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Factors Influencing Malaysian Palm Oil Export Demand in Long-Run and Short Run

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Abstract: Malaysia as a second large global palm oil exporter and it is mainly exporting to India, Europe Union countries, China, US, and the Pakistan. However, the ranking of these top five importer countries are changing due to the few factors, such as the export price, currency stability, the global economic performance, and the competition of soybean oil price. In this study, a time series data from 1980 to 2015 were obtained to determine the factors influencing on the Malaysian palm oil export demand in long-run and short-run. In this study, the result of Engle-Granger (EG) cointegration test found that, all the underlying factors are co-integrated with the export demand for palm oil and are followed the expected sign. In the long-run, world GDP is significantly affected the palm oil export demand while the others are insignificant. In the short-run, the Error Correction Mechanism (ECM) model showed all the factors are significantly influence the changes of palm oil export demand except the exchange rate. In the nutshell, this study suggests that the policy maker have to stabilize the national currency in order to avoid the fluctuation of export demand for Malaysia's palm oil.

Key words: *palm oil, export demand, cointegration, exchange rate stability.*

INTRODUCTION

Palm oil is an edible vegetable oil derived from the fresh fruit bunch of the oil palm trees. Nowadays, palm oil is widely used by the world population's daily life – food and non-food products. Compare to the other vegetable oils such as sunflower oil and soybean oil, palm oil is more cost effective. Palm oil can be produced with a lower cost and selling at the lower price than other edible vegetable oils. Due to the higher demand for palm oil in the international market, there are so many countries are interested to plant the oil palm and produce the palm oil products in their country such as Indonesia, Thailand, Columbia, and Nigeria. In recent, Indonesia and Malaysia both are the main countries to produce and to export the palm oil products in the global market.

In Malaysia, the oil palm crop was primarily from the African oil palm *Elaeis guneensis* and were first planted as an ornamental crop in 1870 while, the economic value of palm oil was unknown by Malaysian government. After 90 years, Malaysian government realized the importance of palm oil and transform it into a commercial crop through the economic diversification campaign which Malaysia's rubber planters had encouraged to transform their rubber plantation area into the oil palm cultivation since 1960's. The main purpose of the diversification campaign had to increase rubber farmers income due to the global rubber price significantly dropped in 1960s [1]. After the diversification policy, the industrial crop cultivation land is mainly transformed into oil palm cultivation consequently the oil palm plantations had become as the largest cultivated industrial crop in Malaysia. Within a relative short time period, oil palm cultivation becomes an important sector on the Malaysian economy contribution and it was given a name of "golden crop" in Malaysia. In the aspect of national economic development, oil palm industry had contributed for 5 to 6 percent of the Malaysia's GDP in the year 2015, while the advancement plans have been made to increase the oil palm revenue to 178 billion Ringgit Malaysia by the year 2020.

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Nowadays, Malaysia is ranked as second largest palm oil exporter country in the world and was mainly exported its palm oil products to India, European Union (EU) Countries, China, United State, and Pakistan. However, the ranking between these top five importer countries experienced some significant changed due to the factors of competition of Indonesia palm oil market, the export price of palm oil fluctuated, Ringgit Malaysia stability concern, the global economic performance, and the competition of soybean oil price. Since 2013, China had significantly dropped its palm oil demand from Malaysian due to the reasons of China economic slowdown and its demand had shifted to the Indonesia's palm oil. Consequently, the rank of China export demand for Malaysia's palm oil was dropped from the first to the third. On the other hand, Pakistan and USA had also reducing their demand for Malaysian palm oil as they had preferred soybean oil as the substitutes of palm oil. In recently, soybean oil price was decrease and this was challenge to the palm oil market. The decrease price of soybean oil is due to the impact of increasing production of soybean in USA. In order to protect their own soybean industry, USA was reducing the demand for palm oil and substitutes it with their local soybean oil.

Even the European countries still maintain their import demand for Malaysia's palm oil, however, the import barriers in the EU region becomes more restricted and it will be affected to the Malaysia's future palm oil export, such as anti-palm oil campaign, labelling, sustainable palm oil certificate, no fossil fuel car in 2040, etc. In order to reduce the impact of anti-palm oil campaign from EU, Malaysia Palm Oil Board (MPOB) and Malaysia Palm Oil Council (MPOC) are encouraging the Malaysia's palm oil industry towards sustainable palm oil practice. The sustainable palm oil certificate such as Roundtable Sustainable Palm Oil (RSPO) and Malaysia's Sustainable Palm Oil (MSPO) will be given to the qualified planters in order to provide the sustainable credibility to the EU demand market.

