Indonesia's CPO Exports and Foreign Exchange Reserves: Evidence From Indonesia and Singapore

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Abstract: This study aims to examine the causal relationship between Indonesia's CPO exports (XCPO), Indonesia's foreign exchange reserves (FRI), Singapore's foreign exchange reserves (FRS), and other variables. The research method used is a time series data regression with the Vector Autoregression (VAR) approach. The estimation of this VAR model will be carried out twice, first the VAR model for Singapore and the second the VAR model for Indonesia. The XCPO variable will be included in both models. The research results on the VAR model for Singapore show that XCPO significantly affects FRS. Meanwhile, the VAR model for Indonesia shows that XCPO does not significantly affect FRI. Thus it can be proven statistically that the money from CPO exports does not return to Indonesia but is kept in Singapore. For this reason, the Indonesian government must be able to provide incentives for exporters so that they feel it is profitable to save their money in Indonesia.

JEL: E31, F14, F31, F51
Keywords: Indonesia's CPO Exports, Indonesia's Foreign Exchange Reserves, Singapore's Foreign Exchange Reserves, VAR.

1. INTRODUCTION

Foreign exchange reserves are an essential indicator that reflects a country's macroeconomic condition (Ariyasinghe & Cooray, 2021). Foreign exchange reserves are essential to maintain financial stability and prevent crises (Azeem & Khurshid, 2019). Suppose you look at what is happening in Sri Lanka now, where its foreign exchange reserves are tiny, under $US 50 million. In that case, it makes the country unable to meet its country's needs, especially in the energy sector. This will put this country at risk of experiencing a blackout of electric energy and a shortage of fuel oil for transportation. Seeing the vital role of foreign exchange, reserves (Stiglitz & Greenwald, 2010) reveals three factors for the demand for foreign exchange reserves in a country, namely: first is the instability of global macroeconomic conditions, second is the view of exports as the best driver of growth and development, and the third is price volatility. Natural resource commodities. This condition encourages a country to maintain its foreign exchange reserves.

Generally, a country's foreign exchange reserves are used to buy goods from abroad. In other words, foreign exchange reserves can support a country's international trade activities. In addition, Indonesia's foreign exchange reserves are also used to pay off foreign debt (BI Communication Department, 2022). For this reason, it is necessary to maintain the continuity of foreign exchange reserves. One of the crucial sources of foreign exchange reserves is exports of non-oil and gas products.

Several studies have shown the significant role of exports in foreign exchange reserves. Minhaj & Wahyudi (2022) found the critical role of exports in increasing Indonesia's foreign exchange and economic reserves. One of the essential export commodities that Indonesia currently relies on is palm oil. An important factor driving the high export of Indonesian palm oil is Indonesia's ample land resources. Land resources for oil palm plantations are handed over by the state to private parties to be adequately managed. The government's hope with intensive oil palm plantation activities in Indonesia is to increase exports which will encourage an increase in the country's foreign exchange.

Palm oil is the commodity with the most significant exports in 2020 and 2021 in Indonesia. In the last ten years, the export value of Indonesian palm oil has always been at the top of Indonesia's main exports. The export value of this commodity continues to increase from year to year in line with the intensification of land resources which is being carried out to encourage this CPO export activity. Oil palm land used was 14.05 million hectares in 2017 to 15.08 million hectares in 2021 (BPS, 2022). The area of land used to grow oil palm is 207 times the size of Singapore.

On the one hand, using extensive land resources in the oil palm plantation sector should encourage increasing foreign exchange reserves for Indonesia. On the other hand, managing oil palm plantations requires a significant investment. One of the countries investing quite a lot in this sector is Singapore, with a contribution of 53 percent of total FDI in this sector (Idris, 2022). Singapore's role in the export of Indonesian products is also huge. As a trading hub, Singapore takes a share of 37.2 percent in the added value of exports from abroad (ASEAN. Secretariat., 2019). For this reason, this study will analyze relationship between Indonesian palm oil exports on Singapore and Indonesia's foreign exchange reserves. In addition, this study will also use other

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variables, especially economic variables related to foreign exchange reserves.

2. LITERATURE REVIEW

This study aims to fill the theoretical gap regarding the variables that affect foreign exchange reserves between countries. Current research only focuses on analyzing the relationship between foreign exchange reserves and other related variables domestically or the interrelationships between variables in only one country. Meanwhile, this article will analyze the spill-over impact of the two related countries, Indonesia and Singapore. Several researchers have examined several vital variables that affect foreign exchange reserves. These variables are inflation, exchange rates, and exports, where the relationship between variables is also a concern in this article. Ariyasinghe and Cooray (2021) examined the relationship between foreign exchange reserves and inflation. The results of this study indicate that there is a long-term relationship between variables. Furthermore, Azeem & Khurshid (2019), using the Vector autoregression (VAR) method, also found that exchange rates affect foreign exchange reserves in the long term.

Isramaulina and Ismaulina (2021) examine the relationship between foreign exchange reserves and Indonesia's economic indicators. The results of this study indicate that exports, exchange rates, and CPI significantly affect Indonesia’s foreign exchange reserves. Furthermore, Andiryani et al. (2020) tested the factors that affect foreign exchange reserves in Indonesia and found that inflation had no significant effect on foreign exchange reserves, while exports and the exchange rate had a significant effect. Febrianti et al. (2021), using Vector autoregression (VAR), examined the relationship between exchange rates and exports and found a two-way relationship between these variables where significant exchange rates pushed exports and vice versa.

