Modelling Agricultural Policy Reforms in the Mediterranean Basin – Adjustments of AGRISIM –

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Abstract: *In recent years the Mediterranean countries encounter a number of changes of the agricultural policy that could influence significantly their agricultural sector and thus their overall economy. They are faced with the ongoing trade liberalisation, the Reform of the Common Agricultural Policy (CAP) of the European Union (EU), since the EU is one of the major trade partners of the Mediterranean countries and the establishment of a Free Trade Area between the EU and the Mediterranean Countries after 2010. The latest is/will be accomplished through the Euro-Mediterranean Association Agreements, was decided in the Summit of Barcelona in 1995 and is particularly up-to date after 2005, 10 years after the establishment of the Barcelona Agreement. These changes are expected above all to influence the trade flows between the EU and the Mediterranean Partner Countries (MPC) and therefore, to have impacts on the production, consumption, domestic and border prices and welfare. Aim of the paper is to discuss methodological issues connected with the modelling of policy changes in the Mediterranean basin and to provide more insights on the modification of the model AGRISIM so as to make it a suitable tool to analyse the trade flows in the Mediterranean basin.*

Keywords: MPCs, Euro-Mediterranean Association Agreements, EU, AGRISIM

1 Introduction

In recent years the Mediterranean countries encounter a number of changes of the agricultural policy that could influence significantly their agricultural sector and thus their overall economy. They are faced with the ongoing trade liberalisation, the Reform of the Common Agricultural Policy (CAP) of the European Union (EU), since the EU is one of the major trade partners of the Mediterranean countries [1] and the establishment of a Free Trade Area between the EU and the Mediterranean Countries after 2010. The latest is/will be accomplished through the Euro-Mediterranean Association Agreements, was decided in the Summit of Barcelona in 1995 and thus, is also known as the Barcelona Process or Barcelona Agreement. It is particularly up-to date in 2005 – year of the Mediterranean as it is by the EU-Commission declared – 10 years after the establishment of the Barcelona Agreement.

These changes are expected above all to influence the trade flows between the EU and the non-EU Mediterranean Countries and thus, to have impacts on the production, consumption, domestic and border prices and welfare. Due to these changes emerges the need to analyse empirically their impacts with appropriate modelling tools, so as to be able to evaluate the policies and to propose further changes if needed on the one side and on the other side to base the discussion of the future of the Mediterranean agriculture on sound empirical analysis.

Aim of the paper is to discuss methodological issues connected with the modelling of agricultural policy reforms in the Mediterranean region. To be more specific, after reviewing existing empirical studies, the points where the future research should focus are identified and a modified version of a trade policy model is introduced.

[1] The twelve Mediterranean Countries that have signed the Barcelona Agreement are: Algeria, Cyprus, Egypt, Jordan, Israel, Lebanon, Malta, Morocco, Syria, the Gaza Strip and the West Bank, Tunisia and Turkey and are called hereafter Mediterranean Partner Countries (MPCs).

For this purpose the paper is organised as follows: in the next section the main trade flows and the trade protection between the EU and the MPCs and static impacts of the Barcelona Agreement up to now are briefly illustrated. The focal point of the third section is on the existing empirical analyses of the impacts of trade liberalisation between the EU and the MPCs. The models employed are shown, compared and the needs for further modelling are discussed. In the fourth and main section of the present paper the adjustments of AGRISIM are presented, where a description of the model functions and of the database of the model is provided. Special emphasis is given on the new model structure and the incorporation of inter-regional trade in the Mediterranean basin. Outlook and conclusions are drawn in the fifth and last section of the paper.

