

RESEARCH ARTICLE

The role of Turkey in the world hazelnut production and exporting

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ABSTRACT

The aim of this study is to estimate the future of the global hazelnut sector for 2019-2025 using the data of 1961-2018. ARIMA model was used to forecast hazelnut production and export quantity. Hirschman Herfindahl Index (HHI) and Concentration Ratios (CR) have been used to determine market status. According to HHI and CR, the world hazelnut market was oligopoly in 1961-2018 and the biggest player in this market was Turkey. Because Turkey was the largest manufacturer and marketer of hazelnut in the industry, 64% of the production and 67% of the exports of world hazelnut were provided by Turkey as the average in the period 2011-2018. Turkey thus determines the world price in hazelnut. According to the concentration ratio, CR₁ will be 0.63 and 0.67 in the export and production; this means that about 63-67% of the world hazelnut production and export will have been provided by Turkey from 2019 to 2025. The number of countries producing, and exporting hazelnuts has risen from 13 to 32, and 9 to 58, respectively in the past fifty-eight years in the world. According to the findings of this study, it was forecasted that the competition degree of Turkey's hazelnut export market will decrease during the period from 2019 to 2025. The results obtained from this study will help policymakers to monitor the way for hazelnut marketing in Turkey.

Keywords: ARIMA model; Exporting; Hazelnut; Production forecasts; Turkey

INTRODUCTION

A hazelnut is the nut of the hazel and is also, known as cobnut or filbert nut according to species. A cob is roughly spherical to oval, about 15-25 mm (0.59-0.98 in) long and 10-15 mm (0.39-0.59 in) in diameter, with an outer fibrous husk surrounding a smooth shell (Sabzavari et al., 2018). Hazelnut is the most commonly cultivated nut after the almond in the world (Bayrakdar et al., 2015).

The varieties of hazelnut are grown around the world for human food, mainly in the Mediterranean climates on steep slopes in mountainous or hilly areas. They are used mainly for confectionary purposes, but also, for table nuts, and oil production (Tombesi, 2005).

Hazelnut is a product brought to Turkey from China about 5,000 years ago to be grown in Turkey (Harman, 2013). World hazelnut production area is 966,196 ha, about 75.4% of which are in Turkey, about 8.1% in Italy, 4.0% in Azerbaijan, 1.9% in Iran, and 1.8% in the USA (FAOSTAT, 2020).

Not only is hazelnut grown in Turkey but some other nuts such as pistachio, almonds, walnut, and chestnut are also, grown (Simsek, 2018). It has been mentioned in historical documents that hazelnut was produced in the Black Sea coast on the north of Turkey and it is well known that hazelnut has been exported from Turkey to other countries (Isik et al., 2014). Also, some German companies have created a notable demand for organic hazelnut cultivation in some provinces in Turkey in a few decades (Demiryurek et al., 2017).

Also, Turkey is the largest exporter of hazelnuts, supplying about 80% of the world's hazelnut exports. Being the largest producer and exporter, Turkey naturally plays an important role in determining world hazelnut prices (Secer, 2008). Anania and Aiello (1999) stressed that the Turkish hazelnut sector is more competitive than Italy due to the lower prices. A similar stance comes from Kilic and Alkan (2006). They underlined that Germany and Italy import hazelnut from Turkey because they cannot meet the domestic demand. However, they have an important role in trade because of their developed industry in hazelnut.

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Esposito et al. (2017) said that 10% of hazelnuts are sold in shell production as fresh and roasted and 90% of them in the shell. They are used as a raw material in many processed products such as bread, sweets, candy, and chocolate (Ciarmiello et al., 2014). Hazelnut has a high consumption share with 35% of hard-shelled fruits in the world. Hazelnut is a feedstock that is widely used in the food industry especially in chocolate. 80% of the world hazelnut production is used in the chocolate sector, 15% in the cake, biscuit, and sweet sector, and 5% in marketing as appetizers (Kilic and Alkan, 2006).

According to Farmer Registration, hazelnut cultivation is done in 37 provinces of Turkey despite almost all of the products subject to commercial farming are carried out in Ordu, Giresun, Samsun, Trabzon, Duzce, Sakarya, Istanbul, Artvin, Bartin, Sinop, Gumushane, Kastamonu, and Rize (TURKSTAT, 2020). Turkish hazelnut production quantity is very crucial for hazelnut prices in Turkey and the World. Due to frost in hazelnut in 2001 and 2014 hazelnut harvest was low. Thus hazelnut price has excessively increased.

Hazelnut, which is one of the products with an important export income of Turkey, has experienced a little decrease in exports compared to the past due to the countries that became new hazelnut producers after the 90s. Since the hazelnut market is an oligopoly market and the dominant firm is Turkey, it is necessary to analyze its competitors well for the advantage of the policies to be made. Thus the aim of this study is to estimate the future of the global hazelnut sector in 2019-2025. This study also aims to determine the relationship between the volume of hazelnut exports with hazelnut selling prices of Turkey.

MATERIAL AND METHOD

Materials

In the study, secondary data has been mainly collected from Food and Agricultural Organization (FAOSTAT), TURKSTAT (Turkish Statistical Institute), ITC (International Trade Centre), Fiskobirlik (Union of Agricultural Cooperatives for the Sale of Hazelnut in Turkey), Black Sea Exports' Union Statistics, Nuts Report of some year in Turkey and previous studies.

