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EUROPE UNION BAN ON PALM OIL: THE TREND OF PALM OIL COMPETITIVENESS AND THE CO-INTEGRATION ON THE SOYBEAN AND RAPESEED OIL

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ABSTRACT

Palm oil highly demanded in global trade and expected to gain more demand in the future market. The primary concern regarding palm oil production is its environmental impact. The issue that is focused on in this study the European Union to promote the banning of oil palm in the world market in 2018 and the European parliament decided to ban palm oil for biofuel used. The Europe Union also promoted soybean and rapeseed as replacement for the banned of palm oil in Europe market. Therefore, this study aims for the effect toward the competitiveness using the Revealed Comparative Advantage (RCA) and Revealed Symmetrical Comparative Advantage (RSCA) indices among the major crude palm oil exporters especially within 1991 to 2020 period of years. Moreover, this study also clarified the Autoregressive Distributed Lag (ARDL) co-integration for the soybean and rapeseed oil toward the competitiveness for 2 largest palm oil exporters in the world from 1989 to 2021.

***Keyword*:** Palm Oil, Soybean, Rapeseed, Export, Competitiveness

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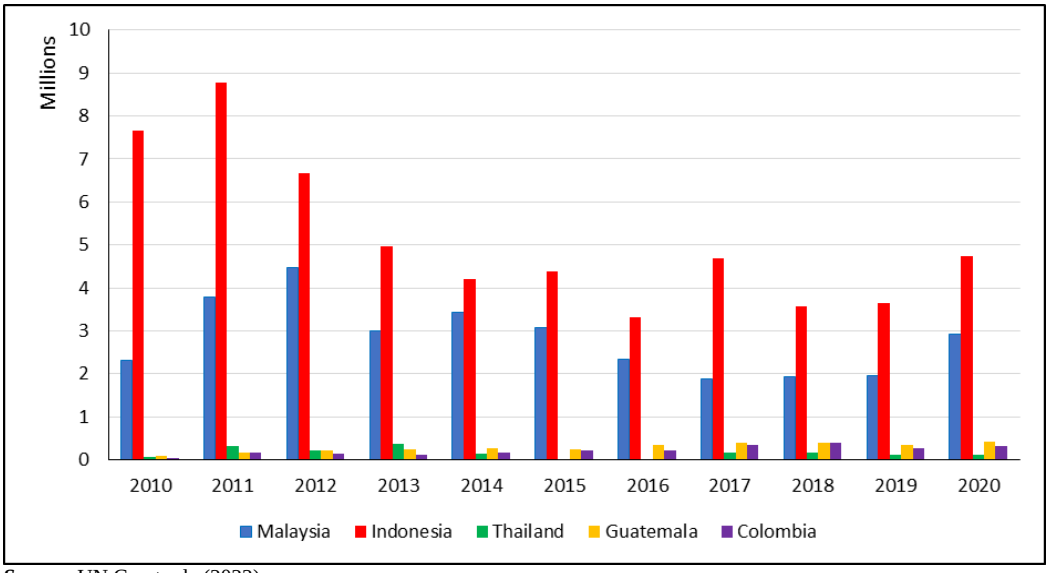
1. INTRODUCTION

Palm oil production has increased dramatically in recent decades and is expected to grow in the global market. The oil palm, Elaeis guineensis, is the world's largest source of vegetable oil and has significantly boosted the economies of many Asian countries (including Indonesia, Malaysia, Colombia, Thailand, Nigeria, the Philippines, Vietnam, Papua New Guinea, and Cambodia) (Anyaoha et al., 2018; Anyaoha & Zhang, 2022). In tandem with the growth of the global population, the global demand for palm oil continues to rise. By 2050, annual demand is anticipated to reach 240 million tonnes, roughly double its 2009 level (Corley, 2009).

One of the most in-demand commodities after vegetable oils is palm oil due to its versatility as an ingredient in a variety of goods, including processed foods, cosmetics, and biofuel, moreover the price that is lower than that of its competitor's commodities (Hinkes, 2020). While palm oil is widely used, it has been linked to negative outcomes such as environment damages, low wages, and the exploitation of foreign workers (Wassmann et al., 2022; Haryati et al., 2022). Deforestation will occur as a result of palm oil cultivation (Descals et al., 2019), which will lead to the loss of animal habitats (Meijaard et al., 2020). According to Dislich et al. (2017), oil palm plantations primarily have a detrimental impact on ecosystem function due to the peatland drainage and forest clearing for oil palm, which release large amounts of carbon dioxide (Wijedasa et al., 2016).

The primary concern regarding palm oil production is its environmental impact. Agriculture is one of the most vulnerable industries to climate change, and it has already been negatively impacted (Zia et al., 2022). According to a Nigerian study, the palm oil industry contributes to climate change (Okoro et al., 2017). Numerous studies have criticised palm oil-producing nations, particularly Indonesia and Malaysia. Based on data in Figure 1, comparing crude palm oil exports from 2010 to 2020 with the five largest producers of palm oil, Indonesia and Malaysia dominant more than 85% of palm oil production (UN Comtrade, 2022).

Figure 1: Export crude palm oil



Source: UN Comtrade (2022)

Indonesia gains the largest market in crude palm oil since 2010 in 2020, and the peak contribution was in 2011 within almost 9 million US dollar (trade value). Malaysia following the rank after Indonesia, and has manage to gains almost 5 million US dollar in 2012. Based on UM Comtrade, the others three countries (Colombia, Guatemala and Thailand) the biggest crude palm oil exporters after Malaysia and Indonesia. However, there was a glaringly wide production disparity between these three countries. Thus, it is rational that some researchers claims that Indonesia and Malaysia were the cause of the problem of global warming.

According to Paterson (2020a), the cultivation of oil palm (OP) in South-East (SE) Asia is threatened by climate change. Sumatra is the leading production region in Indonesia (Paterson, 2019), followed by Kalimantan (Suryantini & Wulandari, 2018). Malaysia as the second biggest exporters of palm oil, suffers the same problem and contributes negatively to climate change (Paterson, 2020b). In contrast, according to the research of Sarkar et al. (2020), the multiple regression applied to climate change on Malaysia oil palm from 1980 to 2010 reveals a negative and significant correlation between annual average temperature and oil palm production.

Palm oil continues to be in high demand on the international market despite frequent criticism from anti-palm campaigns (Hinkes, 2020). To ensure the commodity's continued relevance on the global market, palm oil-producing countries have taken various initiatives to reduce the amount of carbon dioxide emitted into the atmosphere in order to gain recognition of international standards.

Malaysia have made an action and start claim that their cultivate for palm oil was sustainable, and give a proof of certification scheme for company that plant the palm oil using the eco-friendly method (Majid et al., 2021). In between 2008 and 2017, there been rapidly cultivation of palm oil

around the world at a rate of 0.7 Mha per year (FAOSTAT, 2019), thus it is importance for the exporters palm oil countries apply the sustainable cultivation method for planting palm oil.

