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EU Market Access for Mediterranean fruit and vegetables: A gravity model assessment

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Abstract. Since 1995, a liberalization process -the so-called Barcelona Process- has taken place in the Mediterranean area. It aims at establishing a free trade area for 2010 in the Mediterranean Basin. For the moment full liberalization concerns industrial products trade whereas agriculture remains sensitive. Among agricultural products, the fruit and vegetables (F&V) sector is essential for Mediterranean countries, and the EU is their first trading partner. In this context, two questions arise: Firstly, to what extent protection influences trade for the med countries, compared to the other countries? Secondly, what would be the impacts of a greater liberalization on F&V trade between the EU and Mediterranean Countries?
Our model, based on the new developments of gravity trade model focuses on the difficulties faced by the Mediterranean countries to enter on the EU market, compared to the other EU partners, considering the relative impact of the different trade costs. It is estimated at the product level, in a sector with a huge specificity: some products may be very perishable and thus particularly time sensitive. The Mediterranean basin appears as a highly heterogeneous country bloc. Beside the actual level of preferences allowed by the EU, two main elements vary according to the exporting country: its tariff sensitivity and its "non-tariff" trade resistance. Thus, with respect to the Euromed liberalization, the higher the tariff sensitivity, the higher the impact of liberalization on trade and this impact can be limited by a high trade resistance (NTB, logistic constraints…).

Key Words: Fruit and Vegetables, EU-Med agreement, gravity models, transport cost, tariffs

JEL: F13 F17 Q17 Q18

Introduction

Since 1995, a regional liberalization process – the so-called Barcelona Process - has taken place in the Mediterranean area. It aims at establishing a free trade area for 2010 in the Mediterranean Basin. However this trade liberalization is progressing very slowly, notably because the agricultural sector has been largely let out of the process. In November 2005, a new impetus has been given to the Barcelona Process, by establishing a strategy of reinforcing the liberalization in the agricultural sector.

For the Mediterranean Partner Countries, the main concern is a better access for their fruit and vegetable exports to the European market. These products represent the main exports of these countries, and the European Union is their first trading partner. On the other side, for the European Union, the main issue is not only the promotion of its cereal and dairy exports but also the protection of its producers of fruit and vegetables. Indeed, the regulation of trade with third countries is the key element of the Common Market Organization of the sector. It has several objectives, the first being of course the protection of European producers in a sensitive sector, where production is most often highly seasonalized and where perishable products are difficult to stock.

For agricultural products, the agreements define preferences at the entrance of the EU market only for fresh and processed F&V and they provide limited concessions for each partner for precise products and limited quantities and calendars. However, despite those preferences, Mediterranean countries still have to face important trade barriers when exporting horticultual products to the European market.

Within this context, an important issue is to assess the likely impacts of a greater liberalization on Mediterranean F&V exports to the EU. Most of the current studies on the topic are based on simulation models with general (Kuiper 2004, Doukkali 2003) or partial (Eruygur and Cakmak 2005, Chemmitz Grethe 2005) equilibrium framework and are the most often calibrated on one specific country (Morocco, Egypt or Turkey). However, in order to catch the likely impact of a decrease of tariffs, the simulations imply to evaluate at first to what extent European protection influences the F&V trade from MED countries. Thus, the objective of the paper is to analyse the main determinants of the European market access of fruit and vegetables by using a gravity equation. It focuses on the constraints faced by each Mediterranean countries at the entrance of the EU market. These "trade costs" (Anderson and Van Wincoop 2005) include both transport and border related costs (tariffs and non tariffs barriers, information costs, border formality costs…).

Our econometric estimations include 55 fruit and vegetable products. This very disaggregated level of commodity observation permits to take into account the heterogeneity among products, heterogeneity which appears at two levels: first, the nature and the intensity of the EU protection and second the degree of product perishability. The latter is one of the huge specificity of the sector and we assume that the more perishable the products the higher the transport costs. Thus, contrary to the majority of empirical literature using gravity equation, in this paper, transport costs vary not only with the distance but also according to the products. Finally, another originality of our approach is to compare the determinants of trade for the different Mediterranean countries. This is all the more important because the Barcelona process is not a regional agreement *per se*, but is the sum

of ten bilateral agreements signed between EU and each Mediterranean country and the conditions of access to the European market differ from one country to another.

The remainder of the paper proceeds as follows: Section 1 first presents the Mediterranean countries position as suppliers of fruit and vegetables for the European Union (EU15), and then compares tariffs and preferences allowed by the EU for these different suppliers. Section 2 presents the theoretical foundation of the gravity model, based on Anderson and Van Wincoop (2003). This model allows comparison of the access to the EU market for the Mediterranean Countries with the access for the European producers and to other third countries. After a presentation of data and econometric methodology implemented in the third part, the fourth part provides results, a major result being the heterogeneity among Mediterranean countries concerning the access conditions to the European Market. Finally, section 5 concludes.

