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A trade model to evaluate the impact of trade liberalisation on EU tomato imports

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Abstract

The complexity of the Euro-Mediterranean trade liberalisation is difficult to represent in trade models because of the range of instruments still constraining trade as well as the special characteristics of the major traded fruits and vegetables (product differentiation and seasonality). This paper proposes a trade model to assess the impact of trade liberalisation in the fresh tomato market, taking into account trade measures that are defined on a seasonal basis, such as tariff-rate quotas and entry prices. Simulations are carried out in monthly periods. The model considers imports from different sources as imperfect substitutes, following a non-linear Armington-type approach. Different policy scenarios have been run, considering various types of changes in the trade policy for tomatoes, changes that would arise from a new multilateral trade agreement. Model results indicate that, as far as EU producers are concerned, considering tomatoes as a sensitive product would be the less dramatic scenario. By contrast, entry price elimination would have noteworthy consequences on EU producers.

Additional key words: Euro-Mediterranean integration, fresh tomato market, trade liberalisation.

Resumen

Un modelo comercial para evaluar el impacto de la liberalización comercial de las importaciones de tomate de la EU

La complejidad del proceso de liberalización euro-mediterránea es difícil de representar en los modelos de comercio internacional. Ello se debe a la variedad de instrumentos que todavía restringen el comercio y también a las características especiales de las frutas y hortalizas con mayor importancia en el comercio (diferenciación del producto y estacionalidad). Este trabajo presenta un modelo de comercio internacional para evaluar el impacto de la liberalización del comercio en el mercado de tomate fresco, teniendo en cuenta medidas que se definen sobre una base estacional, como los contingentes arancelarios y los precios de entrada. Se realizan simulaciones para periodos mensuales. El modelo considera a las importaciones de distintos orígenes como sustitutos imperfectos, siguiendo un modelo del tipo Armington no lineal. El modelo estudia distintos escenarios de política, considerando diversas variaciones en la política comercial aplicada al tomate, variaciones que provendrían de un nuevo acuerdo comercial multilateral. El modelo muestra que, en lo que respecta a los productores de la Unión Europea, considerar el tomate como producto sensible sería el escenario menos dramático. En contraste, la eliminación del sistema de precios de entrada tendría serias consecuencias sobre los productores europeos.

Palabras clave adicionales: integración euro-mediterránea, liberalización del comercio, mercado de tomate fresco.

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Abbreviations used: AVE (*ad valorem* equivalent), CES (constant elasticity of substitution), DDA (Doha Development Agenda), EMA (Euro-Mediterranean Agreement), EP (entry price), EPQ (entry price quota), EU (European Union), F&V (fruits and vegetables), MFN (most-favoured-nation), MTE (maximum tariff equivalent), PE (partial equilibrium), PTA (Preferential Trade Agreement), QR (quota rent), ROW (rest of the world), SIV (standard import value), SMC (Southern Mediterranean Countries), TRQ (tariff-rate quota), UR (Uruguay Round).

Introduction

The analysis of Euro-Mediterranean agricultural trade liberalisation is a growing area of research. Complexity is a word that defines the bilateral trade liberalisation process in the region. This complexity is difficult to represent in a trade model because of (i) the variety of instruments constraining bilateral agricultural trade; and (ii) the special nature of the most important traded goods (product differentiation and seasonality). This paper proposes a trade model to evaluate the impact of European Union (EU) liberalisation on horticultural imports. The model is applied to several scenarios of trade liberalisation on fresh tomato imports.

The commercial integration process among the EU and a number of countries from the Mediterranean basin has been progressing, within the framework launched in the 1995 Barcelona Conference (Garcia-Alvarez-Coque, 2002). Within this framework, the EU holds preferential trade agreements (PTA) with its Mediterranean neighbour countries – so-called Southern Mediterranean Countries (SMC). One fact of the Euro-Mediterranean process is that there is one major sector that is still excluded from the free trade area provisions: agriculture. For example, the Barcelona Ministerial declaration in November 2005 foresees the progressive liberalisation of trade in agriculture, but "*with a possible selected number of exceptions and timetables for gradual and asymmetrical implementation*".

Research has paid little effort to model the impact of trade instruments applied to fruits and vegetables (F&V) though recent econometric analysis based on the 4gravity approach have studied the impact of policies on F&V trade (Emlinger *et al.*, 2006; Martí Selva and García Alvarez-Coque, 2007). In fact, the number of contributions modeling horticultural trade in the Mediterranean area is scarce and, when F&V have been considered, it has been in a quite general way. Kuiper (2004) reviewed eleven different models that quantified the impact of the Euro-Mediterranean Agreements (EMA) but only one of them (Chemingui and Thabet, 2001) took F&V specifically into account. Lorca and Vicéns (2000) and Bunte (2005) defined multi-commodity models including F&V, but without seasonal specification of policy instruments. In the present paper, a partial equilibrium framework is proposed to study some of the particularities of the EU imports of F&V, including preferences, tariff-rate quotas (TRQ), seasonal windows and entry prices (EP). The model proposed is applied to simulate several ways of reducing EU protection on tomato imports, and the simulations are carried out on a monthly basis.

The next section describes both the specific instruments applied on the fresh tomato imports and the modelling approach used for the simulations. Then, following the discussion about data used and scenarios defined, the results of the simulations carried out are shown. The final section of the paper lists the conclusions drawn from the analysis.

