
1) **ResultsUnit Root Test**

Table 7.MarkUnit Root Test with ADF Method at Level Level

Variable (LN)	ADF test	Mackinnon 5%	Probability	Decision
Rice Import (Y)	-5.71	-3.56	0.00	Stationary
Rice Production (X1)	-2.52	-3.56	0.31	Not Stationary
International Rice Price (X2)	-2.30	-3.56	0.41	Not Stationary
Population (X3)	-1.75	-3.56	0.70	Not Stationary
GDP (X4)	-3.38	-3.62	0.07	Not Stationary

Source: Appendix 3 in the author's thesis

2) **Degree of Integration Test Results**

Table 8.MarkDegree of Integration Test with ADF Test on First Difference

Variable (LN)	ADF test	Mackinnon 5%	Probability	Decision
Rice Import (Y)	-6.65	-2,976	0.00	Stationary
Rice Production (X1)	-8.23	-2,967	0.00	Stationary
International Rice Price (X2)	-5.43	-2,967	0.00	Stationary
Population (X3)	-4.63	-2,967	0.00	Stationary
GDP (X4)	-5.54	-2,967	0.00	Stationary

Source: Appendix 4 in the author's thesis

Cointegration Test Results

Table 9.Long-Term Model Regression Results with Multiple Linear Regression

Variables	Coefficient	Std. Error	t-stat	Prob.	t-table	Decision
C	-185.43	325.74	2.14	0.01		Significant
Rice Production	0.37	2.33	3.34	0.00	2.05	Significant
International Rice Prices	0.97	1.62	2.44	0.00	2.05	Significant
Total population	10.10	17.58	1.02	0.44	2.05 2.05	Not Significant
GDP	-1.17	2.18	1.50	0.14	2.05	Not Significant
R-Squared	0.76		Mean Dep. Var	6.69		
Adj. R Squared	0.55		SD Dep. Var	0.79		
F-Statistic	7.44		Black Criterion	4.49		
Prob (F-statistic)	0.00		Durbin Watson	2.00		

Source: Appendix 5 in the author's thesis

Variables	Critical ValueADF			ADF	Probability	Decision
	1%	5%	10%			
ECT (-1)	-4.32	-3.58	-3.22	-6.23	0.0001	Cointegrated

Table 10. Results of Cointegration Test at Level Level

Source: Appendix 6

Short Term Model (ECM)

Table 11. ECM Model Estimation

Variable (D)	Coefficient	Std. Error	t-stat	Prob.	t-table	Decision
C	-0.36	0.74	-0.49	0.62	2.05	Not Significant
Rice Production	-3.94	2.46	-1.5	0.12	2.05	Not Significant
International Rice Prices	0.04	2.11	0.02	0.98	2.05	Not Significant
Total population	45.95	40.54	1.13	0.26	2.05	Not Significant
GDP	-0.50	3.87	-0.12	0.89	2.05	Not Significant
ECT (-1)	-1.00	0.18	-5.40	0.00	2.05	Significant
R-Squared	0.61		Mean Dep. Var	0.16		
Adj. R Squared	0.53		SD Dep. Var	2.52		
F-Statistic	7.56		Black Criterion	4.39		

Prob (F-statistic)	0.00	Durbin Watson	2.00

Source: Appendix 7 in the author's thesis

Classical Assumption Test

    1) **Normality Test**

Table 12.Normality Test Results

Test	Jarque-Bera	Probability	Information
Normality	2.45	0.29	Normal

Source: Appendix 8 in the author's thesis

    2) **Autocorrelation Test**

Table 13.ResultsAutocorrelation Test

F-statistic	96.31	Prob. F(2,1)	0.07
R-squared	26.86	Prob.Chi-Square(2)	0.06

Source: Appendix 9 in the author's thesis

    3) **Multicollinearity Test**

Table 14.Multicollinearity Test Results

Variable (D)	Coefficient Variance	VIF Uncentered	VIF entralized
C	0.55	5.51	NA
Rice Production	6.09	1.25	1.25
International Rice Prices	4.45	1.89	1.86
Total population	1643.72	3.61	1.04
GDP	14.99	3.53	1.95
ECT(-1)	0.03	1.07	1.07