2 Trade policies and protection in the Mediterranean Region

The main trade flows in the Mediterranean basin are among the countries themselves and in particular between the EU and the MPCs. Although for the EU the MPCs are not the major supplier and are not the most important trade partners regarding agricultural products, the EU seems to be one of the most important trade partners for the MPCs. More than half of their exports are destined to the EU markets and a significant share of the imports (in terms of quantities) originates from EU countries. The MPCs export to the EU mostly fruits and vegetables and import from the EU cereals, dairy and meat products (Quefelec, 2004 [], dell'Aquila and Velazquez 2002 []). The structure of exports of the MPCs is very similar to this of the EU Mediterranean Member States such as Spain, Greece and Italy and fact that implies high competition among these two groups of countries (dell'Aquila and Velazquez, 2002 []).

Essential for the evolution of trade between the EU and the MPCs are the Euro-Med Association Agreements. They were established in 1995, in the Summit of Barcelona and were the result of the Mediterranean Policy of the EU, Policy that started in the beginning of the 70's and is still ongoing. The so-called Barcelona Agreement is implemented through Association Agreements with each of the Partner Countries that replace the Cooperation Agreements of the 70's. Association Agreements have been completed with all the MPCs and are in force between the EU and Tunisia since 1998, Israel since 2000, Morocco since 2000, Jordan and Lebanon since 2002, Egypt since 2004 and on interim basis with the Palestinian Authorities. An agreement has been signed with Algeria in 2001 but is still in the phase of ratification and negotiations have initialled with Syria in 2004 (EU Commission, 2006 []). Aim of the Barcelona Agreement is the formation of a Free Trade Area after 2010. In the negotiations of the Association Agreements a gradual liberalisation of the agricultural trade has been foreseen, but the so far progress is rather limited. In the anniversary conference of the Barcelona Agreement in November 2005 a new 5-year workplan has been developed and a new roadmap for the process of liberalisation of agricultural trade has been set. According to this a new round of negotiations between the EU and the MPCs should start in the first quarter of 2006 (EU Commission, 2006 []).

An indicator of the economic value of trade preference is the value of the preference margin (VPM). In Tables A and B of the Appendix is presented in detail the VPM from imports into the EU of selected commodities for the period 1998-2003. The calculations have been done following Grethe and Tangermann (1998) [] i.e. the value of the preference margin is given as the difference between the MFN duty and the applied duty multiplied by the quantity of the commodity each partner country exported into the EU. In most of the cases the MFN duties are the applied ones and thus the VPM is zero. There are gains for the MPCs due to the preferential treatment only for main export products of the MPCs such as fruits and vegetables. The size of the VPM for a given commodity differs significantly from country to country and this is mainly because of the high variation of the exported quantities and not because of variation of the preferential duty compared to the MFN one. The difference though between the MFN and the applied duty varies

between 0.2 and 7 %. A comparison of the VPM of 2003 with that of 1999 shows clearly that the entry into force of the Barcelona Agreement has only slightly intensified the profits for the MPCs. A potential expansion of exports into the EU of those commodities where already the VPM is positive would result to significant gains for the MPCs. It seems therefore that the MPCs expect to profit from the Barcelona Agreement more from trade diversion effects and less from trade creation. Moreover, because they compete the EU Mediterranean Member States and they produce at lower cost, it is expected that due to a complete trade liberalisation, trade to the rest of the EU countries will be diverted from the Mediterranean EU to the MPCs. This is feared by many Mediterranean EU producers and creates an unwillingness to proceed with the implementation of the Euro-Med. Association Agreements.

It should be noted that the Euro-Med Association Agreements is not the only policy that is supposed to influence the agricultural sector round the Mediterranean basin. As already mentioned in the introduction reforms in the agricultural policies of trade partners of the MPCs such as the EU or changes in the whole world would have impacts in all Mediterranean countries. In this respect both the latest reform of the CAP of the EU and the discussed trade liberalisation during the World Trade Organisation latest round are expected to influence the structure and evolution of agriculture round the Mediterranean.

3 Empirical studies-Literature review

Most of the existing empirical studies focus on analysing the impacts of a future trade liberalisation between the EU and the non-EU Mediterranean countries. The existing empirical studies could be classified into two major categories depending on whether general equilibrium or partial equilibrium models have been applied and then further on whether the applied models are static or dynamic. An overview of the studies examined is given in Table 1.

