

Economic Analysis and Marketing Margin of Walnut Market In Turkey

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ABSTRACT: In the research, grower and consumer prices and the marketing structure of walnut in Turkey it was surveyed. This research focuses on foreign trade, consumption, price fluctuations production and marketing from 2003 to 2017. It has been determined that there is an increase in the number of walnut trees and walnut production over the years and a decrease in walnut yield. In the marketing margin calculations, approximately half of the price paid by the consumer for one kg of walnut is received by the farmer in exchange for the shelled walnut equivalent to the unshelled walnut. This is an important ratio for the farmer and shows that the farmer has a significant profit from this product. Although income was not statistically significant in the forecasted walnut demand model, there was an increase in per capita income in Turkey. Population growth has directly increased walnut consumption. Increases in consumption could not be met with domestic production, so imports increased over the years. With respect to Walnut demand and supply functions, supply elasticity (Se) 0.350 and demand elasticity (De) 0.097 were found. With respect to elasticity coefficients, Walnut growers' sensitivity to changes in prices is higher than consumers'.

Keywords: Marketing Structure, Price Fluctuations, Walnut

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INTRODUCTION

While healthy eating is an important issue in society, consumption habits and income levels of people vary. For these reasons, there is an increase in the demand for some agricultural products. Hard-shelled fruit growing, which is one of the fast-consumed food products, is also among the investment preferences of growers in terms of economy and nutrition (Ketenci and Bayramoğlu, 2018).

Walnut (*Juglans regia L.*), found in the hard-shelled fruits group, his homeland is known as Anatolia. Walnut growing is carried out in a very large region starting from the Far East through Turkey and Europe to the United States. Walnut production in Turkey shows a natural spread and is grown in every region of the country (Koyuncu et al., 2005; ÜCE, 2016; Gülsoy et al., 2016; Bayazit et al., 2016). Walnuts have a wide range of uses compared to other fruit species, as well as a variety of benefits for people. Walnut has a high nutritional value and demand potential for consumers, as well as being used in industrial sectors such as food, furniture, pharmaceuticals, and is preferred by manufacturers. Due to these characteristics, there is an increase in Walnut planting and afforestation areas in the world and Turkey.

With respect to 2017 statistics in Turkey, 1 115 904 tons of hard - shell fruit (hazelnut - walnut - almond - pistachio- chestnut) are produced annually and total 6.213 million tons of fruit production is 17.96 percent share. Turkey has a rate of 18.82% in hard-shelled fruit production in 2017. After our traditional hazelnut products, it is the second place in hard-shell fruit production (TSI., 2019).

Increasing regularly every year, World walnut production increased by 93.05% in the ten-year period (2007-2017) and increased by 1.097 million hectares in 2017 to 3 829 626 tons. Important Walnut producing countries in the world by 2017: China %50.28 (1 925 403 ton) while in first place with the rate of, United States %14.92 (571 526 tons) is second with a rate of, Iran 9.12% (349 192 tons) is third with the rate of and Turkey 5.48% (210 000 tons) is fourth with the rate of ranked (FAO., 2019).

With respect to 2016 data, it is seen that the largest share in World walnut exports, which reached about 3.615 billion \$ in the world, was in the United States with a ratio of approximately (753 million \$) 43.40%, followed by Mexico with 19.43% (337 million \$) and Chile with 8.54% (148 million \$). Turkey is 12th with 1.23% (66 million \$) ranked (FAO., 2019).

In Walnut imports, Germany is in first place with 16.42% of the world's \$1.402 billion (\$230 million) with respect to 2016 data. It ranks Japan with 8.39% (1.177 million \$), Spain with 6.47% (\$91 million). Turkey among the importing countries (33 thousand \$) with a rate of 2.38% 11th. (FAO., 2019).

With respect to the data of the Turkish Statistical Institute for 2017, the Walnut produced in 920 128 decars in Turkey constitutes 5.92% of the production area in Denizli with 54 480 decars. Denizli is followed by Manisa with 49 784 decars areas (5.41%), Bursa with 44 805 decars areas (4.87%), Kahramanmaraş with 41 938 decars areas (4.56%). In terms of production quantity, Kahramanmaraş accounts for 5.19% of the total amount with 10 902 tons of production, Antalya accounts for 3.86% with 8 101 tons, Denizli accounts for 3.79% and Bursa accounts for 3.53% (TSI., 2019).