Suman &Verma (2021) examines the factors that influence foreign exchange reserves in India. Suman & Verma's research (2021) found that exchange rates, exports, FDI, and short-term debt significantly affect foreign exchange reserves in India. Furthermore, using VAR, Hariadi et al. (2020) also found that the export variable had a significant effect on the exchange reserve variable.

3. DATA AND METHODOLOGY

This study compares the role of Indonesia's palm oil exports (XCPO) variable in two vector auto regression (VAR) models in two countries, namely Indonesia and Singapore. The first VAR model is the VAR model related to the role of Indonesia's CPO exports in Singapore's foreign exchange reserves. The variables to be estimated in the first VAR model or this article are called the "Singapore VAR Model" are Singapore's foreign exchange reserves given the symbol "FRS, Singapore Inflation Variable (INFS), exchange rate variable or Singapore dollar exchange rate against the United States dollar with symbol KS, and Indonesian palm oil exports (XCPO).

The second VAR model aims to examine the role of Indonesia's CPO exports in Indonesia's foreign exchange reserves. The second model in this article is called the “Indonesian VAR Model”. The variables analyzed for the Indonesian VAR Model are Indonesia's foreign exchange reserves (FRI) variables, Indonesian inflation variables (INFI), exchange rates or rupiah exchange rates against the United States dollar (KI), and XCPO. So, the XCPO variable will be included in the two VAR models.

The analysis tool used is Vector autoregression (VAR) analysis. The stages of analysis carried out before carrying out the VAR analysis are first: unit root testing, second: determining the optimum lag length, third: cointegration testing, and fourth: VAR testing. The description of each of the VAR test steps is as follows.

3.1. Stationarity (Unit Root Test)

This test aims to determine the content of the unit root in a variable. The content of the unit root will result in non-stationary data during testing so that it can cause spurious regression. Spurious regression does not represent the actual situation caused by the characteristics of the time series, where trends can interfere with the estimation results (Barry et al., 2020). In this study, the approach used for stationarity testing is Augmented Dickey-Fuller (ADF). The hypothesis tested in this stationarity test is as follows.

Hypothesis A (HA): The variable is not stationary.

3.2. Determination of Optimum Lag Length

A critical step in the regression analysis using the VAR model is determining the lag length. This is important because estimating time series data requires an optimum lag of an independent variable in influencing the dependent variable. Determining the optimum lag length in this article uses the Akaike Information Criterion (AIC) approach. This is because the AIC approach with the smallest value is more widely used and preferred by researchers (Gujarati, 2003). The following formula indicates the AIC calculation.

$$AIC\ (k) = T \ln\left(\frac{SSR(k)}{T}\right) + 2n$$

Where T is the number of observations, k is the lag length in the AIC model, SSR (Sum of Square Residual), and n is the number of estimated parameters.

3.3. Cointegration Relationship

Testing the cointegration relationship in this study aims to see whether or not there is a long-term relationship between variables. Furthermore, this test will determine whether the next estimation model will use VAR or VECM. The approach used in this test is the Johansen Cointegration Test. This model examines the number of long-term relationships between variables. The hypothesis to be tested in the cointegration test is as follows.

Hypothesis A (HA): The variable has no cointegration relationship.

3.4. Estimation of VAR Models

After finding that the variables are stationary and there is no co-integration relationship between variables, the analysis is continued with the VAR model. The VAR model that will be used in this study is as follows.

$X_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \beta_p X_{t-p}$ (1)

Where β_0 is a constant, then β_1 to β_p is a lag coefficient from variable X to order p. From formula 1, it can be developed for the Singapore VAR Model and the Indonesian VAR Model.

VAR model for Singapore

The VAR model for estimating the relationship between variables in Singapore follows.

$D(FRS) = \beta_0 + \beta_1{*}D(FRS(-1)) + \beta_2{*}D(FRS(-2)) + \beta_3{*}D(INFS(-1)) + \beta_4{*}D(INFS(-2)) + \beta_5{*}D(KS(-1)) + \beta_6{*}D(KS(-2)) + \beta_7{*}D(XCPO(-1)) + \beta_8{*}D(XCPO(-2))$ (2)

$D(INFS) = \beta_0 + \beta_9{*}D(FRS(-1)) + \beta_{10}{*}D(FRS(-2)) + \beta_{11}{*}D(INFS(-1)) + \beta_{12}{*}D(INFS(-2)) + \beta_{13}{*}D(KS(-1)) + \beta_{14}{*}D(KS(-2)) + \beta_{15}{*}D(XCPO(-1)) + \beta_{16}{*}D(XCPO(-2))$ (3)

$D(KS) = \beta_0 + \beta_{17}{*}D(FRS(-1)) + \beta_{18}{*}D(FRS(-2)) + \beta_{19}{*}D(INFS(-1)) + \beta_{20}{*}D(INFS(-2)) + \beta_{21}{*}D(KS(-1)) + \beta_{22}{*}D(KS(-2)) + \beta_{23}{*}D(XCPO(-1)) + \beta_{24}{*}D(XCPO(-2))$ (4)

$D(XCPO) = \beta_0 + \beta_{25}{*}D(FRS(-1)) + \beta_{26}{*}D(FRS(-2)) + \beta_{27}{*}D(INFS(-1)) + \beta_{28}{*}D(INFS(-2)) + \beta_{29}{*}D(KS(-1)) + \beta_{30}{*}D(KS(-2)) + \beta_{31}{*}D(XCPO(-1)) + \beta_{32}{*}D(XCPO(-2))$ (5)

The VAR model shown from Formula (2) to Formula (5) is a VAR model for Singapore, which is stationary at the first difference and with optimal lag at the second lag. The hypothesis tested for each dependent variable is as follows.

