

Prediction of Malaysian Crude Palm Oil Export Demand Using Time Series Model: Decomposition Method

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Abstract: Palm oil is a vital commodity in Malaysia and it is the largest agricultural contributor to the national gross domestic product especially in the 1990s. Statistical evidence has shown how the demand for this commodity increasing year by year, but the proposed ban to palm oil by the European Parliament's resolution in 2017 has shaking the country. This paper study the pattern of global export demand on the palm oil before and after the resolution. The developed model based on decomposition time series is employed to analyze the monthly export demand for palm oil. The data from January 2014 to May 2019 were transformed through a series of procedure to decompose the data into seasonal and trend. Then, the constructed decomposition model was used to predict future export demand for twelve months. The empirical evidence shows that the developed model is able to predict the future export of this commodity.

Keywords: Decomposition method, time series, palm oil.

1. INTRODUCTION

Malaysia is the second-largest producer and exporter of palm oil in the world, after Indonesia. The demand for this commodity has been increasing due to high demand for food products, cosmetics, detergents, and to a small extent, biofuel. Malaysia palm oil is now exported to more than 200 countries worldwide within total about 20,700 million tonne production [1]. Also, the commodity contributes more than RM77.8 (USD\$18.9) million a year to the country, hence making this crop really important [2].

Historically, the oil palm tree originates from *Elaeis Guineensis*, a species of oil palm tree commonly known as African oil palm. It was introduced in the Malay Federation by the British as ornamental plants in the 1870's. Malaysia has implemented a foundation for expanding the palm oil plantation and the palm oil industry, where the first commercial planting has taken place in the Tennamaran Estate in Selangor in 1917. Oil palm cultivation grew rapidly in the early 1960s under the government's agricultural diversification program that was introduced to reduce the country's economic dependence on rubber and tin [3].

Instead of the growth of demand on palm oil, Malaysia has experienced a crisis of falling demand and Malaysia GDP in 2018 from 5.9% to 4.7% [4]. In average, crisis on palm oil has affected the livelihood of 650,000 smallholders or farmers who rely on oil palm plantation. Considering such impact towards both economic and social factors, hence it is important to keep measuring and monitoring the demand of this crop continuously. Such need has motivated this work and this paper is prepared to model the demand of Malaysia palm oil aiming at explaining the pattern of demand especially in the case of EU ban. The arrangement of this paper is as follows, the next discussion overviews the past studies that were diligently model the demand for palm oil. Then, the following discussion gives the details on the setup methodology carried out by this work. Related results of this work are given and conclusion is highlighted in the final part of this paper.

2. DEMAND ON MALAYSIA PALM OIL

Collection of past studies has discovered some significant variables that explain the demand on this commodity. These variables could be group as either internal factor or external factor. Internal factor comprises local control variables such as export rate and exchange rate whilst external factor includes variables which are often beyond the controlled by

Malaysia such as trading country's economic growth, complement price of the commodity (i.e. soybean price), and GDP of the trading country [1, 5, 6]. In order to determine those significant factors, often ordinary least square (OLS) regression was used as a reference model.

Another angle of interest towards palm oil is to recognize the pattern of demand and to predict its future demand. Descriptive statistics have always been used to depict the pattern of demand on this commodity especially in the reports by Malaysia Palm Oil Council [7, 8]. Another common statistical tool for understanding the pattern which allows for future prediction based on times is time series modeling such as Mad Nasir Shamsudin (1998) who utilized multivariate autoregressive-moving average to predict a short term of crude palm oil prices [9]. This model includes structural explanation of the residual series of the econometric model with time series and has been found perform as efficient as the econometric model.

3. METHODOLOGY

Data Collection:

This study utilized secondary data of Malaysia crude palm oil (CPO) recorded by Malaysia Palm Oil Board (MPOB) from January 2014 to May 2019. The data comprises a monthly total amount of CPO export demand (in million, RM) and year. The pattern of CPO export demand is depicted in Figure 1.

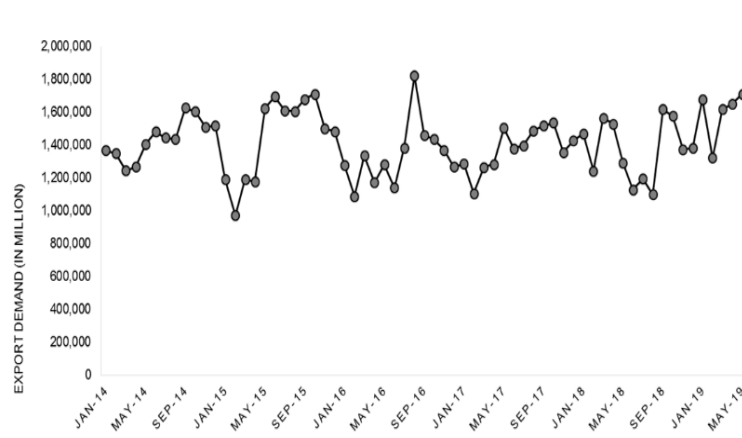


Figure 1: Malaysia CPO Export Demand

Time Series Decomposition

Time series model often on crude palm oil demand (Y_t) was written in a multiplicative form

$$Y_t = T_t \times S_t \times C_t \times I_t \quad (1)$$

Where:

T_t is a deterministic trend-cycle or general movement component, S_t is a deterministic seasonal component, C_t is a deterministic cyclical component, I_t is the irregular (remainder or residual) (stationary) component for $t = 1, 2, \dots, T$.