Walnut prices have also increased with increasing demand in recent years. As a result of studies with TSI data, it was determined that when the last ten-year period (2007-2017) was examined, grower prices increased by 321.10% and consumer prices increased by 197.26%. The United States, which is in the first place in walnut production, is also in the first place in determining prices, leading to the world market. Turkey is one of the countries where the United States exports walnuts. In 2017, Turkey

imported walnuts from the United States for 511.28 \$ (TRADAMAP., 2019). Besides its own production, Turkey also leads the world market by exporting its imported walnuts.

In this study, economic analyses were made taking into account the grower-consumer prices of walnuts in Turkey and the marketing situation was examined. In addition, models related to Walnut supply and demand functions were estimated to determine the factors affecting Walnut supply and demand.

MATERIALS AND METHODS

Material

In this study, annual data on production quantity, production area, yield, grower (farmer's prices) and consumer (retail) prices of Walnut from 2003 to 2017 period were taken from Turkish Statistical Institute (TSI., 2019). The price of fertilizer, the price of oil fuel, the price of agricultural workers are taken from TSI web site. Various publications and sources have also been made available.

Method

The current prices of shelled walnut producer and unshelled walnut consumer are converted into real prices by taking into account grower and consumer price indices (2017=100). Year-to-year fluctuations in prices were first expressed in absolute values, then expressed in percentage of the first two years compared. Marketing margin; It is calculated as the difference between the prices of the growers and the prices paid by the consumers (Topçu, 2003; Topçu, 2004; Aşkan and Dağdemir., 2015; Kumbasaroglu, et al., 2021). The yield of shelled walnut growers was approximately 51.76% based on the mean of all species (Şen, 2011). It was calculated that 1 kg of internal walnuts were obtained from 1.932 kg of shelled walnuts.

While calculating the chain price index, the current prices of growers and consumers were compared year to year by taking into consideration the 2003-2017 year range. There is no basic year in the chained price index. The index for any year is calculated based on the previous year's price. The main purpose of the chain price index is to examine the annual changes of price at the time, i.e. to determine the rate at which prices rise or decrease in the following year compared to the previous year (Dağdemir, 1998).

The quantity of supply of single-year agricultural products is the function of the price of the previous year. However, walnut is perennial and the production determination will not be changed. That's why, walnut production determinations were thought to respond with a hypothetical year delay. When examining the intercourse between price and walnut production, it was taken into account that the effect of price (t) on production for a given year could only occur after one year (t-1), the walnut production series was preserved exactly the same, the price series was analysed by sliding back one year.

When creating supply and demand functions, the supply side corresponds to the demand side. On the demand side, consumption and ex-ports are important, while on the supply side, labour, land, capital and innovation are important (Tan and Xiang, 2019).

Demand and supply function models are forecasted, while series are proved individually by linear, log-log and semi-log models. Semi-logarithmic models (Log-Lin) were used in the analyses that yielded the most appropriate statistical results. All prices in the independent variables are converted to real prices by taking 2017=100. Durbin-Watson test was applied in time series analysis and it was tried to determine whether there was an autocorrelation problem. No autocorrelation problem was detected in the models created.

Model which is forecasted for walnut supply is at the equation1.

$$\text{Log}WP_{(t)} : \alpha + \beta_1 WPP_{(t-1)} + \beta_2 PPP_{(t-1)} + \beta_3 HPP_{(t-1)} + \beta_4 FP_t + \beta_5 LP_{(t)} + \beta_6 DP_{(t)} + \beta_7 P_{(t)} + \epsilon \quad (1)$$

WP : Walnut (shelled) Production Quantity (tonnes)

WPP : Walnut (shelled) Grower Price (₺ kg-1)

PPP : Pistachio Grower Price (₺ kg-1)

HPP : Hazelnut (shelled) Grower Price (₺ kg-1)

FP : Fertilizer Price (₺ kg-1)

LP : Agricultural Labour Price (₺ day-1)

DP : Oil fuel Price (₺ lt-1)

P: Periodicity^{1*} (high productiveness year: 1, low productiveness year: 0) (*Repetition tendency. In other words, the description of fruit kinds and diversities that bear fruit in one year and give little or no fruit the next year. That is, evident productivity year over year.)

Model which is forecasted for the unshelled walnut demand is at the equation 2.

$$\text{Log}WC_{(t)} : \alpha + \beta_1 WCP_{(t)} + \beta_2 PCP_{(t)} + \beta_3 HCP_{(t)} + \beta_4 NP_{(t)} + \beta_5 NI_{(t)} + \beta_6 P_{(t)} + \epsilon \quad (2)$$

WC : Unshelled Walnut Consumption Amount (tonnes) (it was calculated with respect to the yield rate (51.76%) of the shelled Walnut.)