1. Market access for fruit and vegetables coming from Mediterranean countries

The Mediterranean countries involved in the Barcelona Process (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia and Turkey[1]) are important trading partners of the EU with a market share of 4.8% (Table 1). Their main exports are hazelnuts, dried fruits and citrus but also tomatoes and other vegetables. Among the 10 MED countries, beside very small exporters as Algeria or Lebanon, four countries - Turkey, Morocco, Israel and Egypt – play a major part in the F&V trade (Table 2). They account for more than 95% of the F&V exports of the area. Beside MED countries, those of the Southern Hemisphere (Chile, Uruguay, Argentine, South Africa, Kenya, New Zealand and Australia) are also important non-EU exporters (3.14%) to the European Union (apples, grapes).

However, the EU members remain the main suppliers of the European market, providing for 77% of the EU F&V imports. Is this phenomenon only due to the abolition of tariff barriers between EU countries or other determinants explain the trade inside the European market? In other words, what explains the EU border effect (as called by Mayer, 2002) for the non EU countries at the entrance of the European market? More precisely, concerning Mediterranean countries, is their market share explained by the level of preferences allowed in the framework of the EU-MED agreements?

Table 1. World and European Union suppliers of fruit and vegetables in 2003.

	World Imports		EU Imports	
Suppliers	**Million dollars**	**percentage**	**Million dollars**	**percentage**
EU	46 700	51,33%	40 400	76,25%
NMS	1 490	1,64%	1 050	1,98%
Mediterranean countries	4 088	4,49%	3 023	5,76%
Southern hemisphere countries	5 060	5,56%	1 650	3,11%
Rest of the world	33 643	36,98%	6 864	12,95%
Total	90 980	100,00%	52 987	100,00%

Source: COMTRADE database

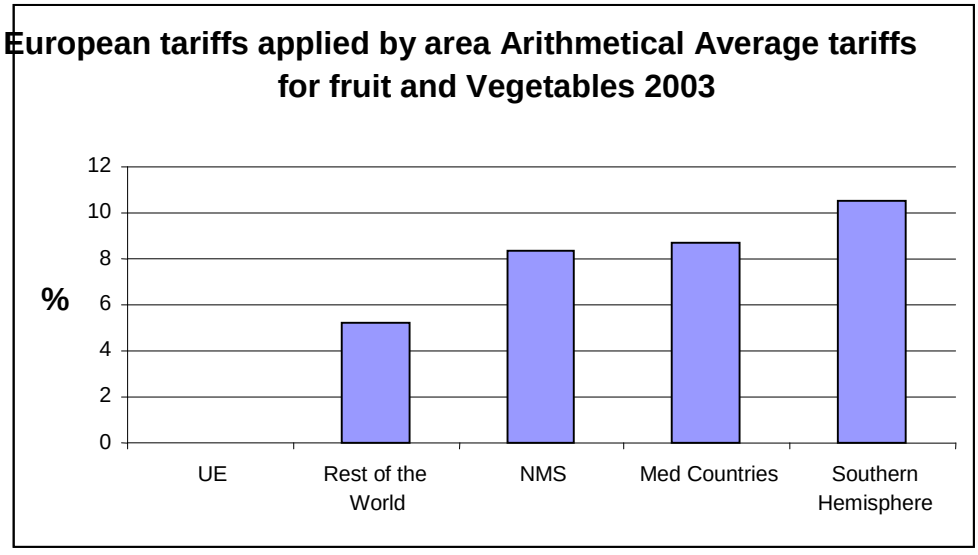
[1] In fact, since october 2005, starting date for the EU enlargement to Turkey, Turkey is excluded from the Barcelona process. Nevertheless, because these two processes are connected, we keep this very important EU partner in our analysis.

Table 2. Mediterranean World and European Union suppliers of fruit and vegetables in 2003

	World Imports		EU Imports	
Exporters	**Million dollars**	**percentage**	**Million dollars**	**percentage**
Algeria	17,9	0,44%	15,7	0,52%
Egypt	209	5,11%	119	3,94%
Israel	876	21,43%	757	25,04%
Jordan	149	3,65%	4,2	0,14%
Lebanon	48,7	1,19%	1,1	0,04%
Morocco	561	13,72%	501	16,57%
Syria	202	4,94%	11,1	0,37%
Tunisia	114	2,79%	104	3,44%
Turkey	1 910	46,73%	1 510	49,95%
Total	4 088	100,00%	3 023	100,00%

Source: COMTRADE database

Despite the Barcelona process, Mediterranean countries don't seem to have, on average, high preferences for their access to the European market. In 2003, the European tariffs applied to Med Countries are, on arithmetical average, a little higher (8.7%) than those applied to the NMS (8.4%) and to the others countries of the world (5.2%) (Graph 1). However, analysing preferences at the country level reveals heterogeneity among the countries and huge preferences for certain countries.



source : TARIC Database

Indeed, despite the fact that the Barcelona process is commonly presented as a regional agreement, it is really a set of bilateral agreements with each of Mediterranean countries and the state of progress of negotiations differs from one country to another. For instance, the agreement with Tunisia was signed as early as June 1995, Libya has for the moment an observer status, and no trade agreements have been signed, and negotiations with Syria are ongoing. Finally, other countries such as Morocco, Egypt and Israel have already renegotiated their initial trade agreement. Within the framework of the negotiations for EU

membership, Turkey has signed a Customs Union agreement with the EU, in continuation of association agreements signed as early as 1963.

