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Competitiveness of Greek virgin olive oil in the main destination markets

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Abstract

Purpose – The purpose of this paper is to analyze the competitiveness of the Greek virgin olive oil in the main destination markets (German, Italian, UK and US market).

Design/methodology/approach – In order to achieve the aim, in the first stage the Revealed Comparative Advantage (RCA_2) Index was employed showing that Greek virgin olive oil has a comparative advantage over the other suppliers (mainly Italy and Spain) in the markets under examination. In the second stage, the estimations of an import demand system for each market were estimated.

Findings – Results demonstrate clearly the competitive advantage of Greek virgin olive oil in the German market but not so clear in the rest of the markets. A strategic shift to export high-quality branded virgin olive oil instead of bulk seems necessity, in order the Greek virgin olive oil to dominate to the international markets.

Originality/value – Though there are similar works, especially for Spanish olive oil, there is no analogous research work for the Greek olive oil.

Keywords Competitiveness, Greece, Trade, Olive oil, AIDS model, Balassa index

Paper type Research paper

Introduction

Traditionally, olive oil is produced in the Mediterranean basin and traded by Mediterranean countries. According to International Olive Council (International Olive Council (IOC), 2016), more than 92 percent of the world olive oil production is concentrated in these countries with 85 percent being produced by the EU Mediterranean member states. In 2016, 98.9 percent in terms of cultivated area for olive oil production, in the EU-28, was concentrated in Spain, Italy, Greece and Portugal (Eurostat, 2016) As it was expected, the European Union's olive oil production leads the world market (around two million tons of olive oil). However, there are also some other major producers around the Mediterranean Sea, such as Tunisia, Turkey, Syria and Morocco.

For the six-year period (2008-2014), Spain is the undisputed leader in the olive sector covering almost 44 percent of global production. Specifically, Spain managed to double its olive oil production from 0.6 million tons in 1990 to 1.2 million tons in 2014 through the introduction of new techniques in cultivation of olive trees. For the same period Turkey, Tunisia, Morocco and Syria almost doubled their production, increasing their market share in global production by 25-35 percent (National Bank of Greece, 2015). In contrast, market share of Italy and Greece has been reduced from the previous decade from 23 to 14 percent for Italy and from 14 to 11 percent for Greece. Generally speaking, decoupling support for olive oil producers as initiated by the new CAP 2014-2020 is expected to lower production rates in the EU Mediterranean countries and, thus, increases the imports from non-EU Mediterranean countries such as Turkey, Morocco, Tunisia and Lebanon. Greece is the third largest producer of olive oil in the world (11 percent of total volume production), coming after Spain (40 percent) and Italy (14 percent). As much as 70 percent of all its production is extra virgin olive oil (International Olive Council, 2012).

Olive oil has been consumed mainly by the producing countries. Between 1990 and 2015, the Mediterranean countries have an average share of about 79.4 percent of the worldwide

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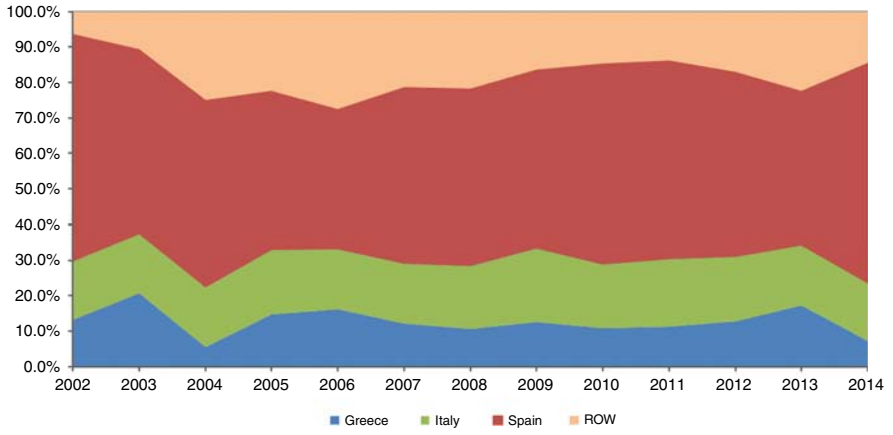
olive oil consumption with EU countries being the main consumer (average share of 83.8 percent of the total Mediterranean countries olive oil consumption) (IOC, 2016). Spain, Italy and Greece continue to account almost half of world olive oil consumption. In recent years, the increasing popularity of the healthy Mediterranean diet, promoting cooking with olive oil instead of other fats and oils, has grown the olive oil consumption faster in non-traditional, i.e. non-producing countries compared to Mediterranean countries. Despite this evolution, Spain, Italy and Greece are not only the main world producers of olive oil, but also the largest exporters as well. These countries alone accounted in 2014 for 66.8 percent of olive oil exports in terms of value (Figure 1). Also, the consumption growth rates between Germany and the UK are different due to the market structure in these markets. In contrast to Germany where the presence of discounters is dominated (Flatau *et al.*, 2007), in the UK the domination of non-discount supermarkets shows a different purchasing behavior with the German market importing directly and the UK market using more importers or brokers (Flatau *et al.*, 2007; Garcia Martinez *et al.*, 2002) influencing the demand for imported olive oil.

Within the EU's market, Italy and to a lesser extent Portugal act at the same time as exporters and importers of olive oil which implies arbitraging activities, i.e. agents in these countries finding it profitable to re-export, after blending it with other oils and bottled it. Almost 80 percent of the EU's virgin olive oil is imported to Italian market (Anania and Pupo d' Andrea, 2008).

Greek olive oil is of superior quality, due to the fact that 80 percent of production is extra virgin olive oil (compared with 65 percent in Italy and 30 percent in Spain). The relative importance of Greek exports substantially increased after its adhesion to the EU in 1981 accounting for almost 28 percent of total EU's imports, on average. As a consequence of these changes, in the case of Tunisia, there has been a progressive loss of its relative importance within EU market. Overall, Greek producers have failed to benefit from the global growth in olive oil demand, mainly due to structural problems such as the high cost of production, small size of farms and high milling cost. As far as the standardization of quality control, which is vital for the promotion of premium olive oil, the fragmented nature of Greek olive oil cooperatives does not facilitate it. Also, the small size of bottling and labeling companies does not allow for the successful promotion of branded products. More specifically, Greek exporters lost market share in both: the important Italian market, comprising the export of olive oil in bulk form (covering 17 percent of Italian imports during 2011-2014, compared with 33 percent



Note: ROW means "Rest of World"
Sources: Eurostat; Authors' calculations

Figure 1.
Evolution of world olive oil exports

during the 1990s) and the international market for branded olive oil (4 percent market share, compared with 6 percent during the 1990s), which is dominated by Spain and Italy, with the gradual entrance of new players, e.g. Tunisia and Portugal.

