

*Research Article*

## Deteminants of Indonesia's Palm Oil Export Volume

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**Abstract:** Palm oil production in Indonesia is basically a commodity for export and Indonesia itself is the largest exporter of palm oil in the world. This can prove that palm oil exports from Indonesia are able to compete with other tea exporting countries. The aim of this research is to determine the influence of land area, production quantity, and world price of CPO simultaneously and partially on the volume of Indonesian palm oil exports from 1994-2023. The data used in this research is secondary data in the form of quantitative data sourced from BPS and the World Bank. The area of this research is the Republic of Indonesia. The data analysis technique used is the Error Correction Model (ECM) analysis technique. The research results show that land area, production volume and world price of CPO simultaneously influence the volume of Indonesian palm oil exports. The production quantity variable partially has a positive and significant effect. The variables of land area and world price of CPO partially have no effect. Considering the importance of exports to a country's economy, it is necessary to increase the export volume of palm oil in Indonesia, as one of Indonesia's leading export commodities, by paying attention to factors that can influence export volume.

**Keywords:** Export, Volume, Palm Oil, Land, Area.

### 1. Introduction

International trade is an important aspect of the economy of every country in the world in this era of globalization, with international trade the economy influences each other between one country and another. International trade is a way that is considered to be able to meet the desired needs by involving other regions. International trade is also the most appropriate way to increase the prosperity of a country's people because not all countries have the same production equipment and conditions in both quality and quantity. (Suhartini & Sutrisna, 2022). International trade occurs because of differences in natural resources such as geography, climate, technology, economic structure, labor specifications, social, and politics. The main benefit of international trade is to increase prosperity by providing each country with the opportunity to specialize in producing goods and services relatively efficiently. Trade provides new opportunities for growth for developing countries, every country will definitely trade between countries to meet the needs and welfare of the community, one of which is export activities, because exports have a major impact on supporting economic growth. (Golda & Widanta, 20022)

International trade is an important thing for every country to do. Currently, there is no country that does not have economic relations between countries. This international trade activity is carried out with the aim of improving the country's standard of living. (Aglia & Indrajaya, 2022). Indonesia is an agricultural country that has abundant natural resources plus Indonesia's position which is considered very strategic. From a geographical perspective, Indonesia is located in a tropical area that has high rainfall so that many types of plants can grow well. Indonesia's development is strongly supported by the agricultural sector. Where one of the agricultural sub-sectors is the plantation sector. The plantation sector has become a mainstay of exports for Indonesia in the international market, so it has a very large role in providing employment, exports and economic growth. In various global economic and

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financial crises, plantations are usually not too disturbed by the impact of the crisis and are even always able to support the country's economy (Kartasasmita 2011).

Palm oil is one of the most widely produced and consumed oils in the world. The oil, which is easy to produce and inexpensive, is often used for a variety of foods, cosmetics, cleaning products, and can also be used as a source of biofuel or biodiesel. Oil palm trees require sufficient sunlight, warm temperatures and high rainfall to maximize their production. Most palm oil is produced in Africa, South America and Asia. The advantages of oil palm in Indonesia are a reflection of the very fertile soil conditions, rainfall and sufficient sunlight conditions. Having high competitiveness in agriculture will make Indonesia able to compete in the Asian and World markets (Ningsih & Wibowo, 2016). The development of the palm oil sector has an important role in economic activities in Indonesia. Palm oil is one of Indonesia's export commodities as a foreign exchange earner outside of oil and gas. Indonesian palm oil exports are not only to developing countries but also to several developed countries such as the European Union, although currently there are still many polemics and complicated regulations between Indonesia and the European Union regarding palm oil. Palm oil is very rapid in Southeast Asia so that crude oil produced from palm oil, or better known as Crude Palm Oil (CPO) makes Indonesia and Malaysia's most dominant export commodities in the world market. Until now, Indonesia is currently the largest producer of palm oil in the world (GAPKI, 2018).

