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Factors affecting pistachio exports in Turkey, Iran and the USA

Erdal KARACAN[1], Rahmiye Figen CEYLAN[2*]

[1]Department of Agricultural Economics, Graduate School of Natural and Applied Sciences, Akdeniz University, Antalya, Turkey
[2]Department of Agricultural Economics, Faculty of Agriculture, Akdeniz University, Antalya, Turkey

Abstract

Agricultural trade is inevitable for all countries to maintain the dietary needs and requirements of people. With rising income and changing life preferences, oriental products had become important commercial products. Pistacia vera, L, or pistachio with its widely accepted name, is an important commercial for West-Mid Asia and its trade is economically promising to producer countries. With this research, it was aimed to search the factors affecting pistachio exports of three prominent producer countries that are Turkey, Iran, and the USA. Within a panel econometric framework, the potential for developing pistachio trade was analysed. Due to the findings for Turkey, it can be noted that the pistachio exporters should focus on developing contacts with close neighbourhoods to increase export revenue. For much of the cases, existence of trade agreements seemed to affect trade revenue positively. Besides, trade partners' income level or the population for the USA case seemed to be trade generating and improving factors. Therefore, the sector should focus on these circumstances for promoting pistachio production and trade.

Keywords: Pistachio, gravity model, trade policy

Introduction

Pistacia vera, L. is one of the oldest hard-shelled fruit originating from West-Mid Asia and geographic locations from Syria to Afghanistan. It is a multi-annual plant specific to desert lands of West Asia and Anatolia and it is tolerant to salinity and drought. It is planted from dioecious trees that are pollinated via winds and that can flourish in hot and dry summer and cold winter conditions. Trees of seven years old are expected to bear fruits and complete yield is retrieved from trees aging between 10 to 12 years (Ferguson et al., 2005). As its economic and nutritional importance is understood in time, Pistacia vera, L. (called as 'pistachio' hereafter) became widespread in different regions of the world (Ak, et al. 1999). However, it cannot be planted under all geographic conditions due to its specific climatic requests. Accordingly, there are few number of producer countries, despite rising demand.

Due to three-annual average values for 2015, 2016, and 2017 retrieved from the Food and Agriculture Organisation of the United Nations (FAO, 2018), 96% of pistachio is being produced in Iran Islamic Republic, the USA, Turkey, China and Syria. Due to 2017 data, Iran ranked the first around the world with 51%. The fruit is extremely important for Iranian agriculture and contributes considerably to Iranian economics (Aghdaie, 2009). Iran was followed by the USA with 24%. The fruit was brought to the USA from Iran in 1848 (Anonymous, 2017). The USA appeared as a significant competitor to Iran with evolving production, irrigation techniques, and rising production volume accordingly (Zheng, et al., 2017). Due to the Ministry of Agriculture of the USA (USDA), 98% of pistachio is being produced in the state of California. China ranks the third with 8% share after the USA and it was followed by Turkey with 7% (Kulekci, 2014).

Anatolia. However, the main reason of limited pistachio production in Turkey, in comparison with Iran and the USA, is the regional orientation. While it is planted more in dry, inclined lands in Turkey, where irrigation possibilities are limited, the plantation takes place more in plains under irrigation conditions in the competitive countries (Tiryaki, 2013). In other words, pistachio is considered as a compensative product for unproductive lands in Turkey (Anonymous, 2010).

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*Corresponding author e-mail: ceylan.figen@gmail.com

While residing in the genetic centre of pistachio, Turkey has a considerable potential with its wild tree abundance. Pistachio, which is called as Antep pistachio referring to the province in which it is abundantly planted, is widespread in the South-eastern

Besides, pistachio is a significant commercial product. Due to 2016 FAO data, value of global pistachio trade had reached to 3 billion US Dollars and the USA ranked the first with around 1 billion Dollars. The USA was followed by Iran this time and Turkey ranked the 8th with 66 million Dollars. From these figures, it was understood that Turkey falls pretty behind of its potential considering its stance in terms of production (FAO, 2018). This is partly due to domestic consumption. However, it is also notable that pistachio is a product that is re-exported for food industry. Therefore, re-exporter countries as Hong Kong, Germany, the Netherlands and Luxembourg have significant share, which are important importers as well (Anonymous, 2017). Turkish pistachio is mostly exported to Germany, Italy, the USA, the UAE, the Netherlands and Israel. Accordingly, Turkey seems to have contracts with re-exporter countries mainly.

