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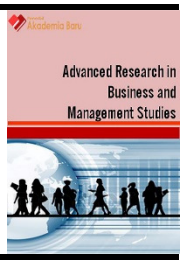

Modelling of palm oil export trend in Malaysia

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ABSTRACT

Oil palm is one of the important export crops of Malaysia. In addition, oil palm industry contributes significantly to the country's wellbeing by being one of the main contributors to the Gross National Product and provides employments. In this study, time series technique is used to analyse and forecast palm oil exports of Malaysia. While various studies are available on modelling of palm oil, very few studies are found focusing on the modelling of palm oil exports. Model based on multiplicative decomposition method is employed to analyse the monthly exports. Time series data from January 2012 to April 2017 are transformed through a series of procedures to decompose the data into seasonal and trend components. Subsequently, the constructed model is used to make forecasting of future export for several months. Results show that the model is able to replicate the pattern of the observed data. A slight negative trend is detected for the export values. The overall forecasted export values show there is some small fluctuation between the months.

1. Introduction

Malaysia is one of the leading world producers of oil palm, accounting for 39 % of global production [1]. Oil palm is also a major export crop of Malaysia, contributing significantly to the country's Gross National Product (GNP) and provides a variety of employment opportunities [2]. As one of the main producers and exporters of palm oil and palm oil products, Malaysia has a vital role to play in meeting the growing global needs for oils and fats. Oil palm is widely used as a primary ingredient in various food products, liquid detergents, soaps, shampoos, lipstick and it is also the main component of bio-diesel. The growing interest and enthusiasm in palm oil products among world's producers indicate that oil palm will continue as a source for sustainable raw material that is rewarding to both producers and users. The upcoming direction of the Malaysian palm oil industry is very much dependent on the trade relations it shares with buyers around the globe.

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In general, mathematical modelling of agriculture product is necessary to investigate the behaviour of historical data and subsequently apply such information in predicting future values. Analysis and forecasting results could help those related to the industry to make appropriate judgement or decisions concerning the production of the crop and export matters. This study aims to use time series technique in analyzing and forecast palm oil exports of Malaysia. Malaysia is dependent on overseas market expansions since a considerable amount of oil palm production is meant for export. While there are numerous studies on modelling of various aspects of palm oil [3-4] worldwide, here in Malaysia, very few studies focused on modelling of export value of palm oil.

2. Methodology

Modelling based on time series approach is employed for analysis and forecasting of export data. Monthly data from January 2012 until April 2017 which is used in this study, was retrieved from Malaysian Palm Oil Council (MPOC). The developed model will be used to make forecasting of monthly export for one year (May 2017 to April 2018)

2.1 Time Series

Time series refers to a series of data arranged according to a chronological order in time and most often the data are evenly spaced. Historical data which is gathered over a particular time interval, are used as input for model building. The analysis of time series is of great importance in a variety of fields, for example in economic [5], hydrology [6-7] and chemistry [8].

Observed time series data help in providing information on the historical pattern of the item under study and such information could be used to predict future movements. Four major elements of which may embed in the historical pattern are average, trend, seasonal and cyclical. Time Series decomposition models such as additive model and multiplicative model could be used to separate or decompose a time series into seasonal and trend components.

Let Y_t be the time series at any time *t*

$$\text{Additive model, } Y_t = T_t + S_t + C_t + R_t \quad (1)$$

$$\text{Multiplicative model, } Y_t = T_t . S_t . C_t . R_t \quad (2)$$

where T_t = Trend value at time t

S_t = Seasonal component

C_t = Cyclical component

R_t = Irregular component

In this study, multiplicative decomposition method is employed because the method fits a wider range of forecasting situations. The first step is using a technique called Moving Average to smooth oil palm export data and lessen the seasonality and random effects. This technique involves averaging the data over a specified number of periods. Then, a Center Moving Average is applied to the transformed data to remove the trend and seasonal components from a time series.