$H_1 = \beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \ldots \beta_8 = 0$a; This means that each independent variable has no significant effect on D(FRS).

$H_2 = \beta_9 = 0, \beta_{10} = 0, \beta_{11} = 0, \ldots \beta_{16} = 0$; This means that each independent variable has no significant effect on D(INFS).

$H_3 = \beta_{17} = 0, \beta_{18} = 0, \beta_{19} = 0, \ldots \beta_{24} = 0$; This means that each independent variable has no significant effect on D(KS).

$H_4 = \beta_{25} = 0, \beta_{26} = 0, \beta_{48} = 0, \ldots \beta_{32} = 0$; This means that each independent variable has no significant effect on D(INFS).

VAR models for Indonesia

After carrying out the stationarity test and determining the optimal lag, the equation developed from formula (1) is obtained. The Indonesian VAR model equation is shown from equation (6) to equation (9) as follows.

$D(FRI) = \Theta_0 + \Theta_1{*}D(FRI(-1)) + \Theta_2{*}D(INFI(-1)) + \Theta_3{*}D(KI(-1)) + \Theta_4{*}D(XCPO(-1))$.(6)

$D(INFI) = \Theta_0 + \Theta_5{*}D(FRI(-1)) + \Theta_6{*}D(INFI(-1)) + \Theta_7{*}D(KI(-1)) + \Theta_8{*}D(XCPO(-1))$.(7)

$D(KS) = \Theta_0 + \Theta_9{*}D(FRI(-1)) + \Theta_{10}{*}D(INFI(-1)) + \Theta_{11}{*}D(KI(-1)) + \Theta_{12}{*}D(XCPO(-1))$.(8)

$D(XCPO) = \Theta_0 + \Theta_{13}{*}D(FRI(-1)) + \Theta_{14}{*}D(INFI(-1)) + \Theta_{15}{*}D(KI(-1)) + \Theta_{15}{*}D(XCPO(-1))$ (9)

After obtaining the Indonesian VAR Model equation, the next step is to test the hypothesis with the Wald test. The hypothesis that will be tested is the significance of the coefficients of each independent variable. These hypotheses are as follows.

$H_1 = \Theta_1 = 0, \Theta_2 = 0, \Theta_3 = 0, \ldots \Theta_4 = 0$; This means that each independent variable has no significant effect on D(FRS).

$H_2 = \Theta_5 = 0, \Theta_6 = 0, \Theta_7 = 0, \ldots \Theta_8 = 0$; This means that each independent variable has no significant effect on D(INFS).

$H_3 = \Theta_9 = 0, \Theta_{10} = 0, \Theta_{11} = 0, \ldots \Theta_{12} = 0$; This means that each independent variable has no significant effect on D(KS).

$H_4 = \Theta_{13} = 0, \Theta_{14} = 0, \Theta_{15} = 0, \ldots \Theta_{16} = 0$; This means that each independent variable has no significant effect on D(INFS).

3.5. Data

The data used in this study is secondary data obtained from related agencies. The data is grouped into six variables. These variables are variables that previous studies have tested in terms of their effect on foreign exchange reserves. The seven variables are first: Indonesia's foreign exchange reserves; second: Singapore's foreign exchange reserves. Third: Indonesian inflation; fourth: Singapore inflation; fifth: Indonesian exchange rate; sixth: Singapore exchange rate; and seventh: Indonesia's palm oil exports. The research data is time series data for the period from January 2010 to December 2022.The types and sources of data in this study are presented in Table **1** as follows.

Table 1. Variable and Data Source.

No	Variable Name	Variable Symbol	Data source
1.	Indonesia's Foreign Exchange Reserves	FRI	Bank Indonesia (BI)
2.	Singapore's Foreign Exchange Reserves	FRS	Monetary Authority of Singapore (MAS)
3.	Indonesian Inflation	INFI	Bank Indonesia (BI)
4.	Singapore Inflation	INFS	Monetary Authority of Singapore (MAS)
5.	Rupiah to US Dollar exchange rate	KI	Bank Indonesia (BI)
6.	Singapore Dollar to US Dollar exchange rate	KS	Monetary Authority of Singapore (MAS)
7.	Value of Indonesian Palm Oil Exports to the World	XCPO	Trade Map Website

4. EMPIRICAL RESULTS

4.1. Description of Indonesia and Singapore's Foreign Exchange Reserves

Even though as a country with a much smaller area compared to Indonesia, Singapore has much larger foreign exchange reserves. In the last eleven years, Singapore's foreign exchange reserves have more than doubled Indonesia's foreign exchange reserves. Singapore's foreign exchange reserves continue to increase significantly, especially during

