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Original Article

Factors affecting revealed symmetric comparative advantage of crude palm oil exports of Indonesia, Malaysia and Thailand♣

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Abstract

This study aimed to investigate the relationship between the comparative advantages, as measured by the RSCA index and selected economic variables for Indonesia, Malaysia, and Thailand's crude palm oil export during 2001-2017. The results of autoregressive distributed lag (ARDL) analysis showed that in the short-run, the interest rate had a negative impact on Indonesia's RSCA, while the one-period lag of the trade openness and the world price of soybean oil exhibited a positive impact. The findings suggested that the one-period lag of the exchange rate and the world price of crude petroleum oil had a short-run positive impact on Thailand's RSCA. It further found no evidence of long-run relationships among the variables in the Indonesia and Thailand's RSCA model. The model results also confirmed no relationships between Malaysia's RSCA and real interest rate, foreign direct investment, trade openness, the world price of crude petroleum oil and soybean oil in the short-run and long-run. This study focused only on crude palm oil export and six independent variables. More palm oil products and economic factors such as GDP and world consumption should be included in future studies. Important policy implications for improving a country's comparative advantage were recommended.

Keywords: autoregressive distributed lag, cointegration, crude palm oil, revealed symmetric comparative advantage

1. Introduction

Palm oil is one of the important vegetable oils in energy sources and food security in the world. Palm oil and its derivatives are used in a wide variety of products, ranging from food products (80 percent), personal care products, or oleo chemistry (15 percent) to biofuel or agro-diesel (5 percent) (European Palm Oil Alliance [EPOA], 2019). Southeast Asia plays a dominant role in palm oil production as it has a suitable area for plantation and cultivation. Indonesia, Malaysia, and Thailand are currently the three biggest palm oil suppliers and exporters in the world.

As the number of uncertain factors in palm oil production, consumption and trade increases, it becomes more likely that these three countries will face fierce competition in palm oil-exporting in the world market. A decline in palm oil production as a result of adverse weather, a reduction in palm oil usage for biofuel production, strictly certification schemes for sustainable palm oil export from palm oil importing countries, and a price competition pressure from soybean oil, a closely substitutable product may create competition for palm oil export (United States Department of Agriculture [USDA], 2019; Zakaria, Salleh, & Balu, 2017).

Many previous studies used the revealed comparative advantage (RCA) and revealed symmetric comparative advantage (RSCA) to examine a country's export competitiveness in palm oil products, especially for Indonesia and Malaysia, the world's top two palm oil producers and exporters (Arip, Yee, & Feng, 2013; Dewanta, Arfani, & Erfita, 2016). A few studies focused on other palm oil producing countries such as Thailand, Nigeria, Ghana, and Côte d'Ivoire (Etuk & Ohen, 2017; Hassanpour & Ismail, 2010; Office of Agricultural Economics [OAE], 2016). Research on the linkages between export competitiveness and economic factors mainly emphasized determinants of export

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quantity and value. Much economic literature indicated that internal and external factors such as exchange rate, interest rate, and price of substituted goods are the crucial factors in determining agricultural products export competitiveness (Talib & Darawi, 2002; Mwansakilwa, Tembo, & Mugisha, 2013; Seng & Ahmad, 2014; Dube, Ozkan, & Govindasamy, 2018). Additionally, only a few previous studies focused on the impact of economic variables on comparative advantage. The world price of crude petroleum oil, trade openness, and foreign direct investment were found to be potentially significant determinants of a country's comparative advantage (Aziz & Dahalan, 2015; Balogh & Jambor, 2017). Nevertheless, there have been no empirical studies on the factor affecting the comparative advantage in palm oil product exports. This study analyzes comparative advantage and factors influencing a comparative advantage in Indonesia, Malaysia, and Thailand's palm oil export during 2001-2017.

2. Materials and Methods

2.1 Data and data sources

The study used annual time series data from 2001-2017. Data on export values for crude palm oil (HS 151110) and total products are obtained from the International Trade Center (ITC) based on Harmonized System classification at the six-digit level. The data on the real gross domestic product, exchange rate, foreign direct investment, real interest rate, and the world price of crude petroleum oil and soybean oil were taken from the ITC, World Development Indicators (WDI), and the United Nations Conference on Trade and Development (UNCTAD) database.

