[Your Institution's Logo if desired]

An Analysis of International Raisin Trade:

A Gravity Model Approach

Bülent Miran[1], Ela Atış[1], Zerrin Bektaş[1], Ece Salalı[1], Murat Cankurt[2]

1. Ege University, TURKEY
2. Adnan Menderes University, TURKEY

Selected paper presented at the
57th AARES Annual Conference at The Sydney
Convention and Exhibition Centre in Darling Harbour,
Sydney, New South Wales, 5th-8th February, 2013
AARES 2013 conference website

This paper has been independently reviewed and is published by
The Australian Agricultural and Resource Economics Society
on the AgEcon Search website at http://ageconsearch.umn.edu/
University of Minnesota, 1994 Buford Ave
St. Paul MN 55108-6040, USA

Published 2013

AARES
AUSTRALIAN AGRICULTURAL & RESOURCE ECONOMICS SOCIETY

An Analysis of International Raisin Trade: A Gravity Model Approach

Bülent Miran[1], Ela Atış[1], Zerrin Bektaş[1], Ece Salalı[1], Murat Cankurt[2]

[1] Ege University, Faculty of Agriculture, Department of Agricultural Economics, Izmir, TURKEY
[2] Adnan Menderes niversity, Faculty of Agriculture, Department of Agricultural Economics, Aydın, TURKEY

An Analysis of International Raisin Trade: A Gravity Model Approach

The countries competing for the world Raisin Market are Chile, Greece, Iran, South Africa, Turkey, and the United States. Raisin is one of the top Turkish export products. Turkish raisin sector is facing an increasing competition in international markets. The aim of this work is to explain the magnitude of the trade flows for raisin from Turkey and other exporting countries to its main importing countries. This objective has been reached by establishing an appropriate econometric model derived from an extended form of the "Gravity Model". To apply gravity model, a panel data with the most important six exporters of raisin and their importing countries between the years of 1999-2008 were set up. Panel data models estimated with pooled ordinary least squares and fixed effects model under some diagnostic tests. Finally, some proposals and suggestions are developed for increasing the international competitiveness of the raisin production.

KEYWORDS: Raisin, Export Analysis, Gravity Model, Panel data, Turkey

1. Introduction

Trade occurs because of differences across countries in technologies (Ricardian theory), in factor endowments, differences across countries in technologies as well as continuous renewal of existing technologies and their transfer to other countries (Rahman 2004, Posner 1961 and Vernon 1966). Quoting from Dreze (1961) Mathur (1999) says that country size and scale economies are important determinants of trade Paas (2000). Quoting from Dreze (1961) Mathur (1999) says that country size and scale economies are important determinants of trade Paas (2000). International trade is an integral part of the total developmental effort and national growth of an economy. This is, in fact, a crucial instrument for industrialization while access to foreign exchange is essential for sustained economic development.

Among many studies using the gravity framework, a high percentage shares the research task of predicting trade potentials. On the other hand, several studies have analyzed the trade enhancing impact of preferential trading agreements. These studies predict the additional bilateral trade that would be a consequence of the economic integration of set of economies. Both the cross section and panel data approach has been used by these studies. The cross-section as also the panel data approach is mainly static and refers to a long run relationship.

In international trade, the gravity model was first introduced by Tinbergen (1962) and Pöyhönen (1963) mainly to account for the patterns of bilateral trade flows among the European countries. Since then, the gravity model has been used and increasingly improved in empirical studies of international trade flows. Linneman (1966) extended the model of Tinbergen to include other trade explanatory variables such as population, and more importantly, complementarity Kien and Hashimoto (2005), Armstrong (2007). Most familiar uses of the model relate to: the examination of bilateral trade patterns in search of evidence on natural (non-institutional) regional trading blocs; the estimation of trade creation and trade diversion effects from regional integration, and the estimation of trade potential Porojan (2000).