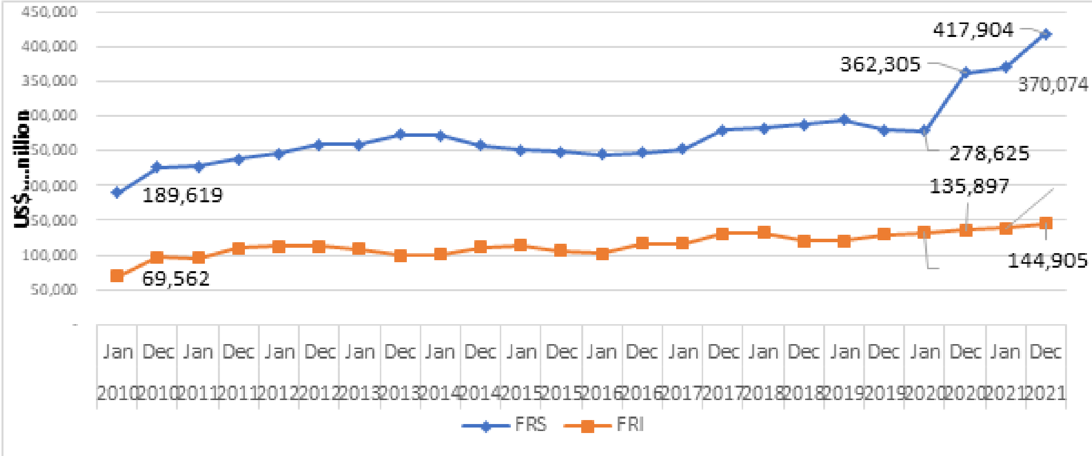

Fig. (1). Indonesia and Singapore's Foreign Exchange Reserves for the 2010-2021 period.

Source: MAS (2022) and Bank Indonesia (2022).

Fig. (2). Singapore Dollar and Rupiah Exchange Rates against the United States Dollar 2010-2021.

Source: MAS (2022) and Bank Indonesia (2022).

the Covid-19 pandemic. In January 2020, Singapore's foreign exchange reserves reached USD 278.6 billion, while Indonesia's was less than half, namely USD 131.7 billion. This value continued to increase in December 2021 to USD 417.9 billion for Singapore and USD 144.9 billion for Indonesia. In other words, Singapore's foreign exchange reserves in that period were close to three times Indonesia's foreign exchange reserves.

Description of Currency Exchange Rate to United States Dollar

The Indonesian rupiah exchange rate against the US dollar has continued to experience an increasing trend since January 2010. The range of the rupiah exchange rate against one US dollar (USD) in 2010-2021 was the lowest IDR 8,991 in December 2010 and the highest IDR 14,481 in December 2018. This shows that the rupiah exchange rate continues to weaken against the USD. Meanwhile, the Singapore dollar exchange rate against one USD fluctuated in the lowest range of S$1.22 in December 2015, and the highest was S$1.45 in December 2016. During the Covid-19 pandemic, the exchange rates for these two currencies were relatively stable, where the Indonesian rupiah was IDR 14,000, and the Singapore dollar wasUS$1.3.

Fig. (**2**) shows the different exchange rate patterns against the US dollar. The rupiah exchange rate pattern tends to increase but is smooth, while the Singapore pattern tends to be volatile but within a specific range. This can happen because of the exchange rate policies of each of these countries. According to Klyuev & Dao (2017), Indonesia implements an inflation-targeting framework (ITF) policy with a floating exchange rate, while Singapore implements a policy of implementing a basket peg where the currency is US dollars and other currencies.

4.2. Description of Inflation Rates in Indonesia and Singapore

Singapore's inflation has remained stable in the last eleven years (2010-2021). The highest inflation ever experienced by

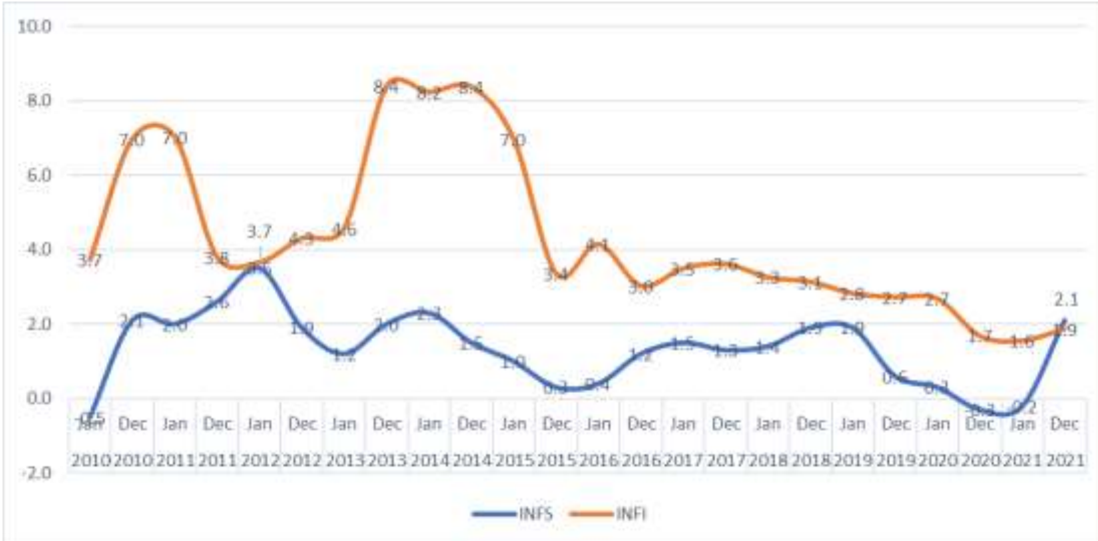

Fig. (3). Inflation Data for Indonesia and Singapore for the period 2010 to 2021. Source: MAS (2022) and Bank Indonesia (2022), processed.