2.2 Dependent and independent variables

The RSCA is used as a dependent variable. The RCA is calculated based on a proportion between the export share of a given commodity in a country and the export share of that commodity in the overall world trade (Balassa, 1979). A country is said to have a comparative advantage (disadvantage) in its export if the corresponding RCA value is higher (lower) than one. Therefore, the RCA value is asymmetric because its value cannot be comparable on both sides of one. The RSCA, introduced by Dalum, Laursen, and Villumsen (1998), is developed to avoid zero and mitigate any asymmetric problem of RCA. The RSCA of country *i* in exporting commodity *j* can be written as:

$$RSCA_{ij} = \frac{RCA_{ij} - 1}{RCA_{ij} + 1} \quad \frac{= [\,(X_{ij} / X_{it}) / (X_{wj} / X_{wt})\,] - 1}{[\,(X_{ij} / X_{it}) / (X_{wj} / X_{wt})\,] + 1}$$

where *i* is Indonesia, Malaysia, or Thailand, *j* is crude palm oil, *t* is the total export value, and *w* is the world market, $RSCA_{ij}$ is the revealed symmetric comparative advantage of country *i* in exporting crude palm oil. The values of $RSCA_{ij}$ vary from minus one (-1) to plus one (+1). The $RSCA_{ij}$ values higher than zero indicate a comparative advantage of a country *i* in crude palm oil export and vice versa.

All independent variables namely, exchange rate (EXR), real interest rate (RINR), foreign direct investment (FDI), trade openness (TO), and the world price of crude petroleum oil (WPCO) and soybean oil (WPSO) were carefully selected following the trade theory and augmented by recent studies for factors influencing comparative advantage. The description of independent variables and related hypotheses are described in Table 1.

2.3 Model specification

The comparative advantage models for Indonesia, Malaysia, and Thailand on crude palm oil product exports can be constructed as functions of the RSCA, relating with the independent variables. According to Narayan (2005) and Pesaran, Shin, and Smith (2001), this study applied the autoregressive distributed lag (ARDL) or cointegration bound test to identify whether there are long-run and short-run relationships among variables in the model. Following Dube *et al.* (2018) and Rahman and Kashem (2017), the ARDL model used in this study for cointegration test is specified as:

$$\begin{aligned}\Delta RSCA_t = {} & \alpha_0 + \sum_{i=1}^{L} \beta_1 \Delta RSCA_{t-i} + \sum_{i=0}^{M} \beta_2 \Delta EXR_{t-i} + \sum_{i=0}^{N} \beta_3 \Delta RINR_{t-i} + \sum_{i=0}^{O} \beta_4 \Delta FDI_{t-i} \\ & + \sum_{i=0}^{P} \beta_5 \Delta TO_{t-i} + \sum_{i=0}^{Q} \beta_6 \Delta WPCO_{t-i} + \sum_{i=0}^{R} \beta_7 \Delta WPSO_{t-i} + \\ & + \lambda_1 RSCA_{t-1} + \lambda_2 EXR_{t-1} + \lambda_3 RINR_{t-1} + \lambda_4 FDI_{t-1} + \lambda_5 TO_{t-1} \\ & + \lambda_6 WPCO_{t-1} + \lambda_7 WPSO_{t-1} + \varepsilon_t \end{aligned} \quad (1)$$

where RSCA is the dependent variable, EXR, RINR, FDI, TO, WPCO, and WPSO are the independent variables, α_0 is the intercept, β_0, β_1,…, β_7 are the coefficient of short-run relationships, λ_0, λ_1,…, λ_7 are the coefficient of long-run relationships, *t* is the time, *i* is the length of the lags, L, M, …, R is the number of the lags, and ε_t is the error term. The F-test is used to determine the existence of cointegration among variables by comparing with the two sets of critical F-values, upper critical bound (UCB) and lower critical bound (LCB) (Narayan, 2005; Pesaran *et al.*, 2001).