3.1 General Equilibrium Analyses

Computable General Equilibrium (CGE) modelling is a widely used tool to analyse the impact of the Euro-Med Agreements since it offers the advantage of capturing economy wide effects. Nevertheless because of the extended database demanded to support such a model, most of the studies focus only on one country, usually Turkey, Egypt, Tunisia or Morocco using national CGE models. A number of studies employing multi-regional, multi-commodity models use the Global Trade Analysis Project (GTAP) without modifying the model structure or the model closure or alternatively use the database of various GTAP versions.

Static CGE Studies

Harrison et. al. (1997)[] developed a CGE model to quantify the impacts of the customs union of Turkey with the EU. In total 7 scenarios were developed, where various policy adjustments Turkey has to undertake are modelled. Together with a tariff reduction of Turkey on the manufactured products so as to comply with the EU Common External Tariff is modelled the impact of improved market access to EU markets, of improved access because of harmonisation of product quality standards, the improved market access to the markets of preferential trade partners of the EU, the reduction of export subsidies, the reduction of trading costs and finally the overall customs union. The gains for Turkey vary between 1 % and 1.5 % of its GDP and compensate the losses of tariff revenues.

Mercenier et. al (1997)[] focus on a customs union between Turkey and the EU and their implications due to trade liberalisation on the agricultural sector using an intertemporal CGE model with imperfect competition. They find welfare gains of just under 1 % of GDP for the Turkish economy.

Rutherford et. al. (1997)[] applied a general equilibrium model to examine the trade liberalisation between Morocco and the EU. They found that the EU-Morocco free trade area will increase the welfare in Morocco by about 1.5 %, whereas the effects are even higher when Morocco liberalises its markets with the rest of the World as well. The model is based on Rutherford et. al. (1993) and belongs to the so-called small open economy models. The Moroccan economy is organised in 19 sectors, assumes no terms-of-trade effects, a single household, no capital accumulation and constant returns to scale production with competitive pricing.

Alessandri (2000)[] uses the GTAP model, version 4, to access the impacts of the EU trade policy within the framework of the Barcelona Agreement. The simulations rest on a 10-regions-10 industries aggregation of the GTAP database. The agricultural sector is represented through two agricultural industries, namely crops and other agricultural products. Examined are the customs union between the EU and Turkey, the Euro-Med Agreements between EU and Morocco and the Euro-Med Agreements between the EU and the rest of North Africa and modelled is the reciprocal elimination of trade barriers (import tariffs) on manufactures. Only two scenarios are relevant for the agricultural sector, where the import tariffs are eliminated and where together with the elimination of the import tariffs output and export subsidies are dismantled. The major findings suggest an increase of the welfare from +3.3 to +2.6 bn US$ for the EU and an ambiguous impact on the MPCs. For example in Morocco the welfare increase varies between +0.38 and +0.47 bn US $ (for the elimination of both import tariffs and output-export subsidies) and in Turkey of about +0.82 bn US $ (for all scenarios). For the rest of the North African countries the welfare is slightly deteriorated (-0.23 bn US $ welfare change).

Konan and Maskus (2000)[] focus on Egypt and examine the interactions between trade liberalisation and changes in domestic fiscal policies. Egypt is modelled as a small open economy that trades differentiated goods and services with multiple regions. The imported and domestic goods are imperfect substitutes and so are domestic goods and exported ones and the model is thus characterised by the Armington assumption. Benchmark data is a SAM of Egypt for 1990, which was updated by the authors up to 1994. Egypt could enjoy welfare gains up to 1 % from reforming its tax system. Trade liberalisation produce also welfare gains but this time lower due to trade diversion effects and due to less tariff revenues. Finally a combined effect would result to welfare gains depending on the extend of each reform.