The main objective of this study is to determine and measure the factors affecting and directing pistachio trade in order to provide insights to agriculture and trade policy makers. The pistachio trade of Turkey and its two main competitors, Iran and the USA, were analysed with an extended gravity model that explain trade flows between 2008 and 2017.

Material and Methodology

Material

Current research aims evaluation of trade potential respecting pistachio with utilisation of secondary data in the scope of gravity framework. Accordingly, pistachio exports of three significant countries (Iran, the USA, Turkey) to 10 trade partners were analysed for 2008 and 2017. Yet, the analysis period for Iran was 2008-2016 due to data availability. Partner countries were selected respecting their importance to the exporting country and data availability. The respective partners were demonstrated in the Table 1.

Table 1. Export partners

Turkey	Germany	Italy	USA	UAE	Netherlands
	Israel	Jordan	Belgium	Egypt	Lebanon
Iran	Hong Kong	Germany	India	Russia	Spain
	France	China	Lebanon	Italy	Canada
USA	Hong Kong	Netherlands	China	Germany	Italy
	Japan	Spain	Israel	Canada	Australia

The explanatory variables projected for this study were the amount of pistachio production, GDP (Gross Domestic Product), per capita GDP, exchange rate, CPI (Consumer Price Index), population and distance between countries. In addition, availability of trade agreements and the purpose of pistachio use were added to the extended gravity model as dummy variables. The secondary data were withdrawn from Turkish Statistical Institute, Ministry of Trade databases of Turkey, FAOSTAT and the World Bank. E-views 9 statistical package was used for panel econometric analysis.

Methodology

Product specific gravity model was used in this research. Gravity model is a successful econometric approach used to measure spatial relationships between variables. The main assumption resides upon the gravity theory itself (Antonucci and Manzocchi, 2006). Some cornerstones regarding evolution of the methodology are as following.

- The success of gravity model was proven in terms of explaining bilateral trade flows. The model appeared as a specific approach in international trade resolutions (Anderson, 2011).
- The estimation outputs of the model are accepted by researchers and policy makers (Bergstrand, 1985; Anderson and Van Wincoop, 2003).
- Econometric equations of the model are not strictly sensitive for different datasets. The model can be estimated respecting cross-sections, time series and panel data depending on the nature of the problem (Bun and Klaassen, 2002).
- The model enables data use without pre-estimation of various elasticity measures.

The standard gravity model involves two explanatory variables as GDP and geographic distance. GDP demonstrates the economic level of the countries, while distance is used as a proxy for transportation costs. Some additional continuous variables as population and exchange rates and dummy variables incorporating information about bilateral trade were added to equations within this study. The proposed extended gravity model is as following.

$$X_{ijt} = \beta_0 XKG_{it}^{\beta 1}\, GDP_{it}^{\beta 2}\, GDP_{jt}^{\beta 3} GDPPC_{it}^{\beta 4} GDPPC_{jt}^{\beta 5} EXC_{it}^{\beta 6} EXC_{jt}^{\beta 7} POP_{it}^{\beta 8} POP_{jt}^{\beta 9}$$
$$DIST_{ij}^{\beta 10} BORD_{ij}^{\beta 11}\, LANG_{ij}^{\beta 12} TA_{ij}^{\beta 13} KA_{j}^{\beta 14} e_{ij}$$

i= 1,…..,N1 and j=1,…….,N2

In this equation, i is the exporter and j is the importer country and t is time referring to years.

