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A gravity approach to assess the effects of Association Agreements on Euromediterranean Trade of Fruits and Vegetables

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1. Introduction

The analysis of regional trade liberalisation remains an interesting area of research. A large number of countries are taking part in preferential agreements (OECD, 2005). This is also true for the Mediterranean region. The aim of this paper is to discuss, through a gravity approach, the influence of Association Agreements on the agricultural trade between Southern Mediterranean Countries (SMCs) and the European Union (EU) in the period 1995-2004. This approach is not shown as a substitute but as a complementary of other modelling approaches that consider the impact of specific policy measures in a more explicit way (see Anania 2001). A yearly analysis makes it possible to study trade changes after the Association Agreement between EU and SMC. For assessment of the Association Agreements, groups of countries with different treatment granted by the EU can separately considered. The hypothesis to be tested is whether the Association Agreements have been effective in improving the competitive position of SMC in the EU for sensitive products such as Fruits and Vegetables (F&V). The Barcelona process aims at a progressive liberalisation of agricultural trade flows, which could lead to an erosion of community preference of EU farming products and to an increase of SMC's exports to the EU. A gravity approach could be of help to study this issue, in particular for differentiated products such as F&V, for which the direct impact of tariff and non-tariff barriers cannot be easily assessed.

Research on EuroMediterranean issues has boosted in recent years (Dessus et al., 2001; Bchir et al, 2002; Kuiper, 2004; Grethe et al., 2005). Complexity is a word that defines the bilateral trade liberalisation process in the region. This complexity is difficult to represent in a trade model, not only because of the range of instruments still constraining trade but also because of the special nature of the most important agricultural traded goods in the region, basically F&V (Swinbank and Ritson, 1995; Rae, 2004). As far as horticultural trade is concerned, this paper attempts for a general assessment of the impact of the EuroMediterranean Free Trade Area of fresh F&V flows of SMC to the EU.

A number of papers have applied the gravity equation to analyze international trade flows. Bergstrand (1985, 1989) explored the theoretical determination of bilateral trade in a series of papers in which gravity equations were associated with simple monopolistic competition models. Helpman and Krugman (1985) used a differentiated product framework with increasing returns to scale to justify the gravity model. Otsuki et al (2000) used the gravity equation method to explain trade patterns countries and to determine the effect of European aflatoxin standards on barrier to African exports of dries fruits and nuts. More recently, several gravity equation models have provided a basis for measurement of Non-tariff Trade Barriers (Burfisher et al 2001; Vido and Prenctice 2001).

The gravity methodology provides an intuitive framework for analyzing trade flows. Gravity models also have the ability to incorporate the characteristics of each country as an individual unit regardless of its size. The methodology has been widely used in the investigation of trade patterns in varying contexts over the past four decades (Sandberg, 2004).

What is intended next is drawing on a gravity methodology to assess the impact of EuroMediterranean Association Agreement on F&V trade from SMC to the EU. In the next section, a background of the EuroMediterranean process is presented. Sections 3 focus on horticultural trade to help to understand its significance for EuroMediterranean trade. Section 4 refers to the basic formulation of gravity models. Section 5 focuses on the adaptation of the modelling approach to horticultural trade in the EuroMediterranean context. Section 6 presents the main results of the empirical analysis and Section 7 summarises the main findings and conclusions.

2. Background of the EuroMediterranean Association

In November 1995, the EU Member States and 12 Mediterranean countries launched in Barcelona an integration process with the goal of favouring *"sustainable and balanced economic development with the view of creating an area of shared prosperity"*[1]. Regional integration, understood as trade liberalisation among the countries involved, was the method chosen, with the aim at creating the Euro Mediterranean Free Trade Area (EMFTA) by 2010.

The Barcelona process launched a new generation of Agreements, the Euro-Mediterranean Agreements (EMA), negotiated by the EU and individual Mediterranean partners, oriented at taking further steps for trade liberalisation on a bilateral basis, that is, through reciprocal liberalisation of trade in manufactures. The economic chapters of the EMAs aim at consolidating regional integration through i) bilateral trade agreements, ii) progressive establishment of a free trade area by 2010, and iii) measures to increase investment flows to the

[1] The Mediterranean partners in that moment were Egypt, Lebanon, Syria, Jordan, Turkey, Malta, Cyprus, Israel, Morocco, Tunisia, Algeria and the Palestinian Authority.

Mediterranean partner countries. Substantial financial assistance is provided to facilitate this integration process.

The commercial integration process among the EU and a number of countries from the Mediterranean basin has been making progress during last years, within the framework launched in the 1995 Barcelona Conference (see Garcia-Alvarez-Coque, 2002). Within this framework, the EU holds preferential trade agreements (PTAs) with its Mediterranean neighbour countries -or SMCs- in the path towards the establishment of the EMFTA. The process is quite dynamic and not all SMCs are in the same stage of implementation of their corresponding FTA (ideally, to be completed by 2010). Agreements with some countries are in a relatively advanced stage of implementation with entry in force at different dates: Tunisia in 1998; and Morocco and Israel in 2000 (even with recent reviews of the tariff provisions). Ratification and entry in force of the Agreements has been relatively recent for Jordan (2002), Lebanon (2003) and Egypt (2004). The agreement with Algeria has been signed but not ratified yet. By the end of 2004, Syria had finalised technical negotiations but signature was pending of solving political problems. Simultaneously, in the multilateral arena, the current Doha Development Agenda might deepen world-wide trade liberalization and involve further changes in the Euro-Mediterranean trade patterns, if the Uruguay Agreement on Agriculture, adopted in 1994, is finally reformed.