Overall, the increased consumption as well as the recent policy developments in olive oil trade flows between producers and non-traditional consumers stress the importance of identifying the competitiveness of the Greek virgin olive oil and also to estimate the nature of the price competition between Greek virgin olive oil and its main competitor virgin olive oils in the same market. Evidence is provided from the examples of Italy, Germany, the UK and the USA because they are among the most important consumers of Greek virgin olive oil. Within this framework, this paper is organized in five sections: the next section gives a closer look on the evolution of Greek exports of virgin olive oil focusing on Germany, Italy, the UK and the USA which are the main market destinations. The competiveness of the Greek virgin olive oil is estimated by applying the Balassa index which is described in the third section. In the next section, the Almost Ideal Demand System (AIDS) is presented which was employed in order to estimate the nature of the price competition within each market. The empirical results are present for each market in the fourth section. Based on them, the fifth section discusses further opinions for raising the competiveness of the Greek virgin olive oil.

Analysis of Greek virgin olive oil exports

The most proper way, to examine the main olive oil export destination markets, is to estimate separately the Greek bulk and the branded olive oil exports. As it happens with most databases, Eurostat records the value and quantity of total exported virgin olive oil and thus it is essential to provide further information on this issue which is of major importance for the olive oil sector.

According to National Bank of Greece (2015), in 2012, the global market for branded olive oil was estimated at about 0.9 million tons. Spain and Italy covered up the highest percentages of branded olive oil (approximately 35 percent), while Greece was laggard (among the main olive oil producers), with a very low percentage (approximately 6 percent).

The main export destinations of Greek virgin olive oil are mainly Italy and then Spain, Germany, the USA and the UK (Figure 2). The percentages which Italy covers up were too high, with a market share of 73.73 percent of the total exported value and 77.70 percent of the total exported quantity. Germany is the next most important market destination importing almost 4.15 percent of the total exported value and 3.44 percent of the total exported quantity. Greece is the second supplier of virgin olive oil in the Italian market that covering on an average of 26 percent of the total virgin olive oil demand, third supplier in the market of Germany and the UK, and finally the fourth supplier in the US market following Tunisia which is the third one (Figure 3).

At this point it should be stressed that concerning the Greek exports of olive oil to Italy, the average percentage of quantity was higher than those of value, indicating that the marketing value was lower compared to other export markets. A remarkable fact is that the same

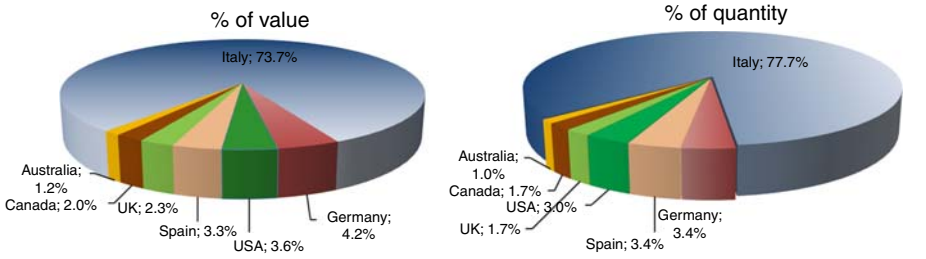


Figure 2.
Average percentages (percent of value and quantity) of the main Greek virgin olive oil export destination markets for the period 1995-2014

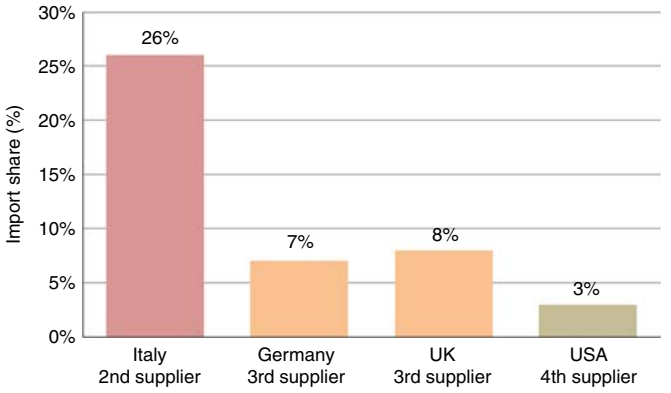


Figure 3.
Top markets of Greek virgin olive oil

phenomenon occurred with Greek exports in Spain. Thus, the question is why the two largest global producers traded olive oil from Greece. Many will support that the answer is complicated and depends on many factors, such as that Greece does not have an organized plan of brand name strengthening, the eruption of financial crisis and its effects in all sectors, the broken reliability of Greece's partners, etc. All these reasons are acceptable and certainly contribute to perpetuating this situation. Although the key answer is that agents in these countries finding profitable to re-export after blending and bottling (Anania and Pupo d' Andrea, 2008).

Italy is considered as the strongest exporter of virgin olive oil. The paradox is that while Italy is the second largest olive oil producer globally, it imports large quantities of bulk olive oil from Spain, Greece and third countries (usually Tunisia, Turkey and Morocco). Italian olive oil processing companies traditionally import bulk olive oil from different origins, qualities and blend it producing a branded product, which re-exports it to international markets as an Italian product. These large international companies have used this strategy to dominate the international market of branded olive oil. This strategic plan is to combine the Spanish comparative advantage of large production quantity, the Greek comparative advantage of high-quality olive oil (virgin and extra virgin olive oil) and the Italian extensive distribution networks and strong brand name.

In the German market, during the last 20 years the olive oil consumption has almost sextupled. In 2012, Germany ranked in the 11th position on the global ranking of olive oil consumption (1.9 percent of global consumption). Thus, Germany is one of the most important market destinations for Mediterranean olive oil producers. At European level, Germany ranked in the 6th place among the EU-28, and in the 1st place among the EU-28, excluding producer countries. The largest percentage of olive oil imports in Germany was covered up by the category of virgin olive oil. The German market is dominated by Italian imports followed by Greek and Spanish olive oil exports with similar but smaller market shares. Therefore, Germany is an important export target-market, where the largest quantity of exported Greek virgin olive oil is branded resulting in higher profits for the country.

