

Analysis Of Rice Exports In ASEAN Plus Three Countries

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Abstract – Rice is the most consumed commodity in Asia. The high demand for rice consumption requires the supply of Rice to meet domestic food needs in each country. This study aims to analyze the factors that affect rice exports in selected ASEAN Plus Three countries. The countries selected in this study include Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Cambodia, Brunei Darussalam, Myanmar, Laos, China, Japan and South Korea. The method used is panel data spatial econometrics—the data used from 2005 to 2020. The research data were obtained from various sources, including the World Trade Organization, ASEAN statistics, World Trade Organization and WITS. The results show the factors that significantly affect GDP, production and exchange rates.

Keywords – Rice Exports, International Trade, Spatial

I. INTRODUCTION

Rice is an important food commodity that must be met and maintained by the state based on Law No. 18/2012, which states that the state must realize the availability and fulfilment of food consumption. Thus, fulfilling food needs becomes very important and strategic to maintain state sovereignty (Purwaningsih 2008). According to Law No. 18/2012 on food, food is everything that comes from biological sources of agricultural products, plantations, forestry, fisheries, livestock, waters and water, both processed and unprocessed, which are intended as food or drink for humans consumption, including food additives, food raw materials, and other materials used in the process of preparing, processing and or making food or drinks. The definition of staple food in the Law is designated as the primary daily diet according to the potential of local resources and wisdom.

The food crisis has become a global issue faced by the world's countries. The highest case of food crisis and hunger has been since 1970, with around 1.02 billion people experiencing a food crisis. It is predicted that by 2050 there will be an additional 2.32 billion people spread worldwide who will have to meet their food needs under the pressure of the increasingly severe threat of climate change and the decreasing amount of agricultural land (Mudrieq 1997). According to Law No. 18/2012 on food, a food crisis is a food scarcity experienced by most people in an area caused by food distribution difficulties, the impact of climate change, natural and environmental disasters and social conflicts, as well as the consequences of war. The food crisis from 2007 to 2008, characterized by rising food prices, posed a severe threat to the Asian region. Therefore, the food crisis faced by various countries in the world is an essential concern because it is related to human survival (Mudji dan Ramadhani 2020).

ASEAN Plus Three (APT) is a region formed to deepen East Asian cooperation in December 1997, starting with an informal meeting between ASEAN leaders and partners, namely China, Japan and South Korea. The association formed is to strengthen and deepen East Asian cooperation at various levels and fields, primarily social, political and economic areas, including finance, tourism, agriculture, forestry, energy, minerals and Small and Medium Enterprises (MSMEs) (Firdaus 2011). Both export and import trade activities are important because the high demand for rice consumption requires an adequate supply of Rice to meet domestic food needs in each country. Some producing countries tend to experience rice consumption shortages, namely Indonesia, Bangladesh, the Philippines and Japan. Rice consumption shortages occurred in Indonesia between 2012 and 2016, averaging 2.02 million tons, the Philippines 1.54 million tons, Japan 635 thousand tons and Bangladesh 618 thousand tons (Pusdatin 2016).

Government intervention in the rice market is carried out from upstream to downstream sectors, from farming to rice marketing. Based on Presidential Instruction (INPRES) No. 7/2009 on rice policy, the government determines policies ranging from encouraging and facilitating the use of certified superior rice seeds, the use of fertilizers, land rehabilitation, irrigation networks, enabling increased investment in the rice business sector, rice purchasing policies by determining price policies, determining guidelines for the provision and distribution of subsidized Rice, procedures for the provision and distribution of rice reserves to maintain price stability, cope with emergencies and food insecurity, and establish policies for exporting and importing Rice to maintain the interests of farmers and consumers.