Source: Appendix 10 in the author's thesis

    4) **Heteroscedasticity Test**

Table 15.Heteroscedasticity Test Results

F-statistic	0.29	Prob. F(23.3)	0.96
Obs*R-Squared	18.64	Chi-Square Prob.(23)	0.72
Scaled explained SS	0.20	Chi-Square Prob.(23)	1.00

Source: Appendix 11 in the author's thesis

Statistical Test

    Coefficient of Determination R2

Table 16. Determination Coefficient Value

Connection	R-Squared Value
Long-term	0.76
Short-term	0.61

Source: Appendix 12 in the author's thesis

From Table 16 the following information can be obtained.
1. In the long-term model, the R-squared value of 0.76 indicates that about 76 percent of the variation in rice imports can be explained by independent variables such as domestic rice production, international rice prices, population, and GDP. This value indicates that the long-term model has very good predictive ability, where most of the variation in the data can be explained by the variables used. The remaining 24 percent of the variation not explained by the model may come from other factors outside the independent variables used, such as rice trade policies, weather factors, or other international market dynamics.
2. In contrast, in the short-term model, the R-squared value was recorded at 0.61, which means that around 61 percent of the variation in rice imports can be explained by the independent variables in the short term. Although this value is lower than the long-term model, the figure of 61 percent still shows that this model is quite capable of explaining fluctuations in rice imports in the short term. However, there is 39 percent of unexplained variation, which may reflect the influence of short-term fluctuations that are not captured by the independent variables in the model.

F-Test of the Effect of Domestic Rice Production (X1), International Rice Prices (X2), Population (X3), GDP (X4) on Rice Imports (Y)

Table 17. Determination Coefficient Value

Connection	F-Statistic Prob. Value	Alpha Value	F-value Count	F-table value	Decision
Long-term	0.00	0.05	7.44	2.74	H1 accepted
Short-term	0.00	0.05	7.56	2.74	H1 accepted

Source: Appendix 13 in the author's thesis

The results of the simultaneous influence test for the analysis of long-term and short-term relationships between dependent variables and independent variables are as follows.
1. The Influence of Domestic Rice Production (X1), International Rice Prices (X2), Population (X3), GDP (X4) on Rice Imports (Y) in the Long Term
Based on the results of the F-test statistics for the long-term model, the F-count value was obtained at 7.44> F-table of 2.74, with a probability value (p-value) of 0.00 <0.05. Therefore, the decision taken is that H0 is rejected and H1 is accepted. This shows that together, the independent variables consisting of Domestic Rice Production (X1), International Rice Prices (X2), Population (X3), and GDP (X4) have a significant influence on the dependent variable, namely Rice Imports (Y) in the long term.
2. The Influence of Domestic Rice Production (X1), International Rice Prices (X2), Population (X3), GDP (X4) on Rice Imports (Y) in the Short Term
Based on the results of the F-test statistics for the short-term model, the F-count value was obtained at 7.56 > F-table of 2.74, with a probability value (p-value) of 0.00 <0.05. Therefore, the decision taken is that H0 is rejected and H1 is accepted. These results indicate that together, the independent variables, namely D (X1) (Domestic Rice Production), D (X2) (International Rice Price), D (X3) (Population), D (X4) (GDP), and ECT

(-1), have a significant influence on the dependent variable, namely D (Y) (Rice Imports) in the short term.