Since the ARDL was estimated by the OLS method using lags of the dependent and independent variables as regressors, the coefficient of the short-run and long-run relationships and a component of error correction term are provided through the error correction model (ECM) model without losing the long-run information (Cetin, Ecevit, Seker, & Gunaydin, 2015). A general error correction model (ECM) is then estimated as in Equation (2).

$$\begin{aligned}\Delta RSCA_t = {} & \alpha_0 + \sum_{i=1}^{L} \beta_1 \Delta RSCA_{t-i} + \sum_{i=0}^{M} \beta_2 \Delta EXR_{t-i} + \sum_{i=0}^{N} \beta_3 \Delta RINR_{t-i} + \sum_{i=0}^{O} \beta_4 \Delta FDI_{t-i} \\ & + \sum_{i=0}^{P} \beta_5 \Delta TO_{t-i} + \sum_{i=0}^{Q} \beta_6 \Delta WPCO_{t-i} + \sum_{i=0}^{R} \beta_7 \Delta WPSO_{t-i} + \sum_{i=0}^{S} \beta_8 \Delta WPOP_{t-i} \\ & + \delta_0 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

The estimated coefficient (δ_0) or the error correction term (ECT_{t-1}) indicates the speed of adjustment at which the dependent variable returns to equilibrium. The error correction coefficient sign is expected to be negative and significant (Egwuma, Shamsudin, Mohamed, Kamarulzaman, & Wong, 2016; Hassan & Balu, 2016).

Table 1. Description and related hypothesis of independent variables

Variable name	Description	Expected effect on RSCA
EXR[1,2]	Official exchange rate (local currency units relative to US$)	+ / -
RINR[2,6]	Real interest rate (%), The lending interest rate adjusted for inflation as measured by the GDP deflator	-
FDI[3,4]	Foreign Direct Investment (current US$), The direct investment equity flows in the reporting economy	+ / -
TO[3]	Trade openness (current US$), an economic indicator calculated as the ratio of a country's total trade and GDP.	+ / -
WPCO[3]	World price of crude petroleum oil (US$/bbl in real 2010 US$)	-
WPSO[1,5]	World price of soybean oil (US$/ton at Netherland ports)	+

Data sources: ITC, UNCTAD, WDI. Reference sources: [1]Talib and Darawi (2002), [2]Mwansakilwa *et al.* (2013), [3]Aziz and Dahalan (2015), [4]Balogh and Jambor (2017), [5]Seng and Ahmad (2017), [6]Dube *et al.* (2018)

At the final stage, the Breusch-Godfrey Serial Correlation LM test (BG-LM) and the Breusch-Pagan-Godfrey test (BP-G) will be used for testing whether there is a problem of serial correlation and heteroscedasticity of the residuals in Equation (1) which followed Dube *et al*. (2018) and Egwuma *et al*. (2016). Moreover, the cumulative sum of recursive residuals (CUSUM) test is conducted following the method of Rahman and Kashem (2017) to examine the stability of the model.

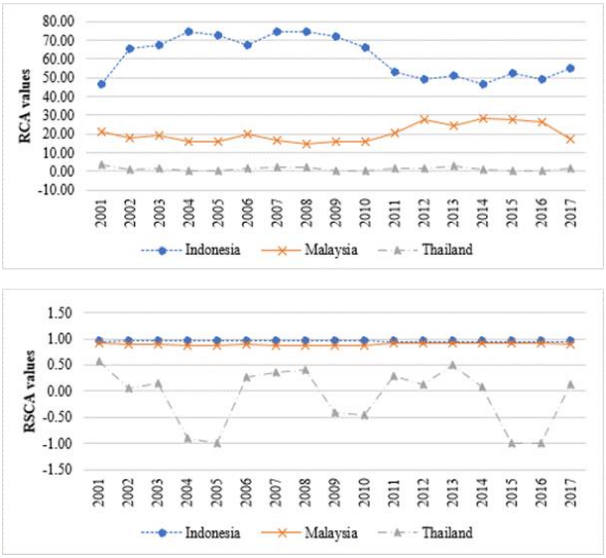
3. Results and Discussion

3.1 The analysis of comparative advantage

Figure 1 showed the RCA and RSCA values of the crude palm oil export for Indonesia, Malaysia, and Thailand during 2001-2017. The study found that RCA values are greater than one for Indonesia and Malaysia, except for Thailand, indicating that Indonesia and Malaysia had a comparative advantage over the study period. Thailand showed a fluctuation of export competitiveness in different periods. It had comparative advantages (for the years 2001-2003, 2006-2008, 2011-2014, and 2017) and comparative disadvantages (for the years 2004-2005, 2009-2010, and 2015-2016).