The same model used in the study of Mercenier (1997), further extended and adjusted, is employed to examine static and intertemporal effects of bilateral trade liberalisation between the EU, Turkey and non-EU Mediterranean countries by Bayar et. al. (2001)[]. The model is based on intertemporal general equilibrium theory with Ramsey-type dynamics. The world is divided into 9 regions with EU, Turkey, Morocco, Rest of Middle East and Rest of North Africa as separate regions. It includes 9 sectors and the products are differentiated according to their geographic origin (Armington assumption). The customs union between Turkey and the EU is integrated in the baseline scenario and two simulation scenarios are developed. In the first one is simulated a trade liberalisation of the manufactures between the Mediterranean countries and the EU and in the second this liberalisation is coordinated among the Mediterranean countries. The data come from simple aggregation of the database of GTAP version 3. Manufacturing trade liberalisation entails static welfare losses for the Mediterranean countries and welfare gains only for the EU for both scenarios, whereas the losses are smaller in the second scenario. Nevertheless, when dynamic aspects such as investment and growth effects are taken into account, then there are welfare gains for all regions. The authors argument that the static effects are the short term effects and there the welfare loses are explained by a deflation of domestic prices in the MPCs and vice versa.

The impacts of trade liberalisation scenarios between Egypt and the EU and Egypt and other Arab countries are examined by Hoekman (2001)[] with a standard, single country, 38-sector, competitive, computable general equilibrium model. Agriculture is

represented by 3 sectors. Three preferential trade liberalisation scenarios are modelled. The first refers to removal of import tariffs of EU goods and improved market access to Egyptian products into the EU (through higher export prices of 1 % for the Egyptian products), the second to additionally removal of the tariffs of USA origin commodities and the third to additionally deep integration with USA through elimination of all trade barriers. The results indicate welfare gains of 0.99 %, 1.26 % and 2.31 % of the GDP for the three scenarios respectively. The highest effects for Egypt are achieved through the formation of a free trade area with the USA, but that to the cost of the rest of the world due to trade diversion and trade creation effects.

A comparative static national computable general equilibrium model has been developed by Hosoe (2001)[] to analyse the impact of the Uruguay Round and the Euro-Mediterranean Association Agreements on Jordan. The model is calibrated to the GTAP database version 3 and input-output tables of Jordan, has 9 sectors and 3 regions (Jordan, EU, rest of world). The Uruguay Round scenario consists of tariff cuts and phase-out of the Multi Fibre Arrangement, whereas the free trade area with the EU scenario reduced tariff rated of 80 % between Jordan and the EU. The agricultural sector is one of the 9 sectors of the model. The welfare is measured by the Hicksian equivalent variation as relative size of the base run GDP. Jordan's welfare is improved in both scenarios by 0.28 % and o.16 % respectively, change attributed to trade creation effects in exports and imports, changes of the sectoral output and trade diversion effects favourably for imports from the EU.

A non-GTAP study has been carried out by Augier and Gasiorek (2003a)[]. An 11 country – 10 sector static CGE model allowing for imperfect competition in product markets and increasing returns to scale in production has been developed in order to examine price and welfare implications of liberalisation between the EU and southern Mediterranean countries. Modelled is full liberalisation of tariffs as well as improved market access and trade-induced changes in productivity. The welfare effect is measured by a compensating variation as a proportion of base GDP. Under the full liberalisation scenario all countries gain due to trade creation except of Jordan-Syria, and Turkey, whereas the highest welfare gains are for Tunisia (8.9 %), Morocco (5.36 %) and Egypt (1.39 %). The tariff reduction-improved market access and productivity scenario results to welfare gains for each southern Mediterranean country while for the EU the effects are rather minor. Same are the tendencies by a reduction of the tariffs of the southern Mediterranean countries to EU level (i.e. to Most Favourite Nation level). The results do not change when the tariff reduction takes gradually place, scenario closer to the framework of the Euro-Med Agreements.