X_{ij}: The value ($) of pistachio exports of Turkey, Iran and the USA (2008-2017)

XKG_{it}: The amount (kg) of pistachio exports of Turkey, Iran and the USA (2008-2017)

GDP_{ijt}: GDP ($) of exporter countries and 10 trade partners (2008-2017)

$GDPPC_{ijt}$: Per capita GDP ($) of exporter countries and 10 trade partners (2008-2017)
EXC_{ijt}: Local currencies ($) of exporter countries and 10 trade partners (2008-2017)
POP_{ijt}: Population (number of heads) of exporter countries and 10 trade partners (2008-2017)
$DIST_{ij}$: The distance (km) between pistachio trade centres of exporter countries and the capitals of trade partners. Determined trade centres are Gaziantep for Turkey, Tehran for Iran and California for the USA.
$BORD_{ij}$: Dummy variable. 1 if there is a common border between exporter and its trade partner. 0, otherwise
$LANG_{ij}$: Dummy variable. 1 if native language of the exporter and its trade partner is the same. 0, otherwise
TA_{ij}: Dummy variable. 1 if there is a trade agreement between exporter and its trade partner. 0, otherwise
KA_j: Dummy variable. 1 if the importer country uses pistachio as a food industry ingredient mostly. 0, if the main purpose is consumption
e_{ij}: Random error

As mentioned earlier, while the time length was taken as 2008 and 2017 for Turkey and the USA, the time length was 2008 and 2016 for Iran due to data availability. Besides, it should be kept in mind that the full list of explanatory variables was provided disregarding the correlation potential between these variables. Yet, the exact equations were set forward within the analysis process.

Selection of the Analytic Technique

Data sets used for statistical analyses are described as cross-sectional, time series, and panel data (Gujarati, 2003). Panel data analysis differs from the other estimation techniques as it incorporates both cross sections and time dimensions simultaneously. Three different methods are used for panel data analysis (Arellano, 2003). These are Panel Least Squares (PLS), Fixed Effects (FEM), and Random Effects (REM) estimation procedures. PLS is suitable for situations where the constant of the regression is fixed for all cross sections and differing times. If the constant changes either for cross sections or for a time period, unidirectional FEM is used and two dimensional FEM is used for varying constant for both cross sections and time. REM estimation, on the other hand, incorporates cross sectional and time dependency data within the error term. The selection among these methods is made due to some specific procedures.

The time dependent cointegration relationship can be detected concerning unit root tests (Levin and Lin, 1992; Levin and Lin, 1993, Levin et al., 2002). After detection of a unit root in the series, there appears a need to test whether this time dependency can be resolved via cointegration. This situation is checked with a panel cointegration test (Pedroni, 1999).

There are also different methods to test the cross sectional dependency of the data. Breusch and Godfrey Lagrange multiplier test is used to decide whether the dataset can be estimated with PLS or random effects estimation incorporating the variation information on the error term (Breusch and Pagan, 1979; Godfrey, 1978, Akıncı et al., 2013). The decision between PLS and FEM estimation, which provides varying information within the solution set is made with Hausman test (Baltagi, 2005). Yet, E-views programme does not provide Lagrange multiplier statistic for the decision between FEM and REM. In exchange, Likelihood Ratio statistic, depending on the assumption that the model can be estimated with the joint panel process, can be used to differentiate between these methods (Baltagi, 2005). Within this research, Hausman cross-sectional dependency and Likelihood Ratio tests were used to decide between FEM and REM, and correlations and goodness of fit of the estimation were checked for PLS preference.

Findings

Prior to analyses, the properness of the variables was evaluated for all countries. The linear relationships between dependent and independent variables were investigated concerning cross-sectional and time characteristics of the data using correlation coefficients and covariance measures (Gujarati, 2003). Depending on this relationship assessment, the findings of the analyses were demonstrated and discussed below.

Model Findings for Turkey

Due to the results of deterministic tests, the pistachio exports of Turkey to 10 countries between 2008 and 2017 were estimated with joint panel methodology. Estimation results were demonstrated in Table 2. Yet, due to pre-recognised autocorrelation among dependent and independent variables, the model was estimated in logarithmic form.