Erdem and Nazlioglu (2008) analyzed the determinants of Turkish agricultural exports to the European Union (EU) by estimating the gravity model for the panel of 23 trading partners in the EU covering the period 1996-2004. In this study, they found that Turkish agricultural exports to the EU are positively correlated with the size of the economy, the importer population, the Turkish population living in the EU countries, the non-Mediterranean climatic environment, and the membership to the EU-Turkey Customs Union Agreement while they are negatively correlated with agricultural arable land of the EU countries and geographical distance between Turkey and the EU countries. Hellvin and Nilsson (2000) examined to what extent there may be a bias in the trade flows between the major trading blocs: the EU, the NAFTA countries, and ASEM members. This paper aims to determine the role of EU in Turkey's trade flows by using the gravity model. Jayasinghe and Sarker (2004) have used an extended gravity model to investigate the trade creation and diversion effect of the North American Free Trade Area (NAFTA) on trade of six selected agricultural -food products from 1985 to 2000. Sayan (1998) evaluated the effects of Black Sea Economic Cooperation on regional trade flows via Gravity models. Karagoz and saray (2010) focused on estimating trade potential for Turkey using the gravity model approach. Bilici, Erdil and Yetkiner aimed to determine the role of EU in Turkey's trade flows by using the gravity model in addition to testing whether the Customs Union (of EU) that Turkey entered in 1996 made a deviation in Turkey's trade flows.

Turkey is a net exporter of grapes as well as the world’s sixth grape producing country behind China, Italy, U.S.A., Spain and France (http://faostat.fao.org). World grape production area according to the average for 2000 – 2010, has been realized in the area of 7 330 634 hectares and production varied depending on weather conditions and amount of grape production reached 65 719 453 tones, in the same period.

In 2010 grape production was 67.1 million tons with 7.1 million hectares of area in the world (http://faostat.fao.org). According to 2010 data, after Spain, France, Italy and China; Turkey ranks fifth, in terms of grape production area.

Turkey’s production area of vineyard with 535 000 hectares in 2000 with a shortfall of 10.68 percent in 2010 declined to 477 785 hectares. While the share of the vineyard production area in the total agricultural land area was %1.38 in 2000, it declined to %1.23 in 2010.

While the grape production amount was 3 600 000 tons in 2000, increased by the ratio of 18.19% and reached 4 255 000 in 2010. Turkey’s grape production amount in 2010 is shared for 52.87% as table grapes, 36.29% as dried grapes and 10.84% as wine grapes (http://tuik.gov.tr).

When the production is determined by region; in Aegean Region seedless raisin, in Marmara Region table grapes and wine grapes, in Mediterranean Region early grapes, in Central Anatolia and Southeast Anatolia Region wine grapes, must grapes, table grapes, seed dried grapes have been planted. When the raisin production in Aegean region is examined, the amount of the production with 76 100 hectares in 2000, reached 85 000 hectares with an increase of 11.70% in 2010.

While the amount of raisin production was 285 000 tons in 2000, by the percentage of 22.46% production increased to the amount of 349 000 tons in 2008, but declined to 248 000 tons in 2010. Turkey's raisin production is mainly concentrated in the Aegean Region, especially produced in Manisa, Turgutlu, Salihli, Akhisar, Menemen, Kemalpaşa, Çal and Çivril districts. As a commodity production in foreign trade, is produced in the provinces of Manisa, İzmir and Aydın, which are in Aegean Region.

The top six raisin exporting countries are Turkey at 212 268 tons, the United States at 157 840 tons, Iran at 134 059 tons, Chile at 63 661 tons, South Africa at 40 226 tons and China at 40 068 tons. In Turkey, a large part of the production of raisin is exported due to the lack of domestic consumption. Produced raisin is regarded 12 % for domestic consumption and stocks and 88 % for export in Turkey.

Turkey's raisin exports totaled 201 744 tons in 2000, than its total exports reached 212 668 tons with an increase of 5.41 percent and export value reached $417 598 from $196 885 with an increase of 112.10 percent.