In 2011-2012, the UK ranked in the 7th place among the EU-28, and in the 2nd place excluding EU olive oil producer countries. The most important British market remains London and the surrounding area of Southeast England. For the UK, the picture is slightly different. Italian imports are again present but equally important as imports from Spain. From a commercial point of view, the importance of these regions is due to the population density, the large number of foreigners (originating from Mediterranean countries) and the high per capita income. From 2010 onwards, concerning the British imports from Greece, a gradual but significant decrease was recorded. Specifically, in 2010, the Greek market

share was 4.24 percent (in terms of quantity) and 4.97 percent (in terms of value). In 2014, the respective percentages shrank at 2.28 and 2.96 percent, respectively. It is noticeable that a large amount of Greek olive oil cannot be recorded because it is imported through Italy and big retail chains sell as a private label product.

Olive oil consumption and imports have grown rapidly in the USA, tripling over two decades. Virgin oil accounts for much of the growth that is driven by higher incomes and changes in information about the role of olive oil in a healthy diet. Quantities consumed of particular types and import sources of olive oil are sensitive to relative prices (Xiong *et al.*, 2013). The USA has always imported most of its olive oil from Italy and Spain; imports from Greece and Tunisia have helped meet the rising demand in this market, there is an extremely small (but growing) percentage of consumers that are willing to pay quite dearly a top quality extra virgin olive oil. According to Xiong *et al.* (2013), EU virgin olive oil demand would rise by more than 20 percent with an increase in income of 10 percent. In contrast, the consumption of non-virgin oil has no statistically significant response to an increase in personal income.

Competiveness of Greek virgin olive oil

While theories describing the idea of comparative advantage have been developed, an important question that arises in this context was how to apply this idea in order to determine the comparative advantage of countries in real world. The issue was arranged with the development of Revealed Comparative Advantage (RCA) index. The concept of RCA is grounded in conventional trade theory. The original RCA index was formulated by Balassa (1965, 1989). However, before Balassa introduced his famous RCA index in 1965, Liesner (1958) had already contributed to the empirical literature of RCA. In this sense, Liesner's (1958) study is the first empirical study in the area of RCA. The proposed RCA simple measure by Leisner is as follows: $\mathrm{RCA}_1 = X_{ij}/X_{nj}$ where X represents exports, i is a country, j is a commodity (or industry) and n is a set of countries (e.g. the EU). A comprehensive/advanced measure of RCA was later presented by Balassa (1965). This is a widely accepted and afterwards modified measure of RCA in the literature. It is expressed as follows:

$$\mathrm{RCA}_2 = \frac{X_{ij}^k/X_{ij}^t}{X_{nj}^k/X_{nj}^t} = \frac{X_{ij}^k/X_{nj}^k}{X_{ij}^t/X_{nj}^t}$$

where X represents exports, k the product under examination, i the country under examination (Italy, German, the USA and the UK in our case), j the trader country (i.e. Greece), n the group of countries (as basis for comparison; in our case the group is EU-28) and t the set of commodities (or industries; in our case, total agricultural exports). In practice, this is a commonly accepted method to analyze trade data. The Balassa index tries to identify whether a country has a "revealed" comparative advantage rather than to determine the underlying sources of comparative advantage. However, since first suggested by Balassa (1965), the definition of RCA has been revised and modified such that an excessive number of measures now exist. Some studies measure RCA at the global level (see e.g. Vollrath, 1991), others at a sub-global/regional level (see Balassa's original index), while some others evaluate the measurement as bilateral trade between two countries or trading partners (see e.g. Dimelis and Gatsios, 1995). RCA_2 measures a country's exports of a commodity (or industry) relative to its total exports and to the corresponding exports of a set of countries, e.g. the EU. A comparative advantage is "revealed", if $\mathrm{RCA}_2 > 1$; the greater the index, the stronger the comparative advantage. If RCA_2 is less than unity, the country is said to have a comparative disadvantage in the commodity/industry; the smaller the index, the greater the disadvantage.

Following the contributions by Balassa, the present empirical analysis is based on the measurement of RCA_2. Since we are interested in the competitiveness of Greek virgin olive oil within a European context, we calculate the RCA_2 presented before with respect to the EU-28 (Figure 4).

According to the results, the comparative advantage of the Greek virgin olive oil is stronger than the two main competitors (Italy and Spain) in all main exports destinations. Specifically, in the Italian market, during the examined time period, the Greek competitiveness presented intense fluctuation. Moreover, in 2014, the index noted an extreme reduction that did not affect the Greek olive oil enterprises; on the contrary, it should serve as trigger for searching new alternative markets instead of Italy. The Greek olive oil export businesses' strategy should not focus on the export of large olive oil quantities in bulk, but export branded olive oil in order to penetrate new, more profitable export destinations.

Between 2001 and 2014, in German market, Greece was the strongest competitor followed by Italy and Spain. More specifically, the competitiveness index has increased over three times. This increase should mobilize Greek companies to invest in this market and to awake them in order to avoid discounts on marketing price. In the US market, Greece was the strongest competitor, but Greek olive oil competitiveness remained stable at low levels. The USA is a promising market for Greek branded olive oil exports. Even if between 2008 and 2011 the Greek competitiveness showed a downward slope, recovering after 2011 as a result of investments concerning the standardization of quality, taking into account that US market is classified in the profitable export markets.

On the other hand, in the UK's market, Greece was less competitive. In 2002, the extreme increase of the competitiveness index was rather unexpected and could not be justified. It would be very interesting and yet impossible to know the reason for this increase. However, from 2002 onwards, there has been a notable decrease, which, from 2008 to 2014, has been stabilized at a relatively low index value.

Ultimately, Greek virgin olive oil enterprises should give emphasis to the index results and try to improve them, primarily in more profitable markets. Greece needs to adopt a comprehensive marketing plan, in order to realize high exports in terms of value and quantity, in markets where virgin olive oil is exported as branded.

