FORECASTING MODEL FOR THE VALUE OF LONGAN'S EXPORT OF THAILAND

Atsawin Saneechai[1]
Phanita Phakdi[2]

[1,2]Lecturer of Bangkok Suvarnabhumi University

Abstract:

The study were to forecasting value of exports longan in Thailand. Study aims to find the forecast models suitable for forecasting the value of Thailand's exports longan exported abroad. To obtain the model forecasting with the lowest error rates and the forecast is for 2 years during 2556 to 2557 by applying statistical forecasting techniques and using a programs to help in the data analysis. The results showed that the model time series of Box-Jenkins Method have the best fit with the model is the value of exports longan are $ARIMA(0,1,2)(0,0,1)_4 : Z_t = \delta + \alpha_t - 0.38872\alpha_{t-1} - 0.57915\,\alpha_{t-2} - 0.47585\,\alpha_{t-4} + 0.18498\,\alpha_{t-5} + 0.27559\,\alpha_{t-6}$ where the model was to forecasted the second period with the recession, the value of exports longan fruit tends to increase from the year 2555 was 8.26% and 0.32% respectively.

Keywords: Forecasting, export value, longan

1. Introduction

Longan fruit should have known in botanical name as Nephelium, Canb or Euphorialongana, Lamk, Sapedadceae (Native). Longan is a tropical and subtropical fruit crops and important that the government provided the goods for export with high annual output value of much billion baht. However, the volume of Longan's exports is not static. It make Thailand did not know the need a constant customer. Moreover, it cannot predict crop Longan to export to meet the needs of customers. It is difficult to prepare the goods to the customer. In some years the total volume of exports made less longan fruit production of remaining in the country as a result, the value of exported goods are going down, therefore, there has been forecasting the volume and value of exports Longan of Thailand.

The Ministry of Commerce can use information of value of Longan's exports each year to compare the value of exports longan fruit each year, the data obtained from forecasting to edit to meet the target and the value of the forecasts also beneficial to individuals as well. There will be three time series analysis approaches including Exponential Smoothing Method, Decomposition Method and Box-Jenkins Method. We use the Department of Commerce data needs to be studied as quarterly time series data from January, 2008 to December, 2013, total 5 years to be considered for the forecast suitable models in the future.

2. Objective

To study and find the forecast suitable models of the value of Longan's exports

3. Method

We use the Department of Commerce data needs to be studied as quarterly time series data from January, 2008 to December, 2013, total 5 years to be considered for the forecast suitable models in the future. These data was analyzed by three time series analysis approaches including Exponential Smoothing Method, Decomposition Method and Box-Jenkins Method.

Autocorrelation Function (ACF)

Study time series Box - Jenkins or ARIMA time series to be studied under a state of homeostasis that is balanced both the mean and variance of a constant process. Then consider the relationship in its own time series data. (Autocorrelation) relationship in itself part of the serial data (Partial Autocorrelation), then you can set various ARIMA models.

$$r_k = \frac{\sum_{t=k+1}^{n}(Y_t - \bar{Y})(Y_{t-k} - \bar{Y})}{\sum_{t=1}^{n}(Y_t - \bar{Y})^2} \quad ; k = 1,2,3...$$

Partial Autocorrelation Function (PACF)

$$\hat{\phi}_{kk} = \begin{cases} r_1 & ; k = 1 \\ \dfrac{r_k - \sum_{j=1}^{k-1}\hat{\phi}_{k-1,j} r_{k-j}}{1 - \sum_{j=1}^{k-1}\hat{\phi}_{k-1,j} r_j} & ; k = 2,3,4... \end{cases}$$

$$\hat{\phi}_{kj} = \hat{\phi}_{k-1,j} - \hat{\phi}_{kk}\hat{\phi}_{k-1,k-j} \quad ; j = 1,2\ldots,k-1$$