Moreover, even if association agreements have been signed, not all products are concerned and some of them may benefit from other type of preferences (allowed notably in the framework of the GSP regime) (Chevassus-Lozza and al, 2005). Thus, on average for the overall MED countries, the EU-Med preferences account only for 26% of the tariff lines in the F&V sector, while 47.3% of their tariff lines may benefit from the GSP regime. Consequently, to estimate the access to the EU market for MED countries, one may take into account all the preferences allowed to these countries.

Since preferences are negotiated for each product and each Mediterranean country, there is a huge heterogeneity concerning tariff regimes among Mediterranean countries (Table 3). Turkey and Lebanon essentially have bilateral preferences (85% and 67% of tariff lines), and Turkey does not benefit from any GSP preferences. On the opposite, 83% of Israel tariff lines are submitted to the MFN regime without any preference.

Table 3. Repartition of tariff lines (CN10) by country and tariff regimes for fruit and vegetables 2003

	MFN	Bilateral preferences	GSP	Total
Algeria	23%	10%	67%	100%
Egypt	22%	9%	69%	100%
Israel	83%	17%	0%	100%
Jordan	23%	8%	69%	100%
Lebanon	12%	67%	21%	100%
Libya	26%	0%	74%	100%
Morocco	17%	49%	34%	100%
Syria	25%	1%	73%	100%
Tunisia	22%	13%	66%	100%
Turkey	15%	85%	0%	100%

The lines are counted month by month

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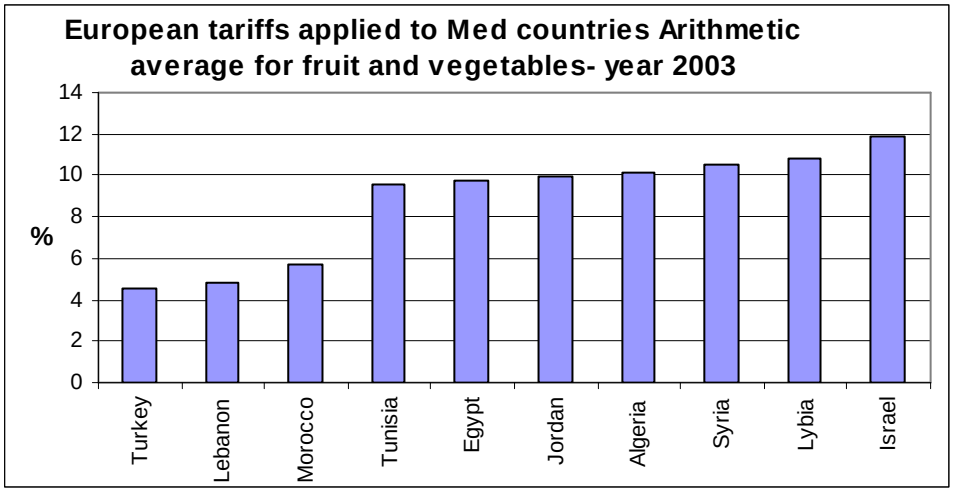
As a consequence, the heterogeneity among Mediterranean Countries remains also important concerning the level of the protection applied by the EU (Graph 2). Turkey, Lebanon, but also Morocco benefit from the lowest tariffs while Israel seems to be submitted, on average, to the highest protection.

Graph 2.



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Finally if we roughly connect these very first results on trade and tariffs, it appears that both of them are not systematically linked. For instance, Israel which is a major exporter on the European market still has to face high tariffs and doesn't benefit from huge preferences; whereas Lebanon benefits from high preferences and low tariffs and has a very low market share in the European market and its exports are very little EU-oriented. On the other side, Morocco and Turkey both have important share of the European market and low tariffs on average. Other components should explain trade to the EU. To answer these questions, we use a gravity-type model, the derivation of which is presented in the following section. Another key point of this part is the fact that preferences are negotiated for each country and each product separately. This legitimates to conduct our empirical work at a disaggregated level, the product level and the country level.

2. The Gravity Model

The Gravity-type model is a widespread model in international trade analysis which permits analysis of bilateral trade volume and nature. It is applied for various purposes, but it is particularly used to assess market access, trade resistance and impacts of regional agreements. Indeed, it permits estimation of trade creation or diversion in case of a regional agreement (Nahuis 2004, Soloaga and Winter 1999), and thus it brings an important contribution to the regionalism debate. On the other hand, the "border effect" methodology (Chen 2004, Head and Mayer 2004, Mayer and Zignago, 2005) offers an analysis of a market access measurement comparing imports from foreign countries to intra-national trade in order to have a benchmark of the best market access possible, the one faced by national producers.