Testing the t-test of the effect of domestic rice production (X1), international rice prices (X2), population (X3), GDP (X4) on rice imports (Y)

Table 18. Long-Term Partial Effect Test

Variable (Ln)	Coefficient	T-value Count	T-table value	Prob.	Alpha Value
C	-185.43	2.14	2.05	0.01	0.05
Rice Production	0.37	3.34	2.05	0.00	0.05
International Rice Prices	0.97	2.44	2.05	0.00	0.05
Total population	10.10	1.02	2.05	0.44	0.05
GDP	-1.17	1.05	2.05	0.14	0.05

Source: Appendix 14 in the author's thesis

Based on Table 18, the partial influence of independent variables on dependent variables in the long term can be explained as follows:

1.   Testing the influence of rice production on rice imports in the long term

The t-test results show that the Rice Production variable (X1) has a coefficient value of 0.37 with a t-count of 3.34> t-table of 2.05. In addition, the probability value (p-value) is 0.00 <0.05. Thus, the decision taken is that H0 is rejected and H1 is accepted, which means that Domestic Rice Production has a significant effect on Rice Imports in the long term. The positive coefficient value indicates that an increase in rice production can paradoxically encourage an increase in rice imports, possibly due to the complex relationship between production, consumption, and national stock needs.

2.   Testing the influence of international rice prices on rice imports in the long term

The International Rice Price variable (X2) has a coefficient value of 0.97, with a t-count of 2.44> t-table of 2.05. The probability value (p-value) of 0.00 is also <0.05. The decision taken is that H0 is rejected and H1 is accepted, which means that the International Rice Price has a significant effect on Rice Imports in the long term. The positive coefficient value indicates that the increase in international rice prices is directly proportional to the increase in Rice Imports, which reflects Indonesia's dependence on the global rice market to meet domestic needs, especially in conditions of limited domestic supply.

3.   Testing the influence of population size on rice imports in the long term

In the Population variable (X3), the t-test results show a coefficient value of 10.10, with a t-count of 1.02 <t-table of 2.05. In addition, the probability value (p-value) of 0.44> 0.05. Thus, the decision taken is that H0 is accepted and H1 is rejected, which means that Population does not have a significant effect on Rice Imports in the long term. These results indicate that although the population is increasing, this factor is not strong enough to affect the volume of rice imports, perhaps because food needs have mostly been met through domestic production or food consumption diversification policies.

4. **Testing the effect of GDP on rice imports in the long term**

Table 19. Short-Term Partial Effect Test

Variable (Ln)	Coefficient	T-value count	T-table value	Prob.	Alpha Value
C	-0.36	-0.49	2.05	0.62	0.05
Rice Production	-3.94	-1.59	2.05	0.12	0.05
International Rice Prices	0.04	0.02	2.05	0.98	0.05
Total population	45.95	1.13	2.05	0.26	0.05
GDP	-0.50	-0.12	2.05	0.89	0.05
Domestic Rice Production	-1.00	-5.40	2.05	0.00	0.05

Source: Appendix 15 in the author's thesis

Based on Table 19, the partial influence of independent variables on dependent variables in the short term can be explained as follows:

1. **Testing the influence of rice production on rice imports in the short term**

The t-test results show that the Rice Production variable (X1) has a coefficient value of -3.94, with a t-count of -1.5 <t-table of 2.05. In addition, the probability value (p-value) of 0.12> 0.05, which is not significant, so the decision taken is that H0 is accepted and H1 is rejected. This means that Rice Production does not have a significant effect on Rice Imports in the short term. The negative coefficient indicates that production can theoretically reduce rice imports, but the insignificant results indicate that the impact is not strong enough to affect import volumes in the short term.

2. **Testing the influence of international rice prices on rice imports in the short term**

In the International Rice Price variable (X2), the coefficient value is 0.04, with a t-count of 0.02 <t-table value of 2.05. Probability value (p-value) of 0.98 > 0.05, also indicates that this variable is not significant at the 95 percent confidence level. Thus, the decision taken is H0 is accepted and H1 is rejected, which means that International Rice Prices do not have a significant effect on Rice Imports in the short term. This very small and insignificant coefficient indicates that international price fluctuations do not directly affect import volumes in the short term, possibly due to price adjustment policies or reserve rice stocks.

3. **Testing the influence of population size on rice imports in the short term**

The Population Variable (X3) has a coefficient value of 45.95, with a t-count of 1.13 <t-table of 2.05. In addition, the probability value (p-value) of 0.26> 0.05, also shows that this variable is not significant at the 95 percent confidence level. Therefore, the decision taken is that H0 is accepted and H1 is rejected, which means that Population does not have a significant effect on rice imports in the short term. These results indicate that although the population continues to increase, its impact on Rice Imports in the short term is not strong enough, possibly due to other factors such as consumption levels or domestic stock availability that are more dominant.