Methods

Policy measures

The complexity of the trade measures that the EU applies on fresh tomato imports is reflected in the following:

- *Preferences.* The EMA differ in the specific quantitative parameters of agricultural concessions (duty reductions, products covered and quantitative limits).
- *Entry prices.* The EP system applies to a group of fruits and vegetables considered particularly sensitive by the EU. Third countries apparently accepted this approach as a *quid pro quo* for the continuing opportunity to export to the EU at high prices without facing high tariffs (Swinbank and Ritson, 1995). The system consists of a two-tiered tariff. When the export price of exports to the EU is above the EP, they must pay an *ad valorem* duty, whereas exports priced below the EP must pay a supplementary specific tariff (a percentage of the Maximum Tariff Equivalent - MTE) after being levied by the *ad valorem* duty. To ease the implementation of the system, the European Commission calculates the Standard Import Value (SIV) for each day and origin, as a proxy of the border import price. When SIV is below 92% of the EP the supplementary tariff is the full MTE to add to the *ad valorem* duty. The MTE can be considerable and may virtually act as a prohibitive tariff (Cioffi and dell'Aquilla, 2004). For tomatoes, it reaches €298 Mg^{-1}.
- Significant reductions of EP for certain quantities of tomatoes traded (or Entry Price Quotas, EPQ) have been agreed with Morocco, creating a preference margin (see Grethe and Tangermann, 1998). Martinez-Gomez (2008) assesses the potential gains from this type of concession. According to the

Agricultural Protocol currently in force, approved in 2003, the period for reduced entry price over a marketing year ranges between October and May. The EP and periods of application for Most Favoured Nation (MFN) non-preferential third countries and for Morocco are given in Table 1.[1]

– *Seasonal windows.* In some periods of the year the EU market is more open to foreign trade than in other periods. For this reasons, a trade model applied on tomato imports requires a seasonal definition of the relevant trade variables, allowing a detailed representation of the changing trade policies.
– *TRQ.* Tariff concessions are limited to negotiated quantities for a number of "sensitive" products. TRQ are usually set and can easily neutralise the market access theoretically improved by tariff preferences. TRQ are applied for Moroccan exports with complete duty elimination (though the EP still applies). Monthly TRQ range from 4,000 Mg for May to 30,000 Mg for December, January, February and March, each. Moreover, there is the so called "*additional quota*", that ensures than a given number of tonnes can be sold over the monthly TRQ from November to May –with limited possibilities of over-passing the monthly quota. There is a seasonal pattern for Moroccan tomato exports: while in summer (from May to September) the exports are almost irrelevant, they are quite important the rest of the year. In those months, in several cases TRQ are surpassed whereas in other cases actual trade flows appear to be bounded as result of the quantitative restriction. Usually, peaks happen in December and March. For the period October to May, exports beyond the quotas are granted a 60% tariff reduction. In the rest of the year, any quantity exported from Morocco is having a 60% tariff reduction.

Taking the marketing year as a whole for modelling F&V trade flows could hardly reflect this complex seasonal regulation and its practical consequences. For this reasons, a model will have as one of its features a seasonal definition of the unknowns, allowing us to make a detailed representation of the changing trade policies that export supplies are facing.

Modelling approach

A partial equilibrium (PE) approach was used, since it allows for a seasonal description of specific commodities' markets[2]. Several studies have focused on a single-commodity approach to examine selected F&V trade, in particular the banana market (Vanzetti *et al.,* 2005; Anania, 2006). Such single-commodity approach could tend to overestimate trade impacts because the transfer of resources between sectors is not considered in an explicit way. However, working with a single-commodity model provides sensible results on geographical impacts with seasonal fluctuations. The proposed model draws on the methodological approach by Francois and Hall (1997)[3] but unites the following characteristics, some of them adequate to study fresh EU F&V trade:

– It is a model tailored to assess specific measures such as EP, preferences and TRQ.
– Impacts are calculated on a seasonal basis.

Table 1. Entry prices, periods of application and reduced entry prices for Morocco

Product and period	Entry price MFN (€ Mg^{-1})	Entry price Morocco (€ Mg^{-1})
Tomatoes from 1 to 30 April	1,126	461
Tomatoes from 1 to 31 May	726	461
Tomatoes from 1 June to 30 September	526	526
Tomatoes from 1 October to 20 December	626	461
Tomatoes from 21 December to 31 December	676	461
Tomatoes from 1 January to 31 March	846	461

MFN: Most-favoured-nation. Source: Taxation and Customs Union database and Euro-Mediterranean Agreement.

[1] Jordan has been granted also a reduced EP since January 2006, with similar preferences as in the Moroccan case while no EPQ has been raised. A new wave of protocols is now (by the end of 2008) in discussion under the framework of the Union for the Mediterranean.
[2] The details in horticultural policies discussed in the present paper are difficult to represent in general equilibrium models.
[3] A similar approach, though using linear equations, can be found in Sarris (1983). Nowadays, computing methods and tools allow for non-linear systems.

– The model considers imports from different sources as imperfect substitutes, through a non-linear Armington-type model.[4]
– The modelled market is the EU-25 and major suppliers are explicitly considered.
– A composite demand is formed by different sources (intra-EU, preferential and non preferential suppliers).
– Projections are based on comparative static simulations on a monthly (or shorter period) basis for a reference marketing year.[5]

Let us start describing the model by defining the main model variables and parameters: P_j = EU market price of the product originating at j; P = composite index of internal prices of a product originating in various sources; W_j = export price of a product originating at j; αi = allocation parameter to aggregate imports from different sources; E = total expenditure on EU imports at internal prices; k^M = constant term for the demand of total imports; k^E_j = constant term for the export supply of a product originating at j; σ = elasticity of substitution; t^o_j = extra-quota total duty; t^w_j = price wedge on country j imports, when TRQ is binding; η = demand elasticity for total imports; μj = export supply elasticity of a product originating at j to the EU market; M^q_j = quota volume for a product originating at j; M_j = imports originating at j; q = composite demand; X_j = export flow originating at j.