Methods

In the study, ITC, Black Sea Exports' Union Statistics, and FAOSTAT annual time series data were taken into consideration. HHI was defined by calculating the export concentration of hazelnut in the world. ARIMA (Autoregressive Integrated Moving Average) model tests were used to forecast the variables for the coming ten years (2019-2025). Annual time series data contain export variables of hazelnut in the last 58 years (1961-2018). Excel

was used to calculate the HH index and ARIMA model estimates were obtained by running the SAS 9.2 in this study.

The HHI Methods

In the study, the export concentration of hazelnut in the world was defined by calculating HHI and The Four Firm Concentration Ratios (CR₁, CR₂, CR₃, and CR₄).

H index is the sum of the squared share of different countries of hazelnuts exports and is calculated using the following equation:

$$H = \sum_{i=1}^n \left(\frac{X_i}{X} \right)^2 \quad (1)$$

The above equation is used to investigate the world market concentration. For the world market X_i is the amount of exports from the first country to other countries. X is the total world hazelnut exports. If used in World's export market, X_i is the rate of the first country in hazelnut exports and X is the total world's hazelnut exports (Secer, 2008).

HHI is the square of the percentage market share of each firm summed over the largest four firms in the market. The HHI can have a theoretical value ranging from close to zero to 10,000. If there existed only a single market participant which has 100% of the market share, the HHI would be 10,000. If there were a great number of market participants with each company having a market share of almost 0% then the HHI could be close to zero. When the HHI value is less than 100, it is considered that the market is highly competitive. When the HHI value is between 100 and 1,000, the market is said not to be concentrated. When the HHI value is between 1,000 and 1,800, the market is said to be moderately concentrated. When the HHI value is above 1,800, the market is said to be highly concentrated (Parkin, 2000; Krugman and Wells, 2009). HHI is a measure of the size of firms concerning the industry and an indicator of the amount of competition among them. Countries in this study were considered as the biggest 4 countries in terms of market share.

In creating this index, a weight equal to the market share of a country is assigned to that country's share. In this way, bigger markets have greater weights (Boshrabadi and Javdan, 2012). This relationship is used to calculate the concentration index in the world's hazelnut exports market. In order to show the features of H , it can be presented in other forms such as in terms of variation coefficients:

$$H = \frac{C^2 + 1}{n} \quad (2)$$

Above all, relation C is variation coefficients of p hazelnut exports to different countries and n is the number of

countries to which hazelnuts exported. Equation (2) states index H , as a function of market distribution inequality between countries and the number of them. If the export market is monopoly inequality in market share distribution does not exist and $C^2 = 0$ and the value of H is one. If there are many equal export markets, again $C^2 = 0$ but $H = 1/n$. The more the number of markets; the closer the value of H to zero, indicating the competitiveness of the market (Boshrabadi and Javdan, 2012). Furthermore, the inverse of H index shows the number of main countries exporting hazelnut in the world trade.

The Four Firm Concentration Ratios are the percentage of the value of sales accounted for by the four largest firms in the industry. This ratio is the main measure used to assess the market structure (Parkin, 2000).

ARIMA models

One of the primary objectives of building a model for a time series is to be able to forecast the values for that series at future times (Creyer and Chan, 2008). Time series data consists of four components: trend, seasonal effect, cyclical, and irregular effect (Bowerman et al., 2005). In our study, the 58-year time series was used and besides criteria such as AIC, BIC, SSE, MSE, and MPE have been taken into consideration in determining the most appropriate ARIMA model.

ARIMA models are one of the most important time series models applied in financial market forecasting over the past three decades (Lee and Tong, 2011; Khashei et al., 2012; Teoh et al., 2012; Khashei and Hijari, 2014).

ARIMA model function is represented by three terms (p, d, q), where p represents the number of autoregressive terms, d represents the number of non-seasonal differences, and q represents the number of lagged forecast errors in the prediction equation. The three steps required to develop an ARIMA model are identification, estimation, and forecasting (Box et al., 1976; Adamowski et al., 2012; Chattopadhyay et al., 2012; Wang et al., 2013).

The ARIMA forecasting equation for a stationary time series is a linear (i.e., regression-type) equation in which the predictors consist of lags of the dependent variable and/or lags of the forecast errors (Khashei et al., 2012; Makridakis et al., 1998).

That is:

The predicted value of $Y =$ a constant and/or a weighted sum of one or more recent values of Y and/or a weighted sum of one or more recent values of the errors.

A non-seasonal ARIMA model is classified as an ARIMA (p, d, q) model, where:

p is the number of autoregressive terms,

d is the number of non-seasonal differences needed for stationary, and

q is the number of lagged forecast errors in the prediction equation

First, let y denote the d^{th} difference of Y , which means (Creyer and Chan, 2008):

$$\text{If } d=0: W_t = Y_t \quad (3)$$

$$\text{If } d=1: W_t = Y_t - Y_{t-1} = \sum_{j=-m}^t w_j \quad (4)$$

$$\text{If } d=2: W_t = (Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2}) = Y_t - 2Y_{t-1} + Y_{t-2} = \sum_{j=0}^{t+m} (j+1) w_{t-j} \quad (5)$$

All univariate time series variables in this study are integrated in order $I(1)$ after conducting appropriate unit root tests, which indicate that the variable in question reaches a constant mean, variance, and covariance between t and $t + 1$ time span after the first differencing the series. Once the stationary is met, we then use ARIMA model to conduct a forecast. Several different ARIMA models were conducted to pick a model representing the series best (Yavuz et al., 2013). In this study with ARIMA hazelnut production quantities were estimated in Turkey. Moreover, this study examined the relationship between the prices of hazelnut with production in Turkey.