As far as agriculture is concerned, the pace of bilateral trade liberalisation is slow. The EMAs have largely tended to lock in the existing status quo (namely the existing preferential agreements, and commitments under WTO), and offer limited improvements in access to the EU for specific products through increases in tariff rate quotas (TRQs), reduction of entry prices (see Swinbank and Ritson, 1995), elimination of tariffs on specific quotas. The five year programme agreed in the Barcelona Mediterranean Conference (27-28 November 2005) foresees to pursue the progressive liberalisation of trade in agriculture, but "*with a possible selected number of exceptions and timetables for gradual and asymmetrical implementation, taking into account the differences and individual characteristics of the agricultural sector in different countries*". Therefore, the Barcelona process can be seen as a controlled agricultural trade liberalisation.

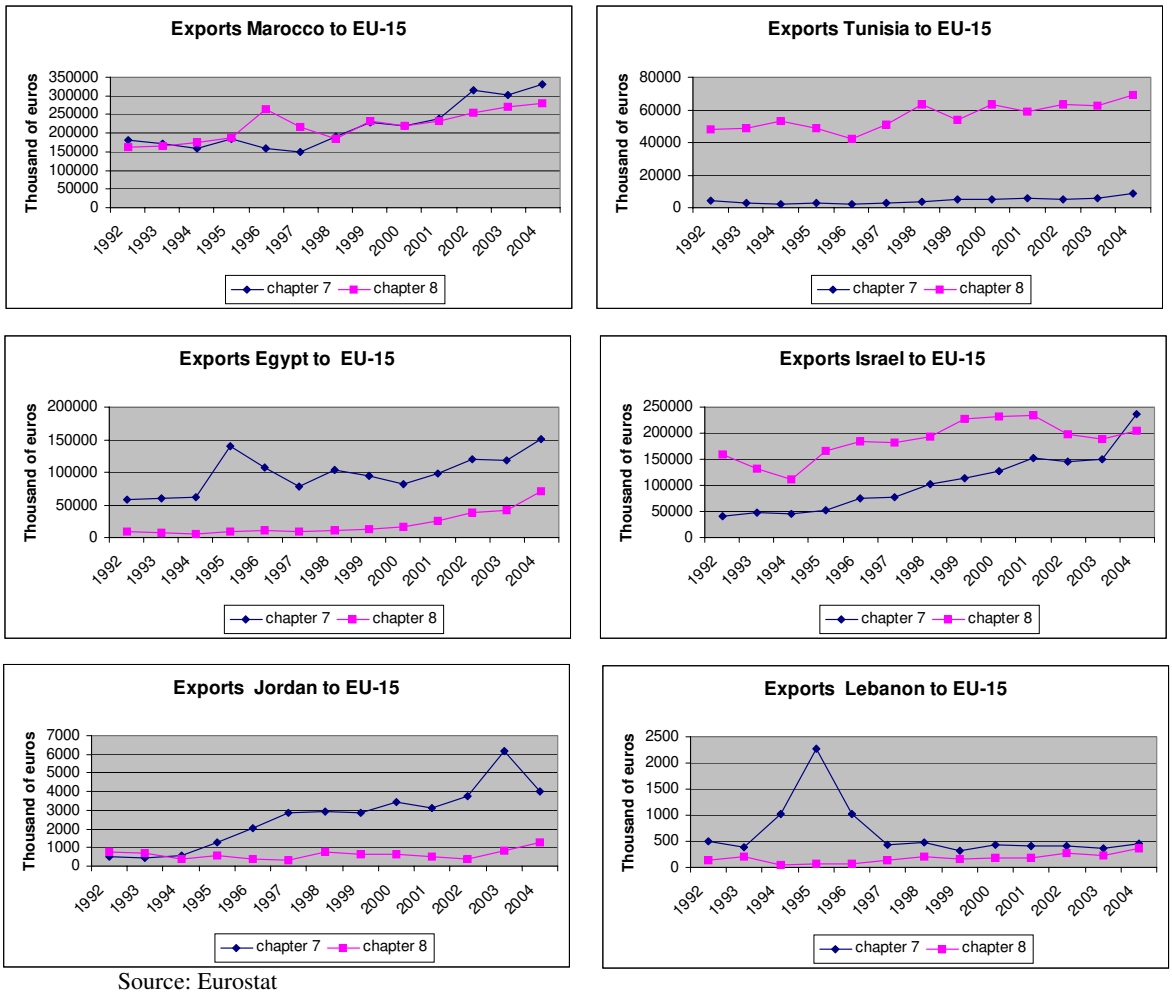
3. Horticultural trade between SMCs and the EU

Current trade patterns between the EU and SMCs reflect the product specialisation of bilateral trade. SMCs concentrate 57% of their exports to the EU on F&V. As a matter of fact, given the overlapping of producing seasons in both shores of the Mediterranean basin, the issue of regional integration appears to be quite more sensitive in the case of perishable products such as F&V than in other groups of products.