Box-Jenkins Method or ARIMA

Box-Jenkins Method or ARIMA is Discrete Linear Stochatis Process

$$Y_t = \mu + \varepsilon_t + \psi_1\varepsilon_{t-1} + \psi_2\varepsilon_{t-2} + \psi_3\varepsilon_{t-3} + ...$$

by μ and ψ_i is constant parameter and $\varepsilon_t, \varepsilon_{t-1}, \varepsilon_{t-2}$ are random error which have no relation to each other

$$Y_t = \delta + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + ... + \phi_p Y_{t-p} + \varepsilon_t - \theta_1\varepsilon_{t-1} - \theta_2\varepsilon_{t-2} - .....\theta_q\varepsilon_{t-q}$$

$$(1 - \phi_1 B)(Y_t - \mu) = (1 - \theta_1 B)\varepsilon_t$$

$$(Y_t - \mu) = \phi_1(Y_{t-1} - \mu) + \varepsilon_t - \theta_1\varepsilon_{t-1}$$

or $$Y_t = \delta + \phi_1 Y_{t-1} + \varepsilon_t - \theta_1\varepsilon_{t-1}$$

ARIMA (p,d,q) :

$$\phi_p(B)(1-B)^d Y_t = \delta + \theta_q(B)\varepsilon_t$$

or

$$\phi_p(B)W_t = \delta + \theta_q(B)\varepsilon_t$$

give $W_t = (1-B)^d Y_t$

for example, ARIMA (p,d,q)

ARIMA (1,1,0)

$$(1-B)(1-\phi_1 B)Y_t = \delta + \varepsilon_t$$

$$Y_t = \delta + Y_{t-1} + \phi_1 Y_{t-1} - \phi_1 Y_{t-2} + \varepsilon_t$$

ARIMA (1,1,1)

$$(1-B)(1-\phi_1 B)Y_t = \delta + (1-\theta_1 B)\varepsilon_t$$

$$Y_t = \delta + Y_{t-1} + \phi_1 Y_{t-1} - \phi_1 Y_{t-2} + \varepsilon_t - \theta_1\varepsilon_{t-1}$$

ARIMA (0,1,1)

$$(1-B)Y_t = \delta + (1-\theta_1 B)\varepsilon_t$$

$$Y_t = \delta + Y_{t-1} + \varepsilon_t - \theta_1\varepsilon_{t-1}$$

Mean Absolute Percent error (MAPE)

$$\text{MAPE} = \left(\frac{100}{n}\right)\sum_{t=1}^{n}\left|\frac{e_t}{Y_t}\right|$$

Error Term

$$e_t = Y_t - \hat{Y}_t$$

Identification time series data is considered preliminary and anticipate that any of the time series data using the theories related knowledge and experience by using SPSS for windows for data analysis. When given a series of experiments were conducted to estimate all parameters in the model.

Diagnostic checking is to investigate the adequacy or suitability statistically by verifying the assumptions and properties, including the relationship. If the models is not consistent with the assumptions in statistical or incompetence, it will be a new and revised models. The need to define a new trial and the parameters of the new model until the model is consistent with assumptions and qualifies statistically. When we gain an appropriate sufficient statistical model then used to forecast future values.

Over time, it should be checked whether the models forecasters use are still adequate by using new information, arising in check. If it finds a suitable excuse for new adjustments. In this study, we use MAPE will consider the MAPE's predictions of how each option and that the lowest MAPE is forecasting models. It will take a prophet to predict the value of Longan’s exports advance further by regression method

4. Result

The result of the value of Longan's exports by Box-Jenkins Method showed as figure 1

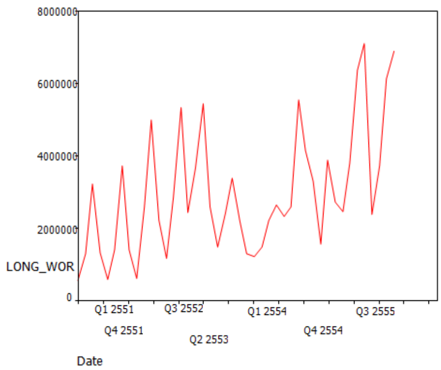

Figure 1 the movement of the value of Longan's export.