WCP : Unshelled Walnut Consumer Price (₺ kg-1)

PCP : Pistachio Consumer Price (₺ kg-1)

HCP : Unshelled Hazelnut Consumer Price (₺ kg-1)

NP : Population (Person)

NI : Domestic revenue (₺ person-1) (transformed to real revenue)

P : Periodicity (high productiveness year: 1, low productiveness year: 0)

RESULTS AND DISCUSSION

From the year of 2003 to 2017 the number of walnut fruitful tree went up 113.83%. So the walnut tends to periodicity, crop amount and productiveness is fluctuations from year to year (Table 1). With respect to a fifteen-year period, yearly mean production is 173 928 tones, mean productiveness to each tree is 30.42 kg.

Çelik (2013) in his study of the hard-shelled fruit pistachios, walnuts, hazelnuts and almonds by determining the appropriate model for obtaining equations. With respect to ARIMA models determined as a result of 29 analyses, the production amounts of hard shelled fruits were forecasted for 2012-2020. With respect to the predicted values, it predicted an increase of 8.03% in walnut in 2012-2020 period.

Although there were fluctuations in walnut consumption in the years from 2003 to 2017, there is an increase as a trend. In the 15 years period mean yearly consumption is calculated as 1.43 kg. Although there was an increase in Walnut imports and exports, there was a significant increase in imports over the years (Table 2).

Ketenci and Bayramoglu (2018), Turkey's walnut production to determine its competitiveness in international markets Revealed Comparative Advantage Index (RCA) have used. Walnut competitiveness in the international market in Turkey described in 2016. They found that the decrease of comparative advantage.

Table 1. Number of Tree Fruitful and Production in Turkey

Years	Fruitful Tree Number (1000 - piece)	Production (tones)	Productivity (kg per ⁻¹ tree)
2003	4 100	130 000	31.71
2004	4 200	126 000	30.00
2005	4 535	150 000	33.08
2006	4 595	129 614	28.21
2007	4 927	172 572	35.03
2008	5 095	170 897	33.54
2009	5 192	177 298	34.15
2010	5 441	178 142	32.74
2011	5 594	183 240	32.76
2012	5 977	203 212	34.00
2013	6 526	212 140	32.51
2014	7 001	180 807	25.83
2015	7 596	190 000	25.01
2016	8 171	195 000	23.86
2017	8 767	210 000	23.95

Source: TSI (2019)

Table 2. Walnut Consumption Per Capita and Marketing in Turkey

Years	Import (shalled) (tones)	Export (shalled) (tones)	Consumption* (shelled) (tones)	Unshalled Walnut** Consumption (tones)	Consumption per Capital (kg year ⁻¹)
2003	15 991	465	145 526	75 324	1.12
2004	26 247	661	151 586	78 461	1.15
2005	23 580	412	173 169	89 632	1.30
2006	25 913	514	155 013	80 235	1.15
2007	23 360	1 136	194 796	100 826	1.43
2008	32 399	2 848	200 448	103 751	1.45
2009	38 162	2 357	213 104	110 302	1.52
2010	33 727	6 134	205 735	106 488	1.44
2011	29 546	7 173	205 613	106 425	1.42
2012	46 627	10 592	239 247	123 834	1.64
2013	32 018	7 787	236 371	122 345	1.60
2014	29 076	8 661	201 222	104 152	1.34
2015	42 949	7 890	225 060	116 490	1.48
2016	70 073	4 593	260 480	134 824	1.69
2017	58 164	6 373	261 791	135 503	1.68

Source: TSI (2019); FAO (2019)

* Consumption = Production + Import-Export

** Unshalled walnut consumption = Shelled consumption X yield rate (51.76%)

Marketing margin: It is the difference between the price paid by the consumer for 1 kg of shelled walnuts and the price paid by the farmer for 1,932 kg of shelled walnuts, which is equivalent to 1 kg of shelled walnuts. When current prices are taken into account, the rates obtained by intermediaries in the year range from 35.07% to 56.90%, while the rates obtained by growers range from 43.10% to 64.93% (Table 3).