Within F&V, citrus fruit and tomatoes are two major products exchanged between the EU and the SMCs, which can be considered sensitive in the EU (eg. with larger potential impacts of trade liberalisation). Within the citrus, the most important products are oranges, tangerines, mandarines, clementines and lemons. SMCs represent 15% of the oranges world exports and 16% of tangerines one. About 60% of oranges supplied by SMCs to the EU are from Morocco and Israel (40% and 20% respectively). The fresh tomato market has evolved during last 15 years, Morocco being the first Mediterranean supplier to the EU, followed by Jordan and Turkey. The importing markets of this product are determined by the characteristics of the tomato itself, because it is not easily conserved and very perishable.

Figure 1 displays the development of F&V exports to the EU originating at six Mediterranean countries. Except for Lebanon, exports to the EU of the rest of countries have been growing since the mid-nineties in both chapters 7 (fresh vegetables) and 8 (fresh fruits). What remains to be studied is the extent that the EMAs might have influenced such developments, at least compared to the control group formed by the EU-15 States.

Figure 1: F&V exports originating at Mediterranean Countries



Source: Eurostat

4. Basic formulation of gravity models

The origin of gravity model analysis in international trade is generally attributed to Tinbergen (1962) and Pöyhönen (1963a,b) who independently and concurrently explored similar models. Since then, the gravity model has become a popular instrument in empirical foreign trade analysis. The basic idea behind this model is that bilateral trade from one country to another (as the dependent variable) can be explained by factors that capture the potential of a country to export goods and services, factors that capture the propensity of a country to imports goods and services, and any other forces that either attract or inhibit bilateral trade.

The gravity equation of international trade takes the following form:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln (D_{ij}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(Y_{jt}) + \beta_4 \ln(Y_{it}/N_{it}) + \beta_5 \ln(Y_{jt}/N_{jt}) + \beta_6 \ln(Q_{it}/N_{it}) + \beta_7 \ln(Q_{jt}/N_{jt}) + \gamma W + u_{ijt} \quad [1]$$

Where, X_{ij}: is the bilateral exports from country i to country j in period t.

Y_{it}: is the GDP of the exporter (country i) in time t.

Y_{it}/N_{it}: is the GDP per capita of the exporter in time t

Y_{jt}: is the GDP of the importer (country j) in time t.

Y_{jt}/N_{jt}: is the GDP per capita of the importer in time t

Q_{it}/N_{it} is the production per capita of the exporter in time t

Q_{jt}/N_{jt} is the production per capita of the importer in time t

D_{ij}: is the bilateral distance between the two capital´s countries

W: is a vector of variables capturing any resistance to trade or binary variables to control the participation in any trade agreement.

u_{ij}: normally distributed error component capturing any random influence

As it is shown in the model, trade flows depend on various economic, geographical and demographical factors. In addition to the core variables of the gravity relationship we are including production per capita. Assumptions needed to derive gravity equations are still under discussion, with gravity often taken to be rather atheoretic (Anderson and van Wincoop, 2003). However, we expect that most of traditional gravity variables have a statistically significant impact on horticultural trade and that it is valid to test the existence and order of magnitude of the impact derived of the Association Agreements in force.

Theoretically, the coefficient of countries´ GDP (β_2 and β_3) must be positive and statistically significant impact on agriculture trade, because a high level of income in the exporting/importing country suggests higher exports/imports. The effect of the distance between countries (β_1) must be negative and statistically significant, because countries that are located

close to each other will trade more and it is a proxy of all possible trade cost sources. However, the coefficient estimate for GDP per capita of the exporters (β_4) may be negative or positive signed, depending on whether the country exports less when it is relatively rich (absorption effect) or whether a richer country exports more than a poorer country by taking advantage of technical capacities and other infrastructural variables linked to development. What also seems reasonable is that relative poorer economies specialise on agricultural exports, which would lead to a negative sign for β_4. The coefficients of GDP per capita for the importers (β_5) have also ambiguous signs for similar reasons (Martinez-Zarzoso and Nowak, 2003).

The standard specification presented above has to be adjusted to represent agricultural trade, in particular F&V trade. One simple way is by introducing the production per capita of F&V for the exporting and the importing countries (β_6 and β_7). One would expect that the production per capita of the exporting country shows a positive coefficient and the corresponding sign of the production per capita of the importing country be negative.

The sign and the significance of the estimated coefficient of the binary variable will reveal if trade preferences have affected imports/exports or not. In our case, the variable to be tested is the influence of the entry in force of an Association Agreement on horticultural trade.