Partial Autocorrelations: LONG_WOR

Lag	Pr-Aut- Corr.	Stand. Err.
1	.386	.151
2	-.229	.151
3	.402	.151
4	.291	.151
5	-.296	.151
6	.007	.151
7	.041	.151
8	-.180	.151
9	.101	.151
10	-.097	.151
11	.051	.151
12	.018	.151
13	.067	.151
14	-.141	.151
15	-.068	.151
16	-.056	.151
17	.060	.151
18	-.003	.151
19	-.102	.151
20	.260	.151
21	.042	.151
22	.050	.151
23	.029	.151
24	-.053	.151

Figure 2 Partial Autocorrelation Function of the value of Longan's export.

From, figure 1 and 2 found that a movement variability and trends in the data were not fixed, so it is necessary to convert the data in constant variance and averages before, as shown in Figure 3.

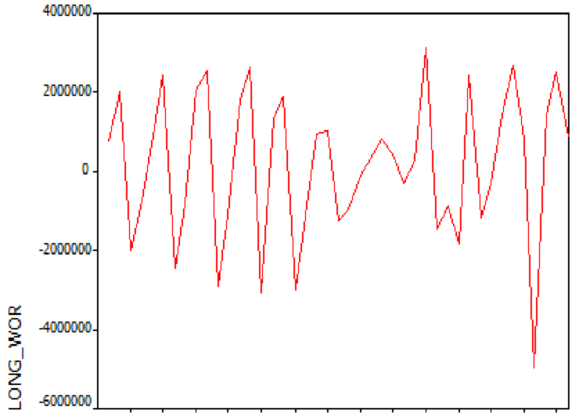

Figure 3 shows the data conversion so steady on average by the time series data for the difference.

Partial Autocorrelations: ERR_3 Error for LONG_WOR from ARIMA, MOD_90 CO

Lag	Pr-Aut- Corr.	Stand. Err.
1	-.114	.152
2	-.049	.152
3	-.152	.152
4	.071	.152
5	-.068	.152
6	-.224	.152
7	.116	.152
8	.113	.152
9	-.031	.152
10	-.076	.152
11	.000	.152
12	-.092	.152
13	.072	.152
14	.033	.152
15	-.009	.152
16	-.046	.152
17	-.025	.152
18	-.066	.152
19	-.301	.152
20	.007	.152
21	-.056	.152
22	.022	.152
23	-.109	.152
24	-.132	.152

Figure 4 PACF

Table 1 Parameter estimation of ARIMA.

ARIMA

FINAL PARAMETERS:

Number of residuals 43

Standard error 1349569.8

Log likelihood -667.26744

AIC 1342.5349

SBC 1349.5797

Analysis of Variance:

	DF	Adj. Sum of Squares	Residual Variance
Residuals	39	75750707204150	1821338528259

Variables in the Model:

	B	SEB	T-RATIO	APPROX. PROB.
MA1	.38872	.28730	1.3530012	.18384697
MA2	.57915	.24126	2.4005594	.02123932
SMA1	-.47585	.16437	-2.8949533	.00618222
CONSTANT	73932.77901	34911.47812	2.1177212	.04062680

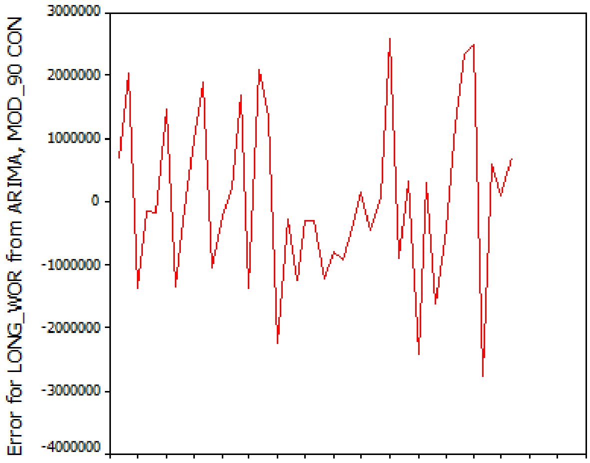

Figure 5 graphs of residues on the time axis in Diagnostic Model

From, figure 5 showed that the distribution of residual in parallel line is around the center. Thus, the average error is zero and constant variance.