A country carries out rice imports for a good reason. Indonesia is a country whose staple food is Rice, making the demand for rice high. The average rice consumption is 87.03%. This figure is close to 100%, which means that rice consumption is very high even though the Covid-19 pandemic conditions have not caused a decrease in rice demand (Isnawati *et al.* 2022). The increased demand for Rice and needing to be matched by sufficient production to meet consumption needs requires a country to import from other countries. Cooperation between Indonesia and China related to the rice trade positively impacts increasing production, prices, investment, consumption, imports, exports and national income (Jamilah *et al.* 2012). Indonesia is a net importer of agricultural commodities (Eva Ervani 2013). Indonesia's role in ASEAN trade in goods and services reached 14.2% in 2014 and 12.9% in 2015 (Allo *et al.* 2017). In addition to Indonesia, China also imports Rice in the next few decades, increasing imports by 3-5% of total world food consumption (Ji-kun *et al.* 2017). Both export and import trade play an essential role in a country's economic growth (Supiyadi dan Anggita 2020). Apart from being importers, countries in ASEAN Plus Three are also the world's rice-exporting countries. China has become an agricultural product exporter with intensive margins since the official establishment of the China-ASEAN Free Trade Area (CAFTA) (Sun dan Li 2018). Thailand is also the world's largest rice exporter.

Differences in geographical conditions lead to differences in the wealth of natural resources owned by each country. The ability of governments to fulfil their food needs is also different. This affects the country's ability to meet domestic food needs independently. Through international trade cooperation, each country can work together to meet the country's needs for goods and services that cannot be produced domestically. Rice is one of the agricultural commodities and is a staple food traded through export and import trade cooperation between countries, especially in ASEAN Plus Three. Conditions that include exchanges of both production activities and materials indicate the existence of spatial interactions in trade activities between countries. Discussing both aspects of production and daily activities, including fabric, energy, population and information, indicates spatial interaction. The pattern of spatial interactions and linkages shows that spatial interactions between regions influence the development of urban development (He *et al.* 2017). Spatial aspects influence export flows between COMESA (Common Market for Eastern Southern African) members (Hamzalouh *et al.* 2017). Therefore, it is important to know the factors that affect rice exports in ASEAN Plus Three.

II. RESEARCH METHOD

2.1. Types and Data Sources

The data used in the research is secondary data, namely in the form of time series panel data from 2005 to 2019 for the analysis of rice import factors and 2005 to 2020 for the study of export factors. The type of data used includes data on rice imports, rice exports, GDP, exchange rates, prices, tariffs, population and production. The data were taken from several sources, namely ASEAN Statistics Database, International Trade Center (ITC) Trade Map, World Bank, Food and Agriculture Organization (FAO), United Nations Conference on Trade Development (UNCTAD), WITS, CEPII and CEIC. The research data

covers 11 ASEAN Plus Three importing countries. For rice export analysis, the 11 ASEAN Plus Three countries include Indonesia, Malaysia, Philippines, Thailand, Vietnam, Brunei Darussalam, Cambodia, Laos, China, Japan and South Korea.

Table 1. Description of data used

No	Variabel	Satuan	Sumber
1	Rice import	Ton	ASEANstat, FAO, ITC <i>World Bank</i> ,
2	Rice export	Ton	<i>WITS</i> , BPS
3	GDP riil	USD	ASEANstast, FAO, <i>World Bank</i>
4	Population	Jiwa	ASEANstast, FAO, IMF, UNCTAD, <i>World Bank</i>
5	Exchange rate	USD	<i>World Bank</i> , CEIC
6	Production	Ton	FAO, UNCTAD, FAOSTAT
7	Tariff	Persen	WITS
8	Rice price		World Bank

2.2. Data Analysis Method

Spatial analysis is an analysis that incorporates spatial or spatial influences into its analysis. In spatial analysis, there is always a correlation between spaces, commonly called spatial correlation, and each observation is not stochastic-free. Ward dan Gleditsch (2008) stated that spatial analysis pays attention to the relationship between locations and the distance between places. The spatial analysis assumes that objects (an area) are not stochastic-free because they are interrelated. Regression analysis with spatial elements is applied in spatial cases with details of location and the relationship between sites. Various types of spatial regression analysis have been developed by researchers, including Spatial Autoregressive (SAR), Spatial Error Model (SEM), Generalize Spatial Model (GSM), Spatial Durbin, and Geographically Weighted Regression (GWR). Factors affecting rice imports in selected ASEAN Plus Three countries will be explained through descriptive analysis tested with GDP, price, production and exchange rate variables. These variables are tabulated into tables or graphs and described based on the tables or graphs.