Demand

The composite demand, q, is defined as a Constant Elasticity of Substitution (CES) composite of intra-EU products and imports from different regions. The composite demand can be described by:

$$q = k^M P^{\eta} \qquad [1]$$

The price P is an index of the prices of the imports originating in various regions:

$$\text{Import price index: } P = \left[\sum_{i=1}^{n} \alpha_i^{\sigma} P_i^{1-\sigma}\right]^{1-1/\rho}, \text{ where } \rho = (\sigma - 1)/\sigma$$

While Eq. [1] represents the composite demand at the EU market, the import demand of product originating at region j is:

$$Mj = \left[\frac{\alpha_j}{P_j}\right]^{\sigma} P^{\sigma-1} E \qquad [2]$$

Supply

The supply of imports originating at j:

$$X_j = k^E_j [W_j]^{\mu j} \qquad [3]$$

The relation between internal prices and export prices being:

$$W_j = \frac{P_j}{(1 + t^w_j)}$$

where $t^w_j \le t^o_j$.

When TRQ are binding, then a price wedge t^w_j for each supplier is calculated endogenously. When exports are over the TRQ limits, then the maximum price wedge is defined to be equal to the maximum tariff t^o_j.

System equations

The model is constructed through a system of non-linear equations, which is solved using GAMS programming. Excess of demanded products originating at j must be zero:

$$M_j - X_j = 0$$

Replacing M_j and X_j with the corresponding Eqs. [2] and [3], the excess demand condition is:

$$\left[\frac{\alpha_j}{P_j}\right]^{\sigma} P^{\sigma-1} E - k^E_j [W_j]^{\mu_j} = 0 \; ; \; j = 1.....n$$

Replacing W_j with its value in terms of P_j:

$$\left[\frac{\alpha_j}{P_j}\right]^{\sigma} P^{\sigma-1} E - k^E_j \left[\frac{P_j}{(1+t^w_j)}\right]^{\mu_j} = 0 \; ; \; j = 1.....n \qquad [4]$$

The total composite import demand can be expressed as follows:

$$k^M P^{\eta+1} - \mathrm{E} = 0$$

where the equation above is specified by multiplying the composite demand for the composite price and then rearranging.

$$\text{Total price index: } P - \left[\sum_{i=1}^{n} \alpha_i^{\sigma} P_i^{1-\sigma}\right]^{1-1/\rho} = 0 \qquad [5]$$

The system is formed by $n + 2$ equations and $n + 2$ unknown variables (n prices, total expenditure E and composite price P).

[4] Armington (1969) approach is still widely used when dealing with heterogeneous products (see Anania, 2001; Bureau *et al.*, 2005).
[5] Two months are split in two different periods, May and December. It occurs because the MFN-EP level changes over these months.

Table 2. Values of elasticities chosen for the simulations

	"Higher"	"Lower"
EU domestic demand elasticity	1	0.5
EU intra trade supply elasticity	2	1
Third country supply elasticity	10	5
Elasticity of substitution	5	2.5

Elasticities

To verify the extent to which results are sensitive to the applied elasticities two sets of assumptions were chosen to represent the parameters characterising the behavioural equations (domestic and import demand elasticities, export supply elasticities and CES parameters). The two sets are labelled "higher" and "lower" elasticities, respectively. The assumptions for these elasticity alternatives are indicated in Table 2.

The value chosen for the elasticity of substitution σ is quite representative of a market where products are quite homogeneous (low product differentiation), so it is likely that the substitution effects are overestimated. Sensitivity analysis can be easily carried out by changing the parameters in the GAMS file written for the model.

Tariff-rate quota

The price wedge for preferential suppliers can be reflected in three kinds of value, depending on the quantity of imports compared to the applied TRQ[6]. If the preferential in-quota tariff is $t^i_j \geq 0$ three resulting situations can be considered:

a) Market equilibrium not constrained by TRQ:

$M_j < Mq_j$ then $= t^w_j = t^i_j$

b) Import demand matching the TRQ:

$M_j = Mq_j$ then $t^i_j < t^w_j < t^o_j$, and t^w_j is estimated endogenously.

Here t^w_j is the price wedge estimated endogenously. Since a new variable is added, a new equation to the system specified above must be added:

$$M^q j = \left[\frac{\alpha_j}{P_j}\right]^{\sigma} P^{\sigma-1} E; \qquad [6]$$

c) Imports exceeding the TRQ:

$M_j > Mq_j$ then $= t^w_j = t^o_j$

where t^o_j is the out-of-quota tariff.

According to Chemnitz and Grethe (2005), the quota system may transfer a part of the economic rent to the importing companies, as these could offer low prices to the exporters, at least when there is a risk of exceeding the TRQ. The basic trade model presented in this study actually assumes that quota rents (QR) are captured by the importer. However, in the simulations different alternatives of QR captured partly by the exporter are considered also. This might be expressed by adjusting the export price of the product originating in a given region by the share of the rent captured by the preferential exporter.

$$W_j' = W_j + (1- \chi)\ (QR/\ Mq_j); \qquad [7]$$

where W_j' is the adjusted export price, QR denotes Quota-Rent, and χ is the share of the QR that is captured by the importer.

Calibration

Calibration is based on unit price normalisation, so $P^o_j = P^o = 1$ and the superindex *o* denotes values at the benchmark situation. This leads to export prices in the benchmark situation given by:

$$W^o_j = \left[\frac{1}{(1+t^{wo}_j)}\right]; j = 1.....n;; \qquad [8]$$

and constants are equal to[7]

$$k^E_j = X^o_j \left[1+t^{wo}_j\right]^{\mu_j}; \quad j = 1.....n; \qquad [9]$$

and $k^M = q^o$

As for the CES weights they are approximated by:

$$\alpha_j = \left[\frac{M^o_j}{q^o}\right]^{1/\sigma}; j = 1.....n; \qquad [10]$$

For each month of the period 2005-2006, levels of initial tariffs for MFN suppliers were calculated by adding the average supplementary tariffs (related to the implementation of the EP) to the MFN *ad valorem* duties.