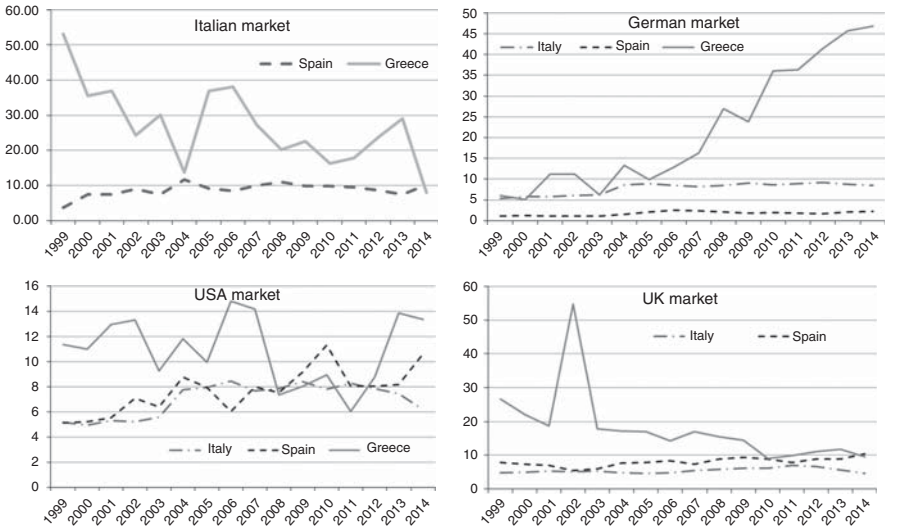


Figure 4.
Evolution of the RCA index for the main export markets of the Greek virgin olive oil

Model specification

The early literature of the trade modeling was mostly concerned with individual countries and large aggregates of commodities due to the fact that researchers were interested in predicting gross trade flows and evaluating the impact of exchange rate fluctuations on balance of payment. However, moving the interest of empirical research on analyzing intervention policies and competitiveness of different exporters, the methodologies shifted toward microeconomic foundations.

The Armington trade model was one of the most popular model that was used as a vehicle in the empirical trade analysis (among others Babula, 1987; Penson and Babula, 1988; Duffy *et al.*, 1990). The Armington model provides an insight in the international trade theory, providing a way to account the fact that commodities are differentiated by place of origins. Thus, this model allows imperfect substitution among goods from different origins. However, this model suffers from the restrictive assumptions of a constant elasticity of substitution, and homotheticity which may lead to biased parameter estimates (Alston *et al.*, 1990; Winters, 1984)

Over the last 20 years, a wide range of solutions has been implemented to overcome the weaknesses of the Armington model. More flexible functional forms for estimating demand systems became available and extensively used in the domestic demand analysis. Hence, following the seminal paper of Winters (1984), a long list of econometric studies was published, dealing with the estimation of import demand models by geographical sources using flexible functional forms such as AIDS, Rotterdam, translog, generalized Leontief and normalized symmetric quadratic functional forms, etc.

The AIDS model of Deaton and Muellbauer (1980) is one of the widely used models. It represents a flexible compete demand system and it does not require the additivity of the utility function. It satisfies the axioms of choice exactly and under certain conditions aggregates perfectly over consumers. de Gorter and Meilke (1987) and Alston *et al.* (1990) are among the first researchers that used the AIDS specification in the context of estimating source-differentiated demand for imported commodities. Although, all imports of commodities, considered in their study, are aggregated into a single commodity, the common assumption of weak separability between imported and domestic demand is relaxed. In most of the studies, it is usually assumed that the demand for imported good is separable from that coming from the domestic production (Lin *et al.*, 1991; Honma, 1993; Yang and Koo, 1994). According to Yang and Koo (1994), it is difficult if not impossible to construct a data set with imported values and domestic prices. This is especially so when the marketing channels are different between import and domestic goods. Thus, this study assumes separability between domestic and import virgin olive oil, especially for the markets of Italy and Spain that both are producers of virgin olive oil.

In the second stage, the value of total imports of a good (in our case olive oil) is distributed among different supplier countries to obtain the corresponding market shares. Taking into account this two-stage procedure, as well as the separability hypothesis, the import demand function of a specific product can be expressed as a function of imported prices from the most important origins and the total imports' value of the product.

Given that the objective of this paper requires that the model allows us to differentiate among several origins, we follow Deaton and Muellabauer's (1980) model which was employed to explain how the total import volumes of virgin olive oil for a specific market are distributed among the main suppliers. The first time that this model was employed as a vehicle in the empirical trade analysis was by Winters (1984) and was formulated in its budget share form:

$$s_{it} = a_i + \beta_i \log \left(\frac{m}{P}\right)_t + \sum_j \gamma_{ij} \log p_{jt} \tag{1}$$

with P being the price index:

$$\ln P = a_0 + \sum_i a_i \log p_i + \frac{1}{2}\sum_j \sum_i \gamma_{ij} \log p_j \log p_i \quad (2)$$

where s_{it} represents market share of the ith country on total county's imports of virgin olive oil for time t; m the total value of imports for virgin olive oil for each destination market; and p_j the unit value of imports coming from county j. The AIDS model in Equation (1) is non-linear due to the non-linear price index in Equation (2). To avoid the non-linearity, Deaton and Muellbauer (1980) proposed the use of Stone price index specified as follows:

$$\log P = \sum_i s_i \log p_i \quad (3)$$

The budget shares (s_i) that are used as depended variables in Equation (1) are also used as independent variables in the aggregate price calculation (Equation (3)). Thus, to avoid simultaneity bias, following the study of Eales and Unnevehr (1988), lagged budget shares (s_{it-1}) are used to compute Stone's price index (Equation (3)). However, a Wu-Hausman endogeneity test is performed to determine whether expenditures may be endogenous. If endogenous expenditures are correlated with the error terms, estimates will be biased and inconsistent. Let the expenditure variables, $\ln(m/\log P)$ in the AIDS model be approximated by the equation:

$$\ln\left(\frac{m}{\log P}\right) = c_i + \sum_j g_{ij} \ln(p_{ijt}) + h_i \ln(\mathrm{CPI}_t) + f_i(\mathrm{ER}_t) + n_i(\ln \mathrm{VI}_t) + z_i(\ln(\mathrm{GDP}_t) + v_i \quad (4)$$

where t is the time, CPI the real price vector for all other products, ER a real exchange rate, VI an index concerning the total value of imports for all goods, GDP a real GDP index and v_{ih} the random error term. This term is partitioned as follows:

$$v_{ih} = f_{ih} v^*_{ih} + e_{ih} \quad (5)$$

where f_{ih} is the correlation parameter such that $E(v^*_{ih}, e_{ih}) = 0$ and e_{ih} are independent for v^*_{ih}. To test the endogeneity of the expenditure variable the residual v^*_{ih} is included in the AIDS equation and the Wald χ^2 test is performed.