For treating specific sectors, such as F&V, and bilateral agreements, the interpretation of gravity models, such as the presented above, needs some note of caution. Gravity-based techniques measure contributes to capture the trade impact of tariff and non-tariff barriers and their removal, but this modelling approach ignores the explicit assessment of specific policy instruments unless applied tariffs in the importing country are included in the RHS of the gravity equation. However, the model must provide for an *ex post* test of statistical significance of trade preferences on bilateral horticultural trade between the EU and Mediterranean countries. The size of the trade effects related to the implementation of FTAs can be also appraised from the coefficients of the binary variables (Nilsson,2002).

5. Application to Fruits & Vegetables in the EuroMed context

Under the introduced framework, the basic idea is that bilateral trade flows from different countries/subregions to the EU countries are determined by variables indicating total potential demand of the importing country, variables indicating total potential supply of the exporting country and binary variables for capturing the supposed increase in the value of country imports from country export due to trade preferences. By using a gravity approach we can assess the trade effects on F&V associated to the Association Agreements, with the possibility to assess the separated impacts on specific products or different levels of product classification, such as Chapter 7 (fresh vegetables) and Chapter 8 (fresh fruits).

Our gravity model is referred to 8 South Mediterranean Countries (Morocco, Algeria, Tunisia, Egypt, Jordan, Syria, Lebanon and Israel) and 15 EU countries. We consider the imports of the 15 EU countries from the 8 SMC and 15 EU countries over the period 1995-2004. Data would be represent 3,450 (15 x 23 x 10) observations but due to zero bilateral trade flows, the real observations used drops to 2,650 for vegetables sample and 2,604 for fruits sample.

The bilateral trade data (in current thousand euros) are obtained from the EU´s External Trade Statistics (Eurostat). Here we consider the data reported by the importing countries about fruits and vegetables every year. Moreover, measures of distance, expressed in kilometres, between countries are computed as straight lines between capitals[2], which are just an approximation of the distance, considering the fact that production and consumption are spread across the exporting and importing countries.

Data on GDP and GDP per capita are available from World Bank´s World Tables. Production variables are obtained from Faostat Agricultural Data, by taking total vegetable and legumes' production for modelling Chapter 7's trade and total fruit and nut productions for modelling Chapter 8's trade. Trade propensity is captured by expressing production in per capita terms. Applied Tariffs and other explicit barriers are not included in the first tests for modelling aggregate Chapters 7 and 8, but they will be considered in future exercises which model specific commodities (eg. Tomato trade).

Finally, our gravity model has a number of dummy variables that represents:

DMAGREB: is equal to 1 if export country is Algeria, Morocco or Tunisia, and 0 otherwise.

DMACHREK: is equal to 1 if export country is Egypt, Jordan, Lebanon or Syria and 0 otherwise.

DISRAEL: is equal to 1 for flows originating at this country and 0 otherwise.

DAA: is equal to 1 if export country has an Association Agreement and 0 otherwise.

The control group is defined by EU countries, so the gravity model should capture the trade disadvantages of not being EU member state. Israel is considered separately because its degree of income differs considerably from the rest of SMC.

[2] We used City Distance Tool that belongs to www.geobytes.com

6. Results

The results of the estimation of gravity equations are presented in Tables 1 (fresh vegetables) and 2 (fresh fruits). Estimated coefficients are showed for each one of the years covering the period 1995-2004. The dummy variable "Association Agreement" gets a value equal to one for Tunisia (since 1998 onwards), Morocco and Israel (since 2000), Jordan (2002), Lebanon (2003) and Egypt (2004). In general, the statistical tests suggest that gravity equations provide with a good representation EuroMediterranean trade flows for F&V. The explanatory power of the model is good (R^2 are close to 70% in most cases) and the estimated parameters present the expected signs and orders of magnitude, though fitness to data is somewhat better for fresh fruits than for fresh vegetables.

The main remarks on the estimated parameters are the following:

The distance to the exporting countries seems to be a strong impediment to EU imports. Distance-elasticity is negative and statistically significant, which seems to be reasonable if consider transport and logistic costs associated to perishable products' trade. The distance parameter even tends to increase over the period. In spite of the technological improvements in logistics there is still a significant premium for proximity to the destination markets related to the regularity requirements imposed by the retailing companies.

GDP-elasticities are positive for both exporting and importing countries, which suggests that the scale of the involved economies matters, as theoretically expected. The value of the GDP parameter is greater for the exporter than for the importer. This reflects that trade flows are positively influenced by variables associated to size, such as the exporting infrastructure and quality control facilities.

Coefficients for GDP per capita are negative and non-significant for most of the years considered. Trade in fresh F&V may be pushed by economic growth. However, from the static point of view, it follows a pattern which is rather linked to the classical comparative advantages (specialisation in agricultural exports in poorer countries) and to the nutritional behaviour of the importing countries still far from "Mediterranean diet" in the relatively richer countries of Europe.