## 2. Research Methods

This study uses a quantitative approach method, this method is used because the data that is realized is data in the form of numbers. In addition, data processing is carried out using statistical analysis. So it can be said that this study is a quantitative study. Quantitative research is a type of research that utilizes data in the form of numbers and is then analyzed using statistical methods (Sugiyono, 2017). This study examines the effect of land area, production volume and world CPO prices on the volume of palm oil exports in Indonesia.

In this study, the analysis tool used is time series data with an error correction model or Error Correction Model (ECM). Time series data is often non-stationary, which can cause the regression results to be questionable, or what is known as spurious regression. Spurious regression is a condition in which the regression results show a significant regression coefficient, even though in terms of the model, the variables are actually not related to each other (Widarjono, 2013). The right model for non-stationary time series data is the error correction model or Error Correction Model (ECM). ECM is a dynamic model used to correct short-term imbalances to return to long-term equilibrium. (Insukindro, 1999) states that ECM can also be used to explain why economic actors face imbalances, namely in the context that the phenomena expected by economic actors are not necessarily in accordance with what happens in reality.

## 3. Proposed Method

### Descriptive Statistical Analysis

Table 1

Variabel	Minimum	Maksimum	Mean	Std. Deviation
Volume Ekspor Minyak Kelapa Sawit	1.479.278	28.628.465	14.715.916	9.771.454
Luas Lahan	1.804.149	15.435.705	8.210.691	4.479.654
Jumlah Produksi	4.008.062	47.120.247	22.302.134	14.963.062
Harga Dunia CPO	287	1276	706,53	257,38

The export volume of Indonesian palm oil has a minimum value of 1,479,278 tons and a maximum value of 28,628,465 tons. From the period 1994-2023, it is known that the mean value is 14,715,916 tons, and the standard deviation value is 9,771,454 tons. This means that the mean value is greater than the standard deviation, indicating that the data used is very diverse. This means that the sample is a good representation of all existing data.

The land area has a minimum value of 1,804,149 hectares and a maximum value of 15,435,705 hectares. From the period 1994-2023, it is known that the mean value is 8,210,691 hectares, and the standard deviation value is 4,479,654 hectares. This means that the mean value is greater than the standard deviation, indicating that the data used is very diverse. This means that the sample is a good representation of all existing data.

The production volume has a minimum value of 4,008,062 tons and a maximum value of 47,120,247 tons. From the period 1994-2023, it is known that the mean value is 22,302,134 tons, and the standard deviation value is 14,963,062 tons. This means that the mean value is greater than the standard deviation, indicating that the data used is very diverse. This means that the sample is a good representation of all existing data.

The world price of CPO has a minimum value of 287\$/Mt and a maximum value of 1276\$/Mt. From the period 1994-2023, it is known that the mean value is 706.53\$/Mt, and the standard deviation value is 257.38\$/Mt. This means that the mean value is greater than the standard deviation, indicating that the data used is very diverse. This means that the sample is a good representation of all existing data.

### Stationarity Test Results

The assumption of data stationarity is an important characteristic in conducting time series analysis. If the data is stationary, then spurious regression or doubtful regression can be avoided. Therefore, it is necessary to first conduct a stationarity test to determine whether the variables used are stationary or not. One way to check data stationarity is by testing the unit root by observing whether the time series data contains a unit root or not. Therefore, in this study, the Augmented Dickey-Fuller (ADF-test) method is used with the unit root test stage at the level level, and if not, then it must be done at the first difference level.

**Table 2**

<b>Variabel</b>	<b>Probabilitas</b>	<b>Keputusan</b>
Volume Ekspor Minyak Kelapa Sawit	0,1102	Tidak Stasioner
Luas Lahan	0,0125	Stasioner
Jumlah Produksi	0,1883	Tidak Stasioner
Harga Dunia CPO	0,4306	Tidak Stasioner

Based on Table 2, the variable of palm oil export volume (Y) has a probability value  $> 0.05$ , which is  $= 0.1102$ . This means that the variable of palm oil export volume is not stationary at the level level. The land area variable (X1) has a probability value  $< 0.05$ , which is  $= 0.0125$ . This means that the land area variable is stationary at the level level. The variable of production quantity (X2) has a probability value  $> 0.05$ , which is  $= 0.1883$ . This means that the variable of production quantity is not stationary at the level level. The variable of world CPO price (X3) has a probability value  $> 0.05$ , which is  $= 0.4306$ . This means that the variable of world CPO price is not stationary at the level level. Based on the Augmented Dickey-Fuller (ADF) test with a probability value of 5%, it states that not all variables in this research model are stationary at the level level or at the unit root, so it is necessary to conduct a degree of integration test.