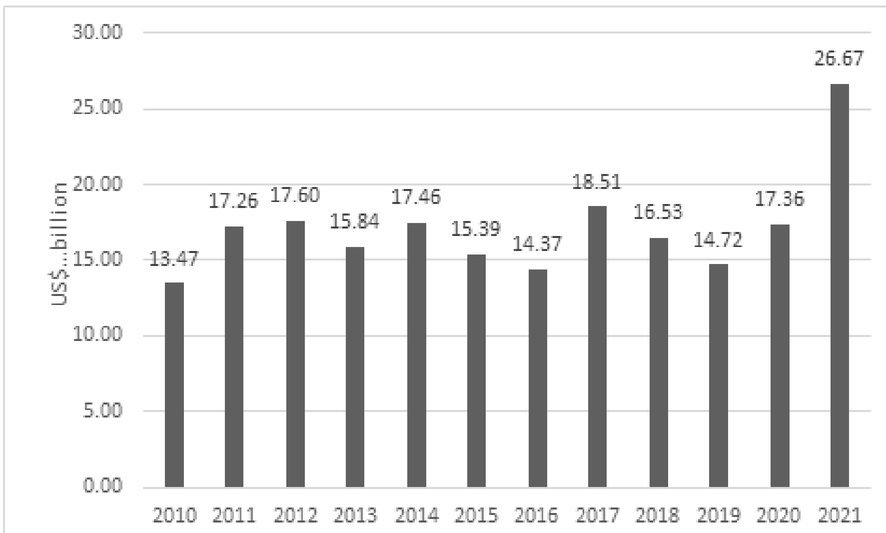

Fig. (4). Export Value of Indonesian Palm Oil for the 2010-2021 Period.
Source: Trade Map Website (2022), processed.

Singapore was 3.5 percent in January 2012. Meanwhile, in January 2010, December 2020, and January 2021, Singapore experienced deflation. In contrast to Singapore, Indonesia experienced inflation which tended to be volatile in the 2010-2015 period, with the highest inflation rate of 8.4 percent in December 2013 and December 2014 and the lowest in December 2015 at 3.4 percent. Indonesia recorded inflation which was also relatively high (7 percent) in December 2010, January 2011, and January 2015. Meanwhile, Indonesia's inflation in 2016-2021 tended to decrease, with the highest rate of 4.1 percent in January 2016, and was relatively stable at below 3 percent. during the Covid-19 pandemic. Inflation in Indonesia and Singapore in January and December from 2010 to 2021 is presented in Fig. (**3**).

4.3. Description of Indonesian Palm Oil Exports

The export value of Indonesian palm oil in 2010-2021 has consistently been above US$ 13 billion. The lowest export value of Indonesian palm oil was US$ 13.47 billion in 2010, then reached US$ 26.67 billion in 2021. The export value of this commodity in 2020 increased by 29 percent from 2010. The highest increase occurred in 2021, namely by 52 percent. The export value of Indonesian palm oil in the 2010-2021 is presented in Fig. (**4**).

4.4. VAR Model

Stationarity Test Results

The stationarity test results at the Level shows that the six variables estimated in this paper (FRI, FRS, INFI, INFS, KI, and KS) are not stationary. Meanwhile, there is only one stationary variable at the level: the XCPO variable. To get an accurate estimate of the VAR model, each variable must be stationary in the same order. Thus, further stationarity testing is needed, namely on the first difference. The results of the stationarity test on the first different show that all variables are stationary in that order. Furthermore, the estimation of the VAR model will be carried out for each variable using a

Table 2. Stationarity Test Results.

No	Variable	Level		First Different	
		Prob.	Explanation	Prob.	Explanation
1.	FRI	0.2377	Accept HA	0.0000	Reject HA
2.	FRS	0.9994	Accept HA	0.0004	Reject HA
3.	INFI	0.4809	Accept HA	0.0000	Reject HA
4.	INFS	0.1115	Accept HA	0.0000	Reject HA
5.	KI	0.6864	Accept HA	0.0000	Reject HA
6.	KS	0.1636	Accept HA	0.0000	Reject HA
7.	XCPO	0.0009	Reject HA	0.0000	Reject HA

Table 3. Cointegration Test Results (1) for Singapore.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.227023	59.61006	47.85613	0.0027
At most 1	0.119315	23.30164	29.79707	0.2315
At most 2	0.036261	5.386839	15.49471	0.7664
At most 3	0.001269	0.179057	3.841466	0.6722

Table 4. Cointegration Test Results (2) for Indonesia.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.176035	54.75120	47.85613	0.0098
At most 1	0.128784	27.44967	29.79707	0.0911
At most 2	0.035385	8.010613	15.49471	0.4643
At most 3	0.020572	2.930867	3.841466	0.0869

first-orderdifference. The stationarity test results are presented in Table **2**.

Cointegration Test Results

Cointegration testing is an essential step in this research. This mainly aims to determine whether the next test will use VAR or the Vector Error Correction Model (VECM). Cointegration test results for the VAR model on Singapore's foreign exchange reserves show that each variable has no cointegration relationship. In other words, each variable does not have a long-term relationship. For this reason, the following next estimate is the VAR model. Cointegration test results for variables related to Singapore's foreign exchange reserves are presented in Table **3**.

The next cointegration test is for variables related to Indonesia's foreign exchange reserves. These variables are FRI, INFI, KI, and XCPO. The test results are presented in Table **4**.