4. **Testing the effect of GDP on rice imports in the short term**

In the GDP variable (X4), the coefficient value is -0.50, with a t-count of -0.12 <t-table of 2.05. In addition, the probability value (p-value) of 0.89> 0.05, indicates that this variable is not significant. Thus, the decision taken is that H0 is accepted and H1 is

rejected, which means that GDP does not have a significant effect on Rice Imports in the short term. The negative coefficient indicates a potential inverse relationship between GDP and rice imports, where an increase in GDP can theoretically reduce imports. However, this insignificant result indicates that the effect is not strong enough to be seen in the short term.

Discussion
The Influence of Domestic Rice Production on Rice Imports in the Long-Term and Short-Term

It is found that, in the long term, rice production has a coefficient of 0.37 with a significance level of 0.00. This positive coefficient indicates that an increase in rice production potentially drives an increase in rice imports. In other words, the higher the rice production, the greater the tendency for imports to rise. The positive coefficient of the rice production variable signifies a statistically significant influence on the volume of rice imports. This is supported by the very low probability value of 0.00—well below the 5 percent significance threshold (0.05). In other words, a 1 percent increase in domestic rice production is predicted to result in a 0.37 percent increase in rice import volume. This finding appears contradictory to the general assumption that increased production should reduce the need for imports. However, this can be explained by considering other dynamics such as rice quality, the variety of rice imported, or consumption demands that exceed national production capacity.

Conversely, in the short term, the relationship between rice production and import volume shows a different tendency. Statistical calculations indicate that the rice production variable does not have a statistically significant effect on import decisions in the short term. This is evidenced by a negative coefficient of -3.94 with a probability value of 0.12—which is higher than the 5 percent significance level. This implies that even though there are changes in rice production, these changes are not yet strong or rapid enough to impact import policy adjustments. This may occur due to several factors, such as pre-determined import decisions or long-term contracts that do not immediately respond to short-term production changes. Overall, these results suggest that, in the long term, an increase in rice production may indirectly lead to increased imports—possibly due to rising demand for certain quality rice varieties that cannot be met by domestic production. Meanwhile, in the short term, production changes are not significant enough to directly affect import policy.

The Influence of International Rice Prices on Rice Imports in the Long-Term and Short-Term

It is observed that, in the long term, international rice prices have a coefficient of 0.97 with a significance level of 0.00. The positive coefficient indicates that an increase in international rice prices can drive up imports. The coefficient of the international rice price variable shows a statistically significant positive effect on rice imports at a probability of 0.00, which is below the 5 percent significance level. If the international rice price increases by 1 percent, the volume of rice imports is expected to increase by 0.97 percent. This indicates a positive relationship between rising global rice prices and the quantity of rice imported.

However, when analyzed in the short-term framework, the effect is not statistically significant. In this context, even if global prices increase, this is not yet strong enough to drive meaningful changes in a country's rice import activities.

Statistical analysis shows that the international rice price variable has a coefficient of 0.04 with a probability value of 0.98. This probability greatly exceeds the common significance threshold (α = 5 percent or 0.05), indicating that the relationship between international prices and rice imports is not statistically significant in the short term. Although the direction of the effect is positive—i.e., rising international prices tend to be followed by increased imports—the influence is statistically weak and cannot be relied upon for decision-making in the short term.

In other words, over a relatively short period, fluctuations in global rice prices are not yet the main factor determining decisions to increase or decrease rice imports. This could be due to other dominant factors in the short term, such as domestic stock availability, national food reserve policies, domestic price stability, or reliance on long-term international trade contracts. Therefore, although there is a positive correlation, it is important to understand that in the short term, rice import policy is not fully responsive to international price movements.

