Forecasting and evaluation for raisin export in turkey

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Abstract. Turkey is the world's second largest raisin producer after the United States and the leading exporter, accounting to 25% of the world's total raisin production and 40–45% of total raisin exports. The European Union is the top export destination for Turkish raisins receiving an average of 80 percent of all Turkish raisin exports. The main objective of the study is to forecast Turkey's raisin export. A time series modeling approach (Double Exponential Smoothing) has been used to forecast raisin export in Turkey. The forecasts for the export of raisin in Turkey have been made for the next five years using by annual data on 1982–2015 years in this study. The forecast results have shown that the raisin export in Turkey will be around 209,738 tons in 2016.

1. Introduction

Geographically, Turkey has one of the most favorable areas for viticulture. According to FAO 2014 statistics', Turkey has the 6th-largest area of land devoted to vineyards, with 467,000 hectares, and it is the 6th-largest world grape producer with 4.2 million tons annually [1].

Drying grapes make up 35%, table grapes make up approximately 30% of the production, grapes for traditional products such as molasses make up 25% and grapes used for alcoholic beverage production make up approximately 10% of this total. The raisin growing area is mainly located in the Aegean region, especially in Manisa, Turgutlu, Salihli, Akhisar, Menemen, Kemalpaşa, Çal and Çivril [2].

The most important grape variety grown in Turkey is Sultana. This grape is the main variety for raisins. Sultana is a white, thin skinned grape, which produces the best raisins available today. Its small berries are oval and elongated. It does not contain seeds and has high sugar content. One kilogram of raisins requires about four to five kilograms of fresh grapes.

Turkey is the second largest producer of raisin in the world. The global raisin production was 1,139,000 tons for the 2015/16 period. During 2015/16, Turkey's raisin supplies dropped drastically due to damages to the fresh crop caused by severe frost and hail. Especially the late spring frost damaged in April 23 and 24. Turkish sultana raisin production is decreased in 2015/16 to 196,109 tons [3].

Raisin has traded domestic and export markets in Turkey. Despite's Turkey's leading role in the production of raisins, domestic consumption is comparatively low, and most of the production (generally around 80 percent) is exported. Mainly raisins are consumed as a snack food in Turkey. Human consumption is around 20–25,000 MT and the industry consumption (for cakes, biscuits and snacks) is about the same amount which account to a total of 45,000–50,000 MT. The reason for low domestic consumption is that grapes are mostly consumed as fresh in the season and there are so many grape alternatives grown throughout the country. Raisins are only consumed when there are no fresh grapes around [3].

This paper aims to forecast Turkey's raisin export by using the time series modeling approach (Double Exponential Smoothing). Time series models use the past movements of variables in order to predict their future values.

Various models such as regression models Auto regressive integrated moving average (ARIMA) model introduced by Box and Jenkins, (1976) and exponential smoothing methods have been used in the literature to forecast time series data. Double exponential smoothing model is a popular tool in short-term forecasting [4]. Bowerman and O'Connell (1993) also suggested this technique for forecasting [5]. Aydoğan used double exponential smoothing method for forecasting dry beans production in Turkey [6]. Chiken's egg production in Turkey by Çiçekgil and Yazıcıhad been forecasted using time-series modeling techniques Double Exponential Smoothing and ARIMA [7]. Rani and Raza used Double Exponential Smoothing method for forecasting price estimation of major pulses in Pakistan [8]. Another study by Marinah and Abdullah used Double Exponential Smoothing method for forecasting the yearly total paddy production of Kelantan based on the data collected for the period of 1970–2009 [9].

Forecasting provides information for decision makers and it will help in developing the strategic plan. This study provides information for strategic planners, international executives and export/import managers who are concerned with the market for raisins. Forecasting raisin export is important as it is the base for creating achievable foreign trade policy, creating adequate regional development policy, formulating and implementing raisin production strategy etc.

This paper is organized as follows. In the next section, the methodology used for this study and the data are described. The results and discussion are presented

Table 1. Typical MAPE Values for Model Evaluation.

MAPE (%)	Evaluation
MAPE $\leq$ 10%	High Accuracy Forecasting
10% <MAPE $\leq$ 20%	Good Forecasting
20% <MAPE $\leq$ 50%	Reasonable Forecasting
MAPE >50%	Inaccurate Forecasting

in following section. Finally, concluding remarks are highlighted.

2. Materials and methods

This study is based on the secondary data to forecast the exports volume of raisin. The data used in this study were obtained from the Turkish Statistical Institute (TIS), FAO and the Ministry of Food Agriculture and Livestock records. The data were used in the analysis includes quantity of export between 1982 and 2015. Export volumes of raisin for five years (2016–2020) have been estimated using Double exponential smoothing method.