As shown in the cointegration test results for variables related to Singapore's foreign exchange reserves, Table **4** also shows that the variables affecting Indonesia's foreign exchange reserves do not have a cointegration relationship. Thus these variables will also be estimated using the VAR model.

Optimal Lag Length Determination Results

The optimal lag length was also determined for two VAR models. The results of determining the optimal lag length for the Singapore VAR model, as shown in Table **5**, show that the optimal lag length is up to the second lag. For this reason, the estimation of the Singapore VAR model is carried out until the second lag.

The VAR model of Indonesia's foreign exchange reserves (Table **6**) shows that the optimal lag of the model extends to the first lag. Thus the estimation of the VAR model with the effect of the lag for the Indonesian equation is carried out until the first lag.

VAR Model Estimation For Singapore

The variables estimated in the VAR model for Singapore are D(FRS), D(INFS), D(KS), and D(XCPO). To estimate the effect of Singapore inflation, the Singapore dollar exchange

Table 5. Optimal Lag Length Determination Results for Singapore.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1996.06	NA	86784831	29.63045	29.71653*	29.66543
1	-1969.34	51.44756	74058320	29.47174	29.90215	29.64664*
2	-1952.29	31.83915	72955881*	29.45608*	30.23082	29.77091
3	-1937.04	27.56198*	73889917	29.46720	30.58627	29.92196
4	-1925.61	19.96797	79310852	29.53502	30.99842	30.12970
5	-1914.51	18.75430	85687783	29.60754	31.41527	30.34215

Table 6. Optimal Lag Length Determination Results for Indonesia.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3333.87	NA	3.52e+16	49.44998	49.53606*	49.48496
1	-3308.08	49.68225	3.04e+16*	49.30485*	49.73526	49.47976*
2	-3292.95	28.23438*	3.08e+16	49.31780	50.09254	49.63264
3	-3283.16	17.70538	3.38e+16	49.40971	50.52878	49.86447
4	-3278.89	7.458941	4.04e+16	49.58354	51.04694	50.17822
5	-3274.02	8.221510	4.79e+16	49.74846	51.55618	50.48307

Table 7. Results of the Wald Test with Variable D(FRS) as the Dependent Variable.

Symbol of Coefficient	C(1)	C(2)	C(3)	C(4)	C(5)	C(6)	C(7)	C(8)	C(9)
Coefficient	-0.010	0.227	1598.699	375.114	14546.500	21187.340	-0.559	2.695	1171.628
Prob.	0.925	0.037	0.378	0.828	0.597	0.441	0.673	0.047	0.023

rate against the United States dollar, and Indonesia's CPO exports on Singapore's foreign exchange reserves, an estimation of the Singapore VAR model is performed with D(FRS) as the independent variable. The equation is presented in formula (3) as follows.

D(FRS) = C(1)*D(FRS(-1)) + C(2)*D(FRS(-2)) + C(3)*D(INFS(-1)) + C(4)*D(INFS(-2)) + C(5)*D(KS(-1)) + C(6)*D(KS(-2)) + C(7)*D(XCPO(-1)) + C(8)*D(XCPO(-2)) + C(9) (3)

Formula (3) does not show the significance of each independent variable, so it is necessary to test the hypothesis with the Wald test for each independent variable. The results of the Wald test (presented in Table **7**) show that two variables influence D(FRS), namely D(FRS) in the first lag and D(XCPO) in the second lag. Variable D(FRS) in the first lag significantly affects the 5 percent level. This means that changes in the value of foreign exchange reserves are affected by changes in the value of these variables in the previous period. The second lag's variable D(XCPO) significantly affects the 5 percent level. In other words, changes in the value of Indonesia's CPO exports in the previous two periods will drive changes in Singapore's foreign exchange reserves. Meanwhile, Singapore's inflation rate and the Singapore dollar's exchange rate against the US dollar did not significantly affect its foreign exchange reserves.

The following VAR model equation for Singapore is D(INFS) as the dependent variable. The Singapore VAR model equation with Singapore inflation as the dependent variable is presented in formula (4) as follows.

D(INFS) = C(10)*D(FRS(-1)) + C(11)*D(FRS(-2)) + C(12)*D(INFS(-1))+ C(13)*D(INFS(-2)) + C(14)*D(KS(-1)) + C(15)*D(KS(-2)) + C(16)*D(XCPO(-1)) + C(17)*D(XCPO(-2)) + C(18) (4)

The results of testing the hypothesis with the Wald test are presented in Table **8** with D(INFS) as the dependent variable showing that all independent variables have no significant effect. The second lag is the independent variable significantly affecting Singapore's foreign exchange reserves. Thus it can be seen that the variable D(INFS) has a one-way causality relationship with the variable D(FRS).

The third VAR model for Singapore has D(KS) as the dependent variable. The model equation is presented in formula (5) as follows.

D(KS) = C(19)*D(FRS(-1)) + C(20)*D(FRS(-2)) + C(21)*D(INFS(-1)) + C(22)*D(INFS(-2)) + C(23)*D(KS(-1)) + C(24)*D(KS(-2)) + C(25)*D(XCPO(-1)) + C(26)*D(XCPO(-2)) + C(27)..(5)

Wald test formula (5) with the Singapore dollar exchange rate (KS) as the dependent variable is presented in Table 9. The test results show that the Singapore exchange rate is

Table 8. Results of the Wald Test with Variable D(INFS) as the Dependent Variable.