RESULTS AND DISCUSSION

Hazelnut production in the world

In the world, hazelnuts are cultivated in an area of around 821,266 ha*years⁻¹ in 2014–2018 years. The average annual hazelnut production during the past five years in the world has been approximately 848,605 tonnes in shell (FAOSTAT, 2020).

In Table 1, productions of the leading countries in hazelnut production in the world in 1961–2018 were shown.

The main hazelnut-producing countries are Turkey, Italy, Spain, the USA, Iran, China, Chile, Azerbaijan, and Georgia. Leader countries in producing were Turkey, Italy, Spain, the USA, and Iran in the year 1961–1990. After the 90s, Azerbaijan and Georgia, and after the 2010s, Chile were taken place within important countries concerning production. The total hazelnut production in Turkey, Italy, Spain, Azerbaijan, the USA, Georgia, Iran, China, and Chile is approximately 0.56 million tonnes which account for 97.14% of world hazelnut production. As seen in Table 1, The average annual hazelnut production of Turkey during 1961–2018 was 65.14%. But the share of Turkey was decreased to 60.1% in 2018. In the same period, Turkey has percent of 73 and 64 of the world in

the production area and quantity, respectively. It has thus ranked first in the world hazelnut production. The hazelnut production increases on account of the production areas that have been expanding through the Black sea coast. The average annual hazelnut production during the past five years in Turkey has been approximately 600,000 tonnes in shell. With its outstanding position, Turkey leads the field among hazelnut-producing countries (TURKSTAT, 2020). Therefore, Turkey has a distinguished place among the other hazelnut producers in the world, thanks to its high quality, which maintains its leading position in production and exportation.

Leader countries’ hazelnuts production forecast

Fig 1 shows the hazelnut production forecast of the World, Turkey, and Italy between 1962-2025. According to fig 1, world hazelnut production is expected to increase constantly until 2025.

The forecasts of production figs for the leading countries are given in fig 2. Azerbaijan is the only country that is

expected to a sharp increase in hazelnut production while the production in Iran and Spain is expected to be constant.

Fig 2 shows the hazelnut production forecast of the other leading countries between 1962-2025.

Fig 2 shows that the world hazelnut sector has undergone major changes. Until the early 1990s, most hazelnuts were grown in Turkey, Italy, Spain, the USA, and Iran. Since then, there has been a dramatic increase in hazelnut production in Georgia and Azerbaijan.

The average yearly hazelnut production forecast in the World, Turkey, Italy, Azerbaijan, the USA, Georgia, Iran, and Spain will be 1.04, 0.70, 0.12, 0.05, 0.04, 0.02, 0.02, and 0.01 million tonnes, respectively. Those seven countries will consist of 91.82% of world hazelnut production according to the forecast study. Turkey will provide approximately 67.1% of the world’ hazelnut production in the period 2019-2025. Fluctuations in Turkey will go in the same direction as world hazelnut production because over

Table 1: Production of leading countries in hazelnut production in the world (million tonnes)

Country	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018	2018	The average of 1961-2018	Ratio of the amount of production in 1961-2018
Turkey	0.14	0.26	0.34	0.45	0.57	0.54	0.52	0.38	65.14
Italy	0.06	0.09	0.12	0.11	0.11	0.11	0.13	0.10	17.57
Spain	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	3.42
USA	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.02	3.63
Iran	0.01	0.01	0.00	0.01	0.02	0.02	0.02	0.01	2.09
China	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.01	1.72
Chile	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.21
Azerbaijan	0.00	0.00	0.00	0.01	0.02	0.04	0.05	0.01	1.78
Georgia	0.00	0.00	0.00	0.01	0.02	0.03	0.02	0.01	1.59
Others	0.01	0.02	0.01	0.02	0.02	0.03	0.02	0.02	2.86
World	0.25	0.41	0.52	0.67	0.82	0.85	0.86	0.58	100.00

Source: (FAOSTAT, 2020)

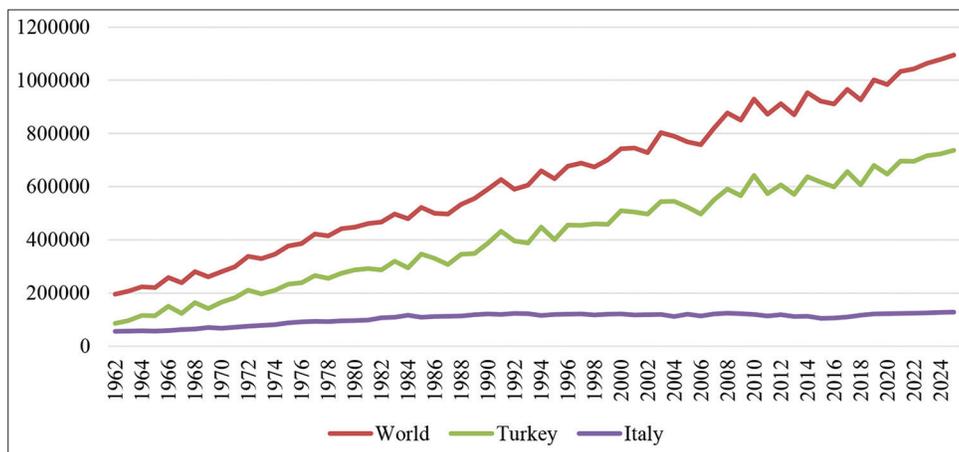


Fig 1. Hazelnut production forecasts of the World, Turkey, and Italy in the period 1962-2025. ARIMA (0,1,1) was used for the World and Italy. ARIMA (2,1,1) was used for Turkey

67% of production comes from Turkey. The production of Turkey will reach 8 times, from 86 thousand to 737 thousand tons, in the period 1962-2025. The average annual production in 2019-2020 is estimated at 663,305 tons of hazelnuts in Turkey whereas the actual value is 688,000 tonnes according to Turkstat 2020. Also, Bars et al. (2018) determined 672.973 tons of hazelnuts production in Turkey. Italy's production will reach approximately 2.2 times, from 58 thousand tons to 128 thousand tons, in the same period.