For preferential suppliers, if a TRQ is binding, a value for the reference price wedge is assigned. If

[6] See Abbot (2002) for a thorough analysis of market equilibrium when TRQ apply.

[7] Benchmark volumes were calculated based on the averages for the reference period 2005-2006 from the information available in COMEXT.

$M_j \geq M^q_j$ the baseline price wedge is taken as the difference between the initial out-of-quota tariff, t^o_j, and the preferential tariff, t^i_j. Three situations are possible in order to calculate the size of the minimum (preferential) tariff t^i_j and the maximum tariff t^o_j to be applied to preferential imports into the EU market:

a) When the preferential supplier's import price > the MFN-EP:

$t^o_j = x$ % MFN *ad valorem* tariff;

$t^i_j = y$ % MFN *ad valorem* Tariff;

where x and y refer to the agreed percentages of out-of-quota and in-quota reductions for preferential suppliers (according to the EMA).

b) When the MFN-EP > the preferential supplier's import price > Agreed EP:

$t^o_j = x$ % MFN *ad valorem* Tariff + MFN Supplementary (*ad valorem*) Tariff;

$t^i_j = y$ % MFN *ad valorem* Tariff.

The supplementary tariff in this case is the corresponding tariff that is triggered when the MFN-EP, but not the agreed EP, is undercut by the preferential supplier's export price. The agreed EP is the reduced EP provided by the EMA.

c) When the preferential supplier's import price < Agreed EP:

$t^o_j = x$ % MFN *ad valorem* Tariff + MFN Supplementary (*ad valorem*) Tariff;

$t^i_j = y$ % MFN *ad valorem* Tariff + Supplementary (*ad valorem*) Tariff.

This last situation takes place when the supplementary tariff is applied to preferential imports because even the agreed EP is undercut. Note that t^o_j is the total duty to be applied on imports when they no longer receive preferential treatment. That is the case, for example, when the TRQ is exceeded.

Results

Effective tariffs in the baseline scenario

Using average data for the years 2005-2006, Moroccan and rest of the world (ROW) SIV were compared to the EP level, and the actual Moroccan imports were compared to the TRQ.[8] A number of reference situations were found, which reflect the complexity of EU tomato trade policies, even for preferential suppliers[9].

For the reference marketing year, in January, February, March, April, the second fortnight of May and the two periods in December, the Moroccan trade is favoured by the reduced agreed EP. The loss of preference could have certain consequences in such months because the Moroccan price undercuts the MFN-EP. Moroccan imports seem to be unrestricted by EP and/or TRQ only in August.[10] For the first fortnight of May, the only constraint is the TRQ, while in the summer period (except in the aforementioned case of August) Moroccan exports are constrained by the EP while no TRQ are in force. In October, the TRQ is not binding, though both preferential and MFN-EP levels act as effective constraints. In November all the trade measures constrain Moroccan flows, since the TRQ is binding and Moroccan export prices are below the two EP levels.

For the ROW suppliers, the average SIV do not undercut MFN-EP levels in the most of the year, with the exception of September, October and November.

Table 3 shows the monthly equivalent tariffs calculated for ROW and Moroccan tomato, which have been using the average 2005 and 2006 trade data, *i.e.* SIV, EP and full tariffs (*ad valorem* tariffs plus additional specific tariffs related to the EP system). Tariffs are expressed in their *ad valorem* equivalents (AVE).

As for calibration and benchmark figures and parameters taken, Table A.1 in the annex shows, as an example, normalised prices, benchmark traded volumes and constants calculated for January, for both scenarios of elasticities.

To start the implementation of the model, the period-by-period import flows from the main suppliers for the average of 2005 and 2006 years are taken as baseline. These flows correspond to the internal sources represented by monthly intra-EU supplies and the main foreign supplier (Morocco). Other minor foreign partners are aggregated as ROW.

Policy scenarios

This trade model is applied to study the trade impacts of several scenarios of trade liberalisation in the EU

[8] The simple average of daily SIV was used as a proxy for the export price in the period for the two origins.

[9] Recent published studies (Cioffi and Dell' Aquilla, 2004 and Chemnitz and Grethe, 2005) have found evidence of localised restrictive effects of the system on EU imports

[10] This statement should be taken with caution, since trade flows in summer are limited and few SIV are reported.

Table 3. In-quota and out-of-quota AVE tariffs on Moroccan tomato imports. Baseline marketing year (2005-2006)

Period	t^i_j (% SIV)	t^o_j (% SIV)
January	0.0	48.0
February	0.0	52.8
March	0.0	49.9
April	0.0	43.3
1-14 May	0.0	3.5
15-31 May	0.0	53.8
June	75.0	No quota
July	109.6	No quota
August	5.8	No quota
September	72.0	No quota
October	4.1	73.0
November	71.9	75.4
1-20 December	0.0	58.0
21-31 December	0.0	55.3

AVE: *ad valorem* equivalent; SIV: Standard Import Value. Source: European Commission, Taxation and Custom Unions database and authors' calculations.

fresh tomato market. Though this paper's aim is to propose a framework to apply to a great variety of alternative policy scenarios, some of the chosen scenarios have connections with possible outcomes of the current multilateral negotiations under the Doha Development Agenda (DDA). When this exercise was prepared, negotiations were still far from conclusion.