The most important raisin export markets of Turkey in 2010 are United Kingdom, Germany, the Netherlands, Italy, France and Belgium (http://faostat.fao.org). While, Turkey's raisin imports totaled 1 505 tons in 2000, it increased 2 555 tons in 2010, then the value of imports increased from $1 464 to $4 808 in the same years. Major raisin imported countries of Turkey are, Uzbekistan, Greece, Japan and Egypt (http://faostat.fao.org).

2. Methodology

The gravity model has been applied to a wide variety of goods and factors of production moving across regional and national boundaries under different circumstances since the early 1940s Oguledo and Macphee (1994). This model originates from the Newtonian physics notion. Newton's gravity law in mechanics states that two bodies attract each other proportionally to the product of each body's mass (in kilograms) divided by the square of the distance between their respective centers of gravity (in meters). Latter on an astronomer, Stewart, and a sociologist Zipf transferred this law to the social sciences and attempted to apply it to spatial interactions, such as trips among cities, using the following specification:

( )

Where I_{ij} is number of trips between country i and country j; pop_i is population in country i, pop_j is population in country j; D_{ij} is distance between country i and country j;G is a coefficient. The gravity model for trade is analogous to this law. The analogy is as follows: “the trade flow between two countries is proportional to the product of each country’s ‘economic mass’, generally measured by GDP, each to the power of quantities to be determined, divided by the distance between the countries’ respective ‘economic centers of gravity’, generally their capitals, raised to the power of another quantity to be determined.”(Christie 2002:1). This formulation can be generalized to

where M_{ij} is the flow of imports into country j from country i , Y_i and Y_j are country i’s and country j’s GDPs and D_{ij} is the geographical distance between the countries’ capitals.

The linear form of the model is as follows:

$$Log(M_{ij}) = \alpha + \beta \log (Y_i) + \gamma \log (Y_j) + \delta \log (D_{ij})$$

This baseline model, when estimated, gives relatively good results. However we know that there are other factors that influence trade levels.

Most estimates of gravity models add a certain number of dummy variables that test for specific effects, for example being a member of a trade agreement, sharing a common land border representing the climatic and ecological similarities, speaking the same language and so on.

Assuming that we wish to test for p distinct effects, the model then becomes:

$$Log(M_{ij}) = \alpha + \beta \log (Y_i) + \gamma \log (Y_j) + \delta \log (D_{ij}) + \sum_{1p} \lambda s G s$$

In this paper, we would make an attempt to apply Gravity model in analyzing the international raisin trade pattern for major exporters. We developed a gravity model that econometrically designates the determinants of international raisin trade flows via panel data approach. With special reference to Turkey which is the leading country in production and export, we aimed probing the ways of increasing raisin export as well as expending raisin consumption for health benefits.

Classical gravity models generally use cross-section data to estimate trade effects and trade relationships for a particular time period, for example one year. In reality, however cross-section data observed over several time periods (panel data methodology) result in more useful information than cross-section data alone. The advantages of this method are: first, panels can capture the relevant relationships among variables over time; second, panels can monitor unobservable trading-partner-pairs' individual effects. If individual effects are correlated with the regressors, OLS estimates omitting individual effects will be biased. Therefore, we have used panel data methodology for our empirical gravity model of trade.

The simplest estimator for panel data is pooled OLS. In most cases this is unlikely to be adequate, but it provides a baseline for comparison with more complex estimators. If a panel data model is estimated using OLS, an additional test item becomes available and the Hausman test is applied. The test compares pooled OLS against the principal alternatives, the fixed effects and random effects models. In other words, the Hausman specification test is often used to test for fixed against random effects (the null). Which panel method should one use, fixed effects or random effects? One way of answering this question is in relation to the nature of the data set. If the panel comprises observations on a fixed and relatively small set of units of interest (say, the exporting countries), there is a presumption in favor of fixed effects. If it comprises observations on a large number of randomly selected individuals, there is a presumption in favor of random effects. The Breusch–Pagan test was used to see if simple pooled model or random effects model is adequate where the null assumes no random effects. For detecting heteroskedasticity, distribution free Wald test was used with the null hypothesis: the units have a common error variance. Variance inflation factors test (VIF) was applied to detect there is multicollinearity as well.