For multiplicative model, ratios R is defined by

$$R_t = \frac{A_t}{T_t} \quad (3)$$

Seasonal indices (denoted by S_t) are then calculated by averaging all values of R_t that correspond to a particular seasonal period. Once S_t is determined, data is deseasonalized by dividing the data by the seasonal indices S_t. The next step is to calculate the trend-cyclical regression using the deseasonalized data. The trend T_t is essentially a simple linear regression model with the slope (denoted by a) and the intercept (denoted by b) at time t.

$$T_t = a\,t + b \quad (4)$$

Lastly, forecasting values (F_t) are estimated by multiplying the transformed values by their corresponding seasonal factors,

$$F_t = (a\,t + b)\,S_t \quad (5)$$

3. Results and Discussion

The graphs of palm oil exports are individually plotted according to year and compared (see Figure 1). The graphs revealed that every year except for the year 2014, the export values in the month of February are always at the lowest value and then picking up throughout the year. The highest export value recorded in the month of August 2016 where Malaysia has exported 1,824,437 metric tonnes of palm oil and the lowest export value recorded in the month of February 2015 where the export value drop to 972,646 metric tonnes of palm oil. Figure 2 shows the export value from January 2012 until April 2017. From the graph, it can be seen that the export value does not display specific trend except the lowest export value in the month of February and export value in drop trend in the last quarter (October to December) every year.

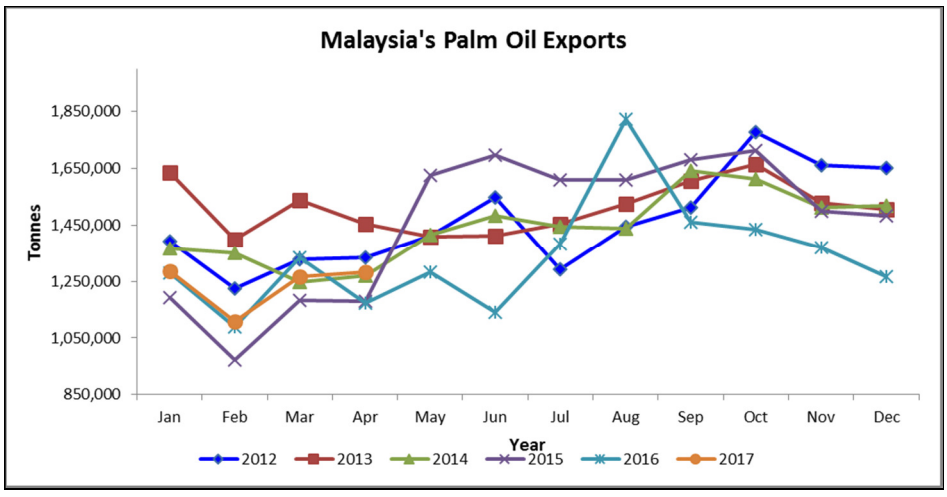

Fig. 1. Palm oil exports by year

In order to construct a model to be used for forecasting, the following steps are taken to decompose the data. The first step is having four-interval simple Moving Average, MA(4) to smooth the data. Subsequently, Centred Moving Average, the average of two months is applied to this altered data. Seasonal indices are then calculated and applied to the transformed data set. The process of decomposition of the data set removes the effect of the season by dividing each original time series observation by the corresponding seasonal indices. The resulting data series will only consist of trend and random variability (the irregular component). Trend equation is calculated to be

$$T = 1{,}483{,}669 - 1{,}376t \quad (5)$$

The slope of the trend equation is negative, indicating the trend of exports is decreasing. Fitted values based on trend equations are estimated. Finally, forecast values are determined by multiplying each of the fitted trend values by their appropriate seasonal factors. The forecasted export values of palm oil for the month of May 2017 until April 2018 are given in Table 1. Figure 3 shows the graphs of historical data (blue line), MA(4) (brown line), the detected trend (green line) and finally the forecasted data (red line).

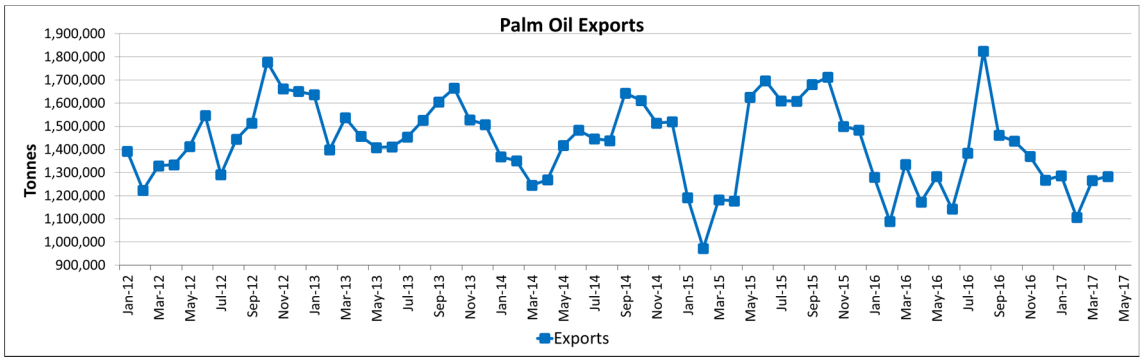

Fig. 2. Graph of palm oil export (2012-2017)