As an illustration of the model defined, three relevant scenarios -related to issues considered under the DDA negotiations- are proposed:

1. Scenario 1: A significant *reduction of the applied tariffs*. The Committee on Agriculture Chair's draft in July 2008 foresees tariff concessions that will be allocated according to a band system, with tariff reductions of 50% or higher. In this exercise, tariff cuts of 50% were assumed, which means to apply such percentage of reduction to the MTE or specific tariff to be applied in case of import prices fall below entry prices. If the procedure adopted in the previous Uruguay Round (UR) negotiations is adopted, the entry price will be reduced in the same estimated value. Note that these reductions are significantly higher that those agreed in the UR (20%).
2. Scenario 2: The hypothesis of fresh tomato being considered as a *sensitive product*. This could involve, according to the Chair's draft, tariff cuts of one third of the normal cut, which means, in our case, a 16% cut, and in turn, an increase in TRQ. The assumption in this exercise is that market access is increased through enlarged TRQ up to 5% of the current domestic consumption. This percentage is a moderate level considering the Chair's proposal[11] but it would involve doubling the current imports. Then, the assumption is that, as result of the negotiation, the TRQ are doubled in exchange of the smaller tariff reduction.
3. Scenario 3: The *phasing out* of the entry price system. This considers the elimination of the corresponding supplementary tariffs associated to the existence of entry prices, the *ad valorem* duties remaining at current levels.

Simulation results

For the "higher" elasticity assumption, simulation results for EU imports are presented in Table 4 as percentage changes in and absolute variations with regard to baseline sales. A summary of the border and internal prices percentage changes is shown in Table 5. In Annex (Tables A.2 and A.3) the detailed seasonal volume and price impacts are given.[12]

Additionally to these results, different possibilities regarding the appropriation of the quota rents on Moroccan tomato were considered in this exercise. The appropriation of this rent would involve changes in the export price. Thus, the higher is the percentage of the rent that accrues to importers, the less is the export price received by Moroccan exporters (and conversely). Table 6 shows how much these prices would change for the three scenarios. A remarkable result is that export prices for Morocco could increase substantially in certain months such as February, April, October and November in Scenario 1. The border price increases would be more modest under the Scenario 3. For the Scenario 2, with expanded TRQ, export price will go up quite significantly, mostly in the first fortnight of May and in October and November.

[11] The Chair's draft proposes increases of TRQ between 0.5% to 6% of domestic consumption depending on the actual size of the tariff cut compared to the cut foreseen for non-sensitive products.

[12] "Higher elasticity" results imply larger trade impacts. The rest of the results are available upon authors' request and are not presented here due to extent limitations.

Table 4. Volume impacts of trade liberalisation on fresh tomato market. Summary (yearly data)

	EU-25	Morocco	Rest of the World
Baseline sales (Mg)	2,313,119.3	217,373.3	80,327.2
Scenario 1: Tariff reduction			
Absolute change (Mg)	-112,832.4	242,391.3	25,045.5
Percent change (%)	-4.9	111.5	31.2
Scenario 2: Sensitive product			
Absolute change (Mg)	-65,258.7	147,212.2	406.2
Percent change (%)	-2.8	67.7	0.5
Scenario 3: Phasing out			
Absolute change (Mg)	-148,152.7	361,434.3	4,938.4
Percent change (%)	-6.4	166.3	6.2

Higher elasticities assumption. EU: European Union. Source: Taxation and Custom Unions database and authors' calculations.

Discussion

In general terms, the effects of the trade liberalisation are lesser when tomatoes are designated as sensitive product by the EU, both in price and in volume figures. With regard to volume terms, the phasing out of EP and the tariff cut scenarios have relatively larger trade effects in quantitative terms, since estimated trade may more than double in tonnes. Even the scenario of sensitive product, due to the required TRQ enlargement, would have a significant impact on Moroccan sales, in spite that they would remain constrained by the enlarged TRQ in most of the periods. Intra-EU sales would be reduced up to 6.8%, a relatively small decrease compared with the Moroccan increases; on the other hand, ROW suppliers expand exports much more under the tariff cut scenario than under the other two possibilities. Therefore, every scenario largely benefits imports from Morocco. This suggests that for this country, multilateral trade liberalisation is as important as bilateral trade liberalisation concerning the EU fresh tomato market.

Monthly effects are quite variable depending on the scenario that is analysed. While the intra-EU sales are reduced virtually in all the periods, its maximum reduction happens between October and May (winter and spring seasons), which coincides, approximately, with the larger increases of Moroccan exports. In summer months, the percentage change for Moroccan exports is significant, but in absolute terms the trade flows would be limited in size. For the ROW suppliers, there is a mixed situation but the most relevant increases take place in October for the three scenarios.

With regard to the variations in price, it seems that further liberalisation in the tomato sector will benefit mostly consumers in winter months, as indicated by the internal prices reduction. For EU producers, while relevant, the reduction figures are not definitively dramatic since their peaks are less than 10%. This is the result of a trade model which incorporated product differentiation in its formulation. On the other hand, export prices for Moroccan suppliers may increase by about 10% in average for the phasing out and tariff reduction scenarios in winter

Table 5. Range of price impacts of trade liberalisation on fresh tomato market (percent changes)

	European Union (domestic price)	Morocco (export price)	Rest of the World (export price)
Scenario 1	-6.9% (21-31 December) -0.0% (August)	-0.6% (1-20 December) 18.6% (June)	-1.9% (21-31 December) 14.8% (October)
Scenario 2	-6.9% (21-31 December) -0.0% (August)	-0.0% (1-20 December) 15.5% (September)	-2.9% (21-31 December) 1.6% (October)
Scenario 3	-8.5% (November) 0.4% (1-20 December)	-1.0% (1-20 December) 25.3% (July)	-3.1% (21-31 December) 12.0% (October)

Higher elasticities assumption. Source: Taxation and Custom Unions database and authors' calculations.