Table 2. PLS Estimation findings for Turkey (10 countries*10 years)

Variable	Parameter Estimate	t-statistic	p-value
LXKG(-1)	0.199898	1.774583	0.079*
LGDP_J	1.101093	4.909919	0.000***
LEXC_I	0.186233	0.409136	0.683
LDIST	-1.196924	-3.303331	0.001***
TA	0.970195	3.240657	0.001***
KA	-1.005636	-2.198412	0.030**
C	5.276014	3.372783	0.001***
R^2	0.552	**F (p)**	17.110 (0.00)***
Y-mean	13.5027	**D-W statistic**	1.981

* 90%, ** 95% *** 99%

Therefore, the joint significance of factors affecting inter-period pistachio export revenue of Turkey was confirmed. The statistical significance of the model was understood from 55% goodness of fit and F-statistic. Besides, the Durbin-Watson

statistic with 1.98 value indicated that autocorrelation between variables was purified with logarithmic transformation.

The results indicated that 39% of pistachio export revenue was retrieved without any effect. In other words, the export of pistachio, which is a multi-annual fruit, can be retrieved irrespective of current production conditions or country specific effects. Besides, a 1% rise in the previous year's exportable amount results in 0.1998% rise in current export revenue. While the quantity exported in 2012 was 2328 kg, it rose to 3948 kg in 2013. There appeared an almost 70% rise. Therefore, with this rise, the export revenue of 2013 had risen by around 14%. This percentage based inference is related to the nature of variables. 1% rise in explanatory variables of logarithmic form, yields **β**% rise in the dependent variable (Benoit and Dubra, 2011). Also a 1% rise in GDP levels of importing countries leaded to 1.101% rise in pistachio export revenue of Turkey. This means that Turkish pistachio exports are related with the income level of the importing country. The value of the currency also affects pistachio trade. If the exchange rate of Turkey rises by 1%, Turkish pistachio export revenue rises by 0.186%. In other words, the devaluation of Turkish Lira against US Dollar affects pistachio export revenue positively.

The distance variable, representing the transportation costs within the gravity approach, affected pistachio exports inversely as expected. Existence of trade agreements is another aspect of the trade relationships. If there was a trade agreement between Turkey and its trade partner, Turkish export revenue seemed to rise by 0.97 Dollars. Yet, with this low impact, it can be noted that trade agreements have negligible effects on pistachio exports. The final dummy variable denoting the purpose of pistachio use indicated that if the importer country uses pistachio as a food industry input, Turkish exports decline, even if the impact is considerably lower. This is related to the acceptance of the product. Turkish pistachio as well as Iranian pistachio was accepted as of high quality and preferred to be used for direct consumption mostly (Erturk, et al., 2015). The situation for Turkey may be seen as contradictory when compared with trade partners indicated in Table 2. However, the declination observed through the parameter estimate is low.

Model Findings for Iran

When the pistachio export data of Iran was overviewed, it was recognised that the quantity of exports data was missing. Accordingly, the pistachio amount produced was used in exchange of the exported amount. Besides, the data set for 10 partners between 2008 and 2016 was considered as more suitable for difference estimation. Accordingly, the inter-period difference estimation within a panel framework was conducted and the results were indicated in Table 3.

Table 3. PLS Estimation findings for Iran with reduced variables (10 countries*8 years)

Variable	Parameter Estimate	t-statistic	p-value
DLX1	-0.354623	-2.593279	0.011***
DLGDP_J	0.614572	2.010567	0.048**
DLEXC_J	-0.235592	-0.337994	0.736
LDIST	0.017712	0.236609	0.813
KA	-0.109331	-1.244926	0.217
C	0.003492	-0.006005	0.995
R^2	0.213175	**F (p)**	3.467 (0.004)***
Y-mean	0.079019	**D-W statistic**	1.749

* 90%, ** 95% *** 99%

Even though the goodness of fit for the estimation was low with 21%, considering the data characteristics, it is acceptable. Besides statistically significant F value and Durbin-Watson, statistic representing the inexistence of autocorrelation, indicated that the outputs can be inferred.