3. Data

The study covers a total of 6 main raisin producing countries. The countries were chosen on the basis of importance in international raisin export which constitutes about 90 % of the total world export. The countries covered are Chile, Greece, Iran, South Africa, Turkey and USA. For each of the exporting countries, data of main raising importing countries with their several characteristics such as GNP, population and some dummy variables between 1999 and 2008 were collected to form a 6 (countries) x 10 (years) x 150 panel data. Data for the years there was no raisin import by any importer were taken as missing value.

4. Empirical results

In this study, gravity model was used to determine the effect of factors such as distance and income which affect the export of the raisin. For implementation of the model, primarily; distributions of the countries which export raisin between the years 1999-2008, have been conducted. According to this distribution, Turkey, Iran, USA, Chile, Greece and South Africa, determined as the most important six countries exporting raisin. Then, data collected relating to the countries which create 90% of the countries to whom each of the countries' export raisin.

In this context, between the years 1999 – 2008, continuous and dummy variables were obtained from the countries which export raisin to the countries and compiled data of the country related to distance, exported volume of raisin, GNP of the importer country, GNP of the exporter country, population, neighborhood level, status of common language, common currency, whether it's an island or not and presence or absence of a connection with the sea.

For estimation of gravity model, panel data analysis method was used. With this purpose, the model prediction performed priorly by POLS (Pooled Ordinary Least Squares). This method may just the beginning for most conditions. However, it's being important in order to establish a ground for comparison to obtain more appropriate bets. The following table presents variable types used in gravity model and their descriptive statistics (Table 1) and export volume of raisin by countries (Table 2):

Table 1: Descriptive statistics for the variables used in the gravity model

Variable	Unit	Variable Type	Mean	Median	Minimum	Maximum
Volume of export	Thousand MT	Continuous	6377.93	2909.00	268.0	63301.0
Population	Individual (1000)	Continuous	80678.8	33095.0	1289.9	1337410
GNP of importer	Real per capita US$	Continuous	12833.1	15145.1	1059.3	28039.5
GNP of exporter	Real per capita US$	Continuous	8182.30	3653.08	838.6	22381.2
Distance	Km	Continuous	7948.91	8506.14	853.0	17228.3
Neighborhood	0/1	Dummy	0.0578	0.0	0.0	1.0
Common language	0/1	Dummy	0.1036	0.0	0.0	1.0
Common currency	0/1	Dummy	0.0697	0.0	0.0	1.0
Island	0/1	Dummy	0.2629	0.0	0.0	1.0
Economic cooperation	0/1	Dummy	0.1855	0.0	0.0	1.0
Connection with sea	0/1	Dummy	0.9223	1.0	0.0	1.0

3.1. Estimation results of Gravity Model

Panel data Gravity model has been built with typical variables and some related dummy variables and empirical exercises were done with Gretl 1.9.9. Estimations results of the gravity model is presented in Table 2.

Table 2: Estimation results of the POLS panel gravity model (Dependent variable- l_Raisin Exportation volume)

Variable	***Coefficient***	***Std. Error***
Constant	7.96574 ***	0.872928
l_Importer GNP	0.545711 ***	0.0568693
l_Exporter GNP	0.123372 ***	0.0385737
l_Distance	-1.02882 ***	0.0650643
l_Population	0.251173 ***	0.0311494
Neighborhood	-0.926717 ***	0.185124
Common Language	0.101064	0.123961
Common currency	-2.04978 ***	0.177178
Island	0.159311 *	0.0941684
Connection with sea	0.536494 ***	0.155413
Economic cooperation	-0.239146 ***	0.0919314
R-squared	0.400300	
Durbin-Watson	1.834004	
F(10, 569)	37.98076	pr=0.0000
Hausman[a]	0.256784	pr= 0.9364
Wald test for heteroskedasticity -Chi-square(6)[b]	0.559402	pr= 0.9970
Breusch-Pagan LM test[c]	1.99188	pr=0.158144