Specification of Research Model

The panel data regression analysis used in this study generally refers to the Alamdarlo (2016) model, which is displayed in the following model:

$$\text{Rice export}_{it} = \alpha + \lambda \sum_{j=1}^N w_{ij} \text{Rice export}_{it-1} + \beta_2 \text{GDP}_{it} + \beta_3 \text{PRICE}_{it} + \beta_4 \text{PROD}_{it} + \beta_5 \text{ER}_{it} + \rho \sum_{j=1}^N w_{ij} \phi_{it} + \varepsilon_{it} \dots \dots \dots (1)$$

Description:

Rice Imports: Rice export (11 ASEAN Plus Three countries) (tons/year)

GDP : Real GDP in year t (US\$)

PRICE : International rice price (US\$/year)

PROD : Rice production in 11 ASEAN Plus Three countries in year t (tons/year)

ER : Exchange Rate of 11 ASEAN Plus Three countries against US\$ (LCU/US\$) in year t

α : constant

β : Coefficient

ϕ_{it} : Error of spatial autocorrelation

λ : Autoregressive spatial Coefficient

- ρ : Spatial autocorrelation coefficient
- w_{ij} : Weight matrix
- ε_{it} : error term

The analysis used in this study is panel data regression analysis. In econometrics, various types of regression exist, one of which is panel data regression which combines observations on several individuals (cross-section) and specific periods (time series). Some of the advantages of using panel data, according to Baltagi (2005), are that the data is more informative, more varied, more efficient, can avoid multicollinearity problems, is superior in studying emotional problems, can measure influences that cannot be observed in pure cross section data and pure time series.

$$y_{it} = \alpha + \beta x_{it} + \lambda_i + \gamma_t + \varepsilon_{it} \dots \dots \dots (2)$$

Description:

- y = Dependent variable
- α = Constant
- x = Independent variable
- β = Coefficient of the relationship between dependent and independent variables
- λ_i = Individual effect
- γ_t = Time effect
- ε_{it} = Error term

Parameter estimation in the spatial regression model equation. In general, Elhorst (2010) explains that the spatial econometric model is divided into several stages as follows:

1. Spatial Autoregressive (SAR) is a model with spatial variables in the response variable and error term. This model depends on the observation of the response variable in neighbouring units. This model is formulated as follows:

$$y_{it} = \lambda \sum_{j=1}^N w_{ij} y_{it} + \beta x_{it} + \mu_1 + \varepsilon_{it} \dots \dots \dots (3)$$

2. The spatial Error Model (SEM) is a spatial variable model of the error term. The focus is on the shape of the residuals. This model is formulated as follows:

$$y_{it} = \beta x_{it} + \rho \sum_{j=1}^N w_{ij} \Phi_{it} + \varepsilon_{it} \dots \dots \dots (4)$$

3. General Spatial Model (GSM) is a spatial variable model on the response variable and error term by including general spatial elements formulated as follows:

$$y_{it} = \lambda \sum_{j=1}^N w_{ij} y_{it} + \beta x_{it} + \rho \sum_{j=1}^N w_{ij} \Phi_{it} + \varepsilon_{it} \dots \dots \dots (5)$$

Description:

- y_{it} = Response variable vector
- x_{it} = Explanatory variable matrix
- β = Regression parameter coefficient vector of size
- Φ_{it} = error of spatial autocorrelation
- λ = spatial autoregressive Coefficient
- ρ = spatial autocorrelation coefficient
- w_{ij} = weighting matrix

ϵ_{it} = error term

III. RESULT AND DISCUSSION

In static panel data analysis, there are three models, namely Pooled Least Square (PLS) or Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The chow test and the Hausman test make the best model selection. Based on the chow test, the probability value is $2.2e-16$, meaning that the probability value is smaller than five per cent, so the Fixed Effect Model (FEM) model is the best model compared to the PLS model. The Hausman test results show that the probability value is $2.2e-16$, meaning that it is smaller than the five per cent level. This indicates that the Fixed Effect Model (FEM) model is the best model. After obtaining the best model, the next step is to conduct a classic assumption test consisting of an autocorrelation test, normality test and heteroscedasticity test.