However, certain study mentioned that the European Union to encourage the global ban on oil palm due to concerns over its impact on wildlife and climate change as a result of deforestation for oil palm cultivation (Abubakar et al., 2022; Paterson 2020a, 2020b). It is obvious that the EU strongly opposes the palm oil market because it is thought to result in significant deforestation and endanger animal species. The world has witnessed the involvement of the European Parliament (EP), which started voting in 2018 to forbid the admission of palm oil products for the production of biofuel in the European Union (EU), as a sign of boycotting deforestation in the Asia region more specifically Malaysia and Indonesia rain forest (Durán & Scott, 2022; Purnomo et al., 2020; Rifin et al., 2020). However, there was no denying that the restriction on palm oil has had a relatively negative influence on palm oil demand especially in the European market. However, by supress this matter as the global issue, may give greater damage in the future for the exporter's countries. The worst effect is many countries not only from European region, but other region around the world may join together to boycott the palm oil commodity in the future.

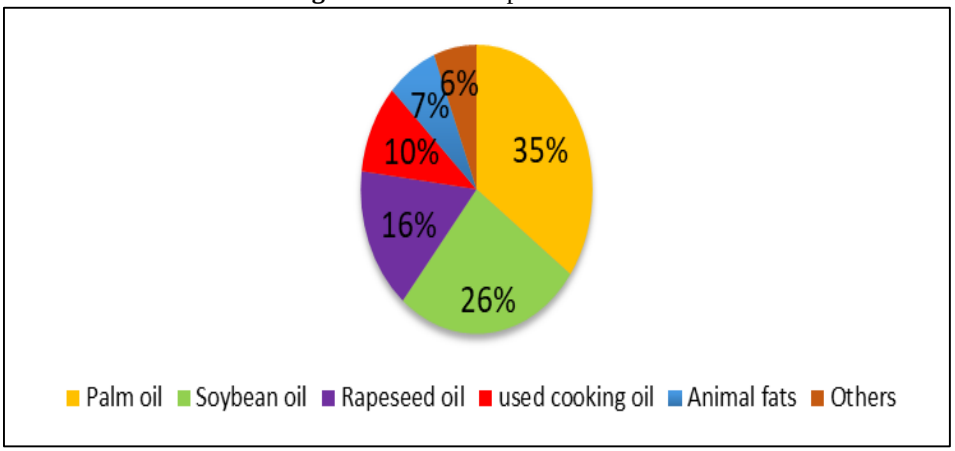
As a result, the palm oil exporting countries such as Malaysia responded to European criticism by supporting sustainable agenda and cultivation through the Malaysian Sustainable Palm Oil (MSPO) project. The plantation of the palm oil may not ably have zero pollution; however, the Malaysian aims to minimise pollution from palm oil production. This is considered as sustaining the palm oil market's positive image on a global scale. As a result, the international reputation of the palm commodity has suffered since the issue of banning palm oil in the European market starting in 2018, prompting an examination of competitiveness among producing countries.

Despite harsh criticism of countries that produce palm oil, the European Union imports the biofuel. Based on Figure 2 shown the European biodiesel production in 2018 and most of largest source was palm oil contributed 35%, followed by soybean oil (26%) and rapeseed oil (16%). In 2017, the EU utilised 46% (EUR 2 billion annually) of imported palm oil as biofuel (Copenhagen Economics, 2018). This shows that in 2018, the biodiesel industry is highly dependent on palm oil compared to rapeseed and soybean oil. If there are restrictions on palm oil to enter the European market, then this will have an impact on the palm oil market. Major oil palm producing countries such as Indonesia and Malaysia will begin to receive a lack of demand, and will relatively affect the markets of both countries (Pratama & Widodo, 2020). According to the theory of substitute goods by Girton and Roper (1981), if there are goods that can replace the main goods such as palm oil, then the demand for soybean and rapeseed is expected to increase which is more good economic impact to Europe countries (Santeramo & Searle, 2019) , especially to those countries that producing the soybean such as France and Russia (Wilcox, 2004; Liefert & Liefert, 2020); and for the rapeseed such as France and Ukraine (Hamulczuk et al., 2019; Flénet et al. 2020).

Figure 3 displays Germany Union's forecasts that oil palm imports have decreased as a result of the EU-27 plus the UK's response to the ban declaration. Sweden was estimated to have reduced its consumption of palm oil the most (-136%), followed by France (-38%), and Denmark (31%). However, among EU countries, the Netherlands, Spain, and Italy were estimated to have a high demand for the palm oil commodity. This is after the EU has stated its intention to prohibit the use

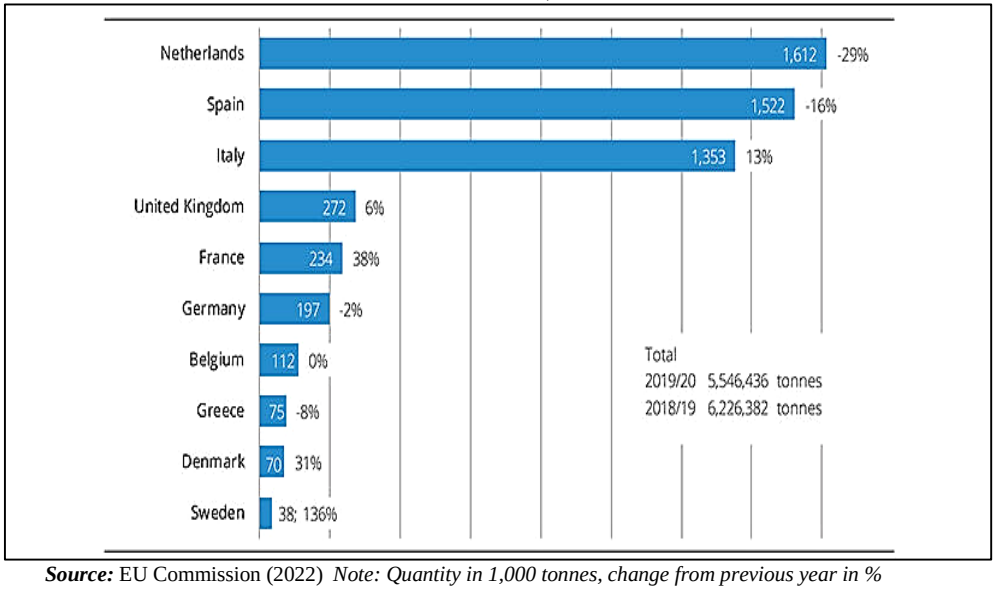
of palm oil, particularly in biofuel (Durán & Scott, 2022; Purnomo et al., 2020; Rifin et al., 2020). Therefore, in this research is study about the effect ban of palm oil by the European toward the competitiveness Malaysia and Indonesia palm oil market using the Revealed Comparative Advantage (RCA) and Revealed Symmetrical Comparative Advantage (RSCA). In fact, the EU has suggested to substitute the palm oil to the soybean and rapeseed commodity will be the reason of co-integrations toward the RCA of Malaysia and Indonesia palm oil.