*** denotes the significance at 1% level, ** significance at 5%, * significance at 1%

[a] Null hypothesis: Pooled OLS model is adequate against fixed effects alternative

[b] Null hypothesis: There is no heteroskedasticity

[c] Null hypothesis: Pooled OLS model is adequate against the random effects alternative

pr refers to probability value that null hypothesis is rejected when it is less than 0.05

VIF indicated no collinearity with values less than 10.

3.2. Interpretation of Model Results

The results of the gravity model which are estimated by taking into account the data of raisin exporting countries between 1999 – 2008 years, were interpreted as follows: Raisin import is expected to increase, as importer countries' GNP increases. Model results have been appropriate with this expectation. This may simply imply that raisin producing countries can benefit from welfare increases in the importing countries. As is expected, raisin export increases as exporter countries' GNP increases. Model confirms this as well. Income elasticity of importing countries (0.54) is higher than that of exporting countries (0.12) which means that the change in income level of the importing countries is more effective on the raisin trade. In other words, in case of a simultaneous increase in worldwide income, supply of raisin might be below the demand which may give rise to an increase in raisin prices. As is expected, cross-national distance has a negative effect on the raisin trade. The ways used in the exportation of raisin should be analyzed and more appropriate/cheaper transportation systems must be found for the raisin foreign trade with far countries.

Raisin foreign trade increases as population increases. This points out that there will be a need for more volume of raisin in future since the world population grows continuously. The model shows that the countries which speak the same language may not choose each other in the foreign trade of raisin. Relatively closer exporters and importers may have a more raisin trade due to possibly lower level of transportation costs. Neighboring countries are not in a good trade relationship for raisin in contrary to expectation. Although to some extent there is a raisin trade among neighbor countries, the climatic and ecological similarities may adversely affect the raisin foreign trade.

The model revealed that common currency is not an advantage in raisin foreign trade. As in the case of Euro Zone, differences in purchasing power of Euro across the EU countries are a drawback rather than an advantage.

Countries which have a connection with sea tend to have more raisin import. Similarly whether a country is an island brings together more raisin import. This is possibly due to relatively lower transportation costs by sea line.

The model disclosed that raisin trade volume is less among the countries which are in the same economic cooperation. The fact that most of the raisin producing countries is not in the same economic cooperation with importing countries may be the reason.

4. Conclusion

Raisin is one of the most important items of Turkish export. Therefore analyzing the international trade of raisin is of great importance. In fact, this analysis holds significant clues not only for Turkey but also all the other countries exporting raisin. For this purpose a gravity model with panel data was estimated. The gravity model yielded results in line with theoretical expectations which are the basis for coping with competition in international market.

Increase in foreign trade will increase the welfare of raisin exporting countries primarily. For the importing countries, this will give rise to an opportunity of using the trade bridge already built for the products they produce.

It appears that exporters of raisin may positively be affected by the worldwide increase in welfare. Taking into account that there is a continuous increase in welfare of the world over time, a sustainable export increase awaits the raisin exporting countries. Similarly uninterrupted increase in population will contribute to the sustainability of the countries' export of raisin. Cross countries distances negatively influence the raisin export. In other words, countries that demand raisin would like to import it from relatively closer raisin producing countries in order to minimize transportation costs and duration. Exporters should focus into the closer importers of raisin, develop some attractive pricing strategies or put different products on the market such as organically grown raisin. Increasing the possibilities of transporting via sea lines will bring extra advantages to increase raisin export.

For a successful competition in the raisin market, exporters also should know that markets change every few years. Technology, globalization, privatization, lifting of the trade barriers and softness in import/export regulations are the major factors, which affect international trade.