### Cointegration Test Results

Cointegration test is the next step after the unit root test and the degree of integration test are carried out. (Ekanada, 2014) states that the basis of cointegration is that a number of time series data can deviate from their average in the short term, but move together. For a longer period of time, the data moves towards a state of equilibrium in the long term. If a number of variables move together in the long term at the same order, it can be said that the variables in the model are cointegrated. In the context of economic theory, if there is a shock in the economic system, then in the long term there is a force that drives the economy to recover to its equilibrium condition. In other words, if there is an imbalance in the short term, there will be a force that drives the economy towards its equilibrium condition (Ekanada, 2014).

Cointegration testing in this study uses the Engle-Granger (EG) cointegration test. To conduct the EG test, first the independent variable is regressed against the dependent variable with the OLS (ordinary least square) regression of the long-term equation and the residuals are obtained. Furthermore, the residual value in the regression equation must be tested for unit root to determine its stationarity. (Widarjono, 2013) suggests that in order for the calculation to be unbiased, the residual test is carried out with the ADF (Augmented Dickey-Fuller) or PP (Philip-Perron) test. In this study, the ADF test will be used with the results of the long-term equation regression calculation with OLS regression in Table 3.

**Table 3**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	0.800015	0.488402	1.638027	0.1135
X2	0.585887	0.418146	1.401157	0.1730
X3	-0.110927	0.147591	-0.751584	0.4591
C	-5.474316	1.506885	-3.632870	0.0012
R-squared	0.964203	Mean dependent var		16.14615
Adjusted R-squared	0.960073	S.D. dependent var		1.000425
S.E. of regression	0.199902	Akaike info criterion		-0.258413
Sum squared resid	1.038982	Schwarz criterion		-0.071586
Log likelihood	7.876189	Hannan-Quinn criter.		-0.198645
F-statistic	233.4426	Durbin-Watson stat		1.296454
Prob(F-statistic)	0.000000			

### Short Term Model (ECM)

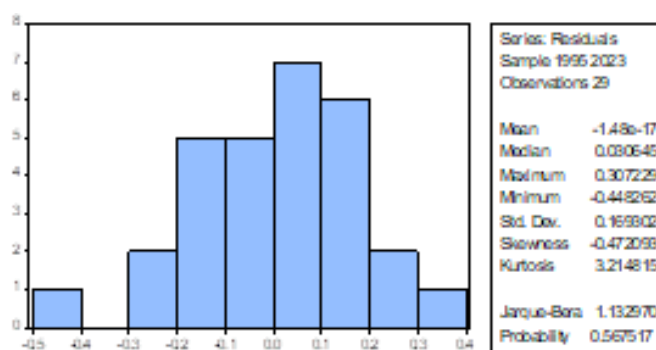
Based on the previous cointegration test, it was found that the volume of Indonesian palm oil exports, land area, production volume and world CPO prices have a cointegration relationship, or in other words have a long-term relationship or equilibrium. However, in the short term, it is very possible that there will be an imbalance or these variables will not reach equilibrium. The technique for correcting short-term imbalances towards long-term equilibrium is called the Error Correction Model (ECM) which was introduced by Sargan and popularized by Engle and Granger (Nachrowi & Usman, 2007).