Figure 2: Biodiesel production in 2018



Source: European Commission (2022)

Figure 3: The Expected Outcome for Palm Oil Import by Major EU Countries (July 2019 -June 2020)



Source: EU Commission (2022) *Note: Quantity in 1,000 tonnes, change from previous year in %*

CONCEPTUAL FRAMEWORK

Figure 4: Conceptual Framework

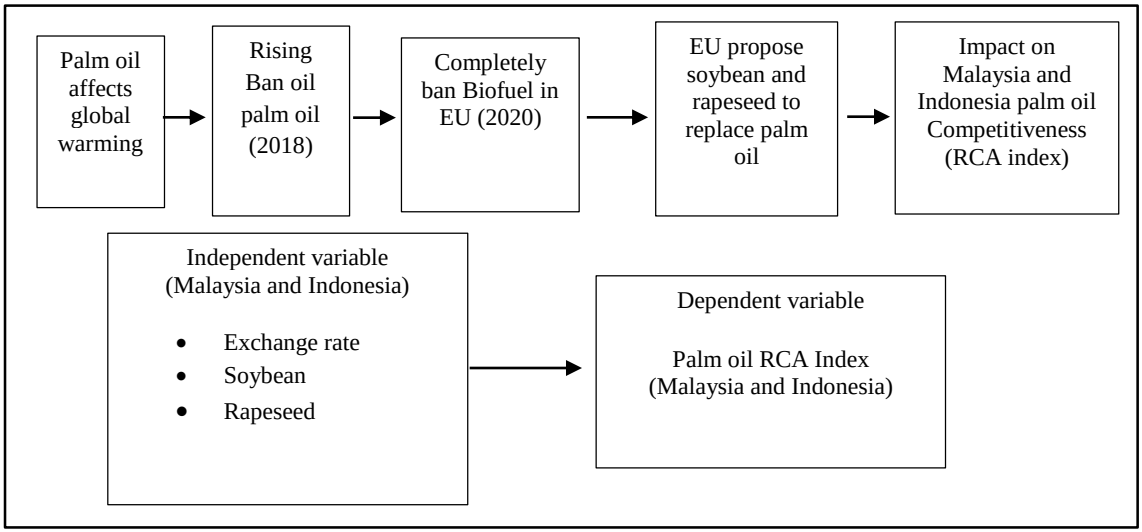


Figure 4 shows the conceptual framework of this study. The prior to the ban on oil palm, a significant number of studies on competitiveness had been conducted on the component of RCA. In 2018, the EU began considering a ban on palm oil, and by 2020, the European Parliament approved a ban on palm oil for biofuel. However, the EU has agreed to continue importing palm oil from sustainable palm oil production for other purposes such as food processing. As a result, this study fills a gap in research conducted until 2020. Furthermore, this study included soybean and rapeseed oil as replacement commodities proposed by European countries (Yahya et al., 2022). The purpose of this study is to i) examine the competitiveness of the top five palm oil exporters using the competitiveness index; RCA and RSCA from 1991 until 2020. The second objective's is to ii) identifying the co-integration for the soybean and rapeseed oil toward the competitiveness for two largest palm oil exporters in the world from 1989 to 2021.

2. LITERATURE REVIEW

2.1 Competitiveness index

According to Flanagan et al. (2007), the term "competitiveness" among popular the writers and researchers in year 1980. After many decades, competitiveness has thru a lot of meaning and numerous phases (Papa et al., 2016). The competitiveness theories have start from the element of CA; known as the comparative advantage, then second come to identify as competitive advantage, then third come to systemic competitiveness and lastly was define as competitiveness. The competitiveness can be understood by any relevant competition that happen between a company,

countries, and region. The identified products, commodities, or services of the companies and countries can compare with cross-sectional time series and panel data time series (Capobianco-Uriarte et al., 2019).

This study was more concerned related to the competitiveness of Malaysia and Indonesia, as both have made significant contributions to the global production of palm oil. According to Gaveau et al. (2022), Indonesia was the largest palm oil exporter in 2019, with 16.24 Mha of oil palm plantation area. Malaysia is the world's second-largest producer and exporter of palm oil. In 2020, crude palm oil production was 19.14 million tonnes, with total palm product exports totalling 26.73 million tonnes (Ghulam et al., 2021). The advantage comparative method known as Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) is preferred by the majority of researchers.

World's leading producer of all four palm oil products that are almost equally rivalry on the international market are from Indonesia and Malaysia based on RSCA index. Thailand also one of the country that been compare within 17 years period of time started in 2001. However, the study reported that level of Thailand was not statically comprehensive compare to Indonesia and Malaysia (Saeyang & Nissapa, 2021), and in 2009 to 2013, Wahyudi (2016) also used the RCA approach to studies the competitiveness of Indonesian palm oil producer commodities to Malaysia's and Singapore's markets.

Previous studies have also concentrated on the competitiveness of palm oil especially relating on the oil palm price. Arias et al. (2020) analysed the prolonged connection among nominal exchange rate, international palm oil prices, and RCA for 26 countries from 2007 to 2015.They observed indication of the "convergence effect" in developing nations, as the impact on the prolonged connection of all elements in specialisation is greater in developing nations than in developed nations. In year 1974 to 1994, Ratti and Vespignani (2015) has observed that a decline in oil prices afflicted the export competitiveness of biodiesel. Nonetheless, from 1996 to 2012, both products' competitiveness improved as a result of the previously stated policies. Elsalih et al. (2019) discovered a positive relationship between oil prices and biodiesel export competitiveness using the NRCA index.

2.2 The co-integration of palm oil commodity

There also a lot of studies the cointegrations of palm oil toward the soybean and rapeseed oil. As the soybean oil are the substitute goods for palm oil, thus there were studies also proven the existent of co-integration between these commodities. Bentivoglio et al. (2018), found that the soybean oil price was affected during the increased of the market share for Indonesia dan Malaysia palm oil. Santeramo and Searle (2019) discover that the import of palm oil has a positive cross-price elasticity in relation to the price of soy oil and that the supply of soy oil responds favourably to increases in palm oil prices. Furthermore, real income and the price of soy beans had a favourable impact on domestic demand in Malaysia, whereas the actual price of palm oil had a negative impact (Abdullah et al., 1993).