Table 6. Variation on export prices for Moroccan tomato under different assumptions of quota rent (QR) appropriation

	$\chi = 0$	$\chi = 0.5$
Scenario 1		
January	5.7	2.9
February	26.5	13.2
March	1.8	0.9
April	21.6	10.8
1-14 May	1.8	0.9
15-31 May	2.9	1.4
June – September	No quota	
October	20.5	10.3
November	37.6	18.8
1-20 December	Quota not binding	
21-31 December	1.8	0.9
Scenario 2		
January	23.6	11.8
February	26.1	13.1
March	24.1	12.1
April	21.9	10.9
1-14 May	0.0	0.0
15-31 May	45.2	22.6
June – September	No quota	
October	32.4	16.2
November	38.3	19.2
1-20 December	New quota not binding	
21-31 December	1.4	0.7
Scenario 3		
January	3.5	1.8
February	3.5	1.7
March	3.5	1.8
April	3.5	1.8
1-14 May	3.5	1.8
15-31 May	5.8	2.9
June – September	No quota	
October	5.7	2.9
November	3.5	1.8
1-20 December	Quota not binding	
21-31 December	3.5	1.8

Note: Higher elasticities assumption. χ is the share of the QR that is captured by the importer. χ=1 in the initial calculations Source: Taxation and Custom Unions database and authors' calculations.

and spring months, when their exports to the EU are increasing significantly. Also for Morocco, the highest increases in export prices are expected to be in summer, as happened with the volumes traded, but the absolute changes still remain less important than in other months with higher volume traded. For the ROW suppliers, the highest increases in prices will happen in October, while for the other period the changes in prices would be of minor significance. Nevertheless, a certain seasonal pattern may be observed as their export prices will tend to drop between the last days in December and April.

Six qualifications to the analysis carried out in this study can be pointed out. The first refers to the import behaviour which is often no competitive in nature, and the system could introduce incentives to collusive arrangements as traders attempt to minimise the risk for supplementary tariffs. The calculations carried out regarding the change in the export price of Morocco according to different shares of appropriation of the quota rent might be a valuable indicator on the extent of the incentives to collude between Moroccan exporters. The second qualification is the possibility for traders to partially elude the influence of EP for storable F&V. In the third place, TRQ have not been respected in some peak marketing periods, probably because the shipments don't require import licenses. Further analysis will have to take into account the way TRQ are managed and its implications for F&V imports. Fourth, the value of the preferences and quota rents requires further research in the empirical field. Fifth, results must be considered in light of the model's sensitivity to certain assumptions, such as the elasticities of the behavioural equations. Finally, the model must become dynamic, as decisions in one month might affect decisions in other periods of the year.

Concluding remarks

The partial equilibrium model described in this article may be useful to assess the impact of trade liberalisation scenarios related to EU F&V imports. The model contributes to the seasonal analysis of trade liberalization in perishable products. The F&V model was applied to the fresh tomato and can be easily extended to other F&V included or not in the EP scheme. The added value of this model lies in the detailed specification of policy instruments and in the monthly differentiation of trade impacts. The model may also be useful to analyse the extension of TRQ and other scenarios for trade liberalisation, including the Doha Development Round and the deepening of the Euro-Mediterranean agreements.

From the results of the simulations, the general conclusion is that the impacts of liberalisation for the EU producers are significant, although not dramatic. This does not contradict the chance for developing countries exporting to the EU to obtain substantial export gains. In the tomato case, Morocco takes the most of the gains due to the liberalisation, while other suppliers experi-

ence mixed results. Seasonally, the effects of liberalisation are mostly noticeable in the period between October and May. For the European suppliers, the designation of tomatoes as a sensitive product would have less detrimental effects than the other two alternatives, which results are relatively close to each other. This designation could stimulate collusive arrangements between Moroccan exporters to increase substantially their export prices, via quota rent transfers to exporters.

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References

ABBOT P., 2002. Tariff-rate quotas: failed market access instrument? Eur Rev Agric Econ 9(1), 109-130. doi:10.1093/erae/29.1.109.

ANANIA G., 2001. Modeling agricultural trade liberalisation and its implications for the European Union, Working Paper nº12. Instituto Nazionale di Economia Agraria, Roma.

ANANIA G., 2006. The 2005 WTO arbitration and the new EU import regime for bananas: a cut too far? Eur Rev Agric Econ 33(4), 449–484. doi:10.1093/erae/jbl026.

ARMINGTON P.S., 1969. A theory of demand for products distinguished by place of production. IMF Staff Papers, Vol.16. Nº 1. doi:10.2307/3866403.

BUNTE F., 2005. Liberalising EU imports for fruits and vegetables. 99th seminar of the European Association of Agricultural Economists: The Future of Rural Europe in the Global Agri-Food System, 23-27 August, Copenhagen.

BUREAU J.C., GOHIN A., JEAN S., 2005. The use of models in support of the WTO negotiations. IATRC Meeting, Sevilla, 19-21 June.

CHEMINGUI M.A., THABET C., 2001. Internal and external reforms in agricultural policy in Tunisia and poverty in rural area. GDN Research Paper, Global Development Network, New Delhi.

CHEMNITZ C., GRETHE G.. 2005. EU preferences for Moroccan tomato exports – Who benefits? XIth Congress of the European Association of Agricultural Economists: The Future of Rural Europe in the Global Agri-Food System. Copenhagen, 24-27 August.

CIOFFI A., DELL'AQUILLA C., 2004. The effects of trade policies for fresh fruit and vegetables of the European Union. Food Policy 29(2), 169-185. doi:10.1016/j.foodpol.2004.03.002.