According to the RSCA results (Figure 1), Indonesia and Malaysia had a positive RSCA value from 2001-2017, indicating a comparative advantage for both countries. Thailand recorded positive and negative RSCA values for crude palm oil export, indicating a comparative advantage and disadvantage during the study period. The results of RSCA, both positive and negative values, is in line with RCA's result, but more symmetrical values. This finding is consistent with the results of previous studies, i.e., Hassanpour and Ismail (2010) and Startiene and Remeikiene (2014).

It can be noted that Thailand's RCA and RSCA values were substantially lower than that of Indonesia and Malaysia. In addition, zero export value of a product reflected zero RCA value. Consequently, the RSCA used to adjust the calculated RCA to be more symmetrically was also illustrated as minus one. According to the relatively low or zero export value, Thailand's RSCA values were close or equal to minus one (-1) in 2004-2005 and 2015-2016. On the other hand, the RSCA value of Indonesia and Malaysia showed a very close to or equal to one (+1) (Figure 1).



Notes: 1) Indonesia, Malaysia, and Thailand's RCA values ranged between 46.78-74.91, 14.80-28.67, and 0.00-3.63.
2) Indonesia, Malaysia, and Thailand's RSCA values ranged between 0.96-0.97, 0.87-0.93, and (-1.00) to 0.57.
3) Thailand did not export crude palm oil in 2005, 2015, and 2016 due to it faced a decrease in oil palm production and palm oil stock shortage.

Figure 1. RCA and RSCA for crude palm oil export of Indonesia, Malaysia, and Thailand, 2001-2017

3.2 Analysis of factors affecting comparative advantage

3.2.1 Results of RSCA model selection

The augmented Dickey-Fuller (ADF) test is used to detect the unit root of each variable. The ADF test results (Table 2) confirmed that all variables are satisfied with the assumption of the ARDL bound test that no variables are I(2). In this study, six independent variables were removed from the model one by one until the diagnostic test results were all acceptable. The selected RSCA models of Indonesia, Malaysia, and Thailand in crude palm oil export and their model selection criteria and diagnostic test statistics are presented in Table 3.

Table 2. Results of unit root test, ADF test

Country	Order of Integration	Variable
Indonesia	I(0)	RSCA_IN10
	I(1)	EXR_IN, RINR_IN, FDI_IN, TO_IN
Malaysia	I(0)	RINR_MA, FDI_MA
	I(1)	RSCA_MA10, EXR_MA, TO_MA
Thailand	I(0)	RSCA_TH10, EXR_TH, RINR_TH, FDI_TH
	I(1)	TO_TH
World	I(1)	WPCO, WPSO

Notes: I(0) = stationary at level form; I(1) = stationary at first differencing

Table 3. Results of diagnostic test of RSCA models selection

Model	Selected ARDL		
	RSCA_IN10 ARDL(1, 1, 0, 1, 1, 0)	RSCA_MA10 ARDL(1, 0, 0, 0, 0, 0)	RSCA_TH10 ARDL(1, 1, 0, 0, 0, 0)
Statistic			
R-squared	0.9612	0.7448	0.8875
Adjusted R-squared	0.9029 [b]	0.5747 [a]	0.7890 [b]
F-statistic	16.5047	4.3775	9.0115
(p-value)	(0.0014) ***	(0.0240) **	(0.0030) ***
Akaike info criterion	-9.5570	-5.4223	0.4013
Durbin-Watson stat.	2.2478	2.1030	1.8766
Breusch-Godfrey Serial Correlation LM test			
F-statistic	0.5401	0.4727	0.0950
Probability	0.4954	0.5112	0.7669
Prob. Chi-Square	0.2117	0.3448	0.6434
Breusch-Pagan-Godfrey test			
F-statistic	0.3139	0.4170	1.0027
Probability	0.9419	0.8499	0.4920
Prob. Chi-Square	0.8236	0.7460	0.3809

Notes: *** and ** significant at 1% and 5% level, respectively. [a] Low adjusted R^2 was due to limited ability of explanatory variables included in the model to explain variation in the RSCA. [b] High adjusted R^2 was most likely due to the simplicity of its oil palm industry that variations in the RSCA were largely explained by the explanatory variables included in the model.