There also study found there was a long run relationship between palm oil price and soybean oil price using the quarterly data from 1980 until 1995 and the granger causality test approach (Alias

& Othman, 1998). However, study by Hassan and Balu (2016), using the granger and Engle approaches found there was not evident of long run co-integrations between palm oil and soybean oil price within the period of 1988 until 2015. As the ban of palm oil in European market have impacted the biodiesel market, there are study conducted by Bentivoglio et al., (2018), used the times series analysis approach to analyse the links between the prices of palm oil, rapeseed oil, and biodiesel. The result indicates there was no causality exist between the price of rapeseed and price palm oil using the granger test. However, the price of palm oil has co-integration with price of biodiesel. On the other study by Rosyadi et al. (2021) using Indonesia oil palm RCA as dependent variable and co-integrate with others 4 variables. Saeyang and Nissapa (2022), also run the competitive index crude palm oil from 2001 to 2017 using the autoregressive distributed lag (ARDL) in the short-run. Pratama and Widodo (2020), also analysed the nontariff impact trade on palm oil after the announce of European Union to ban palm oil. Johku et al. (2019) conducted a study to identify the impact of crude palm oil competitive advantage after European Union ban the palm oil. The study is also comparing Malaysia and Indonesia from 1995 until 2019, using the price value, production value, export value of palm oil and European ban as factors toward the GDP.

Thereby, there was a lack of researches conduct to determine the competitiveness of the largest exporters of crude palm oil, particularly beyond 2018, which was the year the European Union announced it would ban palm oil as a commodity. This study is more realistic to identify the impact of palm oil ban by the European with the data is more further regresses from 1989 until 2021. In addition, this study incorporates soybean and rapeseed as a substitute for palm oil, a commodity that was encouraged by the European Union. The RCA index proxy as the competitiveness for the palm oil to identify the impact of the substitute's commodities such as soybean and rapeseed will have the co-integrations toward the palm oil RCA index.

3. METHODOLOGY

The first objectives will be using the RCA and RSCA indexes to analysing the competitive between 5 major palm oil exporters from 1991 and 2020.

3.1 Competitiveness Index RCA

The revealed comparative advantage (RCA) developed by Balassa (1965) must be calculated by comparing a specific commodity's export share to total export in the observed country. The RCA index can be calculated using the following equation:

$$RCAij = \left(\frac{xij}{Gxj}\right) / \left(\frac{xi}{Gx}\right) \quad \text{(i)}$$

Where,

xij = Total export in country i for commodity j,
xi = Total export by country i,
Gxj = World export for commodity j,
Gx = World export.

The studies determine there is no comparative or zero competitiveness is the RCA value is less than 1, if it is between 1 to 2 consider low competitive, and within value 2 to 4 is moderate. In some case the value exceeds more than 4, then is classify as highly competitive.

In the RCA index, the value can be measure to larger value until infinity, which able to classify the gap of the countries to be compare. However, the accumulated value year to year will create more confusion to understand the current countries that having progressive production in short time. Example, the countries may have low export but may having sudden high production will have more value of competitive index than the countries that having big production but in a constant trend. The symmetric value between -1 to 1 make the competitive graph more accurate and easier to figure out the competitiveness between a country, it was better to modified to more stable chart, known as the revealed symmetric comparative advantage (Mohamad et al., 2022; Tandra et al., 2022).

3.2 Competitiveness Index RSCA

$$RSCAij = (RCAij - 1)/(RCAij + 1) \quad \text{(ii)}$$

Where RSCA is the symmetric index value for RCA. If the RSCAij value is positive, a country has a comparative advantage in exporting the product and competing on the global market. If it is negative, the nation has a comparative disadvantage and cannot compete on the global market.

3.3 Autoregressive Distributed Lag Bounds Test (ARDL)

To answering the second objective of this study, the ARDL method is used to examine the co-integration relationship between RCA of Malaysia and Indonesia, exchange rate, soybean oil (HS 150710) and rapeseed oil (HS 151490) from 1989 until 2021. The frequent use of this method is due to its ability to test different levels of stationarity of variables, as opposed to the Johansen Cointegration test, which can only be used if all variables are I(1). The ARDL method offers greater flexibility regarding the stationarity requirements of the variables, regardless of whether they are a mixture of I(1) and I(0) or both, so long as they are not I(2) or greater. The ARDL model equation is as shown below:

$$\begin{aligned}\Delta LN\, RCA_t^x = \beta_0 &+ \sum_{i=1}^{K} \beta_{1i} \Delta LN\, RCA_{t-i}^x + \sum_{i=0}^{L} \beta_{2i} \Delta LN\, EXCRATE_{t-i}^z \\ &+ \sum_{i=0}^{M} \beta_{3i} \Delta LN\, SOYBEAN_{t-i} + \sum_{i=0}^{N} \beta_{4i} \Delta LN\, RAPESEED_{t-i} + \varphi_1 LN\, RCA_{t-1}^x \\ &+ \varphi_1 LN\, EXCRATE_{t-1}^z + \varphi_4 LN\, SOYBEAN_{t-1} + \varphi_5 LN\, RAPESEED_{t-1} \\ &+ \varepsilon_t \qquad \text{(iii)}\end{aligned}$$

Where,

$LN\ RCA_t^x$: Log revealed comparative advantage in year (t), (x;Malaysia and Indonesia)

$LN\ EXCRATE_{t-1}^z$: Log Exchange rate in year (t), (z; Malaysia and Indonesia)

$LNSOYBEAN_{t-1}$: Log export soybean oil to Europe in year (t)

$LNRAPESEED_{t-1}$: Log export rapeseed oil to Europe in year (t)

ε_t : Error term*

3.4 FMOLS tests for long-run relationship

The research added the alternative for the long run ARDL model. The fully modifies ordinary least squares (FMOLS) method estimated to check the robustness of the long-run ARDL model. The use of these methods is motivated by the fact that, for example, the FMOLS enables for the inclusion of lags of the regresses to remove the issue of endogeneity (Praveen et al., 2022).

Table 1: The values, source, trade value and expected sign of variables.