The components trend-cycle movement, seasonal component, cyclical component, and irregular component were computed following the below

$$T_t = a + bt \quad (2)$$

$$S_t = Y/T_t \quad (3)$$

$$C_t = M_t / T_t \quad (4)$$

$$I_t = S_t T_t / Y \quad (5)$$

Where:

Y is original data value, a is an intercept of the fitted model, b determines a slope of a trend line, and M_t is a moving average by the computed trend.

All computations were performed using SAS EG to obtain an estimated time series model and to predict the future value CPO export demand for June 2019 to July 2020.

4. RESULT AND DISCUSSION

Figure 2 depicts the global pattern of palm oil demand before and after the EU proposed a resolution to ban to commodity. The demand has been identified showing a decreasing pattern prior to the announcement of the EU ban before starting climbing up and gradually decline. Obviously, the plotted line showed by this past data does not indicate clear linear trend, hence a time series trend identification study was performed to check for much explainable trend as depicted by Figure 2.

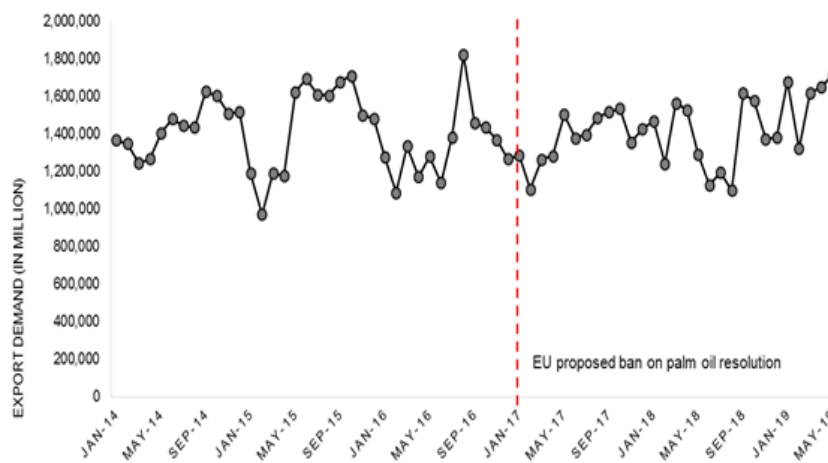


Figure 2: CPO Demand Pattern Before and After EU Proposed Ban Resolution

In order to construct a model to be used for forecasting, the four simple Moving Average (MA4) was calculated to smooth the fluctuation in the data. Next, the central moving average (CMA) of two months was applied to this modified data. Then, seasonal index was computed and applied to the modified moving average data. Finally, decomposition process was performed to remove the effect of seasonality by dividing each observation of the original time series with respective computed seasonal index.

The computed trend was as follows:

$$T = 1,391,630 + 722.86t$$

Whilst, the estimated export value for June 2019 until July 2020 are as tabulated in Table 1.

Table 1: Forecast Value of CPO from June 2019 until July 2020

Month	CPO Export Demand (Forecast value) In Millions
Jun-19	1,381,435
Jul-19	1,429,648
Aug-19	1,436,631
Sep-19	1,497,909
Oct-19	1,384,210
Nov-19	1,432,518
Dec-19	1,439,515
Jan-20	1,446,080

Feb-20	1,335,645
Mar-20	1,381,566
Apr-20	1,387,618
May-20	1,446,080
Jun-20	1,335,645
Jul-20	1,381,566

Figure 3 shows the graph of export demand data (blue line), Moving Average (MA4) (red line), the detected trend (grey line) and finally the forecasted data (yellow line).

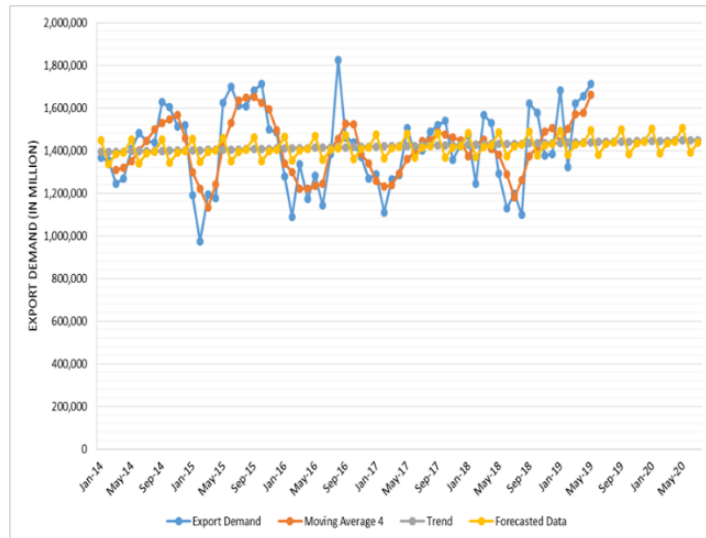


Figure 3: Graph of forecast data

According to figure 3, the forecast value (yellow line) of export demand shows an upward trend and the pattern quite similarly with the actual export (blue line) demand before and after EU proposed ban resolution. Thus, it seems the export demand for palm oil slightly declined after EU proposed to ban since the forecast line shows the seasonal component.

5. CONCLUSION

From the result and discussion, it is found that Time Series Forecasting and Decomposition is able to analyse and to predict monthly export demand CPO. Based on the empirical results, the export values fluctuated between months with the presence of seasonal elements. It is true that the export of palm oil slightly low after the EU ban, but the pattern recorded seem very similar before after the EU ban. This study expects that the export value of this commodity will gradually fall hence necessary actions should be imposed to avoid the value keeps on decreasing. Results of the study will be helpful for the policymakers or government to formulate effective to remain as the main world producer. Furthermore, the findings of the study will also help the managerial business executives for implementing the new potential plan or taking decisions concerned with the expansion of the existing palm oil market since CPO export is major contributor to national income.

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