The constant estimate had appeared as 0.0035 and it can be noted that 4% of the inter-years export revenue average (0.079019) was irrespective of other economic effects. It was important first to note that the difference between the previous two years' performance affected the current year's export performance. Therefore, if there appeared a 1% rise in export revenue between 2014 and 2015, export revenue of 2016 seemed to decline by 0.35%. The main reason behind this inverse relationship is the multiannual characteristic of the pistachio. Accordingly, a rise in the supply is followed by a declination following year. The relationship between the trade partner's income level and Iranian pistachio export revenue is positive as expected. When the national income of the importer country rises by 1%, Iranian export revenue rises by 0.61%. Yet, local currency depreciation of importing countries has inverse effects on the export revenue. 1% depreciation seemed to yield a 0.23% reduction in pistachio export revenue. However, the distance indicator seemed not to affect exports negatively, which is out of expectations. On the other hand, considering the purpose of use, trade contracts with countries using pistachio for the food industry seemed to reduce export revenue. From this finding, it can be inferred both for Turkey and Iran that more profitable trade is made with countries where pistachio is used for direct consumption.

Model Findings for the USA

Difference estimation was found as more applicable for the USA pistachio export revenue model like Iran. Accordingly, the export revenue was estimated against predetermined variables through joint panel methodology, and findings were demonstrated in Table 4.

Table 4. PLS Estimation findings for the USA with reduced variables (10 countries*9 years)

Variable	Parameter Estimate	t-statistic	p-value
DLXKG	0.881199	26.15977	0.000***
DLEXC_J	-0.474645	-0.985494	0.3273
DLPOP_J	5.566586	2.393612	0.019***
DLGDP_J	-0.720630	-1.831918	0.070*
LDIST	0.006562	0.115845	0.908
LANG	-0.029882	-0.748833	0.456
KA	0.013460	0.344043	0.731
C	0.001744	0.003385	0.997
R^2	0.8976	**F (p)**	102.701 (0.00)***
Y-mean	0.112035	**D-W statistic**	2.095695

* 90%, ** 95% *** 99%

While Hausman and Likelihood Ratio tests indicated that PLS estimation is more suitable for the data, insignificance of distance variable and low level of the constant led us to question the appropriateness of the model. It was decided to exclude distance and dummy variables from the equation and proceed with fixed effects estimation of export revenue against quantitative variables. Cross-sectional fixed effects estimation findings were indicated in Table 5.

Table 5. Cross sectional FEM estimation findings for the USA with reduced variables

Variable	Parameter Estimate	t-statistic	p-value
DLXKG	0.879812	24.52544	0.000***
DLEXC_J	-0.681673	-1.175903	0.243
DLPOP_J	4.954180	1.812496	0.073*
DLGDP_J	-0.958309	-1.839688	0.069*
C	0.066150	2.235060	0.028**
R^2	0.898714	**F (p)**	51.872 (0.00)***
Y-mean	0.112035	**D-W statistic**	2.035422

* 90%, ** 95% *** 99%

Therefore, the inter-year difference of USA pistachio export revenue rose by 0.879% with a 1% rise in the exportable amount. Importer countries' increasing population by 1% rise between years yielded a 4.95% rise in export revenue. Importer countries' local currency depreciation by 1% yielded a 0.68% declination in the USA export revenue. This finding is in conformity with international trade expectations. In addition, a 1% rise in GDP of importer countries seemed to result in almost 1% declination in the revenue. This can be considered as a change in trade partner, referring to the similarity of importer countries for all exporters. Following this general review, it was intended to overview cross country differences of the estimation. Accordingly, the estimator equations for 10 trade partners were produced and demonstrated in Table 6.