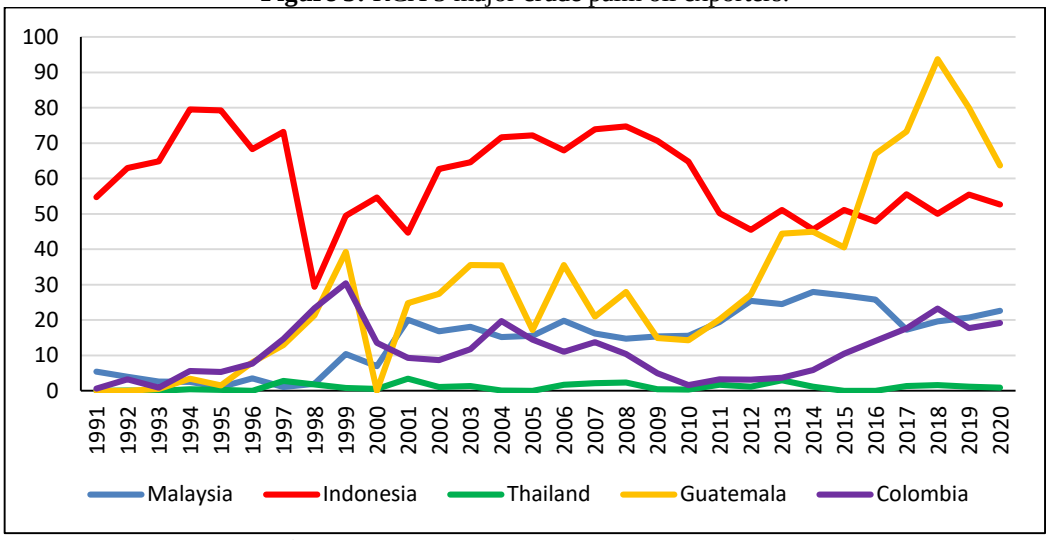
Variables	Symbols	Expected value	Trade value	Source
Export	Export (i, j)	+	US$	UN Comtrade (HS 151110)
Import	Import (i, j)	-	US$	UN Comtrade (HS 151110)
RCA	RCA	No sign	Index	Calculation by Authors
RSCA	RSCA	No sign	Index	Calculation by Authors
RCA	LNRCA	+	Index	Calculation by Authors
Exchange rate	LNEXCRATE	-	US$	World bank
Soybean	LNSOYBEAN	+	US$	UN Comtrade (HS 150710)
Rapeseed	LNRAPESEED	+	US$	UN Comtrade (HS 151490)

Table 1 shows the variable names, symbol, trade value, source and the expected value. LN represent natural log. The RCA and RSCA has no sign as it can be positive or negative according to the calculation from the formula at 3.1 and 3.2. However, for symbol of the LNRCA is expected positive (+) sign as the log required for positive figure. The soybean and rapeseed oil are expected to have positive value as the replacement goods for palm oil commodity. As the ban on palm oil will increases the demand of soybean and rapeseed in the European market.

4. RESULTS AND DISCUSSION

This study has two objectives: comparing the major exporter of crude palm oil from 1991 to 2020 by using the RCA and RSCA indexes with involving the top five countries with the highest contribution to the global market. The second objective have selected only two nations the highest competitive countries (Malaysia and Indonesia) in the 33-year observations from 1989 to 2021, on the soybean and rapeseed oil commodities as the substituted goods toward the co-integration of the palm oil.

Figure 5: RCA 5 major crude palm oil exporters.

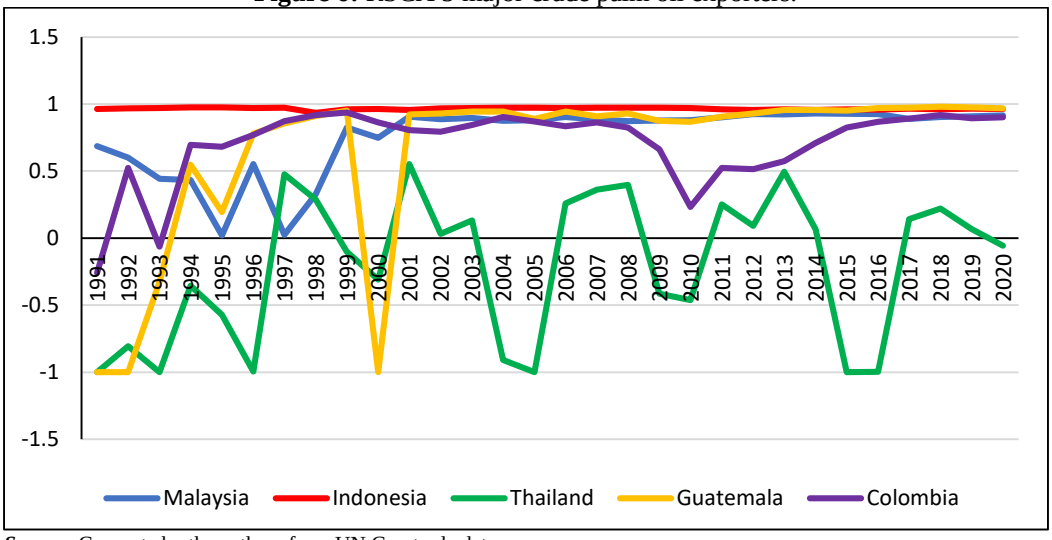


Source: Compute by the authors from UN Comtrade data

The competitiveness of crude oil (HS code 151110) compares 5 majors contribute of worldwide palm oil from 1991 to 2020. Based on Figure 1, there are 5 top global palm oil exporters such as Malaysia, Indonesia, Thailand, Guatemala and Colombia. However, in Figure 5 shows the 5 biggest exporters of palm world and by using the RCA analysis enable to the study for determine which country were having comparative advantage over the world average. Based on the theory, if a country has RCA value more than one (>1), means the country have a comparative advantage (Balassa,1965; Mohamad et al., 2022). Indonesia is the largest exporter for palm oil have strongly competitive since 1991 until 2020. Indonesia RCA peak at 1994 to 1995, and the lowest value was during 1998. However, during year 1998, Indonesia still the highest comparative exporters among the others palm oil producer. Ramadhani and Santoso (2019) also reported the same results when comparing Malaysia and Indonesia.

Guatemala also having progressive RCA value since it hikes from 2015, then sudden drop in 2000, but regain progressive trend in 2001 to 2019. Colombia also having fluctuates trend, as the Colombia RCA at the highest in 1999 and slowly decrease until 2010. Then, the Columbia also regain the competitive slowly increasing until 2020. Malaysia and Thailand have struggle from 1991 until 1998, however Malaysia shows a clear progressive competitive starting 1999 until 2020. There are other studies has similar result reported Malaysia are more dominant than Thailand (Saeyang & Nissapa, 2021; Tandra et al., 2022).

Figure 6: RSCA 5 major crude palm oil exporters.