The theoretical restrictions of adding up, homogeneity and symmetry get hold if the parameters satisfy the corresponding expressions:

$$\sum_{i=1}^{n} a_i = 1 \quad \sum_{i=1}^{n} \gamma_{ij} = 0 \quad \sum_{i=1}^{n} \beta_i = 0 \quad \sum_{i=1}^{n} \gamma_{ij} = 0 \quad \gamma_{ij} = \gamma_{ji} \quad (6)$$

The expenditure and price elasticities for the model are given by:

$$n_i = 1 + \frac{\beta_i}{s_i} \quad (7)$$

$$\varepsilon_{ii} = -1 + \frac{\gamma_{ii}}{s_i} - \beta_i \quad (8)$$

$$\varepsilon_{ij} = \frac{\gamma_{ij}}{s_i} - \beta_i \left[\frac{s_j}{s_i}\right] \quad (9)$$

$$\delta_{ii} = -1 + \frac{\gamma_{ii}}{s_i} + s_i \tag{10}$$

$$\delta_{ij} = \frac{\gamma_{ij}}{s_i} + s_j \tag{11}$$

where n denotes the expenditure elasticities, ε the Marshallian (uncompensated) price elasticities and δ the Hicksian (compensated) price elasticities.

Empirical results

The data used in this study consist of quarterly importation volumes to each market (Italian, German, UK and US market) of virgin olive oil with the country of origin to be different in each market but Greece. Apart from the main suppliers for each market, the rest of the supply countries have been grouped under a single category, "Rest of the World" (ROW). Export quantities and values have been collected from the External Trade Analytical Tables by Eurostat database for the European markets and US International Trade Commission database for the US market. Exported quantity is reported in 100 kg and value in euros for European countries and in dollars for the US market. Since in the above-mentioned data sets the exported prices of Greek olive oil are not reported, the unit value obtained by dividing the value by the quantity was employed as a proxy for exported price. However, the unit price is not what consumers actually pay.

Because the olive oil expenditure shares (s_{ih}) sum to 1, the demand system composed of expenditure share equations for the suppliers would be singular. Hence, the last equation of "ROW" was dropped in order to avoid singularity of the covariance matrix. The coefficients of the dropped equation were recovered from the adding-up condition. The seasonal effects are quite important in terms of explanatory power of the model. The seasonal effects reflected irrefutable seasonal patterns in the part of consumer behavior not explained by exogenous quantity and price changes. In order to capture seasonality effects in the specification of the AIDS model (1), seasonal dummies variables were included as an intercept shifter. So, the final version of the estimated model is given as follows:

$$s_{it} = a_i + \sum_{w=1}^{3} d_{iw} D_w + \beta_i \log \left(\frac{m}{P}\right)_t + \sum_j \gamma_{ij} \log p_{jt} \tag{12}$$

Since the model is a simultaneous equation system, and there are restrictions across equations (group symmetry), Seemingly unrelated regression (SUR) do take them into account which least square (LS) do not. For this reason, SUR is more efficient than the LS estimator. The STATA/MP 14 (2015) software is used to estimate the AIDS model of Equation (12) for each market by the SUR method with homogeneity and symmetry conditions imposed.

The estimated parameters are reported in Table I. As it can be seen, the system for the Italian market has the highest number of coefficients significant at 5 percent level followed by the UK and German market. Also, in all markets under examination, the models fit the data well since systems Berndt R^2 is equal to 0.80 for the German market, 0.84 for the Italian market, 0.74 for the British market and 0.83 for the US market. Furthermore, the seasonal dummy variables in Greek olive oil equations for the UK market show that the Greek olive oil tend to increase during the Spring and Summer which is likely an effect of the British tourists in Greece, during the Summer vacations. The same phenomenon occurs with the Spanish olive oil in the German market, which tends to increase during the Summer. This can be explained as a short-habit effect due to Summer vacations in the Mediterranean Sea.

	α_{ij}	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	β_i	d_1	d_2	d_3
German market										
Greece	−0.8635* (0.11090)	0.0242 (0.02894)	−0.0118 (0.04174)	−0.0094 (0.02118)	−0.0031 (0.00827)		0.0577* (0.00706)	0.0089 (0.01024)	0.0092 (0.01017)	0.0098 (0.01005)
Italy	1.8059* (0.18521)	−0.0118 (0.04174)	0.0362 (0.07648)	−0.0585 (0.04081)	0.0340 (0.01430)		−0.0625* (0.01172)	−0.0057 (0.01740)	−0.0168 (0.01717)	−0.0218 (0.01705)
Spain	0.2622* (0.10010)	−0.0094 (0.02118)	−0.0585 (0.04081)	0.0685* (0.03115)	−0.0007 (0.00800)		−0.0112** (0.00645)	0.0017 (0.00870)	0.0140 (0.00862)	0.0195* (0.00856)
ROW	−0.2046	−0.0031	0.0340	−0.0007	−0.0303		0.0159	−0.0050	−0.0064	−0.0075
	–	–	–	–	–		–	–	–	–
Italian market										
Greece	2.8353* (0.74882)	−0.3216* (0.12586)	0.8674* (0.12333)	−0.5167* (0.08277)	−0.0291 (0.03606)		−0.1421* (0.04073)	0.1236* (0.02903)	0.0299 (0.02808)	−0.0397 (0.02813)
Spain	−2.2558* (0.86293)	0.8674* (0.12333)	−1.5443* (0.17049)	0.6602* (0.09969)	0.0167 (0.04448)		0.1548* (0.04681)	−0.1389* (0.03028)	−0.0894* (0.02936)	−0.0358 (0.02934)
Tunisia	−0.1241 (0.65661)	−0.5167* (0.08277)	0.6602* (0.09969)	−0.2553* (0.09731)	0.1118* (0.03288)		0.0137 (0.03555)	0.0225 (0.02593)	0.0652* (0.02511)	0.0837* (0.02506)
ROW	0.5446	−0.0291	0.0167	0.1118	−0.0994		−0.0264	−0.0071	−0.0057	−0.0081
	–	–	–	–	–		–	–	–	–
UK market										
Greece	0.8902** (0.08603)	0.0517** (−0.00604)	−0.0060 (−0.11785)	−0.0049 (0.07548)	−0.0407** (0.04841)		−0.0525** (0.12180)	0.0074* (−0.00521)	0.0151* (0.00271)	0.0167 (−0.00946)
Italy	−1.5555** (0.28713)	−0.0060 (0.01338)	−0.1178** (0.04278)	0.0755* (0.02976)	0.0484* (0.02183)		0.1218** (0.01816)	−0.0052 (0.02415)	0.0027 (0.02387)	−0.0095 (0.02384)
Spain	0.6125** (0.25161)	−0.0049 (0.00893)	0.0755* (0.02976)	−0.0424 (0.02851)	−0.0281 (0.01633)		−0.0107 (0.01585)	0.0027 (0.02084)	−0.0125 (0.02061)	−0.0217 (0.02052)
ROW	0.8902	0.0517	−0.0060	−0.0049	−0.0407		−0.0525	0.0074	0.0151	0.0167
	–	–	–	–	–		–	–	–	–
USA market										
Greece	0.2179* (0.03371)	−0.0076 (0.00736)	−0.0061 (0.01523)	0.0059 (0.01305)	−0.0019 (0.00555)	0.0097 (0.00954)	−0.0107* (0.00200)	−0.0012 (0.00208)	0.0034** (0.00203)	−0.0019 (0.00197)
Italy	2.2597* (0.24905)	−0.0061 (0.01523)	−0.1835 (0.10631)	0.1094 (0.08202)	0.0591** (0.03201)	0.0211 (0.05075)	−0.0938* (0.01474)	−0.0370* (0.01664)	−0.0435* (0.01597)	−0.0221 (0.01579)
Spain	0.5194* (0.21072)	0.0059* (0.01305)	0.1094 (0.08202)	−0.2988 (0.08097)	0.0058 (0.02693)	0.1777* (0.04043)	−0.0193 (0.01247)	0.0065 (0.01288)	0.0162 (0.01256)	0.0050 (0.01232)
Tunisia	−0.8835* (0.11339)	−0.0019 (0.00555)	0.0591** (0.03201)	0.0058 (0.02693)	−0.0343** (0.01866)	−0.0287 (0.02057)	0.0527* (0.00661)	0.0196* (0.00864)	0.0186* (0.00830)	0.0118 (0.00823)
ROW	−1.1135	0.0097	0.0211	0.1777	−0.0287	−0.1798	0.0710	0.0121	0.0054	0.0072
	–	–	–	–	–	–	–	–	–	–