Table 6. Estimator equations for trade partners of the USA with cross sectional FEM

Country	Estimator Equation
Hong Kong	0.084158 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Netherlands	0.040447 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
China	0.106829 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Germany	0.075431 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Italy	0.053279 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Japan	0.068602 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Spain	0.053183 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Israel	0.101723 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Canada	0.043814 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J
Australia	0.034032 + 0879812* DLXKG- (-0.681673) * DLEXC_J + 4.954180* DLPOP_J - (-0.958309)* DLGDP_J

When cross-sectional impact was set apart, the constant inferred that 59% (0.112035) of the USA pistachio export revenue was irrespective of other factors. Yet, this constant estimate changes for different countries within the FEM framework. As an instance, the share rose to 75% for exports to Hong Kong. However, for the Netherlands, where the cross-sectional impact is negative, this share reduced to 36%. When the countries with negative impact were overviewed, it was understood that share of spontaneous exports to Italy and Spain was 47%, 39% for Canada, and 30% for Australia. On the other hand, countries with a positive impact were China with 95%, Germany with 67%, Japan with 61%, and Israel with 90%. In other words, exports to Hong Kong, China, Germany, Japan, and Israel seemed to be more spontaneous and less related to economic and sectorial fluctuations. However, economic fluctuations affect the Netherlands, Italy, Spain, Canada, and Australia more. Checking out these countries, it can be noted that the USA pistachio exports are maintainable with the European partners and with neighbours as Canada.

Results and Discussion

The main objective of this study was to undermine the advantages and disadvantages that peculiar pistachio (Pistacia vera, L.) exporters hold to contribute to trade planning. Accordingly, pistachio exports of Turkey, Iran, and the USA were analysed for 2008-2017 within a gravity model framework considering trade partners' role in exports.

The results indicated that rising income of importers leaded the rising export revenue for Turkey and Iran. However, the impact was reverse for the USA and this was partly attributed to the purpose of pistachio use and quality of the product. Turkish and Iranian pistachio is preferred more for direct consumption as they were attributed with higher quality and dense taste (Erturk, et al., 2015).

The theoretical expectation from the distance variable included in the model is that there is an inverse relationship between trade and distance, as it reflects higher transportation costs. This variable confirmed its negative effect in the model findings of Turkey. Turkey prefers and should prefer pistachio trade with countries in close proximity to abandon higher transportation costs.

The distance variable was excluded from the model for the USA as it reduced the explanatory power of the model. Yet, the variable did not meet theoretical expectations for Iran as well. In other words, the distance between trading partners or the transportation costs does not affect the pistachio trade of Iran. This could easily be attributed to product quality again that purchasers prefer Iranian pistachio without considering its costs. Besides, a research conducted for Iran to measure impact of transportation infrastructure provided confirmatory findings (Kolaei et al., 2017). It was understood from 2010 data that improved domestic transportation channels induced domestic demand in Iran. Yet, welfare of producers and exporters seemed to get affected inversely due to rising domestic demand. It can briefly be noted that reducing domestic price, leads reducing willingness to produce exportable amounts. When this finding was reconsidered respecting the outputs for Turkey, policy makers would be better off if they improve neighbourhood trade relations and invest in transportation facilities to enable cheaper and efficient trade under appropriate conditions. Besides, reduction of customs procedures might lead preferable outcomes as well.

The models for three countries were run with a year lag considering the multiannual nature of pistachio. The findings indicated that the export revenue and exported amount of product change in line for Turkey and the USA keeping time lag into consideration. However, as the production amount was used for Iran in exchange for the exported amount due to data availability, the situation should be read separately. Accordingly, the pistachio export revenue for Iran was affected by the difference of the previous two years' production amount positively.

Even though the population was considered as an indicator, it was excluded from the model for Turkey and Iran as it reduced the significance of the model. Yet, it was understood that a rising population of importing countries led to the rising export revenue of the USA. Accordingly, it can be suggested for USA to increase pistachio trade contacts with highly populated countries. The depreciation of Turkish Lira against US Dollar contributed to Turkish pistachio export revenue. For Iran and the USA depreciation of trading partners' currency seemed to inversely affect exports. This finding is in line with theoretical expectations.