Our model is based on the new developments of the gravity equation made by Anderson and van Wincoop (2003). We assume that consumers have identical and homothetic preferences and that products are differentiated by origin. The representative consumers in country i maximize a CES utility function U_{ik}:

$$U_{ik} = \left[\sum_j b_{jk}^{\frac{1-\sigma}{\sigma}} c_{ijk}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (1)$$

Under the following budget constraint:

$$\sum_j p_{ijk} c_{ijk} = \sum_j m_{ijk} = m_{ik} \tag{2}$$

We denote i the importing country, j the exporting country, k the product, c_{ijk} the consumption by i of product k from j and b_{jk} consumers' preference for products k coming from j. σ corresponds to the elasticity of substitution of imports of j. P_{ijk} is the price of good k coming from country j paid by consumers in country i, m_{ik} is the country i expenditure for good j. P_{ijk} differ from price in country of origin p_{jk} due to trade cost t_{ijk} that are not directly observable. We follow the iceberg assumption about trade costs that leads:

$$p_{ijk} = p_{jk} t_{ijk} \tag{3}$$

The maximization of (1) under constraints (2) give the bilateral imports by country i from country j for a given good k:

$$m_{ijk} = \left(\frac{b_{jk} p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} m_{ik} \tag{4}$$

P_{ik} is the country i's CES price index for good k:

$$P_{ik} = \left[\sum_j \left(b_{jk} p_{jk} t_{ijk} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{5}$$

The general equilibrium structure of the model imposes market clearance. We consider both international and intranational trade, so with x_{jk} production of good k by country j, market clearance leads to:

$$x_{jk} = \sum_i x_{ijk} = \sum_i m_{ijk} \tag{6}$$

Applying the equation (5) to this market clearing condition, we obtain:

$$x_{jk} = \sum_i \left[\left(\frac{b_{jk} p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} m_{ik} \right] \tag{7}$$

We follow Anderson and van Wincoop 2003 using market clearance (7) to solve for the coefficient b_{jk}:

$$b_{jk}^{1-\sigma} = \frac{x_{jk}}{\sum_i \left[\left(\frac{p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} m_{ik} \right]} \tag{8}$$

Substituting this expression of b_{jk} (8) in (7), it yields

$$m_{ijk} = x_{jk} m_{ik} \left(\frac{p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} \frac{1}{\sum_i \left[\left(\frac{p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} m_{ik} \right]} \tag{9}$$

We differ from Anderson and van Wincoop in not simplify this equation assuming that trade barriers are asymmetric. We pose $A_{jk} = \sum_i \left[\left(\frac{p_{ijk}}{P_{ik}} \right)^{1-\sigma} \frac{m_{ik}}{m_{wk}} \right]$ with m_{wk} total expenditure for product k in the world. It corresponds to a CES index of price competitiveness of j for the good k. This index assesses the global competitiveness of country j on the total destination markets. $\left(\frac{p_{ijk}}{P_{ik}} \right)$ is the price competitiveness of j on market i. This ratio is weighted by the share of country i in the total demand. Introducing this index in (9), we obtain:

$$m_{ijk} = x_{jk} m_{ik} \left(\frac{p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} \frac{1}{A_{jk} m_{wk}} \tag{10}$$

That leads to:

$$\frac{\frac{m_{ijk}}{m_{ik}}}{\frac{x_{jk}}{m_{wk}}} = \left(\frac{p_{jk} t_{ijk}}{P_{ik}} \right)^{1-\sigma} \frac{1}{A_{jk}} = IR_{ijk} \tag{11}$$

We actually regress not the volume of bilateral flow as in traditional gravity equation, but the index of relative bilateral intensity IR_{ijk}. This technique permits to avoid the endogeneity bias, as production and consumption are not explicative variables anymore. This index compares the share of the imports of good k coming from j in the total imports of i to the market share of the exporter j in the international market. An index equal 1 means that the flow of good k between i and j is only determined by the size of the partners. A coefficient different from 1 means that trade is determined by other factors than the size (equation 11): if it is greater than one, it denotes privileged trade links between i and j for good k whereas an index less than one refer to trade resistance between the two countries which could be explained by a low competitiveness of i, but also by the trade costs.

Trade costs t_{ijk} are defined to include all costs incurred in getting a good to a final user other than the production of the good itself (Anderson van Wincoop 2004). These costs comprise transport costs, tariffs and non tariffs barriers, but also information costs, the use of different currencies or the marketing cost. The main problem is to measure these costs for which data are not always available. So, this mandates capturing trade cost by observable cost proxies.

We follow Péridy 2005 and decompose trade costs into different factors: the distance d_{ij} between i and j (proxy of transport costs), tariffs applied by i towards j for good k t_{ijk} and other border variables B_{ijk} that are traditionally used in gravity model in order to take into account information costs and other elements that we cannot measure, as common language, common frontier, and common history. We add a perishability variable in order to catch this major specificity of the fruit and vegetables products.

3. Data and econometrics

The above theoretical development leads to the estimable gravity equation:

$$\ln(IR_{ijk}) = \ln(\frac{m_{ijk}}{m_{ik}}) - \ln(\frac{x_{jk}}{m_{wk}})$$

$$= (1-\sigma)\ln(\frac{p_{jk}}{P_{ik}}) - \ln(A_{jk}) + (1-\sigma)(\ln tariffs_{ijk} + \ln d_{ij} + Contig_{ij} + Colony_{ij} + Periss_{k} + zone_{j}) \tag{12}$$

Insofar as one of our objectives is to assess the impact of different trade barriers and, more precisely, to point out those which prohibit trade, we must take into account not only the actual bilateral trade but also "zero values", i.e. all potential bilateral flows. In this case the suitable procedure is to model the decisions that produce zero values (the decision to export or not), rather than to use the censored regression tobit model mechanically, where zero values are assumed to appear due to censoring (Maddala, 1992). Thus, the most appropriate econometric method for this purpose is a **Heckman procedure** (Heckman, 1979)