Table 3. Walnut Marketing Margin With Respect to Current Price in Turkey

Years	Grower * Price (₺ kg ⁻¹)	Consumer Price (₺ kg ⁻¹)	Marketing Margin	Grower Income (%)	Commissioners Income (%)
2003	7.13	13.05	5.92	54.63	45.37
2004	7.96	12.26	4.30	64.93	35.07
2005	8.71	14.73	6.01	59.17	40.83
2006	8.89	17.65	8.76	50.35	49.65
2007	10.26	20.77	10.51	49.39	50.61
2008	10.82	22.56	11.74	47.96	52.04
2009	10.53	24.43	13.90	43.10	56.90
2010	13.60	25.38	11.78	53.58	46.42
2011	14.76	30.03	15.27	49.16	50.84
2012	16.65	33.91	17.26	49.11	50.89
2013	17.27	37.52	20.25	46.03	53.97
2014	21.29	46.18	24.89	46.11	53.89
2015	25.99	57.09	31.11	45.52	54.48
2016	28.44	56.68	28.24	50.17	49.83
2017	30.83	61.74	30.90	49.94	50.06

Source: Authors' own calculations

* Grower prices are calculated by multiplying the price of walnut with 1.932

Generally, real prices of walnut showed an upward trend with fluctuations. In real prices, the rates obtained by intermediaries vary between 30.89% and 54.87% and the rates obtained by the growers range between 45.13% and 69.11% (Table 4).

Table 4. Walnut Marketing Margin With Respect to Real Prices in Turkey (2017=100)

Years	Grower* Prices (₺ kg ⁻¹)	Consumer Prices (₺ kg ⁻¹)	Marketing Margin	Growers Income (%)	Commissioner Income (%)
2003	22.25	38.97	16.71	57.11	42.89
2004	22.88	33.11	10.23	69.11	30.89
2005	23.15	36.74	13.58	63.02	36.98
2006	21.54	40.12	18.57	53.71	46.29
2007	22.87	44.40	21.54	51.50	48.50
2008	21.84	42.79	20.95	51.03	48.97
2009	20.00	45.77	25.76	43.70	56.30
2010	23.80	43.82	20.03	54.30	45.70
2011	24.26	46.67	22.41	51.98	48.02
2012	25.13	49.68	24.55	50.59	49.41
2013	24.25	52.61	28.36	46.09	53.91
2014	27.46	58.73	31.27	46.75	53.25
2015	31.13	68.97	37.84	45.13	54.87
2016	31.61	65.65	34.04	48.15	51.85
2017	30.83	61.74	30.90	49.94	50.06

Source: Authors' own calculations

* Grower prices are calculated by multiplying the price of walnut with 1.932.

In Table 5, grower and consumer chain indexes are deliberated with respect to the current prices of walnuts and their differences are compared with inflation rates with respect to years. As a result of this comparison, it was determined that the prices obtained by the growers in walnut remained above the inflation rate in 2005, 2007, 2010, 2012, 2014 and 2015. In these years, the prices were in favor of the grower and in other years, against the grower. When we examine the situation of the consumer in 2005, 2006, 2007, 2009, 2011, 2012, 2013, 2014 and 2015, the purchasing power of walnut decreased while it increased in other years.

Table 5. Shelled Walnut Grower and Unshelled Walnut Consumer Chain Indexes and Annual Inflation Rates With Respect To Current Prices in Turkey

Years	Grower Chained Index	Grower Index Difference	PPI	Consumer Chained Index	Consumer Index Difference	CPI
2003	100.00	-	13.90	100.00	-	18.40
2004	111.70	11.70	13.80	93.90	-6.10	9.30
2005	109.50	9.50	2.70	120.10	20.10	7.70
2006	102.00	2.00	11.60	119.90	19.90	9.70
2007	115.40	15.40	5.90	117.70	17.70	8.40
2008	105.50	5.50	8.80	108.60	8.60	10.10
2009	97.30	-2.70	5.90	108.30	8.30	6.50
2010	129.20	29.20	8.90	103.90	3.90	6.40
2011	108.50	8.50	13.30	118.30	18.30	10.50
2012	112.80	12.80	2.50	112.90	12.90	6.20
2013	103.70	3.70	7.00	110.60	10.60	7.40
2014	123.30	23.30	6.40	123.10	23.10	8.20
2015	122.10	22.10	5.70	123.60	23.60	8.80
2016	109.40	9.40	9.90	99.30	-0.70	8.50
2017	108.40	8.40	15.50	108.90	8.90	11.90

Source: Authors' own calculations

With respect to the signs identified in the model forecasted in relation to the supply function of walnut (shelled), there was an accurate intercourse between walnut production and walnut grower real price, agricultural worker fertilizer, real price periodicity and real price. It is determined that there is an inverse intercourse between the grower real price of pistachios, the grower real price of nuts and the real price of oil fuel. Again, it is seen that there is an accurate intercourse between walnut production and the real price of fertilizer and the real price of agricultural workers. The use of time series data can result in results that are contrary to economic theory in the signs of coefficient (Table 6).