Table 4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X1)	-0.157161	0.776476	-0.202403	0.8413
D(X2)	1.812843	0.756735	2.395610	0.0247
D(X3)	-0.212139	0.159190	-1.332618	0.1952
ECT(-1)	-0.679139	0.192356	-3.530635	0.0017
C	-0.035097	0.064730	-0.542203	0.5927
R-squared	0.521671	Mean dependent var		0.098796
Adjusted R-squared	0.441950	S.D. dependent var		0.244793
S.E. of regression	0.182867	Akaike info criterion		-0.404529
Sum squared resid	0.802569	Schwarz criterion		-0.168788
Log likelihood	10.86567	Hannan-Quinn criter.		-0.330698
F-statistic	6.543678	Durbin-Watson stat		2.254035
Prob(F-statistic)	0.001041			

## Classical Assumption Test

### 1) Normality Test



Picture 1

The results of the normality test with the Jarque-Bera test can be seen in Figure 4.5 which shows the results of the residual test from the short-term equation (3.2) with a probability value at  $\alpha = 5\%$ , with the following results. Based on Figure 4.5, it can be concluded that at  $\alpha = 5\%$ , it is known that the residuals of the model in the short-term equation (3.2) which describe the relationship of independent variables that have a significant effect on the dependent variable, are normally distributed. This is because the p-value = 0.567517 is greater than  $\alpha = 5\%$ . Thus,  $H_0$  is accepted and  $H_1$  is rejected, which means that the residuals are normally distributed.

### 2) Autocorrelation Test

Table 5

F-Statistic	2,790135	Prob. F(2,22)	0,0832
Obs* R-squared	5,867521	Prob. Chi-square(2)	0,0532

Based on Table 5, it can be concluded that at  $\alpha = 5\%$ , the residuals of the model in the short-term equation (3.2) which describes the relationship of independent variables that significantly affect the dependent variable, have random residuals, so that there is no residual correlation from one observation to another. This is because the probability of chi-square = 0.0532 is greater than  $\alpha = 5\%$ . Therefore, the assumption of no residual autocorrelation from one observation to another is met. Thus,  $H_0$  is accepted and  $H_1$  is rejected, which means there is no residual autocorrelation.

### 3) Multicollinearity Test

Table 6

Variabel	Centered VIF
Luas Lahan (X1)	1,815792
Jumlah Produksi (X2)	1,845792
Harga Dunia CPO (X3)	1,216868
ECT (-1)	1,106144

Based on Table 6, it can be concluded that the VIF value of each independent variable is less than 10, so the assumption of no multicollinearity is met.

### 4) Heteroscedasticity Test

Table 7

F-statistic	0,921040	Prob. F(4,24)	0,4680
Obs* R-squared	3,859269	Prob. Chi-square(4)	0,4254
Scaled explained SS	2,927109	Prob. Chi-square(4)	0,5701

Based on Table 4.9, it can be concluded with the Chi square probability value = 0.4254 which is greater than  $\alpha = 5\%$ , using the Breusch-Pagan method, so that the assumption of no heteroscedasticity in this model is met.

## 4. Results and Discussion

### The influence of land area on the volume of Indonesian palm oil exports

Based on the test results, it is known that the land area variable has a positive effect and is not statistically significant in the long term or short term. This means that land area has a positive and insignificant effect on the volume of Indonesian palm oil exports. This result is not in accordance with the research hypothesis which states that land area has a positive and significant effect on the volume of Indonesian palm oil exports. This study is in line with (Sudirman & Wardani, 2014) which concluded that land area had no effect on the volume of tea exports in Indonesia in 2000-2012. Research from (Saragih & Sulistyowati, 2020) concluded that land area had a negative and insignificant effect on the volume of Indonesian tea exports in 1987-2016. In addition, research from (Setiawina & Ayuningsih, 2014) concluded that land area had no effect on the volume of Indonesian cinnamon exports in 1992-2011. From previous studies that examined the relationship between the same variables partially, namely the land area variable and export volume, it was stated that increasing land area does not always increase export volume.