EMLINGER C.H., CHEVASSUS-LOZZA E., JACQUET F., 2006. EU market access for mediterranean fruits and vegetables: a gravity model assessment. 98th seminar of the European Association of Agricultural Economists. Chania, 29 June-2 July.

FRANCOIS J.F., HALL H. K., 1997. Partial equilibrium modelling. In: Applied methods for trade policy analysis: a handbook (Francois J.F. and Reinert K., eds.). Cambridge University Press: Cambridge, UK. pp. 122-155.

GARCIA-ALVAREZ-COQUE J.M., 2002. Agricultural trade and the Barcelona process. Is full liberalisation possible? Eur Rev Agric Econ 29, 399-422. doi:10.1093/eurrag/29.3.399.

GRETHE H., TANGERMANN S., 1998. The new Euro-Mediterranean agreements an analysis of trade preferences in agriculture. Commodities and Trade Division, FAO Economic and Social Department, Göttingen, October.

KUIPER M., 2004. Fifty ways to leave your protection. Comparing applied models of the Euro-Mediterranean association agreements. ENARPRI Working Paper No.6/April.

LORCA A., VICÉNS J. (dirs.), 2000. L'impact de la libéralisation commerciale Euro-Méditerranéenne dans les échanges agricoles. FEMISE network. [Online]. Available at www.femise.org. Last access October 2006. [In French].

MARTÍ SELVA M.L., GARCÍA ALVAREZ-COQUE J.M., 2007. Impacto de los acuerdos de asociación en el comercio Euromediterráneo de frutas y hortalizas. Econ Agrar Recurs Nat 7(13), 27-48. [In Spanish].

MARTINEZ-GOMEZ V., 2008. Current preferences of Southern Mediterranean Countries and their erosion after variations of the protection system. XII Congress of the European Association of Agricultural Economists. Ghent, August.

SARRIS A.H., 1983. European community enlargement and world trade in fruits and vegetables. Am J Agr Econ 65(2), 235-246. doi:10.2307/1240869.

SWINBANK A., RITSON, C., 1995. The impact of the GATT Agreement on EU Fruit and Vegetable Policy. Food Policy 20, 339-357. doi:10.1016/0306-9192(95)00039-9.

VANZETTI D., FERNANDEZ DE CÓRDOBA S., CHAU V., 2005. Banana split: how EU policies divide global producers. United Nations Conference on Trade and Development. Policy Issues in International Trade and Commodities. Study Series No. 31. Geneva.

Annex.
Table A.1: Example of calibration

Elasticity scenario:	**"High"**	**"Low"**
Benchmark sales of intra-EU product M^0_1 (Mg)	197,444.1	197,444.1
Benchmark sales of Morocco product M^0_2 (Mg)	37,049.9	37,049.9
Benchmark sales of ROW product M^0_3 (Mg)	10,434.6	10,434.6
Benchmark total sales q (Mg)	244,928.6	244,928.6
Calibrated intra-EU product price P^0_1	1	1
Calibrated internal price for Moroccan good P^0_2	1	1
Calibrated internal price for ROW good P^0_3	1	1
Calibrated Moroccan good export price W^0_2	0.676	0.676
Calibrated ROW good export prices W^0_3	0.644	0.644
Calibrated composite good price P	1	1
Intra-EU supply constant term k^E_1	$1.97 \cdot 10^5$	$1.97 \cdot 10^5$
Moroccan product import supply constant term k^E_2	$1.87 \cdot 10^6$	$2.63 \cdot 10^5$
ROW product import supply constant term k^E_3	$2.43 \cdot 10^4$	$1.59 \cdot 10^4$
Composite demand constant term k^M	$2.45 \cdot 10^5$	$2.45 \cdot 10^5$

EU: European Union. ROW: Rest of the World.

Table A.2: Volume impacts of trade liberalisation on fresh tomato market. Period-by-period results

	Percentage variation (%)			**Final sales (Mg)**		
	EU	**MO**	**ROW**	**EU**	**MO**	**ROW**
Scenario 1: Tariff reduction						
January	-10.4	137.3	-11.1	177,017.7	87,910.9	9,280.5
February	-5.4	65.3	0.8	182,550.1	59,558.2	9,496.1
March	-11.9	170.0	-14.7	178,209.4	97,454.8	8,087.5
April	-2.9	61.3	7.1	186,572.7	30,159.0	6,927.7
1-14 May	-0.4	4.6	13.6	91,780.4	6,422.9	4,380.6
15-31 May	-6.6	225.9	6.00	104,593.9	24,297.8	4,964.5
June	-2.7	451.3	16.6	206,816.6	14,639.5	9,349.3
July	-0.4	172.0	23.0	193,982.1	1,384.5	4,169.3
August	-0.1	9.4	23.8	187,100.8	640.3	2,324.5
September	-0.9	443.0	28.5	176,722.4	2,417.4	6,410.0
October	-9.1	167.5	297.2	154,458.0	23,873.8	28,673.7
November	-6.4	92.2	18.4	169,181.3	52,579.0	3,592.8
1-20 December	0.2	-5.4	15.3	129,610.3	21,618.5	5,541.1
21-31December	-13.3	193.0	-17.7	61,691.3	36,808.2	2,175.1
Scenario 2: Sensitive product						
January	-5.0	62.2	-7.4	187,576.9	60,092.3	9,666.6
February	-5.3	66.7	-8.1	182,718.6	60,081.7	8,659.0
March	-5.1	66.3	-7.6	192,057.3	60,044.6	8,762.6
April	-2.8	60.7	-2.2	186,915.9	30,040.8	6,330.5
1-14 May	-0.4	11.0	3.4	91,780.7	6,816.5	3,985.9
15-31 May	-0.7	19.1	5.2	111,110.5	8,877.9	4,925.2