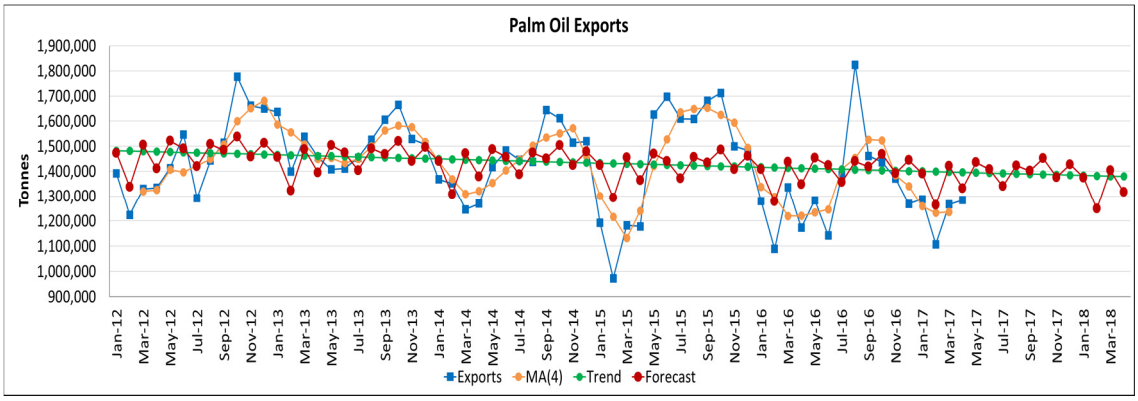

Fig. 3. Graph of forecast data

Table 1
Forecast values

Month	Forecast (Tonnes)
May-17	1,435,819
Jun-17	1,407,118
Jul-17	1,339,785
Aug-17	1,423,237
Sep-17	1,401,192
Oct-17	1,451,571
Nov-17	1,375,360
Dec-17	1,427,601
Jan-18	1,374,334
Feb-18	1,247,695
Mar-18	1,404,061
Apr-18	1,315,763

4. Conclusion

In this study, time series model based on multiplicative decomposition method is employed to analyse and predict monthly exports of palm oil exports. Overall the model has able to capture the pattern of the historical data. Analysis on historical data shows that the export values fluctuated between months and had a slightly decreasing trend. The gradient value of trend equation is found to be negative (-1,376). Results show that the forecast results of palm oil exports have some slight variations between the months. The technique adopted in this study and the forecasted results could be exploited for a more effective managing and decision-making. More studies in modelling are needed to ensure that palm oil will meet the export demands for Malaysia to remain as the main world producer.

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References

[1] Malaysian Palm Oil Industry, www.palmoilworld.org/about_malaysian-industry.html (retrieved 20 June 2017)
[2] Selected Agricultural Indicators, Malaysia, 2016, Department of Statistics Malaysia, Official Portal., www.dosm.gov.my (retrieved 4 June 2017)
[3] Talib, Basri Abdul, and Zaimah Darawi. "An economic analysis of the Malaysian palm oil market." *Oil Palm Industry Economic Journal* 2, no. 1 (2002): 19-27.
[4] Abdullah, Ramli. "Short-term and long-term projection of Malaysian palm oil production." *Oil palm industry economic journal* 3, no. 1 (2003): 32-36.
[5] Feng, Qiaoling. "Economic Forecasting Based on Time Series Analysis." In *Proceedings of the 2nd International Conference on Green Communications and Networks 2012 (GCN 2012): Volume 1*, pp. 277-285. Springer, Berlin, Heidelberg, 2013.
[6] Norzaida, Abas, Mohd Daud Zalina, and Yusof Fadhilah. "Application of Fourier series in managing the seasonality of convective and monsoon rainfall." *Hydrological Sciences Journal* 61, no. 10 (2016): 1967-1980.
[7] A.H. Syafrina, M.D. Zalina and A. Norzaida. “Climate Projections of Future Extreme Events in Malaysia.” American Journal of Applied Sciences.
[8] Alakent, Burak, Pemra Doruker, and Mehmet C. Camurdan. "Application of time series analysis on molecular dynamics simulations of proteins: a study of different conformational spaces by principal component analysis." *The Journal of chemical physics* 121, no. 10 (2004): 4759-4769.