Factors Affecting the Export Demand of Malaysian Palm Oil

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ABSTRACT This paper develops studies made on determinants for export demand of the Malaysian palm oil in the world market especially in top importing countries. The factors comprised in the analysis such as total area planted, production of palm oil, number of population, country's import of palm oil, price of palm oil and its substitutes, GDP of own country and importing countries, exchange rates (MYR/USD) and even to downstream details on number of mills, refineries and biodiesel with oleochemical plants and number of production of palm oil's food and non-food products. For this paper, Ordinary Least Squares (OLS) Regression using model building approach of Multiple Linear Regression (MLR) is being used to obtain the best model equation. Result obtained reflects a different findings from other studies regarding the factors that affect the export demand which are the production of palm oil, price of substitutes (fish oil), and palm oil based product (RBD palm olein) that significantly affects the demand for Malaysian palm oil export.

KEYWORDS: Palm oil determinants, Malaysian palm oil, Export demand, OLS regression, Model building approach
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INTRODUCTION

Palm oil has always been one of the significant oil in the world edible oil market. A report by Net Balance Foundation stated that palm oil won the market through its many benefits which include cheaper price, flexibility of product, less processing requirements and larger yield per hectare. A total of 28 countries were listed as the producers of world palm oil where Indonesia, Malaysia, Thailand, Colombia and Nigeria being the top five producers among others (Gerard, 2017). A number of possible reasons are to be blamed for the fluctuations in export demand of palm oil which includes EU plans to phase out palm oil from the EU biofuel programme by 2020 (Saieed, 2017), value of palm oil export had extremely dropped from RM54.02 billion to RM44.70 billion in year 2017 and 2018 respectively (Ahmad Shahir, 2019), the trade feud between China and United States, price movements of other edible oils and Indonesia's announcement regarding their interest in helping their exporters to reduce export tax from $50 to $0 per tonne (The Star Online, 2018). Thus, the objective of this paper is to estimate the parameters affecting the export demand of Malaysian palm oil and to model the export demand using Ordinary Least Squares (OLS) regression model.

MALAYSIAN PALM OIL EXPORT DEMAND FACTORS

According to Ramli & Mohd Basri (2011), the prices of high quality products of palm oil from Malaysia are very competitive with other oils and fats due to the rising trade and constant demand and availability of palm oil in the global market. In this study, fish oil as substitutes is included. This is because vegetable oils such as palm oil are seen as suitable candidates to replace fish oils in the aqua feed industry (Lin & Shiau 2007). Palm oil is used in many food supplies such as in frying oil, shortenings, margarine, fat for sweets and desserts. Likewise, palm oil and its derivatives are widely used in non-food products such as cosmetic products such as lipstick, shampoo, detergent and soaps. Palm oil is much preferable to use while cooking/frying (Gharby *et al.*, 2014). May (2013) stated that palm oil that undergo downstream sector to be used in non-food application is environmentally friendly.

TRANSACTIONS ON SCIENCE AND TECHNOLOGY

Murshidi & Aralas (2017) have come up with an outcome that stated the price shocks of crude palm oil has significantly impact the country's GDP growth. Their study concludes that Malaysia is a resource-dependent country particularly on oils. The dependency is believed to bring bad impact to the economy's health as the price of oil is volatile in the world market. Global palm oil demand depicts a rising trend as the expanding global population over the long term contributes to the increasing consumption of food and cosmetic products that include some materials that is derived from palm oil (Indonesia Investments, 2017). Being an efficient oil crop in terms of its cheaper price and availability as a cooking medium in the market, palm oil is no doubt a crucial commodity in feeding the developing number of people globally (Green Palm Sustainability, 2016).

The Malaysian Palm Oil Board (MPOB) has huge aspiration in becoming a top leader in the midstream application sector through the implementation of Green Palm Oil Mill and bio refinery plants (Kushairi, *et al.*, 2017). In a recent research made by Chalil & Barus (2018), palm oil planters from top exporting countries like Indonesia and Malaysia began to produce certified palm oil up to 6,444,156 and 5,105,806 tonnes respectively. China has beat United States and EU for its spot in becoming top importer of the Malaysian palm oil and palm-based products. The importing country's ambassador assured that there will be no limits set for the import of Malaysian palm oil and its akin products. Therefore, the total of palm oil being exported to China seen increased from RM7.76 billion to RM8.52 billion in 2017 (The Star Online, 2018).

Lee and Mansur (2019) found out that exchange rate served as exogenous variable and palm oil export is an endogenous factor. The exchange rate however can be controlled by the country's monetary policy while taking both variables asymmetric relationship into consideration. A research written by Jafari, *et al.* (2017) had stated that one of many possible ways for palm oil producing countries like Indonesia and Malaysia to avoid the issue of declining export demand is to agree in adopting a set of sustainability certification such as the RSPO, ISPO and MSPO frameworks. The production of sustainable palm oil is somehow inter-related with the export demand especially in a longer term, which is to support further development of palm oil market.