Elbehri and Hertel (2004)[] employed GTAP version 6.1. to examine the Morocco-EU Free Trade Area vs. a multilateral liberalisation. The world is aggregated into 3 regions, namely Morocco, EU and rest of world and the sectors of the economy into 28 sectors of which 15 refer to manufacturing activities and 9 to agricultural activities. The underlying data are that of the GTAP version 5.3. database and of an incorporated SAM of Morocco for 1990 into the GTAP database. Unilateral liberalisation results to adverse terms of trade for Morocco and thus, to welfare losses. Further, the effects on the output per firm in industries dominated by scale economies and the effects on the aggregated demand for labour are adverse, whereas the imports are diverted to non-EU suppliers. However, a multilateral liberalisation under the WTO Doha Round results to welfare gains for Morocco and this is attributed to lower terms of trade losses, positive scale effects, positive impact on the labour demand and non-preferential imports into Morocco.

Dynamic CGE studies

Chemingui and Dessus (2001)[] have created a dynamic computable general equilibrium models to model sequential tariff cuts due to liberalisation in the trade between Tunisia and the EU. The model considers two representative households, one rural and one urban and additionally a tourist household. It includes 57 sectors, of which 26 relate to agricultural or food industries and distinguishes two trading partners for Tunisia, i.e.

the EU and rest of world. It is calibrated using a SAM for Tunisia. The developed scenarios refer to unilateral liberalisation i.e. tariff reductions or abolitions of non-tariff measures of Tunisia towards imports from the EU or lower governmental support. The results indicate a worsening of Tunisia's agriculture (although the trade volume increases) since the domestic production has to compete with the EU imported commodities. Positive welfare gains are observed only by a multilateral liberalisation.

Löfgren et. al. (2001)[] have developed a dynamically recursive computable general equilibrium model of Morocco to analyse alternative policy scenarios. The model distinguishes between rural and urban activities and households and has a detailed representation of the agricultural sector. Among the 45 activities, 38 are rural and most of the agricultural or livestock products. The EU partnership is implemented in the base run scenario. The results indicate that tariff unification has rather limited impacts, whereas the removal of trade barriers and reduction of the tariffs leads to major expansion of non-agricultural exports, significant growth or the non-agricultural sectors and slow down of the agricultural ones. The effects for agriculture are the same due to trade liberalisation or due to changes in the domestic policy.

3.2 Partial Equilibrium Analyses

Studies focusing on the agricultural sector such as partial equilibrium studies, that could contribute to the future discussion of the Mediterranean agriculture are -until the time this paper is written- very limited.

For example Grethe (2003)[2] [] developed a comparative-static, partial equilibrium model of the Turkish agricultural sector named TURKSIM, to analyse the impacts of the customs union of Turkey with the EU. Complete liberalisation of the agricultural sector leads to significant static welfare gains of 670 million €, whereas it seems that including agricultural products in the customs union with the EU has very similar effects with the liberalisation scenario. Important are the distributional and allocation effects. The liberalisation leads to more equal distribution of real income, reduces intra-sectoral inequalities, but also re-allocates the resources and moves them from the rural to the urban areas.

Augier and Gasiorek (2003b)[] in a preliminary study have employed a partial equilibrium model of imperfect competition to examine the impacts of tariff reduction within the Barcelona Agreement on Morocco focusing on the textile sector. The exogenous parameters of the model are based on detailed data on firm level of the textile sector in Morocco. The first scenario involves an asymmetric reduction of the import tariffs from the side of Morocco of 50 % and results to a decline of the Moroccan textile and clothing sector accompanied by a reduction of the production and of the exports of EU Mediterranean Member States. The results for Morocco are reversed when the costs for access of Moroccan firms to the EU markets are reduced (2nd scenario). Interesting element of the study is that the same scenarios are run with lower aggregation of the set of data of textile sector of Morocco. The increase of market access to the EU benefits clearly the exporting firms (2nd scenario) whereas due to the 1st scenario the exporting firms completely eliminate and the domestic ones suffer from a reduction of the output of 63.9 %. Although the results seem rather unexpected this lies to the formulation of the scenarios. The tariff reduction is asymmetric and therefore not pragmatic.