The observations' normality was investigated using the Ryan-Jonier (RJ Similar to Sapiro-Wilk) test.

The accuracy of forecast is evaluated based on the estimation of error, thus the smaller the value of MAE, RMSE and MAPE, the better the forecast is. The criterion of MAPE is the decisive factor because it is expressed in easy generic percentage term. Table 1 shows the criteria of MAPE for model evaluation based on Lewis [10, 11]

Double Exponential Smoothing Method

Exponential smoothing is probably the most widely used class of procedures for a wide variety of time series data in order to forecast the future. It weights past observations using exponentially decreasing weights. In other words, recent observations are given relatively more weight in forecasting than the older observations and these weights are automatically calculated by use of smoothing constants. There is no need to assign weights to each previous period.

In exponential smoothing, there are one or more parameters to be determined by the forecaster. These parameters assign the weights which are exponentially decreasing weights as the observations getting older. This is a desired situation because "future events usually depend more on recent data than on data from a long time ago" [12, 13]. This gives the power of adjusting an early forecast with the latest observation. The reason for this is that the future is more dependent upon the recent past than on the distant past [14].

The Double Exponential Smoothing model is a refinement of the popular single exponential smoothing model that includes another component, which takes into account any trend in the data. When, there is an increasing or decreasing trend in the data over time, single exponential smoothing forecasts tend to lag behind observations. Double exponential smoothing is designed to deal with such data by taking their trends into account. The double exponential smoothing model for a time series (yt) is given by the model equation:

$$yt = \mu_t + \beta_t \mathrm{t} + \varepsilon_t \tag{1}$$

Table 2. Raisin Exports Amount from Selected Countries (tons) (2012–2016).

	2012	2013	2014	2015	2016
Turkey	247,200	186,900	259,900	201,800	220,000
USA	123,899	159,389	127,279	114,393	125,000
Iran	149,700	130,700	102,200	112,700	120,000
Uzbekist.	20,000	15,700	49,400	67,800	70,000
Chile	67,150	66,000	62,000	67,000	60,000
S. Africa	31,900	35,050	52,900	45,000	45,000
Argentina	29,050	16,300	29,700	35,000	35,000
Other	65,300	78,700	70,000	78,400	74,000
Total	734,199	688,739	753,379	722,093	749,000

Source: [16].

The smoothing equations are,

$$Ft = \alpha y_t + (1-\alpha)F_{t-1} \tag{2}$$

$$F'_t = \alpha(F_t - F_{t-1}) + (1-\alpha)F'_{t-1} \tag{3}$$

where μt represents the time-varying mean (level) term, β_t represents the time varying slope term (called "trend" term by exponential smoothers), ε_t is a white noise error term, F_t is the single smoothed series, and F'_t is the double smoothed series. The symbol α stands for the smoothing parameter, between $0 < \alpha \leq 1$.The forecasts from double smoothing are computed using the following formula.

$$\hat{y}_{(t+h)} = F_t + F'_t[(h-1) + 1/\alpha)]. \tag{4}$$

3. Results and discussion

3.1. Raisin exports

Today dried fruit consumption is widespread. Nearly half of the dried fruits sold are raisins. Raisins may be eaten snack, raw or used in cooking, baking [15]. The global raisin export was 749,000 tons in 2016 [16]. The largest amount of raisin is exported by Turkey. Turkey with 220,000 tons has the highest quantity followed by USA with 125,000 and Iran with 120,000 tons. After these countries, Uzbekistan, Chile, and South Africa are major countries that have the largest quantity of raisins export in the world (Table 2).

Raisin is one of the traditional agricultural export items of Turkey, which exports to approximately 100 countries on five continents depending on changing market conditions. EU countries continue to be the top export destinations for Turkish raisins, accounting for 80 percent of Turkey's raisin exports. The United Kingdom, Germany and the Netherlands continue to be the top three importers of Turkish raisins. Other important raisin import markets from Turkey included Russia, Canada and Japan [3].