The model is estimated on annual data and in cross section, for the year 2002 at the product level - the product level being defined in the FAO nomenclature (i.e. about 55 products for the fresh F&V sector). We focus our analysis on EU imports from all its trading partners (EU and non EU members – among them Med and non Med countries). Thus the dependent variable includes both **international** (m_{ijk}) **and intra-national flows** (m_{iik}); however, the latter are not available at a so disaggregated level. Thus, we had to generate these flows from the data on production (coming from FAOSTAT) and trade (coming from COMTRADE database). For this, we have computed the balance sheet between supply and demand for each product and countries. This needs specific attention on the consistency between the two databases, taking into account the problem of re-exportation which entails for example that some countries without production can present important amount of exports for some products.

Bilateral relative price ($\frac{P_{jk}}{P_{ik}}$) are calculated from production price data of FAOSTAT database for each country and product. Nonetheless, as data needed to calculate the index of global competitiveness (A_{jk}) are not available we don't introduce this variable in our estimation.

For the **transport costs** between two countries – we have taken as proxy the distance between the capitals of i and j d_{ij} and the internal distance calculated by the CEPII [2] . Because of the time sensitivity of fruit and vegetable, these transport costs must be a huge concern in this sector; and the more perishable the product, the higher the costs. Thus, besides the distance we have introduced a multinomial variable corresponding to the degree of perishability of the products. Four groups have been made, using data on time keeping, respiratory intensity, and fragility from the least (group 1) to the most perishable (group 4) (Appendix 1).

As far as **the contiguity variable** (Bij) is concerned, we have introduced a dummy variable equal to 1, if the two trading partners have a common border. It is equal to 0 otherwise. **The common history** has been caught through the dummy colony equal to 1, if the exporting country was a colony of its trading partner.

In order to take into account all the preferences granted, duties included in the estimation are **tariffs applied** by the EU to each of its trading partners. The data come from TARIC database (DG Taxud). Although the model is estimated on annual data and for the FAO nomenclature, we must measure the protection at the most disaggregated level in order to have a comprehensive picture of the protection: i.e. monthly data at the 10-digit level of the combined nomenclature. This permits to catch variations of the tariffs during the year due to the seasonality of protection and the different calendars of preferences. Moreover, the calculation of ad-valorem equivalent may be problematic in the F&V sector, due to the so called "entry price system" applied to some sensitive products such as tomatoes, cucumbers or citrus…. This system implies that the level of protection depends on the level of the import price. If the import price is greater than a threshold – the trigger price – the exporter pays the ad-valorem part of the duty only. If the price is below the trigger price, the exporter has to pay also a specific duty. This duty is at the maximum when the price falls below a certain level, equal to 92% of the trigger price. Consequently, the measurement of

[2] Available on the CEPII website : http://www.cepii.fr/

the ad-valorem equivalent requires an import price to be chosen. Here, in this paper, we have chosen to measure the protection at its maximum level, i.e. when the import price is 92% of the trigger price. Finally, for these specific products, preferences allowed by the EU may be either an exemption or a reduction of the ad-valorem tax, the level of the specific duty remaining the same. Morocco has negotiated lower entry prices for some products (tomatoes and oranges), and preferences allowed for this country are higher. In order to catch this preferential advantage for these products, we have calculated the ad-valorem equivalent on the Morocco prices.

Finally, once the ad valorem equivalent is calculated at the most disaggregated level for each country, we must aggregate this monthly data calculated at the 10-digit level of the combined nomenclature in annual data defined in the FAO nomenclature. We use two methods of aggregation. First, we compute an arithmetical tariff average which permits to catch the whole protection applied during the year, even though some months, tariffs are so high that they prevent imports. This average is introduced in the selection part of the Heckman estimation – probit part - in order to take into account the overall tariff barrier applied at the entrance of the EU market. In the second computation, the average applied by the EU to its trading partner, is weighted by the monthly imports of the EU from this country (by using COMEXT database). This estimation measures the taxes really paid by the exporters when they have entered the EU market in 2002. We introduce this measure in the regression part of the estimation. Finally, we replace tariffs t_{ijk} by $(1+t_{ijk})$ in order not to loose observations where tariffs are equal to zero.

4. Results

From an econometric point of view, the two modeling steps (selection and regression on export volume) are not independent (value of the Chi^2), which justifies the use of the Heckman procedure. Because results of the Probit are quite similar of that of the regression step, we only present the regression step results of the Heckman Procedure (table 4). We'll present in the text the differences when necessary.