Notes: The numbers in parentheses are statistical errors. *,**Statistically significant at 5 and 1 percent, respectively

Table I.
Estimated parameters for the main exports destination markets of Greek virgin olive oil

Considering the US market, the imports from Italy and Tunisia tend to decrease during the Winter and Spring season. In contrast, the imports of Greek olive oil increase during the Spring period. In the Italian market, the seasonality for olive oil imports was confirmed since the dummy variables show that imports from Tunisia tend to increase primarily during Spring and Summer while the imports from Spain tend to decrease during the Winter and Spring period. The imports from Greece tend to increase during the Winter period, when the harvesting and processing of olive oil has been completed.

The Wu-Hausman endogeneity test for the null hypothesis of no autocorrelation between group expenditures and the error term is conducted. The error terms from the auxiliary equations for each market that are shown in Table II are included in the demand equations for each market and tested for significance, where lp_i are the price vectors of products in the certain market; CPI a proxy price index of all other products for each market (base year 2010); GDP a gross domestic product index seasonal adjusted; ER a real effective exchange rate based on CPI; and VI a total goods value of imports index (for all the indices 2010 is the base year). Following Andayani and Tilley (1997), as proxy for the price of all other products a consumer price index is employed while as proxy for total expenditure the GDP index is used. Also, the inclusion of the exchange rate measures the effect of omitted price variable in the model. The Wu-Hausman endogeneity test indicates that simultaneity is not problem for all the markets under examination apart from the German one. The null hypothesis of no correlation between group expenditures and the error terms is not rejected at the 5 percent level of significance for the Italian, British and US market. The Wald χ^2 test statistic is 3.12, 6.97 and 4.05, respectively. For the German market, null hypothesis of no correlation between group expenditures and the error terms is rejected marginally at 5 percent significance level (Wald test statistic equal to 9.42).

Comparative advantage may be defined as an advantage over competitors gained by offering consumers a greater value either by lowering prices or by providing greater benefits and services, such as high-quality products that justify higher prices (Porter, 1985). In this study, any virgin olive oil that carries a higher and statistically significant expenditure elasticity, compared to other virgin olive oil destination, is assumed to be perceived by consumers as a higher-value product. Moreover, countries that supply higher-value products would be expected to prefer facing an own-price inelastic demand. This occurs because the higher prices associated with their virgin olive oil, compared to other suppliers, will result in an increase to their revenues (*ceteris paribus*). Hence, a count that supplies higher-price virgin olive oil is said to have a competitive advantage in a certain market that face a price inelastic and expenditure – elastic demand.

Table III shows the expenditure and Marshallian price elasticities evaluated at the mean point of the explanatory variables. These values are reasonable in terms of signs and magnitude and to the most part are individually significant.

		gi1	gi2	gi3	gi4	gi5	hi	fi	ni	zi
Germany	−19.74	0.71*	−0.94*	−0.19	−0.03		8.35*	−2.44*	0.20	2.11
	(14.789)	(0.371)	(0.476)	(0.317)	(0.125)		(4.165)	(0.882)	(0.660)	(5.624)
Italy	18.37**	−0.43	1.06*	−0.63*	−0.15		0.03	0.00	0.00	−0.03
	(0.807)	(0.371)	(0.288)	(0.364)	(0.234)		(0.020)	(0.010)	(0.003)	(0.021)
UK	13.42**	0.57*	−0.19	−0.02	−0.35*		−0.07**	0.00	0.00	0.09**
	(0.824)	(0.155)	(0.160)	(0.093)	(0.134)		(0.018)	(0.006)	(0.007)	(0.024)
USA	2.91	0.12	−0.94*	1.15*	0.03	0.08	8.80*	1.40*	0.60*	−7.76*
	(3.152)	(0.217)	(0.360)	(0.479)	(0.133)	(0.234)	(2.788)	(0.412)	(0.192)	(3.280)

Table II.
Estimated parameters for each export destination of total expenditure to test for endogeneity

Notes: The numbers in parentheses are statistical errors. *,**Statistically significant at 5 and 1 percent, respectively