The appropriate lag length of the RSCA model is determined by the Akaike Information Criterion (AIC) criteria. Using the AIC, the ARDL (1, 1, 0, 1, 1, 0), ARDL (1, 0, 0, 0, 0, 0), and ARDL (1, 1, 0, 0, 0, 0) exhibited as the best models for Indonesia, Malaysia, and Thailand. According to the small sample size limitation, the maximum number of lags used in this study was selected at one. All three models were a good fit and acceptable for further analysis, as reflected by high R-squared values and the significant F-statistics. The BG-LM test and BP-G test showed the absence of serial correlation and heteroscedasticity problems. It could be concluded that the RSCA models of Indonesia, Malaysia, and Thailand in crude palm oil export were suitable for the next ARDL bound test since they passed all the diagnostics tests.

The CUSUM graphs of the RSCA model for Indonesia, Malaysia, and Thailand (Figure 2) showed that the graphs were within the 5 percent critical bands, indicating the absence of any instability of the coefficients. The RSCA models of Indonesia, Malaysia, and Thailand were stable at a 5 percent significance level from 2001-2017.

3.2.2 Results of cointegration test

Table 4 showed the results of the ARDL bound test for the RSCA models of Indonesia, Malaysia, and Thailand. The findings indicated that the computed F-statistics of RSCA_MA10 (F-statistics = 1.7020) and RSCA_TH10 (F-statistics =1.8420) were less than the F-critical values of the lower bound at the 5-percent level. It could be concluded that there was no long-run relationship between the variables in Malaysia and Thailand's comparative advantage models. In Indonesia's model, the calculated F-statistic (2.8557) was between the lower and upper bound values at a 5-percent level, and then the result remains inconclusive.

3.2.3 Results of factors affecting the RSCA of crude palm oil export

The three ARDL models are tested for the short-run relationship among variables. The short-run coefficients of factors affecting the RSCA of crude palm oil export for the three countries are presented in Table 5 and reported as followed.

1) Factor affecting Indonesia's RSCA of crude palm oil export

Results showed that the real interest rate had statistically significant effects on the RSCA. The interest rate coefficient was negative as expected, indicating an increase in real interest rate led to a decrease in Indonesia's RSCA level for crude palm oil export, with other variables kept constant in

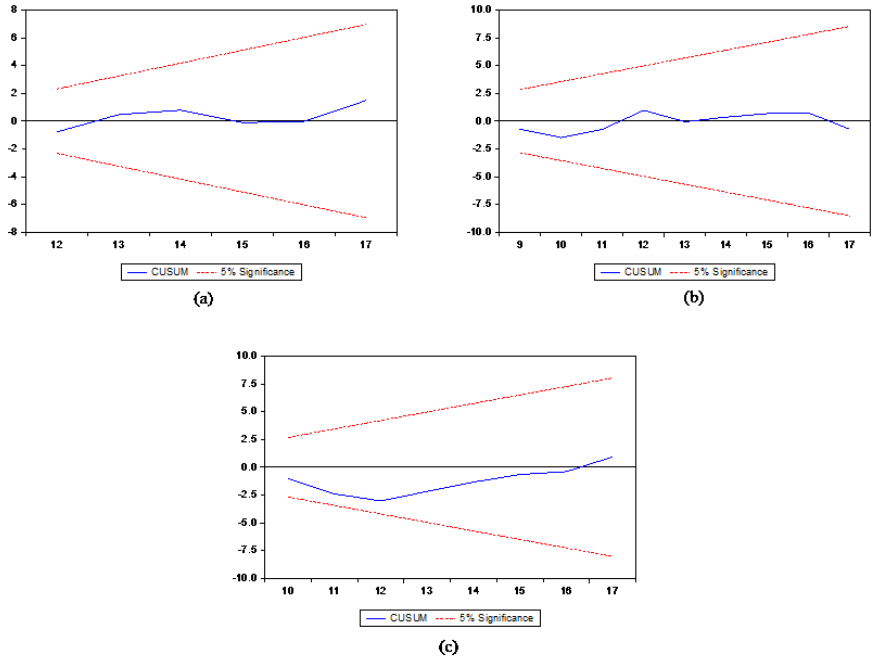


Figure 2. Plot of CUSUM test; (a) Indonesia's RSCA model, (b) Malaysia's RSCA model, (c) Thailand's RSCA model