3.2. Forecasting exports of raisin, using Double Exponential Smoothing Method

Firstly; time series plot was created to determine the trend in the export of raisin from 1982 to 2015 (Fig. 1). Turkey's raisin export volume has increased 2.4 times from 1982 85,000 tons to 202,000 tons in 2015. The exports volume of raisin show an upward trend from 1982 to 2012 but sudden decline is apparent in 2013. This year raisin

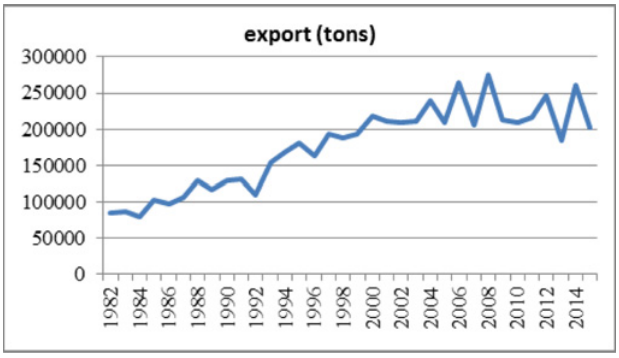

Figure 1. Time series plot of raisin export in Turkey.

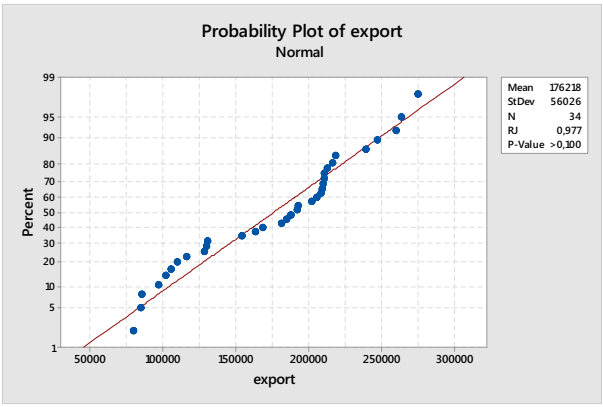

Figure 2. Normality Test results for raisin export.

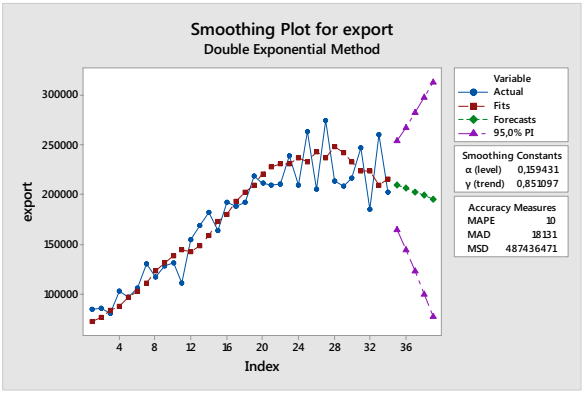

Figure 3. Double Exponential Smoothing forecasting results.

exports decreased to 185,000 tons due to the decrease in production (cold weather and freeze damage on the yields). Export rebound to 260,000 tons in 2014. After a good season in 2014 the freeze and hail in 2015 that resulted in a 22.3% decrease in exports to 202,000 tons in 2015.

The results of the normality tests of series are presented in Fig. 2. The results of the series normality test indicate that the p-value of the series is not significant at the 5% level. As a result, the null hypothesis that the time series have a normal distribution cannot be rejected. Therefore, the raisin export series can be assumed to have a normal distribution as shown in Fig. 2.

The graph of forecasted data which had been calculated using Double exponential smoothing are shown in Fig. 3.

The results of raisin export with 95% forecast interval showed that if the present growth remains the same then the export of raisin will be 209,738 tons in 2016 (Table 3). As shown in the Table 3, the value predicted using in model is near the actual (observed) values for 2016 to 220.000.

Table 3. Five years 95% forecast of raisin export in Turkey using Double exponential smoothing model.

Period	Forecast	Lower	Upper
2016	209738	165317	254159
2017	206127	144573	267681
2018	202516	122658	282373
2019	198905	100222	297587
2020	195294	77515	313072

It is obvious from the analysis that export of raisin will decline in the coming years. Based on this model, raisin export in the following five years will decrease for approximately 3611 tons.

4. Conclusions

Turkey has good ecological conditions for growing raisin grapes. Despite's Turkey's leading role in the production of raisins, domestic consumption is comparatively low, and most of the production (generally around 80 percent) is exported. Raisin has the largest share in the traditional Turkish agricultural export items. It has strategic geographical position offers significant opportunities for trade.

This paper provided a short-term estimation of raisin export for foreign trade. Double exponential smoothing model was used for this purpose. Time series data of 34 years (1982–2015) were used in this study. The analysis of data showed that Turkey's raisin export is decreasing trend in export market. The forecast results have shown that the raisin export in Turkey will be around 209,738 tons in 2016/17. A forecasted value of dates also shows the situation that 2016 to 2019 Turkey will continue to acting important roles in raisin export in the world.

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