	Greece	Italy	Spain	Tunisia	ROW
German market					
P-Greece	*−0.716*** (0.4096)	−0.822 (0.5849)	−0.197 (0.2970)		−0.077 (0.1170)
P-Italy	−0.009 (0.0519)	*−0.893** (0.0953)	−0.066 (0.0504)		0.045* (0.0178)
P-Spain	−0.107 (0.2652)	−0.616 (0.5245)	*−0.136* (0.3854)		−0.002 (0.1001)
P-ROW	−0.101 (0.1988)	0.634** (0.3420)	−0.046 (0.1904)		*−0.291** (0.1112)
Expenditure	*1.813** (0.0995)	*0.923** (0.0145)	*0.861** (0.0804)		*1.381** (0.0693)
Italian market					
P-Greece	*−2.092** (0.5003)		3.625* (0.4347)	−1.901* (0.3215)	−0.087 (0.1394)
P-Spain	1.520* (0.2384)		*−3.993** (0.2857)	1.171* (0.1886)	0.018 (0.0827)
P-Tunisia	−3.471* (0.5687)		4.355* (0.6120)	*−2.717** (0.6606)	0.742* (0.2205)
P-ROW	−0.490 (0.8273)		0.685 (0.8963)	2.483* (0.7277)	*1.221** (0.6154)
Expenditure	*0.455** (0.1563)		*1.284** (0.0860)	*1.091** (0.2372)	*0.418** (0.2869)
UK market					
P-Greece	*−0.297** (0.1489)	0.174 (0.1659)	0.219* (0.1083)		−0.434** (0.1181)
P-Italy	0.063 (0.0780)	*−1.089*** (0.0645)	−0.042 (0.0360)		0.090 (0.0594)
P-Spain	0.187* (0.0728)	−0.010 (0.0215)	*−1.433*** (0.1136)		−0.063 (0.0400)
P-ROW	−0.306 (0.7922)	0.690 (0.1845)	−0.276 (0.1330)		*−1.115*** (0.1546)
Expenditure	*0.339*** (0.0687)	*0.975*** (0.0374)	*1.322*** (0.0480)		*0.503*** (0.0970)
USA market					
P-Greece	*−1.230** (0.2346)	0.007 (0.5051)	0.254 (0.4069)	−0.045 (0.1765)	0.353 (0.3036)
P-Italy	−0.005 (0.0258)	*−1.215** (0.1878)	0.215 (0.1352)	0.107* (0.0539)	0.057 (0.0848)
P-Spain	0.034 (0.0685)	0.631 (0.4540)	*−2.542** (0.4146)	0.035 (0.1411)	0.942* (0.2113)
P-Tunisia	−0.075 (0.1162)	0.579 (0.6957)	−0.090 (0.5506)	*−1.767** (0.3896)	−0.747** (0.4284)
P-ROW	0.055 (0.0707)	−0.155 (0.3912)	1.211* (0.2926)	−0.237 (0.1520)	*0.256* (0.2924)
Expenditure	*0.661** (0.0638)	*0.842** (0.0248)	*0.899** (0.0652)	*2.099** (0.1377)	*1.524** (0.0608)

Notes: The numbers in parentheses are statistical errors. *,**Statistically significant at 5 and 1 percent, respectively

Table III.
Uncompensated price and expenditure elasticities

All expenditure elasticities are positive and significant at 5 percent level. Expenditure on German market is elastic from Greece and ROW (1.81 and 1.38, respectively) and inelastic from Italy and Spain (0.92 and 0.86, respectively). At the Italian market, the imports from Spain show the highest expenditure elasticity, 1.28 and from Tunisia almost unitary (i.e. 1.09) with imports from Greece and ROW being the most inelastic (0.45 and 0.42, respectively). Considering the UK market, apart from the imports from Spain, the imports from all countries show inelastic expenditure elasticity with imports from Greece being the more inelastic (0.34). Finally, at the US market, the imports from the European countries show inelastic expenditure elasticity, while the imports from Tunisia are almost three times more elastic (2.09) than the expenditure elasticity of Greek virgin olive oil (0.66). These findings suggest that Greek olive oil is the most luxurious good only for the German market, that is to say as the imports of olive oil increased, German consumers showed a greater preference for Greek olive oil. In contrast, the increased of imports of olive oil in the Italian, British and US market consumers showed a greater preference for olive oil from Italy, Spain and Tunisia, respectively.

Own-price elasticities are negative and statistical significant, which is accordance with the theory[1]. With respect to the German market, all the own-price elasticities are inelastic whereas Spain shows the smallest own-price elasticity (−0.136). The own-price elasticity of Greek olive oil is −0.716, which means Greece will not gain market share in Germany by its own pricing. As regards the Italian market, all the own-price elasticities of the countries that they include in the model are elastic with the import own-price elasticity of Spain to be the

highest (−3.99) followed by that of Tunisia (−2.71) and then the own-price elasticity of Greece (−2.09) which is almost two times less than the own-price elasticity of Spain. The elastic own-price elasticities in the Italian market imply in some way that imports by Italy are most likely driven by the need at the domestic industry to fulfill a given annual target in terms of bottled olive oil for foreign countries when the domestic production is not enough. Regarding the UK market, all the own-price elasticities are elastic but Greece which is (−3.14). In contrast to the British market, all the calculated own-price elasticities in the US market are elastic whereas Spanish elasticity to be the highest (−2.54) followed by the Tunisian (−1.76) and the Greek one (−1.23). These results indicate that the Greek olive oil could gain market share in the Italian and the US market through competitive prices and for the German and British market through marketing strategies. Such marketing strategies could be price discrimination according to the quality, the awareness of the health benefits of the Mediterranean diet and better promotion of the Greek brand as it is well known that Greece enjoys a higher share of high-quality extra virgin olive oil (almost 80 percent of its total production) which is consider a premium product in the international market. As far as the cross-price elasticities are concerned, significant positive cross-price elasticity indicates a competitive relationship between the exporters, while a significant negative cross-price elasticity reveals a complementary relationship between the two olive oil exporters. However, the cross-price Hicksian elasticities that they present in Table IV denote more clear the relationship between the main exporters. Regarding the German market, there is a complementary relationship between Greece and Italy and between Spain and Italy. The lack of a substitutability relationship could be explained by the difference in quality between olive oil from different sources as has been commented before. On the contrary, in the Italian market there is a significant substitutability relationship between Greece, Spain, Tunisia and the ROW countries and complementary