The change in production levels from past to present in other important countries can be summarized as follows.

Iran was the third country with roughly 20 thousand tons of product in the 1960s, and its production decreased to 2 thousand tons in the following years and estimated that it will be the 6th country in 2025 with around 15 thousand tons of production. The USA was in 5th place with 11 thousand tons of production in the 1960s, and it determined that it will achieve 40 thousand tons of production in 2025 and be ranked 4th world. Spain was in 4th place with 14 thousand tons of production in the 1960s, and it has produced around 30 thousand tons over time and, it determined that it will rank 7th in the world-ranking with its product of approximately 9 thousand tons in 2025. Azerbaijan ranked

6th with 11 thousand tons of production in 1992, and it will be 3rd place in the world-ranking with 56 thousand tons of production in 2025. Georgia ranked 5th with 12 thousand tons of production in 1992, it produced up to 35 thousand tons in 2011, and it may be 5th in the world with 20 thousand tons of production in 2025.

Leader countries' competitive power in the hazelnuts production

Hazelnut production share is broken down among 1961-1970 as follows:

Turkey: 55.51%, Italy: 25.46%, Spain: 6.9%, and Iran: 5.72%

$$HHI = (MS_1)^2 + (MS_2)^2 + (MS_3)^2 + (MS_4)^2$$

$$HHI = (55.51)^2 + (25.46)^2 + (6.95)^2 + (5.72)^2 = 3,810.31 \text{ or } 0.38$$

1,801-9,999 or 0.18-0.99 Oligopoly market

HHI, HHI⁻¹ and CR of like Turkey, Italy, Spain, USA, Iran, Azerbaijan, and Georgia leader countries in hazelnut production from 1961 to 2025 are given in Table 2.

HHI has decreased from 50% to 43% according to the average of 2001-2010 periods and in the period 2011-2018, respectively. H index indicates that the monopoly intensity in Turkey's hazelnut production market has declined during recent years, and the export market moves towards a more

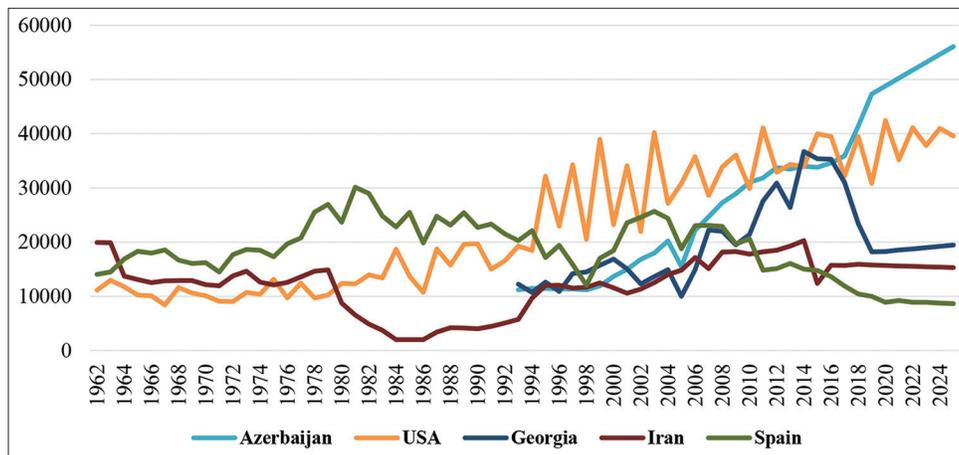


Fig 2. Hazelnut production forecasts of the other leading countries forecasts in the period 1962-2025. ARIMA (0,1,1) was used for Azerbaijan. ARIMA (1,1,1) was used for the USA and Spain. ARIMA (1,1,0) was used for Iran and Georgia

Table 2: The distribution of hazelnut production in the world

Years	HHI	HHI ⁻¹	CR ₁	CR ₂	CR ₃	CR ₄	The Major Producers	Total Country Numbers
1961-1970	0.38	2.63	0.56	0.81	0.88	0.94	Turkey, Italy, Spain, Iran	13-14
1971-1980	0.45	2.22	0.63	0.85	0.91	0.94	Turkey, Italy, Spain, Iran	13
1981-1990	0.47	2.13	0.64	0.87	0.91	0.94	Turkey, Italy, Spain, USA	13-15
1991-2000	0.49	2.01	0.67	0.85	0.89	0.92	Turkey, Italy, USA, Spain	15-25
2001-2010	0.50	2.00	0.69	0.83	0.87	0.89	Turkey, Italy, USA, Azerbaijan	25-32
2011-2018	0.43	2.32	0.64	0.77	0.82	0.86	Turkey, Italy, Azerbaijan, USA	31-32
2019-2025*	0.47	2.13	0.67	0.79	0.84	0.88	Turkey, Italy, Azerbaijan, USA	25-32

Source: (FAOSTAT, 2020). *Forecast with ARIMA model

competitive environment. HHI⁻¹ index shows that the monopoly power of the main hazelnut producers in the world. The main reason for the increase of this value is the increase in the share of the other three producing countries.