Table 4. Results. **, **, *** denote significance at 1%, 5%, 10% respectively*

	Estimation by zone			**Estimation by country**		
	Coeff.	*Std err*	Sign.	Coeff.	*Std err*	Sign.
exporter price competitiveness	-0,17	0,03	***	-0,19	0,03	***
Exotic good	0,83	0,22	***	1,22	0,22	***
Colony	0,90	0,17	***	1,08	0,17	***
Common Border	0,41	0,17	**	0,23	0,16	NS
Tariffs applied to the ROW	-0,92	0,06	***	-0,75	0,06	***
Tariffs Med Countries	-0,79	0,07	***	-	-	-
Tariffs Morocco	-	-	-	-0,42	0,20	**
Tariffs Israel	-	-	-	-0,49	0,17	***
Tariffs Algeria	-	-	-	-3,68	0,76	***
Tariffs Lebanon	-	-	-	-2,86	0,44	***
Tariffs Tunisia	-	-	-	0,14	0,22	NS
Tariffs Syria	-	-	-	0,02	0,38	NS
Tariffs Jordan	-	-	-	-0,36	0,37	NS
Tariffs Egypt	-	-	-	-1,28	0,19	***
Tariffs Turkey	-	-	-	-0,43	0,13	***
Tariffs New Member States	-0,65	0,10	***	-0,74	0,09	***
Tariffs Southern Hemisphere countries	0,21	0,09	**	0,47	0,09	***
Country dummies (ROW reference)						
Med Countries	0,67	0,22	***	-	-	-
Morocco	-	-	-	1,18	0,35	***
Israel	-	-	-	3,69	0,42	***
Algeria	-	-	-	1,08	1,69	NS
Lebanon	-	-	-	0,49	0,73	NS
Tunisia	-	-	-	-2,33	0,57	***
Syria	-	-	-	-7,07	1,22	***
Jordan	-	-	-	-0,28	1,26	NS
Egypt	-	-	-	1,37	0,47	***
Turkey	-	-	-	0,98	0,32	***
New Member State	0,50	0,28	*	1,01	0,27	***
South Hemisphere Countries	1,54	0,27	***	1,57	0,26	***
European Union Border Effect	1,12	0,21	***	1,39	0,20	***
Home Effect	5,61	0,38	***	5,63	0,37	***
Distance	-0,99	0,07	***	-	-	-
Distance Perishability 1				0,04	0,10	NS
Distance Perishability 2	-	-	-	-1,28	0,09	***
Distance Perishability 3	-	-	-	-1,51	0,09	***
Distance Perishability 4	-	-	-	-1,42	0,11	***
Degree of Perishability (Group 1 reference)						
Perishability 2	-2,07	0,13	***	7,81	0,78	***
Perishability 3	-3,32	0,13	***	8,38	0,77	***
Perishability 4	-2,28	0,14	***	8,57	0,84	***
Constant	8,22	0,66	***	0,33	0,83	NS
Number of obs	*18809*			*18809*		
Censored obs	*9991*			*9991*		
Uncensored obs	*8818*			*8818*		
Wald chi2(17)	*3183,50*			*3931,36*		
Prob > chi2	*0*			*0*		
Log likelihood =	-			-		
LR test of indep chi2(1)	*185,03*			*165,67*		
Prob > chi2	*0*			*0*		

Results for "classical" variables are in line with expectations from a gravity model. Distance restricts trade between two countries. Conversely, having a common border and a common history (colony) stimulates trade between partners. Moreover, the bilateral price competitiveness has a significant impact on trade: the higher the production price p_{jk} of the exporting country compared to the internal price on market i P_{ik}, the lower the volume of exports. The dummy "exotic good" is used in order to catch the fact that some products are not produced in the EU countries, and it has a positive sign that means that EU countries, as expected, import more the products they can not produce. In the rest of this section, we focus our analysis on trade costs: tariffs, transport costs and other trade resistances.

1. Perishability increases transport costs

Trade is sensitive to the **perishability** of the commodity exchanged (first three columns of Table 4). The more perishable the products (from group 2 to 4), the lower the volume of trade, compared to the non-perishable products (group 1)[3]. However, the impact is greater for group 3 (tomatoes, cherries, cucumbers…) which seems to be the more time sensitive. This effect could be explained by the fact that products of group 4 (strawberries, raspberries, blueberries…) can be exchanged frozen which can reduce the time sensitivity.

To assess the impact of perishability on **transport costs** we introduce in a second time (???) an interaction terms between perishability and distance (last three columns of table 4). These new variable "distance-perishability" allows to compare the impact of distance for the different perishability groups. It appears from the results that distance has no significant impact for non perishable products (group 1). In other words, transport costs do not determine trade for these products. Conversely, for the other groups of products, distance has an important effect on trade. This relation is even more clear in the selection results, where the more perishable the product, the higher the impact of distance on the probability to trade. However, the coefficient of perishability group dummies is now positive and significant; moreover it is increasing with the degree of perishability. As we catch the impact of transport costs through the distance-perishability coefficient, the perishability group dummies may capture the product-specialization effect. Indeed, products of groups 2, 3 and 4 are overall more exchanged than products of the first group.