In contrast, India's demand for Malaysia's palm oil had increased and to be the top importer country in Malaysia. Since 2013, the Indian rapeseed production is decreasing due to the deficit rainfall in the country while, the demand for cooking oil is increasing due to the huge population growth in India and this caused the country to look for the palm oil importation. Compare to the other edible oils, palm oil views as the most cost efficient product and cheaper to consume. Therefore, in order to fulfill the local demand for cooking oil, India was increasing their import demand for Malaysia palm oil.

As an overall review, the factors influencing on Malaysia's palm oil export demand can be categorized into external (i.e. world's economy growth, and soybean price movement) and internal factors (i.e. palm oil export price and Malaysia's exchange rate). In order to prevent the Malaysia losing their palm oil export market share, it is important to determine the related factors influencing Malaysia's palm oil export demand which is crucial for the policymaker. In this study, we aims to assess the impact of internal and external factors to determine the Malaysia's palm oil export in the long-run and short-run.

LITERATURE REVIEW

Summarized from the previous literature, there are two main factors will influence the export demand for a commodity, which is the internal and external factors. The internal factors are represents the local control variables such as export price and exchange rate. In contrast, the external factors are represents the global influence factors such as the trading country's economic growth, and the substitution price or complement price.

[2] had included the real world GDP, export price, soybean price (substitution price) and exchange rate to determine the export demand of Malaysian palm oil. The finding had shown that the export price have a negative causal impact on the export demand for palm oil, while the price of substitute products of palm oil playing a significant role to determine the export demand of palm oil. This finding was supported by the finding from [3], [4], and [5]. In addition, [6] stated that the changes in palm oil price will reflect the changing structure of user demand in US and EU market.

[7] investigated the export demand for palm oil in five major importers which are India, China, Bangladesh, Pakistan and USA. There are five single equation models representing the demand of these countries then those equations were analyzed via autoregressive distributed lag (ARDL) procedure. In [7] study, the determinants that been included in the export demand are palm oil price, price of substitutes products (soybean price) and real income of the country (real GDP) of those countries. The finding showed that exchange rate was seemed to be a vital component in trade models [8].

[9] had conducting a research to analyze the factors affecting the performance of Indonesia's CPO export. The analysis had included the factors of export financing, soybean oil world price, sunflower oil world price and negative campaign. The results had showed the export financing has a positive impact on CPO export volume while negative impact shown by the price towards the CPO export volume as stated in the demand theory. The small coefficient number indicates that the export volume of CPO is inelastic to export finance. The theme of the black campaigns on Indonesia's CPO which are high cholesterol and

non-environmental friendly in production process had pull down the export volume of CPO then it had create a bigger market for substitutes products like soybean oil and sunflower oil. In [9] study, the soybean oil price and sunflower oil price has a significant impact. Besides, the price of coconut oil and rapeseed oil are both not significant while the crude oil price was insignificant to determine the export of CPO.

Furthermore, [10] had found that the prices of palm oil and substitute oils price and national income of the selected countries (real GDP) are significant. The other factors like bio-fuel mandate, trade policies and exchange rate also confirm to be major factors affecting demand for palm oil in the selected five Asia countries (India, China, Japan, Bangladesh, Korea and Pakistan).

[11] investigated the factors affect the import demand for Indonesian and Malaysian palm oil in Italy. The authors included the Malaysian palm oil price, Indonesian palm oil price, world palm oil price, exchange rate, population, income (GDP), price of substitutes (soybean price) and the import volumes of palm oil. The results showed the relationship between Malaysian palm oil price and import demand in Italy is negative and this finding supported by [12].

DATA

This study utilizes a data which adopted covering from the year 1980 until 2015.The data of export demand for Malaysian palm oil (TMEX) was derived from variables including the palm oil export price (EXPR) and the soybean oil world price (SYBWP) which were collected from the Malaysian Oil Palm Statistics 2015 (35th Edition) which launched by Malaysian Palm Oil Board (MPOB). Besides that, the exchange rate of Malaysian Ringgit per USD (MYR/USD) obtained from the Bank Negara Malaysia Monthly Bulletin (www.bnm.gov.my) and the Real World GDP (RGDPW) was obtained from the World Bank Indicator (www.worldbank.org).