Symbol of Coefficient	**C(10)**	**C(11)**	**C(12)**	**C(13)**	**C(14)**	**C(15)**	**C(16)**	**C(17)**	**C(18)**
Coefficient	0.00	0.00	-0.09	0.11	1.91	1.24	-0.00	0.00	-0.02
Prob.	0.18	0.06	0.28	0.17	0.15	0.34	0.50	0.35	0.53

Table 9. Results of the Wald Test with Variable D(KS) as the Dependent Variable.

Symbol of Coefficient	**C(19)**	**C(20)**	**C(21)**	**C(22)**	**C(23)**	**C(24)**	**C(25)**	**C(**
Coefficient	0.000	-0.000	-0.008	-0.011	0.007	-0.070	0.000	-0.
Prob.	0.093	0.493	0.267	0.094	0.948	0.514	0.413	0.

Table 10. Results of the Wald Test with Variable D(XCPO) as the Dependent Variable.

Symbol of Coefficient	**C(28)**	**C(29)**	**C(30)**	**C(31)**	**C(32)**	**C(33)**	**C(34)**	**C(35)**	**C(36)**
Coefficient	0.008	0.004	-5.312	97.241	31.049	618.700	-0.598	-0.280	-0.940
Prob.	0.240	0.536	0.963	0.375	0.986	0.722	0.000	0.001	0.977

significantly influenced by D(FRS(-1) and D(INFS(-2), respectively at the level of 10 percent. In other words, changes in the value of Singapore's foreign exchange reserves in the previous month significantly affected the Singapore dollar exchange rate. Meanwhile, changes in the inflation rate in the previous two months also affected the Singapore dollar exchange rate. Wald's test of equation (3) to equation (5) produces a one-way causality relationship between D(KS) with D(FRS(-1) and D(INFS(-2).

Singapore's VAR model with Indonesian CPO exports (XCPO) as the dependent variable. This is to see the effect of variables related to Singapore's foreign exchange reserves on Indonesia's CPO exports. The equation for D(XCPO) as the dependent variable is presented in Formula (6), and the Wald test is presented in Table **10**.

D(XCPO) = C(28)*D(FRS(-1)) + C(29)*D(FRS(-2)) + C(30)*D(INFS(-1)) + C(31)*D(INFS(-2)) + C(32)*D(KS(-1)) + C(33)*D(KS(-2)) + C(34) *D(XCPO(-1)) + C(35)*D(XCPO(-2)) + C(36) (6)

The last Singapore VAR model with the Indonesian palm oil export variable as the dependent variable. The results showed that the Indonesian palm oil export variable was only influenced by Indonesian palm oil exports in the first and second lags with a significance level of 99 percent or at a 1 percent level. This means that the other independent variables have no significant effect. Various studies have shown that the exchange rate affects exports, but in this study, Indonesian palm oil exports, which utilize ample land resources, result in a significant oversupply. This excess production can be a driving factor for Indonesia's palm oil exports. Xie & Baek (2020) found that each business sector in ASEAN countries responds differently to exchange rates such as exports from micro, small, and medium enterprises (MSMEs) are more sensitive to exchange rates, exports from companies that use inputs from abroad are not affected by the exchange rate, then the export sector is susceptible to the exchange rate. Because the results of the Wald formula (3) test with D(FRS) as the dependent variable show that D(XCPO) has a significant effect, the causality relationship between the two variables is one-way.

The results of hypothesis testing for the Singapore VAR equation show the direction of causality of each variable in the equation. The direction of causality for each of these variables is one way. The causality relationship can be described in Fig. (**5**) as follows.

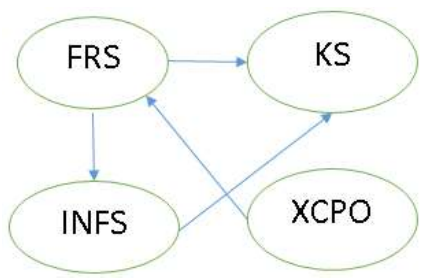

Fig. (5). The Direction of Causal Relationships between Variables of the VAR Model for Singapore.

The exciting thing from Fig. (**5**) is that Singapore's foreign exchange reserves significantly affect two other variables: Singapore’s inflation and Singapore's dollar exchange rate against the US dollar. Conversely, these two variables do not affect Singapore's foreign exchange reserves. Meanwhile, external variables originating from Indonesia, such as Indonesia's CPO exports, have significantly boosted Singapore's foreign exchange reserves.

VAR Model Estimation For Indonesia

Indonesia's VAR variables consist of Indonesia's foreign exchange reserves (FRI), Indonesian inflation (INFI), the rupiah exchange rate against the US dollar (KI), and Indonesia's CPO exports (XCPO). These four variables will produce four equations, where each variable will be the depend-

Table 11. Results of the Wald Test with Variable D(FRI) as the Dependent Variable.

Symbol of Coefficient	C(1)	C(2)	C(3)	C(4)	C(5)
Coefficient	0.119	28.911	0.001	0.253	463.472
Prob.	0.224	0.954	0.999	0.700	0.085

Table 12. Results of the Wald Test with Variable D(INFI) as the Dependent Variable.

Symbol of Coefficient	**C(6)**	**C(7)**	**C(8)**	**C(9)**	**C(10)**
Coefficient	-0.000	0.255	-0.000	-0.000	0.005
Prob.	0.217	0.003	0.402	0.891	0.905

Table 13. Results of the Wald Test with Variable D(KI) as the Dependent Variable.