Production per capita has a positive parameter for exporters and a negative one for importers, which seems consistent with the theory though the positive effect for exporters is more evident for fresh vegetables, the export of this product being more connected with short-term fluctuations in production. For most of the studied period, the production per capita parameter is not significant for importers, which suggests that import flows are less connected to domestic production than to other variables that affect demand for F&V.

Some of the dummy variables included correspond to the region where the trade flow is originated. Cultural and historical links between the exporting countries and the EU may explain different coefficients with changing origins. It is not surprising that, against the control

group, dummies for Magreb and Mashrek are below cero. This result denotes a lack of commercial integration between the EU15 and SMCs, with a clear disadvantage of these countries compared to EU countries. This seems consistent with the nature of third countries of SMCs. DISRAEL is not statistically significant for most of the studied period, which indicates a behaviour similar to the EU15 countries.

The coefficient for the dummy variable for the existence of an Association Agreement (AA) is positive, which means that counteracts the non-preferential status of non-EU Mediterranean countries. Its coefficient is significant since 2000, which means that the AA has contributed to increase horticultural exports to the EU of the SMC involved. Nevertheless, if we add the coefficients for DAA and DMAGREB, this sum is negative or very small. This result suggests that the AAs have hardly achieved the objective of integrating the Magreb economies in the EuroMediterranean market. Similar comments apply to Mashrek and only Israel presents a clearly positive gain.

Table 1. OLS estimated coefficients for Chapter 07. Fresh Vegetables

Variables	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Distance	-1,12***	-1,48***	-1,50***	-1,55***	-1,83***	-1,82***	-1,90***	-1,70***	-1,83***	-1,79***
GDP importing countries	1,02***	1,05***	1,06***	0,97***	1,04***	1,05***	1,09***	0,98***	1,18***	1,04***
GDP exporting countries	1,46***	1,39***	1,39***	1,33***	1,15***	1,26***	1,31***	1,41***	1,35***	1,28***
PIB/pop. import	-0,23	-0,39	-0,18	-0,46	-0,61	-0,20	-0,69	-0,60	-1,00***	-0,99***
PIB/pop Export	-0,32	-0,39	-0,63	-0,28	-0,98**	-1,20***	-1,09***	-1,00**	-1,60***	-0,69***
Production per capita export	1,48***	1,50***	1,31***	1,60***	1,31***	1,17***	1,14***	1,12***	1,17***	1,47***
Production per capita import	0,20	0,21	0,19	0,19	0,27	0,35*	0,19	0,28	-0,03	0,13
Dmagreb	-0,12	-0,48	-0,40	0,75	-2,33*	-5,22***	-5,99***	-3,35***	-5,06***	-3,40***
Dmachrek	0,65	0,46	-0,30	0,19	-1,42	-1,79*	-1,40	-1,64	-3,22***	-2,33***
DAA	--	--	--	-2,78***	-1,82**	3,20***	4,07***	1,64***	0,82**	1,74***
DIsrael	0,21	0,49	0,64	0,69	0,87	-2,77**	-3,27***	-0,78	-0,16	-1,03*
R^2	0,62	0,67	0,62	0,65	0,644	0,68	0,70	0,69	0,67	0,72
No. Observations	249	249	249	250	274	273	279	273	275	279

Note: ***, **, * denote 1%, 5% and 10% significance level

Table 2. OLS estimated coefficients for Chapter 08. Fresh Fruits

Variables	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Distance	-1,46***	-1,27***	-1,42***	-1,45***	-1,47***	-1,60***	-1,65***	-1,59***	-1,79***	-1,89***
GDP importing countries	0,74***	0,74***	0,89***	0,88***	1,17***	1,09***	1,16***	1,02***	1,09***	1,01***
GDP exporting countries	1,30***	1,21***	1,16***	1,15***	1,09***	1,20***	1,29***	1,32***	1,43***	1,21***
PIB/pop. Import	0,15	0,45	0,33	-0,03	-0,75*	-0,30	-0,52	-0,52	-1,01***	-1,05***
PIB/pop Export	-0,78**	-1,30***	-1,10***	-1,13***	-0,73*	-1,28***	-1,38***	-0,97***	-1,34***	-1,40***
Production per capita export	0,66***	0,55***	0,59***	0,56***	0,68***	0,52***	0,54***	0,57***	0,61***	0,54***
Production per capita import	-0,14	-0,14	-0,13	-0,11	-0,23***	-0,17**	-0,20**	-0,26***	-0,29***	-0,26***
Dmagreb	-0,02	-1,90*	-1,78*	-2,06*	-0,96	-4,05***	-4,37***	-2,40**	-3,22***	-4,81***
Dmachrek	-2,69	-4,82***	-4,67***	-4,76***	-3,68***	-4,35***	-4,24***	-3,40***	-4,34***	-5,96***
DAA	--	--	--	0,66	0,26	2,54***	2,83***	1,76***	1,83***	3,01***
DIsrael	1,62***	0,79	0,70	0,64	0,76	-1,09	-1,51	-0,50	-0,65*	-1,90***
R^2	0,658	0,701	0,705	0,718	0,719	0,729	0,727	0,723	0,718	0,712
No. Observations	237	244	244	240	270	270	269	271	279	280

Note: ***, **, * denote 1%, 5% and 10% significance level

The contribution of the Association Agreements to the exports from a Mediterranean country to the EU can be assessed by calculating the percentage change of total exports associated with the coefficients of the dummy variables (subregion effect plus the Association Agreement effect). This relative change is obtained by taking first differences in equation [1]:

$$\Delta X/X = \gamma_1 \Delta W_1 + \gamma_2 \Delta W_2 \quad [2]$$

Where γ_1 and γ_2 are the coefficients of the dummy variables related to the subregion effect (Magreb, Mashrek, Israel) and to the existence of the Association Agreement, respectively.