METHODOLOGY

In this study, the Engle-Granger cointegration test (hereafter the EG test) is employing to analyze the long-run cointegration relationship between the influence factors and export demand for Malaysia's palm oil. Firstly, estimate the long-run equation with ordinary least square (OLS) method as:

$$Y_t = c + \beta_1 X_t + \varepsilon_t \quad (1)$$

where Y_t denotes as the endogenous variable and the X_t denote as the exogenous variable(s). In this study, the equation (1) can be re-written as:

$$\ln TMEX_t = C + \beta_1 \ln ERMY_t - \beta_2 \ln EXPR_t + \beta_3 \ln SYBWP_t + \beta_4 \ln RGDPW_t + \varepsilon_t \quad (2)$$

where β_1, β_2, β_3 and β_4 are the long-run coefficients for the Malaysia's exchange rate (ERMY), Export price of palm oil (EXPR), World soybean oil price (SYBWP) and World real GDP (RGDPW) respectively. The *ln* denotes that all variables are transformed into a logarithm form. In order to examine the stationary level of the residual series (ε_t) gained in Eq. (2), an Augmented Dickey Fuller test is employed and show as:

$$\Delta\hat{\varepsilon}_t = (\rho - 1)\hat{\varepsilon}_{t-1} + \sum_{j=1}^{k} \delta_j \Delta\hat{\varepsilon}_{t-j} + u_t \quad (3)$$

where the $\Delta\hat{\varepsilon}_t$ indicates the first different of estimated error term which obtained from the equation (2). If the null hypothesis result gives the value of ρ-1=0 is rejected in the ADF test, it means the estimated variables (ERMY, EXPR, SYBWP, RGDPW and TMEX) have a long-run cointegrated relationship and the long-run estimated regression or equation (7) does not produce a spurious regression.

After the cointegration test, the analysis is proceeding into the ECM estimation in order to confirm the short-run equilibrium among the estimated variables. In the ECM the error term (ε_t) can be considered in the equation (7) as the long-run equilibrium error or the disequilibrium magnitude. Thus the error term can be used to relate the short-run behaviour of export demand (TMEX) to its long-run value. In general the ECM can be expressed as:

$$\Delta y_t = \Omega_0 + \alpha\hat{\varepsilon}_{t-1} + \sum_{i=1}^{k} \Phi_i \Delta y_{t-i} + \sum_{h=0}^{r} \theta_h \Delta x_{jt-h} + u_t \quad (9)$$

where the u_t is the stochastic term while $\hat{\varepsilon}_{t-1}$ is the lagged value of the error term in the equation (7). Plus, the y_t is represent the $TMEX_t$ and the x_j represents the exogenous variables including ERMY, EXPR, SYBWP and RGDPW. The *k* and *r* are the optimum lag length selected based on the general to specific approach and in order to avoid the auto-serial correlation on u_t. Nevertheless, α is the long-run speed of adjustment or call it as an error correction coefficient plus Φ_i and θ_h illustrate the short-run elasticity.

In the study, the ECM equation (9) can be proposed as:

$$\Delta \ln TMEX_t = \Omega_0 + \alpha\ ECT_{t-1} + \sum_{i=1}^{k} \Phi_i\, \Delta lnTMEX_{t-i} + \sum_{h=0}^{r} \theta_h\, \Delta lnERMY_{t-h} + \sum_{h1=0}^{p} \theta_{h1}\, \Delta lnEXPR_{t-h1} + \sum_{h2=0}^{q} \theta_{h2}\, \Delta lnSYBWP_{t-h2} + \sum_{h3=0}^{S} \theta_{h3}\, \Delta lnRGDPW_{t-h3} + u_t \quad (10)$$

where the $ECT_{t-1} = \ln TMEX_t - c - \beta_1 \ln ERMY_t + \beta_2 \ln EXPR_t - \beta_3 \ln SYBWP_t$ and the α is expected to be negative if the variables are cointegrated.

RESULTS AND DISCUSSION

The stationary test is to check for the stationary level of the data (Table 1). The unit-root test is to test either the data are stationary at order I(0) or at order one I(1). The summary results of ADF and PP tests shows all the data are not stationary at level. However, it turns to be stationary with 1% significance level after transformed it into the first difference. This indicates that the all series are stationary at order one or there are I(1) variables.