Table 4. ARDL bound test of cointegration for RSCA model

Model	k	Calculated F-statistic	Critical Value Bounds*		
			Significance	I(0) Bound	I(1) Bound
RSCA_IN10	5	2.8557	5%	2.62	3.79
			1%	3.41	4.68
RSCA_MA10	5	1.7020	5%	2.62	3.79
			1%	3.41	4.68
RSCA_TH10	5	1.8420	5%	2.62	3.79
			1%	3.41	4.68

Note: * Pesaran *et al.* (2001), k is the number of independent variables in the model

Table 5. ARDL models of crude palm oil export for Indonesia, Malaysia, and Thailand

Model	Indonesia		Malaysia		Thailand	
	ARDL(1, 1, 0, 1, 0, 1)		ARDL(1, 0, 0, 0, 0, 0)		ARDL(1, 1, 1, 0, 0, 0)	
Regressor	Constant	1.4001	Constant	0.5899	Constant	-7.5025
		(5.3691)		(2.2801)		(3.0427)
	RSCA_IN10 (-1)	-0.3833	RSCA_MA10 (-1)	0.3484	RSCA_TH10 (-1)	-0.3664
		(-1.5545)		(1.4156)		(-2.0034)
	EXR_IN	0.0000	RINR_MA	0.0021	EXR_TH	-0.0105
		(1.6362)		(1.4578)		(-0.1192)
	EXR_IN(-1)	-0.0000	FDI_MA	0.0000	EXR_TH(-1)	0.2208
		(-2.2608)		(1.6513)		(4.7021)***
	RINR_IN	-0.0014	TO_MA	-0.0087	RINR_TH	0.1914
		(-3.7628)***		(-0.2563)		(2.2384)
	TO_IN	-0.1199	WPCO	0.0004	TO_TH	-3.8133
		(-1.9747)		(1.5817)		(-1.4541)
	TO_IN(-1)	0.0907	WPSO	-0.0000	WPCO	0.0385
		(2.5706)**		(-1.4298)		(3.2371)**
	WPCO	-0.0001			WPSO	0.0010
		(-2.0691)				(1.5101)
	WPCO(-1)	-0.0002				
		(-1.7682)				
	WPSO	0.0000				
		(2.9751)**				

the short-run. This result was in line with many empirical studies showing that high interest rates negatively impacted local investment. The export performance of a country in terms of export volume and export competitiveness was reduced due to lower investment, especially in the production of agricultural commodities (Dube *et al.*, 2018; Mwansakilwa *et al.*, 2013). However, in the study by Egwuma *et al.* (2016), the interest rate was found to has a negative impact on Nigeria's palm oil but not significant.

It can be observed that the one-period lag of the trade openness was statistically significant related to Indonesia's RSCA on the crude palm oil export. This study showed that the negative coefficient of trade openness was aligned with the expectation and consistent with the previous study by Aziz and Dahalan (2015). They suggested that a country with a higher trade openness was expected to have more competition from trade increases. However, the openness to trade without proper restrictions on trade could negatively affect the comparative advantages. Trade openness was also associated with the export quality and export variety, as confirmed by Huchet, Mouel, and Vijil (2018). Hence, trade openness can enhance economic growth when a country has specialized in high-quality products and the variety of their export (a proxy for the extensive margin). On the other hand, an adverse effect of trade openness can be found when a country has specialized in low-quality products. Therefore, a country can achieve a comparative advantage from trade openness by better-utilizing resources in a country and a better production condition.

As expected, the coefficient of the world price of soybean oil was positive and had a statistically significant effect on Indonesia's RSCA. This finding indicated that an increase in soybean oil price led to an increase in the RSCA level. Soybean oil is a highly substitutable commodity with palm oil. Increasing soybean oil prices will rising palm oil demand since palm oil price is at a discount against soybean oil price (Hassan & Balu, 2016; Talib & Darawi, 2002). According to Abdullah (2011) and Songsiengchai, Sidique, Djama, and Azman-Saini (2020), the soybean oil price was associated closely with the palm oil price. Further, the soybean oil price has a positive and significant impact on Indonesia's palm oil industry in production and export demand (Abdullah, 2011; Bentivoglio, Finco, & Bucci, 2018). The price difference between soybean oil and palm oil also plays an essential role in determining palm oil demand from Indonesia in China (Zakaria *et al.*, 2017).