The relative export change can also be expressed as follows:

$$\Delta X/X = (X_{EU} - X_R)/X_R \quad [3]$$

Where X_{EU} - X_R is the export variation for a given third country R if it were to become a member of the control group EU, *ceteris paribus*. This change would imply $\Delta W_1 = -1$ if no Association Agreement exists ($W_2 = 0$, eg. only the subregion effect applies); and $\Delta W_1 = -1$ and $\Delta W_2 = -1$ if an Association Agreement is in force (subregion effect plus Association Agreement effects apply). By introducing these changes in equation [2] as well as the value of the relative change given by [3], and by rearranging the equation, the ratio X_R/ X_{EU} is calculated as follows:

$X_R/ X_{EU} = 1/(1 - \gamma_1)$ for a third country without Association Agreement; and
$X_R/ X_{EU} = 1/(1 - \gamma_1 - \gamma_2)$ for a third country with Association Agreement.

Tables 3 and 4 show the calculated ratios, expresses in terms of percentage change of expected trade for Magreb (Table 3) and Mashrek (Table 4) countries compared to the reference 100% attached to the control group. In other words, the ratios defined express the relative importance of Mediterranean country-EU Member State trade with respect intra-EU Member State trade, after having controlled for GDP, GPD per capita, production per capita and distance variables.

Three main conclusions draw from the tables:

(i) Without Association Agreements the expected trade is between 14.3% and 29.7% of the reference (100%) for Magreb countries, and between 14.4% and 30% for Mashrek countries. This supports the idea that third countries may be suffering export losses as a result of trade diversion in fresh horticultural trade to the EU.

(ii) With Association Agreements, the expected trade of the involved Mediterranean countries increases significantly, and it reaches for Magreb 37.6% (fresh vegetables) and 61% (fresh fruits); and for Mashrek 62.9% (fresh vegetables) and 28.5% (fresh fruits).

(iii) The Association Agreements do not seem to boost exports to the extent that the ratio is closer to 100%. Consequently, their impact appears to be limited. The Association Agreements don't show any time trend to boost Med countries' exports.

Table 3. Percentage of expected trade of Magreb countries compared to control group (EU countries = 100%)

	2000	2001	2002	2003	2004
Fresh vegetables					
Without Association Agreement	16,1	14,3	23,0	16,5	22,7
With Association Agreement	33,1	34,2	36,9	19,1	37,6
Fresh fruits					
Without Association Agreement	19,8	18,6	29,4	23,7	17,2
With Association Agreement	39,8	39,4	61,0	41,8	35,7

Table 4. Percentage of expected trade of Mashrek countries compared to control group (EU countries = 100%)

	2003	2004
Fresh vegetables		
Without Association Agreement	23,7	30,0
With Association Agreement	29,4	62,9
Fresh fruits		
Without Association Agreement	18,7	14,4
With Association Agreement	28,5	25,3

7. Conclusions

The present paper has studied the horticultural trade flows between SMCs and the EU, with focus on the possible influence of the Association Agreements. Fruit and vegetables have been considered sensitive products of the EuroMediterranean integration. The question is posed on the extent that bilateral integration has improved market access for horticultural export flows from SMCs to the EU15.

The empirical analysis carried out through the use of a gravity approach suggests that horticultural trade flows are well explained by the distance, the size of the economies, and the production per capita of the involved countries. These results are quite as expected from economic theory.

More interestingly, SMCs, in particular the Magreb region, perform relatively worse than the exporting countries from inside the EU. This can be explained by the trade deviation effects of EU integration and/or by the growing demands for quality and service imposed by horticultural retailers, which are better mastered in developed economies. This could also

explain why Israel performs better than exports flows originating at the Magreb and Mashrek subregions.

What seems more relevant, the fact that an Association Agreement has entered in force appears to be significant as an explanatory of both fruit and vegetables' trade flows to the EU. However, while the impact of such arrangements has contributed to boost SMC's horticultural exports, it has not been sufficient to compensate the export loss related to the nature of SMCs as third countries. SMCs may have obtained gains from the EMAs but the Barcelona process is still far to achieve its initial goals, at least concerning crucial products for the SMCs' export strategy. An integrated EuroMediterranean horticultural market is yet to be completed. The presented approach supplies a method to monitor future developments in the EuroMediterranean process.