The dummy variable referring to the existence of trade agreements had appeared as an export inducing factor for Turkish export market. However, this variable was excluded from the model of Iran and the USA due to loss of statistical power. Finally, the purpose of pistachio use had appeared as effective as well. If the importer focuses on using pistachio as a food sector input, export revenues of Turkey and Iran reduce. Accordingly, these countries, which produce a higher quality of pistachio that is preferred for direct consumption, should also focus on developing contacts with countries preferring pistachio as a food industry input. Therefore, increasing trade contacts with the European countries can be considered as a sector improving alternative for these countries.

Conclusion

Pistachio (Pistacia vera, L.) has been produced in a few number of countries and contributes to agricultural exports of those countries. Departing from low dispersion of the product around the world, this research focused on a comparative analysis of pistachio trade for three leading countries, namely Turkey, Iran and the USA. The pistachio trade of these countries were analysed with an extended gravity model for 2008 and 2017 to undermine the effects of cost items, specifically transportation costs.

The importance and value of pistachio for the concerned countries was confirmed with descriptive assement and findings of analyses. Yet, the contribution and effects of the product are different. Even if the USA has entered the market later than its two competitors, the country achieved a higher international reach with specific infrastructure and irrigation systems. American pistachio is considered as a food industry input. This was understood from the reverse effect of income level of importer countries. The purchasers prefer American pistachio for chocolate and confectionary industries irrespective of their income. Yet, Turkish pistachio has been preferred by neighbouring countries despite its quality, which was understood from negative impact of the distance variable representing transportation costs. From these analytical findings, there are some specific suggestions for Iran and Turkey. The producers, exporters and market authorities in Iran and Turkey should also focus on improving productive

technologies and increasing contact with food industry representatives of developed countries in order to increase market coverage. Finally, considering the importance of the fruit for agriculture and economies, product development and improving storage facilities should be taken as policy dynamics for all concerned countries.

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Author Contributions
The manuscript is was prepared out of Mr. Karacan' s accepted MSc thesis. Dr. Ceylan guided the thesis and manuscript preparation process.

Conflict of Interest
Authors declare no conflict of interest.

References
Aghdaie, S.F.A. (2009). Investigating effective factors on Iran's pistachio exportation, International Journal of Marketing Studies ,7(1): 462-473.

Ak, B.E., Kaska, N. and Acar I. (1999). 'Dünyada ve GAP bölgesinde Antep fıstığı üretimi yetiştirme ve işleme yöntemlerinin karşılaştırılması'. (Comparison of pistachio production and processing methods between the world and South-eastern Anatolia Region). GAP 1st Agricultural Congress, Şanlıurfa, Turkey, 19-28.

Akıncı, M. et al. (2013). 'Petrol fiyatları ile ekonomik büyüme arasındaki ilişki: OPEC ve petrol ithalatçısı ülkeler için zaman serisi analizi', (The relationship between oil prices and economic growth: Time series analysis for OPEC and oil importer countries) Atatürk University Journal of Social Sciences Institute, 17(1): 349-361.

Anderson, J.E. and Van Wincoop, E. (2003). Gravity with gravitas: a solution to the border puzzle. American Economic Review, (93): 170-192.

Anderson, J.E. (2011). The gravity model. Annual Review of Economics, vol. 3:133-160. Boston College and NBER.

Anonymous. (2010). Turkish Ministry of Education, 'Antep fıstığı yetiştiriciliği'. (Production of Antep pistachio) Ministry of Education Horticulture Unit Ankara, Turkey. retrieved from http://www.megep.meb.gov.tr/mte_program_modul/moduller_pdf/Antep%20F%C4%B1st%C4%B1%C4%9F%C4%B1%20Yeti%C5%9Ftiricili%C4%9Fi.pdf on 07.04.2018.