The Influence of Population Size on Rice Imports in the Long-Term and Short-Term

In the long term, the population variable has a coefficient of 10.10 with a significance level of 0.44, indicating that population growth tends to reduce the demand for imports. The positive sign of the population coefficient indicates a statistically insignificant influence on rice imports, as the probability value of 0.44 exceeds the 5 percent significance level. This suggests that if the population increases by 1 percent, rice imports will rise by 10.10 percent. However, in the short term, the analysis results show that population size does not have a significant effect on rice imports. This indicates that short-term changes in population are not yet impactful enough to influence import decisions. In the short term, the positive coefficient of the population variable is also not statistically significant in affecting rice import changes, with a probability of 0.26—above the α = 5 percent threshold. Furthermore, in the short term, the coefficient of population size is 45.95 with a significance level of 0.26, suggesting that a 1 percent increase in population actually causes a 45.95 percent decrease in rice imports.

The Influence of Gross Domestic Product (GDP) on Rice Imports in the Long-Term and Short-Term

In the long term, Gross Domestic Product (GDP) has a coefficient of -1.17 with a significance level of 0.14. The negative sign of this coefficient indicates that an increase in GDP actually leads to a reduction in import demand. The coefficient of the GDP variable reflects a statistically meaningful negative influence on rice import volume, with a probability value of 0.14, which is still below the 5 percent significance level. If GDP increases by 1 percent, rice imports are estimated to decline by 1.17 percent. This finding is consistent with research conducted by Siregar (2022), which also reported similar results.

Meanwhile, in the short term, the GDP variable shows a negative coefficient of -0.50 with a significance value of 0.89, indicating that its influence on changes in rice import volume is not statistically significant because the probability of 0.89 exceeds the 5 percent threshold. In other words, when GDP increases by 1 percent in the short term, rice imports will decrease by 0.50 percent, but this change is not strong enough to be considered statistically significant. Therefore, in the short term, GDP does not have a meaningful impact on rice import volumes.

CONCLUSION AND SUGGESTIONS

Based on the results of the analysis, it was found that variables such as domestic rice production, international rice prices, population size, and Gross Domestic Product (GDP) have a significant influence on Indonesia's rice import volume, both in the short and long term. Collectively, these four variables significantly affect the extent of rice imports. Partially, in the long term, domestic rice production and international rice prices exhibit a significant positive influence on import volume, indicating a dependency on imported rice despite rising prices and increased domestic production. Conversely, population size exerts a positive but statistically insignificant effect, while GDP shows a negative yet also insignificant influence on rice imports, suggesting that national economic growth has not yet directly reduced import dependency.

The findings indicate that although rice production has shown fluctuations, it tends to increase each year. However, this level of production remains insufficient to meet domestic demand. Therefore, the application of technology is crucial to enhancing rice productivity in Indonesia. In addition, the volatility of global rice prices can directly impact domestic inflation rates. When international rice prices increase, import costs rise accordingly, which may force the government and importers to pass on these costs to consumers through higher retail prices. Hence, it is recommended that the government prioritize local farmers' production to strengthen national rice stocks by providing support such as fertilizers and agricultural equipment to boost harvest yields.

This study also finds that Indonesia's population has grown significantly each year. The ongoing population growth drives increasing demand for rice; however, even with improvements in domestic productivity, the rate of increase is insufficient to meet the growing demand due to the population growth outpacing production growth. Therefore, population control through Family Planning (KB) programs and educational initiatives on its benefits could help curb the growth rate, particularly in densely populated areas.

Finally, a higher GDP can serve as a solution to reduce import dependency. A high GDP reflects strong economic growth, which can stimulate domestic production and lessen the need for imports. Suggested solutions include improving agricultural productivity, developing local industries, and strengthening export diversification. The government could also implement fiscal policies such as lowering taxes and providing subsidies to encourage investment and economic growth, as well as monetary policies such as reducing interest rates to control inflation and stimulate investment.

These research findings suggest that optimizing domestic production and managing fluctuations in international rice prices are crucial strategies for sustainably managing rice import volumes. Moreover, stable national economic growth has been proven to significantly contribute to reducing long-term dependence on rice imports.

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