	Greece	Italy	Spain	Tunisia	ROW
German market					
P-Greece	*−0.730*** (0.4077)	−0.973** (0.5880)	−0.212 (0.2984)		−0.085 (0.1165)
P-Italy	−0.086** (0.0517)	*−1.762** (0.0948)	−0.153* (0.0506)		0.000 (0.0177)
P-Spain	−0.188 (0.2639)	−1.535* (0.5084)	*−0.227** (0.3881)		−0.050 (0.0997)
P-ROW	−0.144 (0.1978)	0.008 (0.3421)	−0.096 (0.1914)		*−1.767** (0.1116)
Italian market					
P-Greece	*−2.495** (0.4829)		2.784* (0.4732)	−2.132* (0.3176)	−0.157 (0.1384)
P-Spain	1.333* (0.2266)		*−4.382** (0.3133)	1.063* (0.1832)	−0.015 (0.0817)
P-Tunisia	−3.708* (0.5523)		3.861* (0.6651)	*−2.853** (0.6493)	0.701* (0.2194)
P-ROW	−0.903 (0.7960)		−0.176 (0.9818)	2.318* (0.7258)	*−3.240** (0.6176)
UK market					
P-Greece	*−0.445** (0.1490)	−0.479* (0.1134)	−0.437* (0.1700)		−0.639* (0.1167)
P-Italy	−0.090* (0.0212)	*−1.524** (0.0671)	−0.202* (0.0702)		−0.185* (0.0383)
P-Spain	−0.092* (0.0357)	−0.226* (0.0787)	*−1.695** (0.1132)		0.013 (0.0574)
P-ROW	−0.431* (0.0788)	−0.666* (0.1379)	0.042 (0.1844)		*−0.945** (0.1575)
USA market					
P-Greece	*−1.272** (0.2343)	−0.788 (0.4846)	−0.003 (0.4151)	−0.109 (0.1766)	0.172 (0.3036)
P-Italy	−0.042 (0.0257)	*−1.903** (0.1791)	−0.007 (0.1381)	0.052 (0.0539)	−0.100 (0.0855)
P-Spain	0.000 (0.0682)	−0.022 (0.4286)	*−2.753** (0.4231)	−0.018 (0.1407)	0.793* (0.2112)
P-Tunisia	−0.071 (0.1157)	0.638 (0.6671)	−0.071 (0.5612)	*−1.762** (0.3889)	−0.733** (0.4285)
P-ROW	0.279** (0.1553)	−0.438 (0.3746)	1.120* (0.2984)	−0.260 (0.1518)	*−2.375** (0.2916)

Table IV.
Compensated price elasticities

Notes: The numbers in parentheses are statistical errors. *,**Statistically significant at 5 and 1 percent, respectively

relationships between Tunisia and ROW countries. The relationship between Greek and Spanish olive oil in Italian market is in accordance with previous studies (Gil *et al.*, 2004). This degree of substitution between Greece and Spain has to do mostly with the production conditions in Spain. The Greek exports increase to Italy when Spanish production is relatively low. Also, the competition between Tunisia and ROW countries highlights the fair competition among the non-EU countries where they face the same barriers to entry in the European market. In addition, in the British market the lack of substitutability relationship among different sources can be explained by the difference in quality. Finally, as regards the US market, the most of the compensated cross-price elasticities are not statistically significant apart from those between Spain and ROW, which is not clear indication for the relationship between these source countries.

Summary and conclusions

This paper analyzed the import demand for virgin olive oil in several markets, which are considered as main destinations of Greek virgin olive oil. The objective was to determine the relative position and the competitiveness of Greek exports of olive oil and the degree of substitutability with virgin olive oils coming from other countries. The AIDS model was employed as a vehicle in this study. The aim of this study was twofold. First objective is to examine if Greece has a "revealed" comparative advantage using the RCA_2 index proposed by Balassa. According to the results, the comparative advantage of the Greek virgin olive oil is stronger than the two main competitors (Italy and Spain) in all main export destinations that were examined in this study. The second objective is to estimate the impacts of economic factors (virgin olive oil prices and imports' expenditures) as well non-price factors such as seasonality on the demand for source olive oils in the main destinations markets of the Greek olive oil.

Following Porter's definition concerning comparative advantage, for the German market, inelastic own-price elasticity and high statistically elastic expenditure elasticity of Greek virgin olive oil means that Greek virgin olive oil has a competitive advantage compared to imported olive oil from other suppliers such Italy, Spain or ROW. As far as the Italian market is concerned, judging by the relatively high (in absolute values) own-price elasticities and higher and statistically significant expenditure elasticities for Spanish and Tunisian virgin olive oil compared with Greek, means that Spain as well as Tunisia have a competitive advantage against Greek. Structural problems (i.e. high cost of production, small size of farms and high milling cost) as well as the fragmented nature of Greek olive oil cooperatives that does not facilitate the standardization of quality control, which is vital for the promotion of premium olive oil, are most likely the main reasons why the Greek virgin olive oil lost the comparative advantage in the Italian market.

As far as the US market is concerned, all the own-price virgin olive oil elasticities are elastic while the expenditure elasticity of Tunisia is elastic which means that Tunisia has the competitive advantage in the US market. Finally, as regards the UK market, even the own-price edacity of Greek virgin olive oil is inelastic, the expenditure elasticity is also inelastic compared with the other suppliers and it is not clear which country has the competitive advantage in this market.

Consumers, in traditional as well as new international markets, appear to become more aware of the beneficial qualities of virgin olive oil (in which Greece has an advantage), with its share over refined olive oil increasing from 70 percent in 1990 to 80 percent in 2014. In the same vein, international organizations and industry representatives are pushing for more controls and higher quality standards concerning the determination of commercial grades of virgin olive oil. The stricter definition of extra virgin olive oil would offer an advantage for Greek producers (since most of the Greek production is extra virgin olive oil) and allow thm to differentiate their product. Thus, targeting to the premium level of international market

appears a necessary strategy in order the Greek olive oil to gain the profits that deserves. The branding strategy would be more effective if it covered a wide range of products from specific regions with common characteristics (like Messinia, Crete) or even better, a national promotion of the Greek brand, through products that fit certain quality criteria.

Note

1. The only positive and statistically significant own-price elasticity is that of ROW in the Italian market most likely due to aggregation of different source countries into a single one.

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