CR₁ value has risen to 69% from 56% between 1961-2018. This means that about 56-69% of the world hazelnut production has been provided by Turkey. In recent years, Georgia, Azerbaijan, and Chile have increased their production of hazelnuts and that's why the share of Turkey in the world production was reduced. Turkey will provide approximately 67% of the world' hazelnut production in the period 2019-2025.

CR₂ has decreased from 81% to 77% in the same period. It means that the most important second country (Italy) in the world hazelnut production decreased from 25% to 13% between 1961-2018. Italy will provide approximately 12% of the world hazelnut production in the period 2019-2025.

Change in CR₃ is from 88% to 82% according to the average of 1961-1970 and in the 2010-2018 periods. It means that hazelnut production for the most important third country (Spain, USA, or Azerbaijan) has reduced from 7% to 5%. It is estimated that Azerbaijan will provide approximately 5% of the world hazelnut production in the 2019-2025 periods.

Change in CR₄ decreased from 6% to 4% in the same period. It means that hazelnut production for the most important fourth country (Iran, the USA, Spain, Azerbaijan, or Georgia) decreased. The USA will provide approximately 4% of the world hazelnut production in the 2019-2025 periods.

As shown in Table 2, there have been fluctuations in the amount of hazelnut production all over the countries years

after years; however, its production has increased in recent years. The number of countries producing hazelnut was 13 in 1961, whereas it has risen to 32 in 2018. The table also, shows that the most important producer countries are Turkey, Italy, Azerbaijan, the USA, and Georgia in the last few years.

Hazelnut export in the world

The volume of hazelnut export of leading countries in the period 1961-2018 is given in table 3.

Turkey was the world leader in hazelnut exports all of the years. Turkey is followed by the Italians, Georgia, and Azerbaijan. Hazelnut was shipped approximately 228.25 thousand tonnes*years⁻¹ in the world among 2011-2018. Turkey's hazelnut export volume is approximately 151.98*years⁻¹ thousand tonnes between these same periods. In another word, 66.58% of the hazelnuts are exported from Turkey (Table 3). Turkey sets the price that the market price for hazelnuts. While Italy occupies 2nd place, Georgia holds 3rd place and Azerbaijan is fourth on the list.

Leader countries' hazelnuts export forecast

Fig 3 Hazelnut export forecasts of the World, Turkey, and Italy in the period 1962-2025

Export forecasts of the World, Turkey, and Italy are in line with production estimates. The shape of the World and Turkey's estimates are almost identical. Approximately 25-35% of the world' hazelnut production is exported. The average yearly hazelnut export quantity will be 262.4, 164.2, and 25.3 thousand tonnes, respectively in the World, Turkey, and Italy. Turkey will provide approximately 62.6% of the world hazelnut export in the period 2019-2025.

Fig 4 shows the hazelnut export forecast of the other leading countries in the period 1962-2025.

Table 3: The volume of hazelnut export of leading countries in the period 1961-2018 (thousand tonnes)

Country	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018	Ratio of the amount of exporting 2011-2018
Turkey	57.11	111.72	113.34	137.59	144.70	151.98	66.58
Italy	10.64	18.32	26.84	18.57	16.57	20.18	8.84
Georgia	0.00	0.00	0.00	1.91	7.80	18.23	7.99
Azerbaijan	0.00	0.00	0.00	1.57	7.84	13.92	6.10
Germany	0.36	1.62	6.36	5.80	3.47	5.18	2.27
Netherlands	0.00	0.12	1.77	1.61	2.36	3.93	1.72
Chile	0.00	0.00	0.00	0.00	0.01	3.32	1.45
Spain	5.19	6.35	5.26	3.86	3.38	1.84	0.81
USA	0.10	0.54	1.52	2.37	2.24	2.03	0.89
France	0.01	0.21	0.72	0.80	1.63	0.82	0.36
Austria	0.01	0.01	0.07	0.77	0.62	0.51	0.22
Others	0.48	0.67	1.64	3.23	3.92	0.36	0.16
World	73.89	139.57	157.52	178.07	194.52	228.25	100.00

Source: (FAOSTAT, 2020)

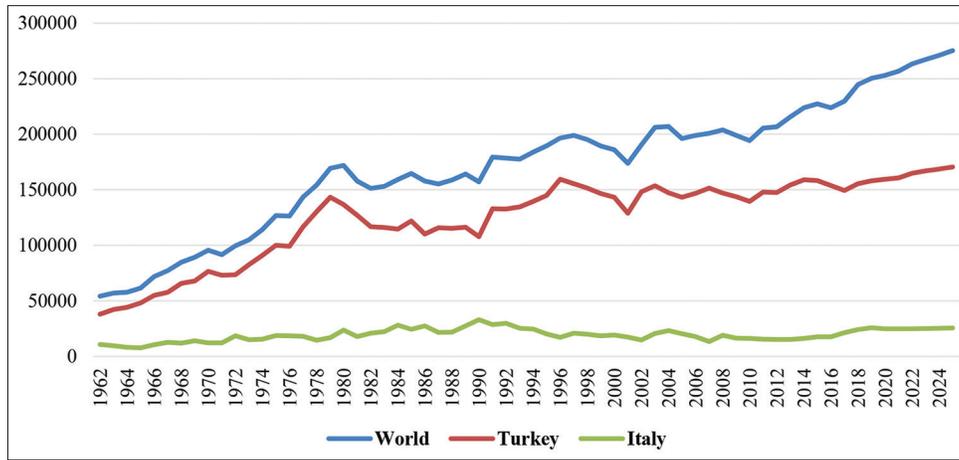


Fig 3. shows the hazelnut export forecast of the World, Turkey, and Italy in the period 1962-2025. ARIMA (3,1,1), ARIMA (0,1,1), and ARIMA (1,1,1) were used for the World, Turkey, and Italy, respectively