Table 6. Walnut Supply Function Regression Analysis

LogWP	Coefficient		Standart Error	P (t)	P (F)
α	11.131	***	0.077	0.000	
WPP	0.028	***	0.008	0.000	
PPP	-0.018	***	0.003	0.000	
HPP	-0.008	**	0.004	0.029	
FP	0.289	***	0.059	0.000	0.000
LP	0.013	***	0.001	0.000	
DP	-0.037	*	0.020	0.057	
P	0.163	***	0.018	0.000	
RHO	-0.697	***	0.191	0.000	

*: %10, **: %5 and***: % 1 is significant in severity levels.

RHO: Adjusted Correlation Coefficient

The Durbin-Watson test was applied to the Walnut supply model, the problem of autocorrelation was identified and the regulation of autocorrelation was made. As a result, the Durbin-Watson statistic is 2,960 and it has been determined that there is a negative intercourse between the remains (RHO: -0.697) (Tablo 6).

R^2 value in the model is high (0.979) and with respect to the F test, the model forecasted for Walnut supply function was statistically significant at 1% ($p=0.000$) significance level. Independent variables such as walnut grower real price, pistachio grower real price and periodicity 1%, hazelnut grower real price 5% and oil fuel real price 10% are statistically important and other independent variables are found to be unimportant (Table 6).

Table 7. Walnut Demand Function Regression Analysis

LogWC	Coefficient	Standard Error	P (t)	P (F)
α	7.345 ***	1.004	0.000	
WCP	0.002	0.005	0.648	
PCP	-0.013	0.003	0.007	
HCP	0.001	0.002	0.616	0.000
NP	0.001 **	0.001	0.011	
NI	-0.001	0.001	0.684	
P	0.056	0.033	0.133	

*: %10, **: %5 and ***: % 1 is significant in severity levels.

With respect to the signs identified in the model forecasted on demand function of unshelled Walnut, there is an inverse intercourse between consumption of walnut and pistachio consumer real price and domestic income. It has been also determined that there is an accurate intercourse between the consumer real price and the consumer real price in walnut in unshelled hazelnut and the population and periodicity. With respect to economic theory; while an inverse intercourse between walnut consumption amount and real unshelled walnut consumer price is expected, a correct intercourse has emerged. Likewise, while an accurate intercourse was expected between national income and consumer real price of pistachio nuts, an inverse intercourse has emerged (Table 7).

Durbin-Watson test was applied to walnut demand model and no autocorrelation problems were found. In the model, R^2 value is high (0.961) and with respect to the F test, the model forecasted for unshelled hazelnut demand function was found statistically significant at 1% ($P=0.000$) importance level. Again, it was detected that the population of the Independent Variables was statistically significant at 5% importance level and that the other independent variables were unimportant (Table 7).

CONCLUSION

It has been determined that there is an increase in the number of walnut trees and walnut production over the years and a decrease in walnut yield. There has been an increase in domestic total walnut consumption and per capita consumption. Although revenue was not statistically significant in the predicted Walnut demand model, there was an increase in per capita income in Turkey. Unshelled walnut is an important input in the dessert industry. Therefore, it can be said that the increase in income increases consumption in other sectors where walnut is used, and indirectly increases the consumption of walnuts per capita. On the other hand, population growth directly increased the consumption of walnuts. Increases in consumption could not be met with domestic production, so imports increased over the years.

With respect to walnut demand and supply functions, supply elasticity (Se) 0.350 and demand elasticity (De) 0.097 were found. When $Se > De$, with respect to Spider Web theory, prices move away from the centre towards the environment and the movement increases with expanding fluctuations. With respect to elasticity coefficients, Walnut growers 'sensitivity to changes in prices is higher than consumers'.

In the marketing margin calculations, approximately half of the price paid by the consumer for one kg of walnut is received by the farmer in exchange for the shelled walnut equivalent to the unshelled walnut. This is an important ratio for the farmer and shows that the farmer has a significant profit from this product. Therefore, growers are more sensitive to imports and prices.

Conflict of Interest

The article authors declare that there is no conflict of interest between them.

Author's Contributions

The authors declare that they have contributed equally to the article.

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