Table 1: Findings of Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests

Variable	ADF Test		PP Test	
	Level	**First Diff.**	**Level**	**First Diff.**
TMEX	-1.916	-7.641***	-2.202	-7.693***
	(0)	(0)	(3)	(3)
ERMY	-1.265	-5.654***	-1.260	-5.663***
	(0)	(0)	(2)	(2)
EXPR	-1.033	-7.997***	-1.935	-8.649***
	(2)	(1)	(6)	(23)
SYBWP	-1.686	-6.376***	-1.745	-7.155***
	(0)	(1)	(5)	(33)
RGDPW	-0.844	-3.642***	-0.823	-3.642***
	(0)	(0)	(2)	(0)

Note: All variables are converted into the form of logarithm, ***, ** and * represents as significant at 1%, 5% and 10% significance level, respectively. The number in the parenthesis (…) represents the optimum lag selected for the test. To select optimum lag order in ADF test, the Schwarz Info Criterion (SIC) is adopted and to select the best lag order in PP test, Newey-West Bandwith (NWB) is used.

Engle–Granger two steps co-integration test:

Since all variables are stationary on the first difference or I(1), the next step is to estimate the co-integration regression of four independent variables determine on the total export quantity of Malaysia's palm oil. The Engle–Granger two steps co-integration test is applied in this study and the test reveals that residual was stationary at zero order or I(0) so the estimated variables among the four variables (ERMY, EXPR, SYBWP and RGDPW) are exist a long-run co-integration relationship with the TMEX (Table 2).

Table 2: Summary of Engle–Granger Co-integration Test

TMEX	**C**	***ERMY***	***EXPR***	***SYBWP***	***RGDPW***
	α	β_1	β_2	β_3	β_4
	6.457	0.291	-0.135	0.095	1.020
	(0.42)***	(0.22)	(0.14)	(0.17)	(0.10)***
Engle-Granger Cointegration Test : $\Delta\varepsilon_t = \beta\varepsilon t_{-1} + \sum_{i=1}^{K} \lambda \Delta\varepsilon_{t-i} + Vt$	-4.928***				
Critical Values	**1%**	**5%**	**10%**		
	-4.07	-3.37	-3.03		
Diagnostic Checking					
R^2	0.953	**Serial Correlation**		3.480 [0.175]	
Adj. R^2	0.947	**Jarque-Bera**		1.972 [0.373]	
F- Stats	156.954 [0.000]	**ARCH**		0.039 [0.842]	

Note: All variables are converted into the form of logarithm, ***, **, * represents as significant at 1%, 5% and 10% significance level, respectively. The number in the parenthesis […] represents the p-value while the number on parenthesis (…) represents standard error value.

The long-run regression shows the all independent variables are following the expected sign. The ERMY, SYBWP and RGDPW are carried positive relationship and the EXPR have negative sign. However, the RGDPW have found a strong positive relationship on determining the TMEX and it is statistically significant at 1% significant level. The other exogenous variables have not statistically significant to determine the TMEX, indicating that we have not enough statistical evidence to claim that the ERMY, EXPR, and SYBWP have a strong impact on determine the TMEX in the long-run.

Based on the estimated coefficients show in Table 3, the ERMY is estimated about 0.291 and this indicates that the rise of 1% in exchange rate will cause to the total export quantity of Malaysia's palm oil increase by 0.291%. Furthermore, the SYBWP elasticity is estimated in about 0.095, representing that increase of 1% in SYBWP will increase the total export quantity of Malaysia's palm oil by 0.095%, holding the others constant. However, the elasticity of Export Price (EXPR) is estimated about -0.135, illustrate that if there is 1% increase in export price and it will lead to the export demand for Malaysia's palm oil to decrease by 0.135%, holding other constant. Compared to the other factors, the real GDP have a higher positive elasticity to determine the Malaysia's export demand for palm oil. The elasticity of RGDPW is estimated about 1.02 which indicates that the every increase of 1% in world GDP will lead to the total export of palm oil in Malaysia to rise about 1.02%, holding other factors unchanged.

Through the diagnostic checking, the value of R-squared is really near to 0.953 means that there are 95.3% of the variable TMEX variation is explained by the ERMY, EXPR, SYBWP and RGDPW. The F-statistic for the long-run regression is statistically significant at 1% significance level and this confirmed that all explanatory variables are important to determine the TMEX even the individual t-test only confirmed that RGDPW is statistically significant to affect the TMEX. Furthermore, the auto-serial correlation, Jarque-Bera test and ARCH test shows insignificant to reject the each tests null hypothesis, which means that the estimated long-run regression is no auto-serial correlation problem, the residual is normally distributed and there are no heteroscedasticity problem, respectively. In the nutshell, the EG cointegration regression is fulfilled the Classical Liner Regression Model (CLRM) basic assumptions and it is considered a Best Linear Unbiased Estimator (BLUE).