Table A.2: Continued

	Percentage variation (%)			Final sales (Mg)		
	EU	**MO**	**ROW**	**EU**	**MO**	**ROW**
June	-0.3	25.9	6.3	211,867.2	3,342.5	8,521.7
July	-0.1	33.4	6.7	194,589.0	679.1	3,618.5
August	-0.0	3.1	6.9	187,283.3	603.8	2,007.3
September	-0.5	324.0	11.7	177,348.4	1,887.7	5,568.5
October	-3.4	124.7	16.6	164,155.3	20,053.8	8,414.6
November	-6.2	90.5	8.2	169,508.5	52,119.4	3,283.8
1-20 December	-0.1	-0.2	4.3	129,282.1	22,807.7	5,012.0
21-31 December	-13.3	195.6	-25.2	61,667.0	37,137.9	1,977.3
Scenario 3: Phasing out						
January	-11.0	151.1	-23.8	175,769.8	93,044.7	7,955.1
February	-12.2	170.5	-26.2	169,457.5	97,472.1	6,956.2
March	-11.2	160.7	-24.1	179,775.9	94,123.2	7,193.2
April	-6.3	154.0	-14.2	180,032.7	47,486.3	5,554.8
1-14 May	0.0	0.0	0.0	92,184.7	6,140.6	3,856.8
15-31 May	-5.6	204.0	-12.7	105,634.8	22,665.6	4,090.8
June	-2.1	409.7	-4.8	208,083.3	13,535.7	7,636.0
July	-0.9	857.1	-2.0	193,126.0	4,872.6	3,322.6
August	0.0	0.0	0.0	187,361.1	585.5	1,877.7
September	-0.5	399.4	4.4	177,404.9	2,223.4	5,207.9
October	-10.3	300.0	210.1	152,410.8	35,705.8	22,379.9
November	-16.4	282.5	-20.7	151,137.7	104,673.9	2,406.5
1-20 December	0.8	-9.2	1.8	130,358.1	20,733.9	4,894.0
21-31December	-12.5	182.9	-26.9	62,229.5	35,544.4	1,934.3

Higher elasticities assumption. EU: European Union. MO: Morocco. ROW: Rest of the World. Source: Taxation and Custom Unions database and authors' calculations.

Table A.3: Internal and export price changes after trade liberalisation on fresh tomato market. Period-by-period results

	Internal price change (%)			Export price change (%)	
	EU	**MO**	**ROW**	**MO**	**ROW**
Scenario 1: Tariff reduction					
January	-5.3	-22.1	-5.2	9.0	-1.2
February	-2.8	-13.0	-4.0	5.2	0.1
March	-6.2	-25.0	-5.6	10.4	-1.6
April	-1.5	-11.0	-3.4	4.9	0.7
1-14 May	-0.2	-1.2	-2.8	0.5	1.3
15-31 May	-3.3	-24.7	-5.8	12.5	0.6
June	-1.3	-30.3	-4.8	18.6	1.6
July	-0.2	-18.4	-4.3	10.5	2.1
August	-0.1	-1.9	-4.3	0.9	2.2
September	-0.4	-29.2	-5.5	18.4	2.5
October	-4.6	-23.2	-29.0	10.3	14.8
November	-3.2	-16.2	-7.7	6.8	1.7
1-20 December	0.1	1.2	-2.7	-0.6	1.4
21-31 December	-6.9	-27.0	-5.9	11.4	-1.9

Table A.3: Continued

	Internal price change (%)			Export price change (%)	
	EU	**MO**	**ROW**	**MO**	**ROW**
Scenario 2: Sensitive product					
January	-2.5	-12.4	-2.0	5.0	-0.8
February	-2.7	-13.1	-2.1	5.2	-0.8
March	-2.6	-12.9	-2.1	5.2	-0.8
April	-1.4	-10.8	-1.5	4.9	-0.2
1-14 May	-0.2	-2.4	-1.0	1.1	0.3
15-31 May	-0.4	-3.9	-1.5	1.8	0.5
June	-0.1	-4.7	-1.4	2.3	0.6
July	-0.1	-5.7	-1.4	2.9	0.7
August	-0.0	-0.6	-1.4	0.3	0.7
September	-0.3	-25.4	-2.5	15.5	1.1
October	-1.7	-17.0	-5.3	8.4	1.6
November	-3.1	-15.9	-5.9	6.7	0.8
1-20 December	-0.0	-0.0	-0.9	-0.0	0.4
21-31December	-6.9	-27.2	-4.1	11.5	-2.9
Scenario 3: Phasing out					
January	-5.7	-23.3	-2.7	9.7	-2.7
February	-6.3	-25.2	-3.0	10.5	-3.00
March	-5.8	-24.0	-2.7	10.1	-2.7
April	-3.2	-20.7	-1.5	9.8	-1.5
1-14 May	0.0	0.0	0.0	0.0	0.0
15-31 May	-2.9	-23.1	-1.3	11.8	-1.3
June	-1.0	-28.9	-0.5	17.7	-0.5
July	-0.4	-36.7	-0.2	25.3	-0.2
August	0.0	0.0	0.0	0.0	0.0
September	-0.3	-27.8	-1.2	17.5	0.4
October	-5.3	-29.8	-26.1	14.9	12.00
November	-8.5	-32.5	-7.6	14.4	-2.3
1-20 December	0.4	2.5	0.2	-1.0	0.2
21-31December	-6.5	-26.1	-3.1	11.0	-3.1

Higher elasticities assumption. EU: European Union. MO: Morocco. ROW: Rest of the World. Source: Taxation and Custom Unions database and authors' calculations.