Symbol of Coefficient	**C(11)**	**C(12)**	**C(13)**	**C(14)**	**C(15)**
Coefficient	0.001	76.451	- 0.123	0.004	39.566
Prob.	0.928	0.159	0.198	0.958	0.177

Table 14. Results of the Wald Test with Variable D(XCPO) as the Dependent Variable.

Symbol of Coeefisien	**C(16)**	**C(17)**	**C(18)**	**C(19)**	**C(20)**
Coefficient	0.01084	-4.06064	0.04233	-0.46474	7.10243
Prob.	0.33940	0.94350	0.67550	0.00000	0.81880

ent variable. The results of the Indonesian VAR modeling with D(FRI) as the dependent variable are shown in formula (7)and the results of the Wald test are presented in Table **11**.

D(FRI) = C(1)*D(FRI(-1)) + C(2)*D(INFI(-1)) + C(3)*D(KI(-1)) + C(4)*D(XCPO(-1)) + C(5) ….(7)

Based on Table **11**, all independent variables (inflation, exchange rate, and Indonesian CPO exports) do not significantly affect Indonesia's foreign exchange reserves. The exciting thing is that the CPO export variable from Indonesia to the world should significantly affect Indonesia's foreign exchange reserves, but this variable has no significant effect. Conversely, these variables significantly affect Singapore's foreign exchange reserves.

The following Indonesian VAR equation has D(INFI) as the dependent variable. The equation resulting from the VAR estimation is shown in formula (8), and the Wald test results are presented in Table **12**.

D(INFI) = C(6)*D(FRI(-1)) + C(7)*D(INFI(-1)) + C(8)*D(KI(-1)) + C(9)*D(XCPO(-1)) + C(10) ……(8)

The Wald test results from equation (8) coefficients show that all independent variables do not significantly affect the dependent variable. The variable influencing Indonesia's inflation is the lag itself, namely Indonesia's inflation in the first lag, a significance level of 95% or a 5 percent level. This means that changes in Indonesia's inflation in the previous month will affect changes in the inflation rate.

The next Indonesian VAR model is the Indonesian exchange rate as the dependent variable. The equation form of the model is presented in formula (9), and the Wald test results of the equation are presented in Table **13**.

The test results in Table **13** show that the independent variable does not significantly affect the Indonesian exchange rate. In other words, foreign exchange reserves, inflation, and Indonesia's CPO exports significantly affect the rupiah exchange rate against the US dollar.

The last Indonesian VAR model with D(XCPO) as the dependent variable. The VAR model is shown by equation (9). The Wald test of equation (9) is presented in Table **14**.

D(XCPO) = C(16)*D(FRI(-1)) + C(17)*D(INFI(-1)) + C(18)*D(KI(-1)) + C(19)*D(XCPO(-1)) + C(20)..(9)

Based on Table 14, the variable that significantly affects D(XCPO) is D(XCPO) in the first lag. This variable has a significant effect at the 1 percent level. The results of the Wald test on the Indonesian VAR model with D(XCPO) as the dependent variable, as in formula (9), are the same as the results of the Wald test on the Singapore VAR model shown in formula (6). Where Indonesia's macroeconomic indicators, such as the rupiah exchange rate, inflation rate, and foreign exchange reserves, do not affect Indonesia's CPO exports.

5. CONCLUSION

Although a small country in Southeast Asia, Singapore has foreign exchange reserves that reach 2.8 times Indonesia's foreign exchange reserves. During the Covid-19 pandemic, the currency exchange rates of the two countries tended to be stable. The two countries (Indonesia and Singapore) were able to maintain the inflation rate during the Covid-19 pandemic, which was three percent for Indonesia and below one percent for Singapore. Indonesia's CPO exports have continued to increase since 2010. A significant increase in Indonesia's CPO exports occurred in 2021, reaching 53 percent from 2020.

The stages of the VAR test show that for the stationarity test, all variables in this study are stationary at first difference. In the cointegration test, it is known that all variables have no cointegration relationship, so the analysis will be continued with VAR. The results of testing the Granger Causality relationship found a one-way causality relationship. The VAR model for Singapore shows that Indonesia's CPO exports (XCPO) significantly affect Singapore's foreign exchange reserves (FRS). Furthermore, the FRS significantly affects inflation and the exchange rate in Singapore. This means that XCPO indirectly affects several Singapore macroeconomic indicators. The VAR model for Indonesia shows that Indonesia's CPO exports have no significant effect on Indonesia's foreign exchange reserves as well as other Indonesian macroeconomic indicators such as Indonesia's exchange rate and inflation. Thus it can be proven statistically that the money from CPO exports does not return to Indonesia but is kept in Singapore. Furthermore, this study found that Indonesia's XCPO was not influenced by other variables originating from Indonesia, such as the rupiah exchange rate to the United States dollar (KI), Indonesian inflation (INFI) and FRI or independent variables originating from Singapore, such as the Singapore dollar exchange rate against the US dollar. States (KS), Singapore inflation (INFS), and FRS. XCPO is affected by its lag. In other words, Indonesia's CPO exports have become a product that Indonesia typically exports from quarter to quarter.

However CPO cultivation in Indonesia has used vast land resources reaching 207 times the area of Singapore's territory. For this reason, Indonesia must optimize foreign exchange earnings from this sector. With a large export value but the money is still being saved abroad, for this reason the government must be able to provide incentives for exporters so that they are willing to bring the money from CPO exports to Indonesia.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest

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