2. The EU border effect

The country dummies catch the specific effects on a group of countries (or of a single country) in the explanation of the bilateral trade of EU F&V, all the other determinants being taking into account (transport costs, tariffs….). The value of the coefficients is given in reference to the group of the ROW countries. Our estimation displays a significant and important **home effect** of 5.6, and a notable **EU border effect** (1.12). In other words, each European country trades much more with itself than with other third countries (home effect) and moreover European countries import more from the European market than from the rest of the world (EU border effect).. Comparing the home and the EU border effect

[3] The value of the coefficients of the dummies perishability must be read in comparison of the reference to the group 1(group of products the less perishable). So, a negative value signifies that the products belonging to the given group are less exchanged than those of group 1.

shows that the "EU Market fragmentation" as called by Head and Mayer (2002) is still very important in the fruit and vegetable sector. European countries trade much more with themselves than with European partners despite the common market. Is it due to the specificity of the products in this sector, i.e their perishability?

Coupling the **perishability groups with the EU and the Home dummies** points out the importance of the perishability on trade resistance again (Table 5). Perishable products are more exchanged within the EU and notably within the national territory. Higher the perishability of the products, higher the Home and EU border effects.

Table 5.

	Coefficient	*Std err*	significance
EU Perishability 1	-0,86	*0,24*	***
EU Perishability 2	2,28	*0,26*	***
EU Perishability 3	2,17	*0,26*	***
EU Perishability 4	2,27	*0,28*	***
Home Perishability 1	2,47	*0,53*	***
Home Perishability 2	6,67	*0,55*	***
Home Perishability 3	7,41	*0,50*	***
Home Perishability 4	6,44	*0,53*	***

, **, * denote significance at 1%, 5%, 10% respectively*

3. The access of Mediterranean basin to EU market (tariffs and trade resistance)

The first estimation (first three columns of table 4) compares the **impact of the European protection** applied to fruit and vegetable products coming from third countries, by distinguishing four groups of countries: Mediterranean basin, Southern Hemisphere countries, New Member States (NMS) and the Rest of the World (ROW). As expected, tariffs have a significant and negative impact on trade, for the three groups ROW, the MED countries and the NMS. However, the impact is not significantly different between, on one hand the ROW and the MED countries, and on the other hand between the MED countries and NMS.

Finally a puzzling result remains: i.e the postive impact of tariffs on exports from Southern Countries. This should mean that tariffs stimulate trade. But in fact, this result can be explained by the product specialization of these countries. They are specialized in highly protected products by the European Union, such as apples or grapes. They can export on European markets because of their competitiveness and their production calendar despite high tariffs.

As above mentioned country group dummies catch all the other determinants - once taken into account protection, transport costs and price competitiveness- that impede or enhance trade. All these coefficients are estimated in reference to the ROW. We retrieve here the home and the EU border effects above mentioned. Nevertheless, the comparison of the coefficients obtained for the different areas to the EU value, reflects the overall capability of the countries to access to the EU market, in comparison to the EU members. A higher value of the coefficient signifies a trade advantage on the EU market in comparison to the EU. A smaller value signifies a trade resistance at the entrance of the EU market. Concerning countries of the ROW, the coefficient is merely the inverse of the EU dummy

coefficient (-1.12). It reveals a trade resistance for the ROW at the entrance of the EU that could be explained by determinants as Non Tariffs Barriers or logistic constraints. Mediterranean countries still have a trade resistance at the entrance of the EU market (0.67-1.12 = - 0,45) but they have a better access to the European market than the ROW. This trade resistance is equivalent for the New member States. Southern Hemisphere Countries have a specific advantage on the European market.

4. The heterogeneity of the Mediterranean basin

From the above results, it appears that the tariff sensitivity of MED countries is similar to that of the ROW and the overall area suffers from a disadvantage at the entrance of the EU market (trade resistance). Are these results the same for each Mediterranean countries or do they differ among the area? In order to answer this question, we disaggregate, in the last three columns of Table 4, the impact of tariffs and the country dummies for each country of the Mediterranean area.

Results on competitiveness, production, consumption, common border and history are the same as in the first estimation. EU border effect, home effect, Southern Hemisphere effect remain the same, but the new specification of the model makes the coefficient of tariff non-significant for the New Member States.

From the econometric results (Table 4), the Mediterranean area appears as a **highly heterogeneous country bloc**. Concerning tariff elasticities, we can distinguish, among the area, three different groups of countries. For Algeria, Lebanon and Egypt the sensitivity to tariff is very high compared to the ROW. Conversely, Syrian, Tunisian and Jordan exports to the European Union seem to be not sensitive to tariffs and a decrease of tariffs should have a low impact on their trade. Finally, the tariff sensitivity for Turkey, Morocco and Israel is quite low compared to that of the ROW but remains significant.

Concerning the country dummies, Tunisia and Syria display a very high trade resistance, especially for Syria. Algeria, Lebanon and Jordan face the same trade resistance as the ROW. Conversely, Israel has a huge trade advantage on the EU market. The Israeli logistic and organizational competencies can be at the origin of these non-price competitive advantages. Finally, for Turkey, Egypt and Morocco the access to the European markets is not significantly different than that of the EU members.

To assess the potential impact of a decrease of protection, two elements must be taken into account: the tariff sensitivity of the exporting country (tariff coefficient) and its trade resistance (captured by the country dummies) compared to European suppliers. The higher the tariff sensitivity the higher the impact of liberalization on trade but this impact can be eroded by a high trade resistance (NTB …).