Furthermore, the Lagrange Multiplier test is conducted to see the spatial effect on the model. The Lagrange Multiplier (LM) test shows that the spatial effect on error (LMerr), Robust spatial effect on error (RLMerr), and robust spatial effect on lag (RLMlag) has a p-value <0.05 , so reject H_0 . The model has a spatial influence on errors and a strong spatial influence on mistakes and lags. Model selection in spatial panel data analysis is made by selecting the best model between the General Spatial Model (GSM), Spatial Autocorrelation Model (SAR) or Spatial Error Model (SEM). The parameter estimation comparison table of the spatial panel data model is as follows:

Table 2 Comparison of spatial panel data model parameter estimates

	Parameter Estimation	Panel Data Regression (Fixed Effect)	SAR Panel	SEM Panel	GSM Panel
Regression Coefficient	β_1	5.773*	-2.906*	5.899*	-7.520*
	β_2	0.277*	-2.977	0.185	-4.952
	β_3	-0.367	-6.147	-1.795*	-2.323
	β_4	-0.001	9.711	-0.001*	-3.354
Spatial Coefficient of Influence	λ	-	4.632	-	3.706
	ρ	-	-	4.632	0.395

Notes: *) significant at a 5% level

The comparison of regression coefficients on the Spatial Autocorrelation Model (SAR) shows that the Coefficient β_1 of the SEM model is positive at 5.899. This means that an increase in GDP by 1% affects the increase in rice exports by 5.899%, with other variables considered constant. The positive GDP per capita variable indicates that GDP per capita will affect the productivity of a country's rice exports and increase product availability so that the supply of rice products increases. These conditions affect a country's rice exports to increase. A country's GDP per capita illustrates the welfare condition of a nation. When people's welfare is high, their purchasing power for a product is high, so public consumption is also high and has an impact on increasing rice exports. Adi (2017) stated that national GDP could increase people's purchasing power through imports. In addition, an increase in national income increases the ability of the community to carry out the production process, thereby increasing exports.

The coefficient β_3 of the panel SEM model has a coefficient value of -1.795 and is significant at the 5% level. This shows that if there is a 1% increase in rice production, it will reduce rice exports by 1.795%. Market liberalization between countries makes the economy of a country more open. World rice market prices also cause fluctuations in the domestic rice market. He *et al.* (2017) stated that world food prices increased in 2008, causing some exporting countries to worry about food safety by imposing export bans which triggered an increase in world food prices.

The panel SEM model has a spatial coefficient of 0.80 and is significant at the 5% level. This shows that a country surrounded by n other countries will affect each surrounding countryside by 0.80 multiplied by the export value of the surrounding nations. The spatial effect of neighbouring countries on rice exports in ASEAN Plus Three countries needs to be strengthened by cooperation among ASEAN Plus Three countries in dealing with food security issues, maintaining rice production and price stability. Spatial panel data regression includes General Spatial Model (GSM), Spatial Autoregressive Model

(SAR) and Spatial Error Model (SEM). Based on the best model selection test with AIC, BIC, and RMSE, it can be seen that the highest R Square value compared to other models is the Spatial Error Model (SEM) model. The SEM Panel model is the best model that can explain the influence of rice exports in 11 ASEAN Plus Three countries.

Table 3 Spatial Error Model (SEM) Estimation Results

Variable	Koefesien	Pr(> t)
GDP	5.89934016	<2.2e-16*
PRICE	0.18481285	0.47534
PROD	-1.79504096	0.04342*
ER	-0.00105346	2.781e-09*
R-Squared	0.8011292	

Note the level of significance at *5%.

The SEM estimation results show that the R-square is 0.8011292. This means that 80.11% of the diversity in the export value of rice commodities in the ASEAN Plus Three region can be explained by the independent variables in the model, and other variables outside the model explain the rest. The resulting SEM model equation is as follows. The results of spatial panel regression with the Spatial Error Model (SEM) show that the variables of GDP, Production and Exchange Rate have a significant effect on rice exports in 11 ASEAN Plus Three countries, and the Price variable has no significant impact.