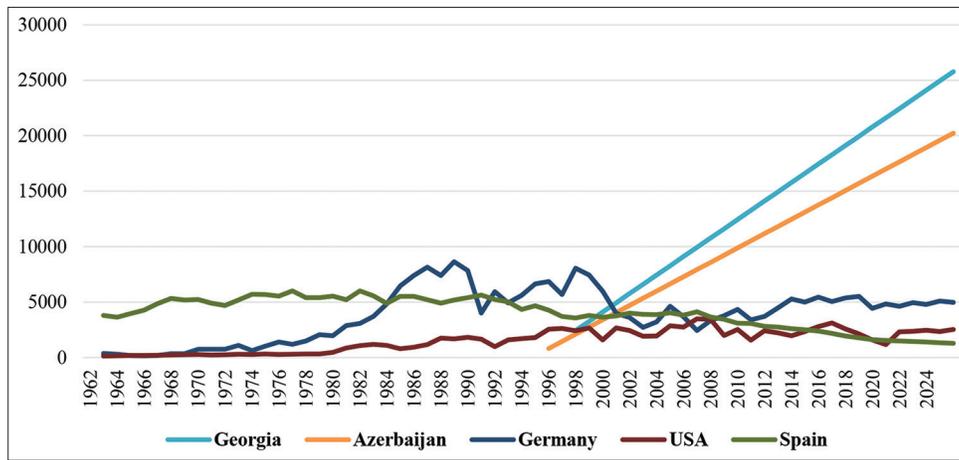


Fig 4. Hazelnut export forecasts of the other leading countries in the period 1962-2025 (tonnes). **Note:** ARIMA (0,1,1) was used for Georgia, Azerbaijan, and Spain. ARIMA (1,1,1) were used for Germany ARIMA (5,1,1) was used for the USA

Georgia and Azerbaijan have achieved a rapid increase in export after 1995. While the export amount of Spain has decreased significantly over the years, the export amount of the United States has increased, even though fluctuations seemed over the years. Another country to be noted is that Germany, which is not leading in production, is in the front ranks in export. As it is known mainly Germany took hazelnuts from Turkey and it is selling again bringing some standards in the world market. The increase and decrease in exporting of Turkey, in this way lead to increases and decreases in the volume of exporting of Germany, too. The average yearly hazelnut export quantity will be 23.3, 18.3, 4.8, 2.1, and 1.5 thousand tonnes, respectively in Georgia, Azerbaijan, Germany, the USA, and Spain.

Leader countries’ competitive power in the hazelnuts export

Share of hazelnut export quantity is broken down among 1961-1970 as follows:

$$HHI = (MS_1)^2 + (MS_2)^2 + (MS_3)^2 + (MS_4)^2$$

Turkey: 77.29%, Italy: 14.41%, Spain: 7.02%, and Germany: 0.48%

$$HHI = (77.29)^2 + (14.41)^2 + (7.02)^2 + (0.48)^2 = 6,230.55 \text{ or } 0.62$$

1,801-9,999 or 0.18-0.99 Oligopoly market

HHI, HHI⁻¹ and CR of like Turkey, Italy, Spain, USA, Iran, Azerbaijan, and Georgia leader countries in hazelnut export quantity is given from 1961 to 2025 in Table 4.

CR₁ value has risen to 80% from 67% between 1961-2018. This means that about 67-80% of the world hazelnut export has been provided by Turkey. According to ITC (ITC, 2020), Turkey is the main exporter of hazelnut to the European Union. The countries where Turkey exports mostly are Italy (40.67%), Germany (14.37%), France (7.93), Poland (4.79%), Canada (3.98%), and Switzerland (3.92) in 2019. Exporting to these countries have constituted about 75% of the total hazelnut exports of Turkey in 2019. Aytac (2021) projected the hazelnut export quantity will be over

Table 4: The distribution of hazelnut export quantity in the world

Years	HHI	HHI ¹	CR ₁	CR ₂	CR ₃	CR ₄	The Major Exporters	Total Country Numbers
1961-1970	0.62	1.60	0.77	0.92	0.99	0.99	Turkey, Italy, Spain, Germany	9-14
1971-1980	0.66	1.51	0.80	0.93	0.98	0.99	Turkey, Italy, Spain, Germany	11-19
1981-1990	0.55	1.82	0.72	0.89	0.93	0.96	Turkey, Italy, Germany, Spain	18-27
1991-2000	0.61	1.64	0.77	0.88	0.91	0.93	Turkey, Italy, Germany, Spain	25-52
2001-2010	0.56	1.77	0.74	0.83	0.87	0.91	Turkey, Italy, Georgia, Azerbaijan	51-56
2011-2018	0.47	2.13	0.67	0.76	0.84	0.90	Turkey, Italy, Georgia, Azerbaijan	49-58
2019-2025*	0.41	2.44	0.63	0.72	0.81	0.88	Turkey, Italy, Georgia, Azerbaijan	49-58

Source: (FAOSTAT, 2020). *Forecast with ARIMA model

five hundred thousand tons from 07/2020 to 06/2023 by the Prophet algorithm. Germany and Italy import the raw material from Turkey and re-export it by processing or without processing. Sezer et al. (2017) highlighted that Turkey is the first country at hazelnut production and export in the world with its large margin of production. In order to further strengthen this position or to lessen the loss of blood in this position; it needs to fight better with some diseases like powdery mildew. Yavuz et al. (2005) expressed that the biggest threat to hazelnut production is the subsidy. This subsidy is considered to be too high in areas thus even not suitable ones for hazelnut growing are increasing to production. This case shows that poor quality production has raised the world and Turkey hazelnuts prices have reduced. Demiryurek et al. (2017) stated that the demand for organic hazelnut production in Turkey depends on the request of German companies. The quality of the hazelnuts cultivation in Turkey is attracting the attention of big German companies and they meet some needs of producers as they buy to guarantee the firm's products. This explanation shows that Turkey is the most important country in the hazelnut external trade.