METHODOLOGY

Data Collection

Data for this study are collected based on monthly inputs ranged from year 2012 up to 2018. The data are secondary data which were obtained from reliable database platforms such as from the Department of Statistics Malaysia (DOSM) and Malaysian Palm Oil Board (MPOB) for the nation's information on palm oil. Other sources include Malaysian Palm Oil Council (MPOC), Bank Negara Malaysia (BNM) and International Monetary Fund (IMF). The data is regularly updated to ensure that the information is up to date for researchers and the public to access.

Variables

The variables used in the study includes both dependent and independent variables. The dependent variable is the export of palm oil (EXPORT). As for the independent variables, they are the price of palm oil (PRICE), production of CPO (PRODUCTION), price of substitutes of palm oil – soyabean oil (SUB1), price of substitutes of palm oil – cotton oil (SUB2), price of substitutes of palm oil – groundnut oil (SUB3), price of substitutes of palm oil – sunflower oil (SUB4), price of substitutes of palm oil – rapeseed oil (SUB5), price of substitutes of palm oil – coconut oil (SUB6), price of substitutes of palm oil – fish oil (SUB7), food and non-food production – C.P. stearin (FNF1), food and non-food production – C.P. olein (FNF2), food and non-food production – RBD palm oil

(FNF3), food and non-food production – RBD palm olein (FNF4), food and non-food production – RBD palm stearin (FNF5), food and non-food production – PFAD (FNF6), food and non-food production – cooking oil (FNF7), number of population (POPULATION), total area planted (AREA), number of palm oil processing sectors – PO mills (POPS1), number of palm oil processing sectors – refinery plants (POPS2), number of palm oil processing sectors – oleochemical plants (POPS3), number of palm oil processing sectors – biodiesel plants (POPS4), import of palm oil (IMPORT), GDP of own country (GDP1), GDP of main importing countries – India (GDP2), GDP of main importing countries – China (GDP3), GDP of main importing countries – Netherlands (GDP4), GDP of main importing countries – Spain (GDP5), GDP of main importing countries – Italy (GDP6), GDP of main importing countries – Germany (GDP7), exchange rate using average period (EXRATE).

Data Preparation

Listwise deletion is often performed to handle missing data or incomplete data (Peugh and Enders, 2004). The variables that undergo listwise deletion are SUB2, POPS1, POPS2, POPS3, POPS4, POPULATION, and AREA. Next is assigning missing value to the SUB3 variable to avoid any unwanted significant effect on the result of the analysis (Kang, 2013). All the variables were then transformed using log transformation. Logarithmic variables are often used in forecasting and economic analysis procedures to stabilise the variance of series (Lutkepohl and Xu, 2012). Existence of outliers is also removed to avoid the distortion on result of the analysis through normality or error variance (Osborne and Overbay, 2004).

Data Analysis

Analysis of data starts off with removing any source of multicollinearity using Pearson correlation and Variance Inflation Factors (VIF) tests to indicate whether there are any significant relationship between the variables. For Pearson Correlation test, all the chosen variables have values of correlation that are below 0.95. As for the VIF test results, all the chosen variables have values less than 5 and therefore are acceptable and they are clear from any source of multicollinearities.

Model Building Approach for Multiple Linear Regression

Method approach used is as proposed by Zainodin, J. *et al.* (2018). The approach consists of four model building phases.

Phase 1: All Possible Models

The quantity of all possible models are identified using the formula in equation 1.

$$N = \sum_{j=1}^{q} ({}^{q}C_j) = \frac{q!}{j!\,(q-j)!} \quad (1)$$

where,

N = number of possible models

${}^{q}C_j$ = number of possible combinations for j=1,2,3,...,q, and

q = single independent variables (excluding the dummy variables)

Phase 2: Selected Models

OLS method using multiple regression equation model is conducted to estimate the coefficients of selected models from the all possible subsets. According to Gujarati and Porter (2009), multiple regression model is when the dependent variable or regressand, Y depends on two or more explanatory variables or regressors, X. The full model was developed as shown in equation 2:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \epsilon \quad (2)$$

where,

Y = dependent variable or regressand
β_0 = coefficient
β_k = coefficient of independent variable X_k
X_k = independent variables
k = 1,2,...n
ϵ = error term

Global test was conducted to observe the performance of a certain sector when the variables used are relatedly important to the subject being studied (Dymova *et al*., 2009). In other words, it is to test whether the independent variables affect the dependent variable significantly. Wald test will be carried out afterwards to justify the removal of the insignificant variables as it is a method of examining the importance of particular independent variables in a statistical model (Kyngäs & Rissanen, 2001).

Phase 3: Best Model

Next, eight selection criteria (8SC) analysis is performed on the filtered models based on the model size to select the best model.

Phase 4: Goodness of Fit Tests

Goodness-of-fit (GOF) tests is performed to describe how well the statistical best model obtained fits into the set of observations (Olivares & Forero, 2010). GOF is used to test whether the sample data is normally distributed. Randomness test by observing the scatterplot are conducted and normality test using Kolmogorov-Smirnov is performed since the sample size is above 30. The aim is for the null hypothesis to not be rejected with p-value greater than 0.05 (Mordkoff, 2011).