To sum up these results, and by connecting the two effects, it appears that **Israel and Egypt** are the two countries that may be more sensible to a decrease of tariffs. In the case of Israel its huge "non price advantage" may be amplified by its sensitivity to the tariff variations. In the case of Egypt, it has an important elasticity to tariffs and displays also important other advantage at the entrance of the EU market (due probably to logistic and organizational competitiveness). **Morocco and Turkey** also present other important advantages but they display small tariff elasticities, so they should be less sensitive to a decrease of tariffs than Israel and Egypt. **Algeria and Lebanon** have high tariffs sensitivity

but present a trade resistance similar to that of the Rest of the World in accessing the European market. Thus the competitiveness of these countries depends not only on tariffs, but also on non-tariffs components such as organization, adaptation to European norms or logistic capacities. Therefore the positive impact of a decrease of tariffs may be canceled by a non competitive position of these countries. Lastly, **Tunisia, Syria and Jordan** are not very sensitive to tariffs and their access to the EU market is more constrained by non tariff or non price determinants. In this context, as for Algeria and Lebanon, in order to benefit from the liberalization process, these countries must at first improve their non price competitiveness…

	Trade advantage : "Non Price Competitive advantage"		**Trade Resistance =ROW**	
	Trade advantage > EU Exporters	**Trade advantage = EU Exporters**	**Trade Resistance =ROW**	**Trade Resistance>ROW**
High Tariff sensitivity ≥ROW		Egypt	Algeria Lebanon	
Low Tariff sensitivity <ROW	Israël	Turkey Morocco		
No Tariff Sensitivity			Jordan	Tunisia Syria

The above estimations are robust to changes in the specification. We test two different specifications: firstly, we leave out the observations for the Rest of the World, that does not change significantly the coefficients of our estimation, and secondly, we leave Southern Hemisphere countries. In this second case, only the colony coefficient changes and becomes larger. Concerning multi-colinearity, tests show no colinearity on our dependent variables, except between distance and southern Hemisphere country dummy.

5. Conclusion

In order to assess the impact of the EU-MED trade liberalization we built a gravity model focused on EU fruit and vegetable imports. The model is estimated on annual data for the year 2002 at a disaggregated product level (using FAO nomenclature for 55 products) and includes both trade between EU and all its trading partners and intra-EU trade. The index of relative bilateral intensity in flows is explained by relative prices and "trade costs", those trade costs including transport costs, EU applied tariffs and other trade resistance.

A first set of conclusions deals with transport costs. Our estimations reveal that transport costs and their impact on trade differ with the degree of product perishability. This result reinforces our choice to work at a disaggregated level, in order to catch this product specificity that is rarely taken into account in international trade models

A second set of conclusions shows that with respect to the Euro-Med liberalization process, the Mediterranean area appears as a highly heterogeneous bloc. Israel is the only country that does show better non price competitive advantage on the EU market than the EU countries themselves, revealing other advantages than prices such as logistic or

organizational competitiveness. It has also the highest average tariff. Thus, because of its tariff elasticity, the impacts of liberalization on Israeli exports should be very important, ceteris paribus.

Egypt also displays important non price competitive advantage and even higher tariff sensitivity than Israel, with current tariffs being quite high. Being the fourth exporter in the market, the impact of liberalization could impact significantly its exports.

Morocco and Turkey are currently the two countries that share the highest part of the Euro-Med fruit and vegetable market, and they benefit of high preferences (low tariffs). They are in a medium position from the point of view of tariff elasticities and present the same non price competitive advantage than European Suppliers. Consequently, the impact of liberalization should be positive for those countries but lower than for Israel or Egypt, and may even be jeopardized by the erosion of their preferences.

Finally, the other Mediterranean countries appear to be in different situations one from another. But we should not expect important impacts of liberalization on their exports because either they show low tariff sensitivity (Jordan, Tunisia, Syria) or low current tariffs (Lebanon), or none of them present significant non price competitive advantage.

Liberalization process in the Mediterranean area is gradual and tariffs concessions for agricultural products remain restricted to specific quantities or periods that are renegotiated by the Mediterranean countries. Thus, preferences vary with the seasons and the year. As the estimations in this paper are made on annual data, it should be necessary to take into account these characteristics of the protection in order to improve our conclusions. Lastly, we show that some countries display trade resistance at the entrance of the European Market: a specific work on these Non tariffs Barriers could be interesting to understand more precisely these effects.

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Appendice 1. Perishability groups

Group 1	Almonds Beans, Dry Beans, Green Broad Beans, Green Chick-Peas Garlic Hazelnuts (Filberts) Lentils Onions and Shallots, Green Onions, Dry Peas, Dry Pistachios
Group 2	Apples Avocados Bananas Carrots Dates Grapefruit and Pomelos Kiwi Fruit Lemons and Limes Oranges Pears and Quinces Pineapples Potatoes Sweet Potatoes Tang.Mand.Clement.Satsma
Group 3	Artichokes Asparagus Cabbages Cauliflower Cherries Chillies&Peppers, Green Cucumbers and Gherkins Grapes Mangoes Papayas Peas, Green String Beans Tomatoes
Group 4	Apricots Blueberries Cantaloupes&oth Melons Currants Eggplants Figs Lettuce Mushrooms Peaches and Nectarines Plums Raspberries Spinach Strawberries Watermelons