CR₂ has decreased from 92% to 76% in the same period. It means that the most important second country (Italy) in the world hazelnut production decreased from 25% to 10% between 1961-2018. The main reason for this is the re-exporting of the product through developed hazelnut processing in Italy. The reason for the reduction in the share of Italy's exports is due to declining in hazelnuts sales from Turkey to Italy because of reduced purchasing of hazelnut from Turkey in 2011-2018. Georgia is the second country hazelnut exporting in some years. Also, according to ITC (ITC, 2020), like Turkey, In Italy either large part of hazelnut was exporting to European Union countries. the leading countries in exporting are Germany (51.63%), France (17.31%), Poland (6.92%), Austria (5.70%), Spain (4.57%) and Switzerland (3.92%) in 2019. Exporting to European countries has consisted of 88% of the total hazelnut exporting of Italy in 2019. Germany and France consisted of a large part in hazelnut importing from Turkey

and Italy. USDA (2010), explained that approximately 90% of the Italian harvest goes to processing companies, whereas fresh consumption represents the remaining 10%. Furthermore, low-quality shelled hazelnuts are often used by cosmetic companies. Also, it was expressed by the USDA (2014) that Italy achieved adequate production due to the use of pesticides and fertilizers, technological advances in mechanization, and effective irrigation methods in hazelnut production. This situation strengthens Italy's second place in hazelnut exports.

The value of CR₃ decreased from 99% to 84% according to the average of 1961-1970 and in the 2010-2018 periods. It means that hazelnut exporting for the most important third country has reduced from 7% to 5%. Also, according to ITC (2020), Georgia, unlike Italy and Turkey, but like Azerbaijan, because it also, makes top exports to the same 3 countries. That is, Georgia makes 57.12% of the hazelnuts exporting to these three countries. The leading countries in exporting are Germany (20.59%), Italy (20.11%), Czech Republic (7.30%), Russia (6.95%), Lithuania (5.53%), France (5.07%), Spain (4.78%), Poland (4.35%), Belarus (4.03%), and Ukraine (3.46%) in 2019. Exporting to these countries has constituted about 82% of the total hazelnut exports of Georgia. Especially Italy and Germany have a large part in hazelnut imports from Georgia in the last two years. But Russia doesn't maintain its share in the past thus it has got a great decline in the last two years.

Change in CR₄ increased from 0% to 6% in the same period. This shows that hazelnut production for the most important fourth country, Azerbaijan, increased. Azerbaijan usually exports hazelnut to Russia, Ukraine, and Kazakhstan in contrast to exporting Italy and Turkey to the European Union (ITC, 2020). Leading countries in exporting are Russia (50.13%), Italy (24.75%), Germany (15.45%), Georgia (1.70%), and Poland (1.61%), in 2019. Exporting to these countries has constituted about 93% of the total hazelnut exports: Especially Italy has a larger part in hazelnut imports from Azerbaijan in the last two years. While Russia has maintained a share of importing

Azerbaijan hazelnuts, Ukraine's share has declined considerably in the last 10 years.

As a result, the number of countries playing a role in hazelnuts exports of Turkey is around 90 countries. Although Azerbaijan and Georgia have been producing since the 1990s, they export to approximately 35-45 countries around the world.

The estimations show that the share of export volume in the first 4 countries from these about 60 countries will be approximately 88%. Turkey, Italy, Georgia, and Azerbaijan, will keep their positions as the leading countries in the export of hazelnuts in 2019-2025 as much as they were in 2001-2018.

The volume of hazelnut export in the world will show a linear increase until 2025 and the volume of annual export will reach 275 thousand tonnes. Similarly, Turkey's production will increase linearly in the same period and 62.5% of world hazelnut export in 2019-2025 will be provided by Turkey. Italy's hazelnut production in the same years will follow bumpy trends and will provide about 9.6% of the world's hazelnut production. The percentage of hazelnut export in Azerbaijan and Georgia will be 8.9, and 7.0, respectively in the same years. Turkey will continue to be the undisputed number one in the world. But, the market share of Georgia and Azerbaijan will rise.

Hazelnut price in the world

In Table 5, export revenue by leading countries in hazelnut export in the world among 1961-2018 was shown.

Hazelnuts unit prices ranged from \$1.19 to \$7.68 in the world and \$1.17 to \$7.71 in Turkey between 1961-2018.

Hazelnut prices sometimes raise and fall throughout the world at the same time. Therefore, there have been fluctuations in prices (Table 5). This is since a significant part of the world hazelnut production and export got some provisions in Turkey's law and the effects of the policies on the domestic market are very important. The implemented price of hazelnut in Turkey is more than near the price in the world market. The demand for hazelnuts is approximately 1.00 million tonnes in the world in recent years. If Turkey doesn't present 70% of this demand to the market, hazelnut prices will rise. This was one of the reasons for an excessive increase in prices of hazelnut among 2011-2018 because supply does not meet the demand. Sisman (2018) projected market concentration (CR_4) and prices from a global have a positive correlation in terms of cross-country perspective. Also he said that because of oligopoly of the market and considering the high dependence of the households that produce hazelnuts on the incomes obtained from agricultural trade, evaluating their hazelnut production may be to their advantage.