Source: Compute by the authors from UN Comtrade data

The RCA and RSCA is taken the same concept of the comparative advantage. The RSCA in Figure 6 is more likely stable chart as the value are calculate in range of 1 to -1 (Mohamad & Zainuddin, 2021). Therefore, even the Indonesia has high value in RCA index, the other countries as such Malaysia, Guatemala and Colombia able to gain similar value especially during these 3 countries steadily competitive in 2017 to 2020. The was in certain years where Thailand and Guatemala were having totally loss competitiveness, such as in years 1991, 1993, 1996, 2005, 2015 and 2016 for Thailand, and Guatemala within early 1991-1992 and 2000. Thus, both countries showing highly fluctuates trend, but the Guatemala regain more stable and comprehensively positive value after year 2000. Indonesia strongly competitive since 1991 until 2020, and almost get the perfect 1 value in RSCA. Malaysia was always in a positive value since 1991 until 2020, and the Malaysia RSCA value has struggle start with fluctuates trend from 1991 until 1997, after 1998 Malaysia was strong rise until 2020. The Europe Union have promoted to ban palm oil in 2018 as their claim the commodity has harm the global and contribute to the climate change crisis (Abubakar et al., 2022; Paterson 2020a, 2020b). However, based on figure 4, in the RCA index only Guatemala having a down trend and Thailand in RSCA index after 2018. Malaysia and Indonesia that the top 2 global exporter have no effect proven in the RCA and RSCA index. The study furthermore analyses the regression analysis of the co-integrations of RCA for Malaysia and Indonesia crude palm oil towards the suggested replacement commodity as such soybean and rapeseed oil. As the Europe Union was the only region that seriously want to ban palm oil, thus to make this study more relevant, the data involving the soybean and rapeseed was the world export of the selected commodities to be import by the European countries only.

The next objectives analyse only focus to conduct only for Malaysia and Indonesia as both countries have leave huge gaps of the export value compare to the other palm oil exporters. Furthermore, there are some years that the others countries have zero value in RCA. Thus, the other countries not suitable for further analysis because of this study using RCA as the dependent

variable, and using the soybean and rapeseed oil, together with exchange rate as the independent variables.

Table 2: Descriptive Statistics for Malaysia and Indonesia

Malaysia					
Variables	**RCA**	**EXCRATE**	**SOYBEAN**	**LNSOYBEAN**	**RAPESEED**
Mean	14.43	3.42	541384.00	12.87	828544.30
Median	15.55	3.52	393998.00	12.88	729276.20
Maximum	31.93	4.30	1719257.00	14.36	1993353.00
Minimum	1.04	2.50	54074.05	10.90	64375.88
Std. Dev.	9.14	0.58	417272.80	0.90	560961.30
Skewness	-0.06	-0.24	1.10	-0.49	0.23
Kurtosis	1.86	1.66	3.73	2.63	1.78
Observations	33	33	33	33	33
Indonesia					
Mean	57.65	8416.40	541384.00	12.87	828544.30
Median	55.46	9159.32	393998.00	12.88	729276.20
Maximum	79.54	14582.20	1719257.00	14.36	1993353.00
Minimum	22.44	1770.06	54074.05	10.90	64375.88
Std. Dev.	13.65	4331.73	417272.80	0.90	560961.30
Skewness	-0.42	-0.38	1.10	-0.49	0.23
Kurtosis	2.91	1.92	3.73	2.63	1.78
Observations	33	33	33	33	33

The Table 2 shows different statistics for Malaysia and Indonesia data for the analysis and its pertinent classes before adding the natural logarithm. The index competitiveness RCA was the dependent variable, Malaysia and Indonesia exchange rate as the independent variable. The analysis using same data for the soybean and rapeseed oil as the data was the exported worldwide to the European countries since 1989 to 2021. The table displays for both mean, median minimum and maximum skewness and using the kurtosis value to determine it normality value. According to Bai and Ng (2005), normal data set can be detected on the kurtosis value. Example, if the kurtosis is larger than 3, the dataset will have heavier tails than a normal distribution, however if the kurtosis is less than 3, the dataset has lighter tails than a normal distribution. All the variables show stability for the kurtosis value except for soybean oil that has higher kurtosis value (3.73) which is not normally distribute. However, by the natural logarithm for soybean oil have solve the issue and the value drop to 2.63 (normally distribute). Base on the previous research, there also other researcher has made log to soybean in order to gain the kurtosis value below 3 (Chandio et al., 2022). The analysis proceeds to use the natural logarithm to all the variables before proceed the co-integration analysis.

In Figure 7, there was 6 illustrated graphs of all the time series data that the study used for conducted the co-integration ARDL model. All the graphs showing the upward trend during 1989 to 2021, except for the log RCA Indonesia (LNRCAINDONESIA) was highly fluctuated trend until 2020 and decreasing pattern at 2021.

Figure 7: All individual graphs for dataset trends

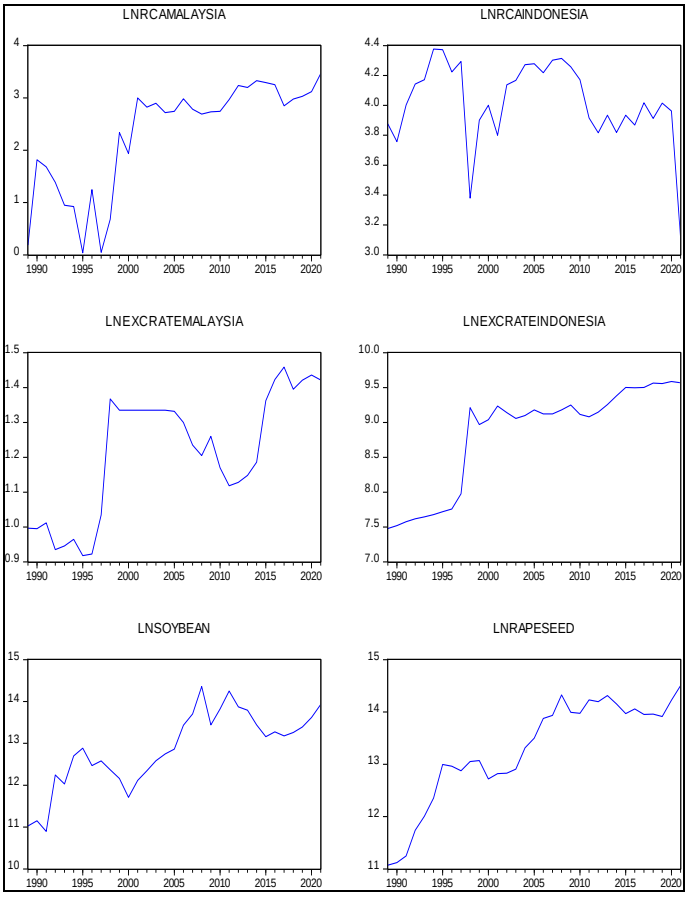


Table 3: Unit root test results

Countries		Malaysia		Indonesia	
Unit root	**Variables**	**Level**	**First dif.**	**Level**	**First dif.**
ADF	LnRCA	-3.0338	-3.0039***	-2.6487	-6.2826***
	LnExcrate	-1.7709	-4.4314***	-1.7567	-5.8514***
	LnSoyb	-2.4600	-6.7568***	-2.46	-6.7568***
	LnRap	-2.0003	-4.5943***	-2.0003	-4.5943***
PP	LnRCA	-3.4098*	-8.3680***	-2.5043	-6.2819***
	LnExcrate	-1.9638	-4.3703***	-1.7279	-5.8525***
	LnSoyb	-2.5098	-6.6945***	-2.5098	-6.6945***
	LnRap	-2.0534	-4.6842***	-2.0534	-4.6842***
KPSS	LnRCA	0.1022	0.087	0.113	0.2368
	LnExcrate	0.0904	0.0675	0.1514**	0.1466
	LnSoyb	0.0972	0.1088	0.0972	0.1088
	LnRap	0.1444*	0.1947	0.1444*	0.1947