Further developments of the gravity method applied must focus on specific products as trade liberalisation is not uniform across different F&V. Another interesting question to be examined through a gravity type modelling approach is the estimation of the tariff-equivalent connected with NTBs in the context of Mediterranean countries. Following Deardorff and Stern (1997) and Dean et al (2003), we could calculate the gap between the domestic "inside the border" price of imported good and the c.i.f. price of imported good, as a percentage of the latter. The "inside the border price" could be the unit value of intra-EU imports of significant EU importers (eg. Germany, UK, etc). On the left hand side of the equation, the difference between this unit value and c.i.f. unit value could be regressed on transport costs (or distance), actual duties or tariffs, and a dummy variable could capture the effect of NTBs. Estimates could also be performed on a monthly basis so it is possible to catch the seasonal variations in NTBs. It is also possible to capture also the constraining impact of explicit tariffs (when there are preferential tariffs on selected partners), or the enhancing effect of given regulations, when they act as standards that facilitate trade (Beghin and Bureau, 2001).

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Annex 1

Composition of Chapter 7 and 8

Vegetables	Fruits
▪ Potatoes ▪ Tomatoes ▪ onions, garlic ▪ cauliflowers, cabbages ▪ Lettuce ▪ carrots, turnips, ▪ cucumber, gherkins ▪ Others vegetables	▪ Coconuts, Brazilian nuts ▪ Other fresh nuts ▪ Bananas ▪ dates, figs, pineapple, guayabas ▪ Citrus ▪ Grape ▪ Melons and water melons ▪ Apple and pears ▪ apricots, peaches, cherry, nectarine ▪ strawberry and raspberry

Source: Comext

Annex 2

Statistics of variables

	1995							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	153.620	1.216.592	1	1	4.846	29.148	18.264	98.737
Fruit exports (Thousand euros)	85.336	787.359	1	1	6.030	47.233	14.214	121.817
Distancie (Km)	4.021	2.991	560	173	2.640	1.766	894	962
GDP (Bill $)	88	2.458	7	66	38	455	28	639
Population (Thousand people)	58.180	81.539	4.005	3.598	20.340	25.557	19.380	24.461
GDP per capita	15.829	34.557	1.009	10.695	3.844	17.285	5.299	11.586
Vegetable production per capita	0,2947	0,3986	0,0904	0,0402	0,1963	0,1688	0,0743	0,0972
Fruit production per capita	0,3666	0,4679	0,0557	0,0039	0,1712	0,1390	0,1110	0,1466

Source: Comext

	1996							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	135.925	1.168.834	1	1	4.469	42.810	99.397	118.277
Fruit exports (Thousand euros)	116.182	853.128	1	2	7.405	52.902	18.809	130.302
Distancie (Km)	4.021	2.991	560	173	2.687	1.367	965	672
GDP (Bill $)	96	2.383	7	73	41	656	634	686
Population (Thousand people)	59272	81818	4077	3620	20179	27727	24504	26139
GDP per capita	16.953	37.085	1.120	11.181	4.184	23.984	5.659	7.501
Vegetable production per capita	0,3035	0,4042	0,0876	0,0461	0,2025	0,1616	0,0640	0,1094
Fruit production per capita	0,3435	0,4882	0,0622	0,0042	0,1778	0,1462	0,0977	0,1617

Source: Comext

	1997							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	122.851	1.122.758	1	1	4.352	45.325	15.110	122.683
Fruit exports (Thousand euros)	88.862	866.131	2	8	7.077	54.882	16.935	131.353
Distancie (Km)	4.001	2.991	560	173	2.653	1.388	884	699
GDP (Bill $)	100	2.114	7	80	43	614	33	631
Population (Thousand people)	60.416	82.012	4.146	3.652	20.926	27.763	20.583	26.116
GDP per capita	17.135	33.733	1.106	10.498	4.164	22.378	5.667	6.594
Vegetable production per capita	0,2992	0,3956	0,0843	0,0459	0,1952	0,1640	0,0639	0,1054
Fruit production per capita	0,3336	0,4443	0,0545	0,0047	0,1751	0,1404	0,0964	0,1570

Source: Comext

	1998							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	165.348	1.157.728	1	2	5.392	50.340	19.896	131.653
Fruit exports (Thousand euros)	98.572	891.361	1	5	7.185	57.102	17.474	134.793
Distancie (Km)	4.084	3.363	560	173	2.684	1.357	863	677
GDP (Bill $)	101	2.151	8	86	44	640	34	651
Population (Thousand people)	61.580	82.057	4.210	3.694	21.033	28.015	20.630	26.255
GDP per capita	16.870	33.773	1.083	11.068	4.099	23.197	5.469	6.577
Vegetable production per capita	0,2835	0,4079	0,0904	0,0415	0,1976	0,1648	0,0515	0,1083
Fruit production per capita	0,3143	0,4265	0,0618	0,0027	0,1744	0,1347	0,0846	0,1489