Anonymous. (2017). Turkish Ministry of Economics, Antep Pistachio. Exporters General Directorate of Ministry of Economics (Agricultural Products Directorate Sector Report), Ankara, Turkey.

Antonucci, D. and Manzocchi, S. (2006). Does Turkey have a special trade relation with the EU? A gravity model approach. Elsevier, Economic Systems 30 (2006): 157-169.

Arellano, M. (2003). Panel Data Econometrics, Oxford University Press, New York, pp. 231.

Baltagi, B.H. (2005). Econometric Analysis of Panel Data, ISBN 0-470-01456-3.

Benoit J-P. and, Dubra, J. (2011). Apparent Overconfidence. Econometrica 79(5):1591-1625.

Bergstrand, J.H. (1985). The gravity equation in international trade: Some microeconomic foundations and empirical evidence. Review of Economics and Statistics, (67): 474-481.

Breusch, T. and Pagan, A. (1979). A simple test for heteroscedasticity and random coefficient variation, Econometrica, 47(5) 1287-94.

Bun, M.J.G. and Klaassen, F.J.G.M. (2002). The importance of dynamics in panel gravity models of trade. UVA Econometrics Discussion Paper, No. 18. pp.17.

Erturk, Y.E., Geçer, M.K., Gulsoy, E. and Yalcin S. (2015). Antepfıstığı üretimi ve pazarlaması (Production and marketing of pistachio), Iğdır Univ. J. Inst. Sci. & Tech. 5(2): 43-62.

FAO, 2018. Food and Agriculture Organization (FAO) data retrieved from. http://www.fao.org/home/en/ on 01.07.2018.

Ferguson, L., Polito, V. and Kallsen, C. (2005). The pistachio tree; botany and physiology and factors that affect yield. Pistachio Production Manuel, 4th ed. Univ, of California Coop. Ext., Davis, CA, pp. 31-39.

Godfrey, L. (1978). Testing against general autoregressive and moving average error models when the regressors include lagged dependent variables, Econometrica, 46(6): 1293-1301.

Gujarati, D.N. (2003). Basic Econometrics, 4th edition, McGraw Hill, New York.

Kolaei, F K., Yekani, S.A.H., Mojaverian, S.M. (2017). 'Impact of improving transportation infrastructure on pistachios production competitiveness in Iran'. Journal of Agricultural Economics Researches, 8(4): 151-170.

Kulekci, M. (2014). The determination of profit efficiency in pistachio production; application of data envelopment analysis. Journal of Agricultural Faculty of Gaziosmanpasa University, ISSN:1300-2910: 94-103.

Levin, A. and Lin, C.F. (1992). 'Unit root test in panel data: asymptotic and finite-sample properties', Discussion Paper, 92-93, Department of Economics, University of California at San Diego (PDF) Panel Unit Root Tests: A Review. retrieved from: https://www.researchgate.net/publication/252756953_Panel_Unit_Root_Tests_A_Review on 14.08.2018.

Levin, A. and Lin, C.F. (1993). 'Unit root test in panel data: new results', Discussion Paper, 93-56, Department of Economics, University of California at San Diego. (PDF) Panel unit root tests: a review. retrieved from: https://www.researchgate.net/publication/252756953_Panel_Unit_Root_Tests_A_Review on: 14.08.20188.

Levin, A., Lin, C.F. and Chu, C.J. (2002). Unit root tests in panel data: asymptotic and finite sample properties, Journal of Econometrics, 108 (revise version of 1992's work): 1-24.

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors, Oxford Bulletin of Economics and Statistics, 61(1): 653-670.

Tiryaki, F. (2013). 'Antepfıstığı sektörü ve yaşanan sorunlar' (Antep pistachio sector and problems experienced), Panel report, Problems and Solutions from Production to Consumption of Antep Pistachio, TEMA Foundation. Istanbul. ISBN: 978-975-7169-71-0.

Zheng, Z., Saghaian, .S and Reed, M. (2012). Factors affecting the export demand for U.S. pistachios, International Food and Agribusiness Management Review (IFAMA), 15(3):139-154.