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

The unit root test is vital subject to be analysis to determine the order of integration variables, thus to identify whether the regression was suitable for ARDL model. Table 3 shows the order levels and first differences root tests to all the variables using the Augmented Dickey-Fuller (ADF), Phillip Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests for Malaysia and Indonesia. All the unit test are using the constant and trend at level then, at the first different by using with constant only.

Using the ADF shows the data for LNRCA (reveal competitive advantage for Malaysia and Indonesia), LNEXCRATE (exchange rate of Malaysia and Indonesia), LNSOYBEAN (world export for soybean oil to Europe) and LNRAPESEED (world export rapeseed oil to Europe), shows Indonesia has not stationary at levels I(0). Using the first differences able to make the data to find the stationary for all the variables. Malaysia on the other hand has PP test RCA found to be significant as same with the first different I(1)t. However, this study still performing the ARDL approach as the result for Malaysia unit roots using the ADF test found all variables are not stationary at levels and significant at first different. The KPSS test also having similar result with all variables for both countries are significant at first differences. Thus, this confirm the ARDL method is suitable for this study.

Table 4: Estimated Short-Run using ARDL Approach Compared Malaysia and Indonesia

Countries	**Malaysia ARDL (4, 1, 4, 2)**				**Indonesia ARDL (1, 1, 0, 0)**			
Variables	**Co-efficient**	**Std. Error**	**t-Statistic**	**Prob.**	**Co-efficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LNRCA(-1))	0.3461 **	0.1563	2.2145	0.0439	0.7540 ***	0.2240	3.3663	0.0024
D(LNRCA(-2))	0.6017 ***	0.1516	3.9696	0.0014				
D(LNRCA(-3))	-0.1038	0.1438	-0.7219	0.4823				
D(LNRCA(-4))	-0.4690 ***	0.1304	-3.5975	0.0029				
D(LNEXCRATE)	-0.5691	1.2107	-0.4701	0.6455	-0.7274 ***	0.2045	-3.5575	0.0015
D(LNEXCRATE(-1))	3.1830 ***	1.0095	3.1530	0.0070	0.6880 ***	0.1878	3.6635	0.0011
D(LNSOYBEAN)	0.1903	0.4127	0.4611	0.6518	-0.0634	0.1576	-0.4022	0.6908
D(LNSOYBEAN(-1))	-0.3777	0.3709	-1.0182	0.3258				
D(LNSOYBEAN(-2))	0.7778 **	0.3615	2.1518	0.0494				
D(LNSOYBEAN(-3))	-0.0362	0.2711	-0.1336	0.8956				
D(LNSOYBEAN(-4))	0.4809 ***	0.1762	2.7289	0.0163				
D(LNRAPESEED)	0.0320	0.6518	0.0491	0.9615	-0.0030	0.1923	-0.0158	0.9875
D(LNRAPESEED(-1))	1.0582	0.7155	1.4790	0.1613				
D(LNRAPESEED(-2))	-1.5634 **	0.7201	-2.1711	0.0476				
Adjusted R-squared	0.9144				0.4172			

Notes: *(*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.*

The Table 4 indicates the results of ARDL in short-run for Malaysia and Indonesia. The Indonesia short-run ARDL model represent by (1.1.0.0) with low adjusted R-squared. The RCA index for Indonesia is 0.7540, showing significant and positive. This finding is similar with Jokhu et al. (2019) and Riffin et al. (2020), on the ban of the European Union have no impact on competitiveness of Indonesia palm oil. The exchange rate also significant for Indonesia is having double signs with negative and positive. However, there no result to extend the co-integration for soybean and rapeseed to the palm oil competitiveness.

The Malaysia on the other hand shows a good result and high adjusted R-squared (91%) for the short-run the model (4,1,4,2) with the RCA competitive index having 3 significant, soybean 2 significant, exchange rate and rapeseed both with only 1 significancy. The RCA for Malaysia is having both signs, at first and second lags are positive, then by increasing the lags have given the sign change to negative. Meaning the Malaysia competitive index for palm oil having an impact when the ban of palm oil by the European countries which is contradicted with Jokhu et al. (2019) study. The soybean shows the positive sign with the higher lag given 0.4809 for soybean mean that the demand for export of soybean to Europe is increasing. This result is relevant with the other studies that mention the increasing demand of Europe for soybean as the Europe trying to highlight the environmental issue (Guilpart et al., 2022; Varacca & Sckokai, 2020).

The exchange rate for Malaysia is positive, however, the rapeseed was negative. This results clearly shows that the competitiveness of Malaysia palm oil (RCA) can has negative impact to rapeseed. Thus, the European countries are more chosen the soybean oil to replace with palm oil during the ban campaign, however the demand for rapeseed shows different result compare to soybean.

Table 5: Bounds test results

Countries	F-statistic	90% lower bound	90% Upper bound	95% lower bound	95% Upper bound	97.5% lower bound	97.5% Upper bound	99% lower bound	99% Upper bound
Malaysia	5.60	2.37	3.20	2.79	3.67	3.15	4.08	3.65	4.66
Indonesia	1.47	2.37	3.20	2.79	3.67	3.15	4.08	3.65	4.66

The Table 5 report a result of the bounds test for co-integration. This bound test is important to determine the existing of the long-run co-integrations by using the F-statistics test. According to Pesaran et al (2001), if the F-statistic has higher value than the upper bound at 5% significant level, there is a long-run relationship between the dependent and independent variables. Therefore, based on the bounds test results for the Malaysia (5.60 > 3.67) determine there is long-run co-integrations between RCA and the exchange rate, soybean oil, and rapeseed oil. However, Indonesia has difference interpretation as the F-statistic for Indonesia (1.47 < 3.67) is lower that upper bound test at any significant levels. Therefore, this mean there are no long run co-integration for Indonesia RCA and the exchange rate, soybean oil, and rapeseed oil.