2) Factors affecting Malaysia's RSCA of crude palm oil export

The coefficient of all independent variables in Malaysia's RSCA model was not significant, indicating that real interest rate, foreign direct investment, trade openness, the world price of crude petroleum oil and soybean oil had no significant impact on Malaysia's RSCA. However, the model was significant as a whole at a 5-percent level (F-statistic = 4.3775). The model was good for its prediction of Malaysia's RSCA of crude palm oil in this study.

3) Factor affecting Thailand's RSCA of crude palm oil export

The findings indicated that the coefficient of a first lag period of the exchange rate was positive and had a statistically significant effect on Thailand's RSCA in the short-run. This result suggested that depreciation in Baht currency in the past year significantly influenced Thailand's comparative advantages in the current year. As the local currency depreciation, a country's exports become cheaper, which leads to an increase in the demand from importing countries. The loss in value of a country's currency against other foreign currencies can influence exports and competitiveness. This study's result was consistent with the findings of Dube *et al.* (2018) and Mwansakilwa *et al.* (2013).

The results further suggested that the world price of crude petroleum oil had a positive and significant impact on Thailand's RSCA. The sign of coefficient was not in line with the hypothesis of the study. However, many studies had consistently found a positive relationship between the price of crude petroleum oil and crude palm oil (Nazlioglu & Soytas, 2012; Songsiengchai *et al.*, 2020). The rapid increase and high crude petroleum oil prices had caused many countries to reconsider using biodiesel produced from vegetable oils as alternative renewable energy. The rise in biodiesel production caused the world's demand for palm oil to increase simultaneously (Abdullah, 2011; Wangrakdiskul & Yodpijit, 2015).

4. Conclusions

The RCA and RSCA were used to identify Indonesia, Malaysia, and Thailand's comparative advantages in their crude palm oil exports in the world market. The results indicated that Indonesia and Malaysia had a comparative advantage from 2001-2017. Thailand gained both comparative advantage and disadvantage in the exports of crude palm oil during the study period. The findings confirmed that RCA and RSCA are strongly consistent in determining whether a country revealed comparative advantage.

The results based on the ARDL approach suggested that all three RSCA models of Indonesia, Malaysia, and Thailand were good fit and sufficient for interpretations. The ARDL bound tests indicated no long-run relationships among the variables in Malaysia and Thailand's RSCA model except Indonesia's RSCA model that revealed an inconclusive result.

The findings found that in the short-run, the real interest rate, trade openness and the world price of soybean oil had significant impact on Indonesia's comparative advantage. The lag period of the exchange rate and the world price of crude petroleum oil were the main factors influencing Thailand's comparative advantage. The results from this study suggested that Indonesia needs to ensure an appropriate interest rate to encourage local investment to improve its production technologies which could further enhance a country's comparative advantages. The government should perform a flexibility policy in the openness to trade in line with appropriate restrictions on trade and fundamentals of its

palm oil industry. Further, market intelligence in analyzing and forecasting the world's vegetable oil (demand, supply, price, trends, and competitors) is also necessary. As for Thailand, The Thai government should stabilize its local currency and ensure that the value of the Thai baht is at a proper level. Additionally, promoting the exchange risk insurance for palm oil exporters should be taken. The policy measure of balancing the palm oil production and domestic demand would have needed to consider expanding oil palm plantations, high yield cultivars, and the relaxation of import regulation for palm oil.

Furthermore, there was no relationship between Malaysia's comparative advantage and real interest rate, foreign direct investment, trade openness, the world price of crude petroleum oil and soybean oil in the short-run. Malaysia oil palm industry is highly advanced, there might be other complex variables that were not identified in this study.

Some recommendations for further study are as follow: 1) this study is limited only crude palm oil export. More palm oil products such as refined palm oil and palm kernel oil should be included in future studies. 2) The ARDL bound test provides a valuable framework for analyzing the relationships among variables in the model. It is recommended to apply ARDL approach in other agricultural products. 3) This study only focused on six variables. A comparative advantage can be shaped by factors not included in this study. Further studies may consider other economic factors such as GDP, the world consumption, income level, and palm oil exports of competing countries. Moreover, research in identify factors influencing comparative advantage at bilateral and regional level would provide helpful information for determining the policy measures to improve a country's comparative advantage.

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