RESULT AND DISCUSSION

In this result, multicollinearity test using both Pearson correlation and VIF tests respectively decreases the number of independent variables down to only 13 variables. In Phase 1, the number of all possible subsets to be examined is 8,191 possible models. Global test and Wald test shows results that the variables in the study can be removed without causing much harm to the model fit in the second phase. Phase 3 result indicates that model with 3 independent variables is the best model equation as shown in equation 3 below. The best model equation with its estimated parameter value is therefore Y =1.827 + 0.357PRODUCTION + 0.226SUB7 + 0.232FNF4 + ϵ.

$$Y\,(EXPORT) = \beta_0 + \beta_2 PRODUCTION + \beta_5 SUB7 + \beta_8 FNF4 + \epsilon \quad (3)$$

where,

β_0 = coefficient
β_k = coefficient of independent variable
ϵ = error term

Based on the best model equation (eq. 3), the residuals are obtained and GOF tests are carried out based on the residuals. The residuals are assumed to be normally distributed. It is found that the residuals are random and minimal obvious pattern exists. The residuals are distributed between the upper control limit (UCL) and lower control limit (LCT) at ±3 standard deviation of the error as shown in the scatter plot in Figure 1 below. As for the normality test using K-S test, since the significance value obtained is more than the significant value 0.05, thus the null hypothesis is not rejected. The result depicts that residuals of best model equation is normally distributed. Both

randomness and normality tests indicate that the residuals are random, independent and normal. The results are shown in the Figure 1 for randomness test and Figure 2 and Table 1 for normality test respectively below.

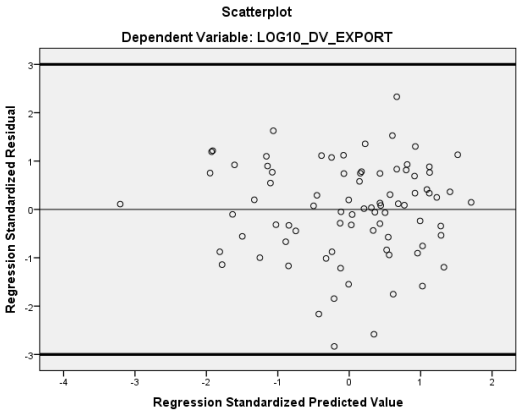

Figure 1. Standardised residuals scatterplot for best model M92

Table 1. Normality test for best model using Kolmogorov-Smirnov test

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Unstandardized Residual	0.076	83	0.200

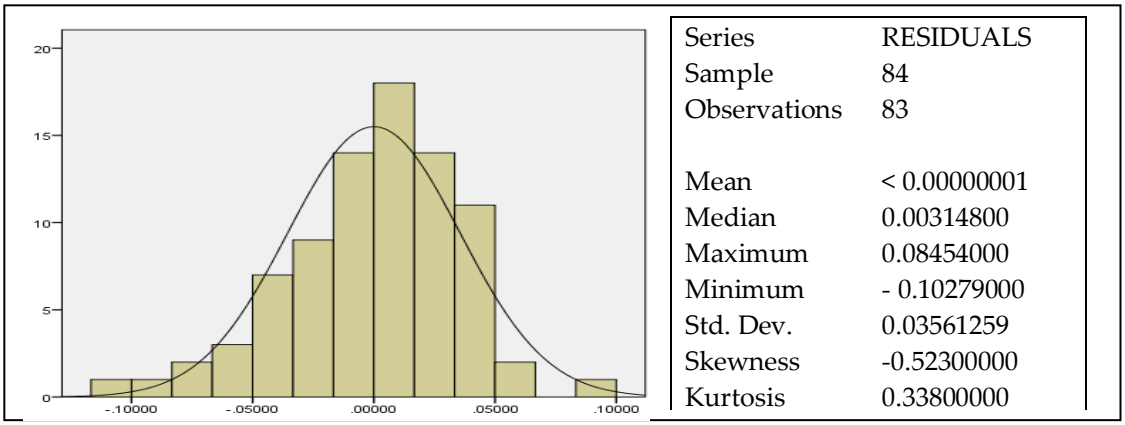

Figure 2. Residuals frequency distribution for best model equation

CONCLUSION

According to the findings above, model with three independent variables is the best model to describe the factors affecting the export demand of Malaysian palm oil. The corresponding factors that affect the export demand of the Malaysian palm oil are the production of palm oil itself (X_2), the price of fish oil which acts as the palm oil substitutes in the edible oil market (X_5) and the RBD palm olein production (X_8). The randomness test based on the scatter plot of the residuals shows that the resulting error term of best model is random and independent. Furthermore, by taking ±3 standard deviation lines for UCL and LCT which indicates that there are no outliers. The best model is now capable to be used in estimating or forecasting by looking at the number of unit increase or decrease in each of the chosen factors in the best model equation.

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