Table 2 Monitoring results by K-S TEST

One-Sample Kolmogorov-Smirnov Test

		Error for LONG_WOR from ARIMA, MOD_90 CON
N		43
Normal Parameters[a,b]	Mean	29336.62090
	Std. Deviation	1337910.684
Most Extreme Differences	Absolute	.087
	Positive	.087
	Negative	-.058
Kolmogorov-Smirnov Z		.570
Asymp. Sig. (2-tailed)		.901

a. Test distribution is Normal.

b. Calculated from data.

From Tables 1 and 2 showed the random error is a normal distribution, therefore, the model for predictive value of Longan's export by Box - Jenkins is the model of $ARIMA(0,1,2)(0,0,1)_4$
Which is

$$(1-B)Y_t = \delta + (1-\theta_1 B - \theta_2 B^2)(1-\Theta_1 B^4)a_t$$

when $Z_t = (1-B)Y_t$

then,

$$Z_t = \delta + (1-\theta_1 B - \theta_2 B^2 - \Theta_1 B^4 + \theta_1\Theta_1 B^5 + \theta_2\Theta_1 B^6)a_t$$

$$Z_t = \delta + a_t - \theta_1 a_{t-1} - \theta_2 a_{t-2} - \Theta_1 a_{t-4} + \theta_1\Theta_1 a_{t-5} + \theta_2\Theta_1 a_{t-6}$$

$$Z_t = \delta + \alpha_t - 0.38872\alpha_{t-1} - 0.57915\,\alpha_{t-2} - 0.47585\,\alpha_{t-4} + 0.18498\,\alpha_{t-5} + 0.27559\,\alpha_{t-6}$$

Table 3 showing the value in 2012 and the forecast export value of Longan in 2013 and 2014 (the dollar).

quarter	The value	Forecast in 2013	Forecast in 2014
1	2210210	4061732.028	4809537.259
2	3652000	3931727.739	4721977.128
3	6321560	4720034.146	4806754.716
4	7120750	4995481.049	4904329.983
Total	19304520	17708974.96	19242599.09

From table 3, it can forecast the value of Longan's export in 2013 as 17708974.96 baht and in 2014 as 19242599.09 baht

Table 4 showed a comparison of the forecasts that in 2013 with the actual value in the year 2012 (the dollar).

year	actual value	forecasts	difference	
			increase /decrease	%
2012	19304520			
2013		17708974.96	1595545.04	8.26
2014		17708974.96	61920.91	0.32

Table 4 showed expectation to export Longan of the world in the year 2013 to 2014 that increased from the year 2012 was 8.26%, 0.32% respectively.

5. Conclusion

The results showed the fixed time series and found that data of Longan was stationary series at First Difference and forecasting model export value of Longan is ARIMA (0,1,2) (0,0,1) 4 and the model to determine the predictive value of Longan's export to advance to the second period showed a rising trend. Therefore, Box – Jenkins method can be used and planning decisions and the value of Longan's exports in the future.

6. References

[1] Thatree Jantharakorika. (2010). Forecasting the export value of Thailand. *Journal of Rajamangala University of Technology Thanyaburi.*

[2] Songsiri Taesombut. (2006). *Quantitative forecasting.* Kasetsart University: Bangkok.

[3] Wichai Surachirtkiet. (2001). *Forecasting Techniques*. King Mongkut's University of Technology North Bangkok: Bangkok.