Table 6: Malaysia Long-Run coefficients using ARDL approach and FMOLS test

Approach	**ARDL LR**		**FMOLS**	
Dependent Variable LNRCA				
Variables	**Co-efficient**	**Probability**	**Co-efficient**	**Probability**
LNEXCRATE	4.1817*	0.0521	3.2334**	0.0381
LNSOYBEAN	1.6560	0.2286	0.4895	0.4614
LNRAPESEED	-0.7570	0.5942	-0.0312	0.9646
Constant	-14.1147***	0.0000	-7.3747***	0.0057

Notes: *(*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.*

Given that co-integration between variable in the ARDL long-run model exists only for Malaysia. Thus, in Table 6 shows the Malaysia long-run (LR) ARDL approach with the alternative method of FMOLS to check the robustness of the LR result. There are 2 variables that are significant which is the exchange rate (4.1817) and constant (-14.1147). The FMOLS test also indicates the same significant for these variable and similar signs, as the exchange rate (3.2334) are both positive and the constant (-7.3747) was negative sign. Meaning the ARDL long-run is strongly reliable result, however, this study unable to see the co-integrations of the Malaysia palm oil competitive index forward the export of soybean and rapeseed in the long-run.

Table 7: Model diagnostic test results Malaysia and Indonesia

Countries	**Malaysia**		**Indonesia**	
Test	**F-test**	**Probability**	**F-test**	**Probability**
ARCH	0.3256	0.5732	0.9399	0.3403
Heteroscedasticity;Breush-Pagan-Godfrey	0.3858	0.9572	0.3374	0.8856
Serial Correlation LM Test	1.6690	0.2327	0.3716	0.6935

Figure 8: Malaysia CUSUM

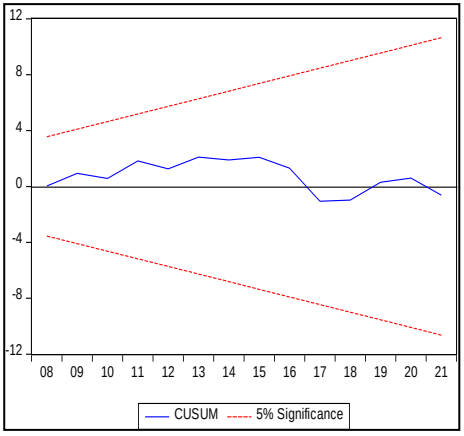


Figure 9: Indonesia CUSUM

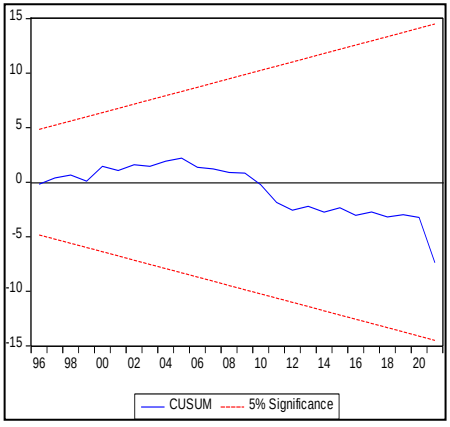


Table 7 diagnostic analysis to ensure the stabilities of the ARDL model for both Malaysia and Indonesia. The both model ARDL proven to free from any heteroscedasticity problems as the all the test; ARCH, Jarque-Bera test and Breush-pagan-Godfrey were tested. Malaysia shows Breush-Pagan-Godfrey test with 0.3858, compare to Indonesia at 0.3374. Indonesia has the highest F-test with 0.9399 for ARCH test compare to Malaysia (0.3256). The LM test also clearly shows no correlation problem for both models as Malaysia record (1.6690) and Indonesia (0.3716). The estimation of CUSUM test for Malaysia and Indonesia shown stability existed for both ARDL model (Figure 8 and 9) with in the critical limits at 5% significance level, thus no autocorrelation issues.

5. CONCLUSION

The harvesting of palm oil is the leading cause of deforestation across the world and is a major factor in the elimination of natural ecosystems that are essential to the survival of many endangered animal species, including orangutans, tigers, and elephants. In addition to this, the extraction of palm oil causes the emission of significant quantities of carbon dioxide and other greenhouse gases into the atmosphere, which adds to the problem of global warming. Therefore, the Europe Union has brought this matter to ban oil palm in 2018, and parliament EU also agree to ban oil palm for biofuel used that may negatively affect the palm oil market in the global market. The impact of it are studies in this research and this study proven from the competitiveness index that Thailand was reported slowly lose the competitiveness in RSCA and Guatemala snidely reduce competitiveness in RCA after 2018. However, the findings also proven that Malaysia and Indonesia that dominant 80% of the worldwide crude palm oil export does not really have impact the within 2018 to 2020 based on the competitiveness index (RCA and RSCA). The boycott from Europe may has small impact as the EU was also favourable for import palm oil in the global market but the real biggest importer countries was China and India, thus the EU may not strong player to make a change (Tandra et al., 2022; Wang et al., 2022).

As the analysis of the ARDL short-run co-integrations effect of soybean and rapeseed as the replacement commodity for crude palm oil have 2 differences conclusion. Malaysia RCA have detected to have an impact from the ban of the European Union, however Indonesia RCA having no impact of the restriction of palm oil to enter EU market. There also an increasing in demand for soybean oil at European countries as replacement goods for palm oil (Varacca & Sckokai, 2020). Thus, the European Union suggested soybean to place the palm oil is expected within the theory of replacement good (Yahya et al., 2022; Girton & Roper, 1981). However, there no significant impact on banning the palm oil the toward the export of soybean and rapeseed oil in European within a long-run ARDL analysis.

However, the short-run co-integration effect toward the Malaysia RCA is not strongly impactful. Since, Malaysia and Indonesia still indicate highly competitive as the RCA index shows exceed 4 and both having positive value for RSCA. Thus, there is such a large demand for palm oil in the international market, moreover, it is unlikely that any other oil could ever completely replace it. However, the actions involved in palm oil cultivation should be taken very seriously because of the impact they have on deforestation. According to Brandi et al. (2015), there are small farmers who fail to comply with the standards for oil palm cultivation. This affects the reputation of the oil palm industry at international market.

Consequently, all oil palm farms in Malaysia and Indonesia should take the initiative to implement more sustainable agriculture practices. Therefore, this study emphasizes to implement sustainable policies seriously in Malaysia and Indonesia, together with providing evidence such as "Indonesian Sustainable Palm Oil" (ISPO) and Malaysian Sustainable Palm Oil (MPSO) certificates (Cheah et al, 2023; Cattau et al, 2016), is necessary to maintain investor confidence and market palm oil as a sustainable commodity. As the range of the study within 1989 to 2021 and only been using the soybean and rapeseed oil exported to European market, meaning this study is only shown an early stage of the effect of the banning of European to the palm oil market for the biofuel use. Therefore,

there still more researches can be done after several of months or years to see the outcome and the impacts to the palm oil market.

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