### The influence of production volume on the volume of Indonesian palm oil exports

Based on the test results, it is known that the variable of production quantity has a positive and statistically significant effect in the short term, which means that an increase in production quantity will also increase the export volume of Indonesian palm oil and a decrease in production quantity will also decrease the export volume of Indonesian palm oil. The positive value of the regression analysis is in accordance with the theory put forward by Adam Smith regarding the Theory of Absolute Advantage which proves that the higher the production, the higher the export volume. The results of this study are in accordance with (Rosita, et al., 2014) which states that the production variable has a positive and significant effect on exports,

if the production of goods and services increases economically, domestic needs have been achieved, then there will be an excess surplus from the production that can be exported to be traded abroad to gain profit and increase export value. The results of this study are also supported by the results of previous research from (Wirawan & Indrajaya, 2012) which states that the increase in export volume is inseparable from the increase in production quantity due to the increasing area of rubber plantations, advanced equipment and the increasing need for the product itself. This research is also supported by the results of previous research from (Nurmalita & Bowo, 2019) and (Alam, et al., 2021) which stated that production has a significant effect on export volume.

### **The influence of world CPO prices on the volume of Indonesian palm oil exports**

Based on the test results, it is known that the world CPO price variable has a negative effect and is not statistically significant in the long term or short term. This means that the world CPO price has a negative and insignificant effect on the volume of Indonesian palm oil exports. This result is not in accordance with the research hypothesis which states that the world CPO price has a positive and significant effect on the volume of Indonesian palm oil exports. The factor that makes the world CPO price have a negative effect on the volume of Indonesian palm oil exports is due to the form of the Indonesian export system often using a Memorandum of Understanding (MoU) or cooperation contract, so that price changes do not have much effect. This contract is signed between the producer company (palm oil exporter) and the consumer company (palm oil importer) and also the trading price that has been set in the contract based on the value of the producer's currency against the US dollar. This makes the CPO price have no effect on the volume of palm oil exports. In addition, Indonesia is the first palm oil producing country in the world. However, the world CPO price is controlled by Malaysia. The reason why the determination of the world CPO price is under the control of Malaysia is because the country has long been recognized as the largest palm oil and CPO producer in the world. Malaysia determines the world price of palm oil and CPO commodities, including for Indonesia, through Bursa Malaysia Derivatives (BMD). BMD itself has a history of CPO trading since 1980. The role and existence of BMD causes the world price of CPO to be set with reference to the Malaysian ringgit currency. In addition, the price of palm oil and CPO commodities is also determined by the United States dollar. This is in line with research conducted by (Maygirtasari, 2015) who conducted research on the factors that influence the volume of Indonesian crude palm oil (CPO) exports, including international CPO prices. The results of this study indicate that international CPO prices have an insignificant positive effect on the volume of Indonesian CPO exports. These results also support previous research conducted by (Abolagba, et al., 2010) which explains that international prices are not a variable that significantly influences the volume of Nigerian cocoa and rubber exports. These results are also in accordance with research by (Risdiyati, et al., 2021) and (Wirawan & Indrajaya, 2012) which states that prices do not have a significant effect on Indonesia's export volume. This is due to the increasingly competitive price competition in the world market and also the unstable economic conditions caused by the global crisis so that importing countries are reluctant to buy. This result is also supported by research (Dewi & Indrajaya, 2020) entitled "The Effect of Production Amount, International Prices, and Exchange Rates on Indonesian Paper Exports" in this study explains that partially International Prices show a negative insignificant effect on Indonesian paper exports. The results of this study are also supported by (Simanjuntak, et al., 2017) entitled the influence of production, international prices and the rupiah exchange rate on the volume of Indonesian seaweed exports (Study in 2009-2014) which concludes that international prices are negative and insignificant on the volume of Indonesian seaweed exports.

## 5. Conclusions

Based on the results of data processing and analysis and analysis in the previous chapter, the following conclusions can be drawn:

- 1) Land area, production volume and world CPO prices simultaneously have a significant effect on the volume of Indonesian palm oil exports from 1994-2023.
- 2) Land area and world CPO prices partially have no effect on the volume of Indonesian palm oil exports from 1994-2023. The amount of production partially has a positive and significant effect on the volume of Indonesian palm oil exports from 1994-2023.

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