Source: Comext

	1999							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	189.588	1.155.252	1	1	5.564	45.138	21.840	123.493
Fruit exports (Thousand euros)	97.201	835.540	1	1	6.797	48.679	17.450	123.223
Distancie (Km)	3.977	3.363	560	173	2.562	1.312	876	686
GDP (Bill $)	101	2.115	8	19	45	615	34	642
Population (Thousand people)	62.770	82.037	4.271	427	21.415	27.013	20.158	26.283
GDP per capita	16.463	44.704	1.051	11.247	3.938	24.148	5.248	7.782
Vegetable production per capita	0,2894	0,4030	0,0986	0,0430	0,1923	0,1616	0,0645	0,1114
Fruit production per capita	0,2897	0,4760	0,0687	0,0031	0,1633	0,1441	0,0756	0,1624

Note: This year Luxembourg is separated from Belgium so the minimum of population is very low

Source: Comext

	2000							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	185.352	1.264.306	1	1	5.635	47.875	21.895	136.641
Fruit exports (Thousand euros)	98.999	948.295	1	1	6.675	50.760	17.136	126.578
Distancie (Km)	4.104	3.363	560	173	2.638	1.316	898	694
GDP (Bill $)	110	1.878	8	18	50	552	40	581
Population (Thousand people)	63.976	82.164	4.328	434	21.248	26.410	21.045	26.291
GDP per capita	17.544	41.970	1.084	10.301	4.604	22.739	6.095	7.654
Vegetable production per capita	0,2577	0,3990	0,0855	0,0411	0,1914	0,1549	0,0593	0,1130
Fruit production per capita	0,2651	0,4755	0,0610	0,0036	0,1604	0,1481	0,0645	0,1582

Source: Comext

	2001							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	189.138	1.064.213	1	1	6.068	49.700	22.313	131.532
Fruit exports (Thousand euros)	108.413	865.230	1	1	7.219	50.634	18.414	124.470
Distancie (Km)	4.012	3.363	560	173	2.583	1.329	863	704
GDP (Bill $)	112	1.948	9	20	51	570	39	595
Population (Thousand people)	65.177	82.260	4.385	439	21.969	26.499	20.870	26.290
GDP per capita	17.373	44.838	1.148	10.882	4.480	23.397	5.860	7.685
Vegetable production per capita	0,2424	0,3670	0,0925	0,0365	0,1736	0,1420	0,0522	0,1077
Fruit production per capita	0,2679	0,4656	0,0660	0,0038	0,1565	0,1349	0,0667	0,1546

Source: Comext

	2002							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	249.336	1.241.739	1	1	7.467	54.875	29.308	147.569
Fruit exports (Thousand euros)	122.730	964.530	1	2	7.084	54.847	18.180	136.742
Distancie (Km)	3.977	3.363	560	173	2.610	1.305	854	686
GDP (Bill $)	118	2.038	9	21	51	599	39	624
Population (Thousand people)	66.372	82.440	4.441	444	23.005	26.624	22.112	26.353
GDP per capita	17.977	47.100	1.174	11.634	4.346	24.709	5.833	8.252
Vegetable production per capita	0,2540	0,3381	0,0934	0,0359	0,1917	0,1402	0,0466	0,1044
Fruit production per capita	0,2479	0,4367	0,0704	0,0035	0,1568	0,1357	0,0546	0,1519

Source: Comext

	2003							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	226.388	1.255.292	1	1	7.013	57.359	26.323	149.900
Fruit exports (Thousand euros)	108.272	1.030.500	1	1	6.664	59.718	16.714	147.061
Distancie (Km)	4.021	3.363	560	173	2.591	1.307	868	697
GDP (Bill $)	110	1.795	10	26	50	597	36	606
Population (Thousand people)	67.559	82.537	4.498	448	22.424	27.321	22.197	26.527
GDP per capita	16.481	672.776	1.220	2.912	4.408	31.561	5.514	48.165
Vegetable production per capita	0,2484	0,6197	0,0917	0,0355	0,1945	0,1458	0,0399	0,1114
Fruit production per capita	0,2329	0,4538	0,0725	0,0028	0,1551	0,1289	0,0534	0,1432

Source: Comext

	2004							
	Maximum		Minimum		Mean		Standard Deviation	
	SMC	EU	SMC	EU	SMC	EU	SMC	EU
Vegetable exports (Thousand euros)	234.616	1.166.059	1	1	8.676	55.414	28.947	143.879
Fruit exports (Thousand euros)	115.297	1.062.754	1	1	7.172	59.888	17.874	144.170
Distancie (Km)	4.104	3.363	560	173	2.642	1.332	913	708
GDP (Bill $)	118	2.714	11	19	53	827	37	881
Population (Thousand people)	68.738	82.600	4.554	450	23.034	26.896	22.532	26.431
GDP per capita	17.292	69.207	1.093	1.832	4.681	31.599	5.738	15.229
Vegetable production per capita	0,2457	0,3602	0,0902	0,0308	0,1935	0,1437	0,0393	0,1097
Fruit production per capita	0,2296	0,4485	0,0699	0,0028	0,1532	0,1416	0,0507	0,1560

Source: Comext