Hazelnut export price has increased since the beginning of the 2000s. Previously, export prices had decreased due to hazelnut surpluses and the policies applied by the Government. Turkey's high production and its large carry-over stocks resulted in low hazelnut prices on the international markets. Low Turkish prices and large stocks in Italy and Spain encouraged the European Union to limit Turkish hazelnut imports, to allow Italy and Spain to eliminate their stocks (Secer, 2008). Attention was also, drawn to Germany as a prior hazelnut importer country. The main reason for this is the re-export of the product through the developed hazelnut processing industry in the country (Secer, 2008; Erkan, 2012). Although

Table 5: Unit export price of leading countries in hazelnut export in the world (\$kg⁻¹)

Countries	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018	2019-2025 [*]
Turkey	1.17	1.90	2.79	3.41	4.93	7.71	7.13
Italy	1.28	2.22	3.14	3.66	5.74	8.81	10.20
Georgia	0.00	0.00	0.00	0.00	4.31	6.85	3.17
Azerbaijan	0.00	0.00	0.00	0.00	4.20	5.34	5.03
Spain	1.24	2.16	3.12	3.54	4.93	8.11	11.42
Chile	0.00	0.00	0.00	4.48	6.28	9.81	
Austria	0.00	0.00	0.00	0.00	6.80	9.83	
Germany	1.37	2.23	3.15	3.54	6.04	9.17	8.63
USA	1.30	1.31	2.06	2.63	4.05	5.89	5.60
France	0	2.34	3.21	3.79	5.59	7.95	
Netherlands	0.00	0.00	3.12	3.66	5.30	7.97	
World	1.19	1.94	2.87	3.41	4.94	7.68	6.97

Source: (FAOSTAT, 2020)¹

Arima models given below used in determining the export values

ARIMA (1,1,2) for Turkey and ARIMA (0,1,1) were used for Georgia and Azerbaijan.

ARIMA (5,1,1) was used for Italy, Spain, and the USA.

ARIMA (5,1,0) and ARIMA (5,1,3) were used for Germany and the World, respectively

¹ With the divide exported quantity of export income of hazelnut exporting price of hazelnuts was obtained.

Germany has not gotten any hazelnut production area, it is the import of hazelnut from Turkey and standardizing production that is exported to other countries at a high price.

Hazelnuts prices will be not as high as Italy and Germany in Azerbaijan, Georgia, the USA, and Turkey in the 2019-2025 periods. Also, another remarkable factor is that the extreme price decreases will continue in Georgia after 2015.

CONCLUSION

This paper has highlighted Turkey's role in hazelnut trade with a foresight study covering the 2019-2025 periods. Turkey's hazelnut production in the last decade constitutes 64.8 percent of the world's hazelnut production. And it is estimated that she will keep her production level within the next 7 years. This shows that Turkey will continue its leading position in hazelnut production. Turkey is the undisputed number one in hazelnut production and trade in the world. As being the largest producer and exporter, Turkey naturally plays a crucial role in determining world hazelnut prices. Ten exporting countries are playing a major role in the world. Hazelnuts market exhibits characteristics of oligopoly market and especially Turkey has a huge effect on determining the price of hazelnuts in the world market since it is quite competitive with regard to prices. Thanks to substantially lower production costs in Turkey when compared with Italy and Germany. So, the countries which have a highly developed industry in hazelnuts such as Germany and Italy would prefer to import hazelnut from Turkey in order to re-export to the world market as they cannot meet the domestic demand. As understood from the foresight study for the next 7 years, the volume of hazelnut production of Turkey, Azerbaijan, and Georgia will increase in contrast to a decrease in the production of Italy. Therefore, Turkey needs to keep an eye on these four countries' hazelnuts production and marketing status in order to keep its position. Hazelnuts export of Turkey is primarily marketed to the European Union. The number of countries importing hazelnut from Turkey has not been more than 90 countries so far. Considering that over 200 countries in the world and many countries like Ghana, Senegal, Paraguay, and Honduras have not even eaten habits for hazelnuts, there is thus a need to advertise and provide information in these countries, for the expanding marketing share of Turkey on this product. World hazelnut production is around one million tonnes; this quantity underproduction leads to an increase in the price. With the technological progress in the hazelnut industry in Turkey, Turkey's role will strengthen in the world market.

RECOMMENDATIONS

Some areas do not meet the quality criteria in Turkey but they are even benefited from the support given to hazelnut producers. So they continued to increase their production. In the future, if the production amount of hazelnut-producing low-quality areas can be reduced when production will increase high-quality production, and Turkey will continue to protect its market power. In order to create high hazelnuts price of Turkey both by protecting the market share and making quality products and searching for new markets. If Turkey's hazelnut production's 30% supply to the new markets, Turkey and the world's hazelnut prices will increase to about 50% by providing technological efficiency and increasing the demand for this product, the price of hazelnuts and export revenue of Turkey will increase. Hence hazelnuts export value is very important for Turkey, as it will provide an additional increase in prosperity indirectly.

Authors' contributions

All authors were contributed to the writing of the article. Author #2 and Author #4 have contributed to the compilation and preparation of the data, while Author #1 translated the article in English and Author #3 did the language spelling check. Author #1 submitted the article by writing all correspondence and revisions.

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