Error-Correction Mechanism (ECM) Analysis:

The results of the short-run analysis by using the ECM model are reported in the summary Table 3. All of the variables are estimated followed the expected sign even in the short-run. The negative coefficient for ECT lagged one is estimated in value of -0.565 and it is statistically significant at 1% significance level. This indicates that the market self-adjustment is playing a significant impact to auto-converge the short-run disequilibrium back to the equilibrium point. Moreover, the magnitude speed of adjustment (-

0.565) show that the market itself have a moderate speed to converge in the short-run.

Table 3: Error-Correction Mechanism Analysis

Variable	Coefficient	Std. Error	P-Value
C	0.017	0.020	0.385
ECT(-1)	-0.565***	0.196	0.007
Δ(ERMY)	0.185	0.154	0.238
Δ(EXPR)	-0.298**	0.124	0.024
Δ(SYBWP)	0.318**	0.155	0.050
Δ(RGDPW)	0.881**	0.373	0.026
$ECT_{t-1} = TMEX_{t-1} - 0.291ERMY + 0.135EXPR - 0.085SYBWP - 1.020RGDPW$			
	(0.219)	(0.135)	(0.174)	(0.095)
	[0.194]	[0.323]	[0.628]	[0.000]***
Diagnostic Checking				
R-squared	0.627	**Serial Correlation**	1.680 [0.431]
Adj. R-squared	0.526	**Jarque bera**	1.256 [0.533]
F- stats	6.245 [0.000]	**ARCH**	1.281 [0.527]

Note: All variables are converted into the form of logarithm, ***, ** and * represents as significant at 1%, 5% and 10% significance level, respectively. The number in the parenthesis […] represents the p-value while the number in parenthesis (…) represents standard error of coefficient.

Based on the estimated ECM, the short-run elasticity for EXPR, SYBWP and RGDPW are statistically significant at 5% significance level to determine the short-run TMEX. However, the exchange rate is still statistically insignificant to affect the short-run TMEX. This ECM's findings explained that even the EXPR and SYBWP have no long-run impact on the TMEX, but these two variables still can have a short-run impact on the changes of TMEX. The short-run elasticity for exchange rate (ΔRGDPW) is estimated in magnitude of 0.881 which is the higher short-run elasticity than other factors on determine the changes of export demand for Malaysia palm oil in short-run.

In order to show the unbiased estimation of the ECM model, some important diagnostic tests are applied such as R-squared, auto-serial correlation test, Jarque-Bera normality test and ARCH test. The R-squared in this ECM model is 0.627 which around 62.7% of the variation of ΔTMEX was explained by the ΔERMY, ΔEXPR, ΔSYBWP and ΔRGDPW. Where 37.3% remains are not explained in the estimated regression. Besides that, it shows statistically significant at 1% significant level which indicates that the model is fit explained by the all independent variables. In order to confirm that the estimated regression free from the auto-serial correlation problem, the auto-serial correlation test is applied and show insignificant to reject the null hypothesis of the residuals is serial correlated. Meanwhile, the estimated regression's residual is not correlated and the ECM model is confirmed unbiased. In addition, the regression's residual is found normally distributed and the variance of the residual is homoscedasticity and constant. This because of the Jarque-Bera test and ARCH test both are failed to reject the null hypothesis on it test respectively.

CONCLUSION

Based on this study, the findings shown that the exchange rate is one of the important factor that influencing the export demand of Malaysian palm oil. This indicates that, the policy makers are encouraged to stabilize the national currency in the way to sustain the survival of the Malaysian palm oil demand.

The factor of palm oil export price thus gives impact on the Malaysian palm oil export demand and this finding can suggest a non-price strategy to be adopted to reduce the impact of price changes towards the export demand. For example, the industry can produce a high quality palm oil with a product differentiation in order to maintain the consumer preferences towards Malaysian palm oil.

Furthermore, the finding shown that the export price of Malaysian palm oil had give a negative impact towards the palm oil export demand. So, the Malaysia's palm oil industry has to manage their stock and production according to the changes of export price. For example, if the export price is expected to decrease in next three months, the industry has to prepare the current stock of

palm oil in order to fulfill the future demand. Finally, the world GDP also found to have a significant influence on the export demand for Malaysian palm oil. Therefore the decision making on Malaysian palm oil stock control planning is important to avoid any shortage or over surplus in the market.

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