References

1. Armstrong S (2007) Measuring Trade and Trade Potential: A Survey, Asia Pacific Economic Papers, 368, Australia-Japan Research Centre.

2. Bilici O, Erdil E, Yetkiner IH (2008) The Determining Role of EU in Turkey's Trade Flows: A Gravity Model Approach, Working Paper no: 08/06 October.

3. Christie E (2002) Potential Trade in Southeast Europe: A Gravity Model Approach, Working Paper, The Vienna Institute for International Economic Studies-WIIW downloaded on 14 March 2002.

4. Dreze J (1961) Leo Exportation Intra-CEE en 1958 et al Position Belge', Recherches Economiques de Louvain (louvin), 27, 7171-738.

5. Erdem E, Nazlioglu S (2008) 18th International Conference of the International Trade and Finance Association, May 22, meeting at Universidade Nova de Lisboa, Lisbon, Portugal

6. Hellvin L, Nilsson L (2000) Trade Flows Between Trading Blocs: The Case of the EU's Trade with Asia and NAFTA, Swedish Network for European Studies in Economics and Business, Discussion Paper, http://www.snee.org/filer/papers/36.pdf.

7. Jayasinghe S, Sarker R (2004) Effects of Regional Trade Agreements on Trade in Agrifood Products: Evidence from Gravity Modeling Using Disaggregated Data, Working Paper No. 374, Center for Agricultural and Rural Development, Iowa State University.

8. Karagoz K, Saray MO (2010) Trade Potential of Turkey with Asia-Pacific Countries: Evidence from Panel Gravity Model, International Economic Studies Vol. 36, No. 1 (New Issue), Spring & Summer pp. 19-26.

9. Kien NT, Hashimoto Y (2005) Economic Analysis of ASEAN Free Trade Area By Country Panel Data, Discussion Paper No. 05-12, Osaka School of International Public Policy, Osaka University, Osaka, Japan.

10. Mathur SK (1999) Pattern of International Trade, New Trade Theories and Evidence from Gravity Equation Analysis', The Indian Economic Journal, Vol. 47, N0.4: 68-88.

11. Oguledo VI, Macphee CR (1994) Gravity Models: A Reformulation and an Application to Discriminatory Trade Arrangements. Applied Economics 26: 107-120.
12. Paas T (2000) Gravity Approach for Modeling Trade Flows between Estonia and the Main Trading Partners', Working Paper, No. 721, Tartu University Press, Tartu.
13. Posner MV (1961) International Trade and Technical Changes, *Oxford Economic Papers,* No. 13: 323-341.
14. Pöyhönen P (1963) A Tentative Model for the Volume of Trade Between Countries, Weltwirtschaftliches Archiv, 90, 23-40.
15. Rahman M M, (2004), The Determinants of Bangladesh's Trade: Evidences from the Generalized Gravity Model, The Economic Society of Australia's 33 rd Conference of Economists 2004, The University of Sydney, NSW 2006, AUSTRALIA.
16. Sayan S (1998) Could Regional Economic Cooperation Generate Trade Creation and Trade Diversion Effects without Altering Trade Policies of Members? Preliminary Results from a Gravity Application to BSEC, Discussion Paper No. 98-10, Bilkent University.
17. Tinbergen J (1962) An Analysis of World Trade Flows, J. Tinbergen (ed.): in Shaping the World Economy, New York: The Twentieth Century Fund.
18. Vernon R (1966) International Investment and International Trade in the Product Cycle Quarterly Journal of Economics, No.80: 190-207.
19. Zhang J, Kristensen G (1995) A Gravity Model with Variable Coefficients: The EEC Trade with Third Countries, Geographical Analysis, Vol. 27: 307-20.
20. http://faostat.fao.org
21. http://tuik.gov.tr

Acknowledgements

This article is based on a research project funded by The Scientific and Technological Research Council of Turkey (TOVAG 110-O-283). We extend our thanks to the Council.