GDP significantly and positively affects rice exports in ASEAN Plus Three countries. The resulting probability value is <2.2e-16 and smaller than the five per cent absolute level. GDP has a coefficient value of 5.899. This means that every 1% increase in GDP affects the increase in rice exports in ASEAN Plus Three by 5.899%. Amir *et al.* (2020) countries in ASEAN that have a percentage contribution of exports to GDP below 50% are Indonesia and the Philippines. The country that has the most significant percentage contribution of exports to GDP is Singapore. This shows that the stable value of exports influences the economy of countries in the ASEAN region. Exports and imports in international trade are transactions of buying and selling goods and services carried out by residents of a country with other countries based on mutual agreement. International trade is reflected in export and import activities which are components of a country's GDP formation from the expenditure approach. Increasing net exports is an essential factor in increasing the value of a country's GDP.

Liberalization of markets between countries causes a country's economy to be more open and results in dependence between countries. Free calls have consequences for rice prices in the domestic market to be more open, which causes fluctuations in domestic rice prices due to changes in rice prices in the world market (Herliana 2022). Thailand is a major rice exporter to Indonesia, so the cost of Rice in Thailand affects the number of Indonesian imports (Paipan dan Abrar 2019). The analysis results show that international rice prices do not significantly affect rice exports in ASEAN Plus Three. The coefficient value of rice price is 0.185, meaning that if the global cost of rice increases by 1%, it will affect the growth in rice exports in ASEAN Plus Three. Price is one factor that affects the demand for goods in a country. If the price of Rice on the international market increases, Rice producing countries can increase their production, but if the price on the global market decreases, it will increase the demand for goods in importing countries and affect the increase in exports.

Based on data (USDA 2020), ASEAN is the world's third-largest Rice producing region, with a market share of 24.94 per cent. The analysis shows that rice production significantly affects rice exports in ASEAN Plus Three. The production coefficient value is negative 1.795. This means that a 1% increase in production will reduce rice exports in ASEAN Plus Three countries by 1.795%. The Covid-19 pandemic has had a significant impact on the national economy. The Covid-19 pandemic affects domestic trade, especially agricultural products. The policies implemented during the pandemic have disrupted the food economy, including the decline in the balance of staple foods, the disruption of distribution from surplus areas to deficit areas and the dynamics of price variations between regions and between times that require handling stock management and logistics. The Covid pandemic has negatively impacted agricultural commodities' export performance (Suryana *et al.* 2020).

The exchange rate is the price of one country's currency against another. The supply and demand of coins in the market determines exchange rates. The estimation results show that the exchange rate significantly affects rice exports in ASEAN Plus Three. The coefficient value of the exchange rate is negative -0.001. This indicates that a 1% increase in the exchange rate decreases rice exports by 0.01% in ASEAN Plus Three countries. The exchange rate of a country's currency against the dollar measures the value of buying and selling goods abroad. Changes in exchange rates affect export prices, import prices, and domestic prices. Fluctuations in the exchange rate will affect the volume and value of exports. Fluctuations in the exchange rate affect the export performance of agricultural products, including rice exports. The influence can benefit the country or even be an obstacle for business people and related governments. The rupiah's depreciation against the dollar is a factor in the supply curve shifting to the right. The exchange rate reflects a country's competitiveness in international trade. The depreciation of the rupiah against the dollar makes the price of Indonesian Rice relatively cheaper and encourages export supply.

IV. CONCLUSION

Factors that significantly affect rice exports are GDP (Gross Domestic Product), PROD (Production) and ER (Exchanger Rate), and variables that have no effect are Price variables. GDP significantly and positively affects rice exports in ASEAN Plus Three countries. The resulting probability value is $<2.2e-16$ and is smaller than the actual level of five per cent. GDP has a coefficient value of 5.899. This means that every 1% increase in GDP affects increasing rice exports in ASEAN Plus Three by 5.899%. The analysis shows that rice production significantly affects rice exports in ASEAN Plus Three. The production coefficient value is negative 1.795. This means that a 1% increase in production will reduce rice exports in ASEAN Plus Three countries by 1.795%. Exchange rates are determined by the supply and demand of currencies in the market. The estimation results show that the exchange rate significantly affects rice exports in ASEAN Plus Three. The Coefficient of the exchange rate is negative -0.001. This indicates that a 1% increase in the exchange rate decreases rice exports by 0.01% in ASEAN Plus Three countries.

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