Table 1: Overview of empirical studies on modelling agricultural policy reforms on the Mediterranean Basin.

Type of model	Study	Scope of the study
Computable General Equilibrium Models		
static	Augier and Gasiorek	Euro-Med Agreements

[2] Parts of this study have been published as Grethe (2004)[] and Grethe (2005)[].

	(2003a) Harrison et. al. (1997) Hoekman (2001) Konan and Maskus (2000) Rutherford et. al. (1997)	Turkey customs union Egypt trade liberalisation Egypt trade liberalisation+fiscal policies EU-Morocco free trade area
- GTAP	Alessandri (2000) Bayar et. al. (2001) Elbehri and Hertel (2004) Mercenier et. al. (1997) Hosoe (2001)	Euro-Med Agreements Euro-Med Agreements EU-Morocco free trade area Turkey customs union Jordan trade liberalisation
dynamic	Chemingui and Dessus (2001) Löfgren et. al. (2001)	EU-Tunisia trade liberalisation Morocco trade liberalisation
Partial Equilibrium Models		
static	Augier and Gasiorek (2003b) Grethe (2003)	Euro-Med Agreements on Morocco Turkey customs union

It should be noted that reviews of empirical studies of applied models for the Euro-Med Association Agreements and of models for regional and preferential agreements (including the Euro-Med) are given for example by Kuiper (2004)[] and Nielsen (2003)[] respectively. Moreover, an extensive literature review on the sustainability of the impacts of the Euro-Med Agreements has been prepared by the consortium of the SIA project[].

By taking a deeper look on the existing empirical studies one can clearly see that although the Euro-Med Agreements have been analysed and the impacts of trade liberalisation between the EU and the MPCs have been discussed, the results focus on the whole economy and the impacts are mostly due to liberalisation in economic sectors other than agriculture. Indeed the agricultural sector in most of the above mentioned studies is given a less significant place and is very often represented either aggregated or through a limited number of commodities. Furthermore most of the studies focus on one region, only few multi-regional models have been developed but no clear conclusions for the future of the agricultural sector can be drawn from them.

The forthcoming change of the agricultural policy regime of the Mediterranean countries and especially the creation of a Free Trade Area between the EU and the non-EU Mediterranean countries combined to a lack of empirical studies creates the need to analyse empirically their impacts.

Within MEDFROL an empirical analysis is carried out with the partial equilibrium model AGRISIM. In order to perform the analysis AGRISIM had to be extended and adjusted. The extensions are related with an update of the data base of the model, with covering new commodities and with a different regional composition. The commodities are typical for the Mediterranean region and at the same important for the external trade of the Mediterranean countries and their main trade partners, as olive oil, tomatoes, apples and oranges covered by the model. The adjustments of the model deal with transformation of the model in order to be able to model the bilateral trade relationships of the EU and the non-EU Mediterranean countries. This task emerged

from the need to model comprehensively the Euro- Mediterranean Association Agreements.

4 Trade Policy Model AGRISIM

4.1 General derscription

For the empirical analysis the model AGRISIM will be used. AGRISIM (Agricultural Simulations Model) is a partial equilibrium, multi commodity, multi region model. It is comparative static in nature, with non – linear supply and demand functions and constant elasticities. Trade is modelled as net trade (for more details see Pustovit 2003 []; Schmitz 2002 []). The base version of the model includes 9 commodities: wheat, coarse grains, rice, oilseeds, sugar, milk, beef, pig meat and poultry meat. The database was recently updated up to the year 2001 and was extended by three commodities, namely cotton, olive oil and tobacco in an effort to illustrate better the effects of the latest Reform of the Common Agricultural Policy (CAP) of the European Union (for more details see Kavallari et.al. 2005 []).

The main structure of the model is shown in Figure 1. The regions are connected with each other with a market clearing mechanism, whereas the world market price that yields from this mechanism is fed into the domestic markets through the domestic prices. The net trade summed from all regions, which is given by the difference between supply and demand, is fed again to the world market clearing mechanism.

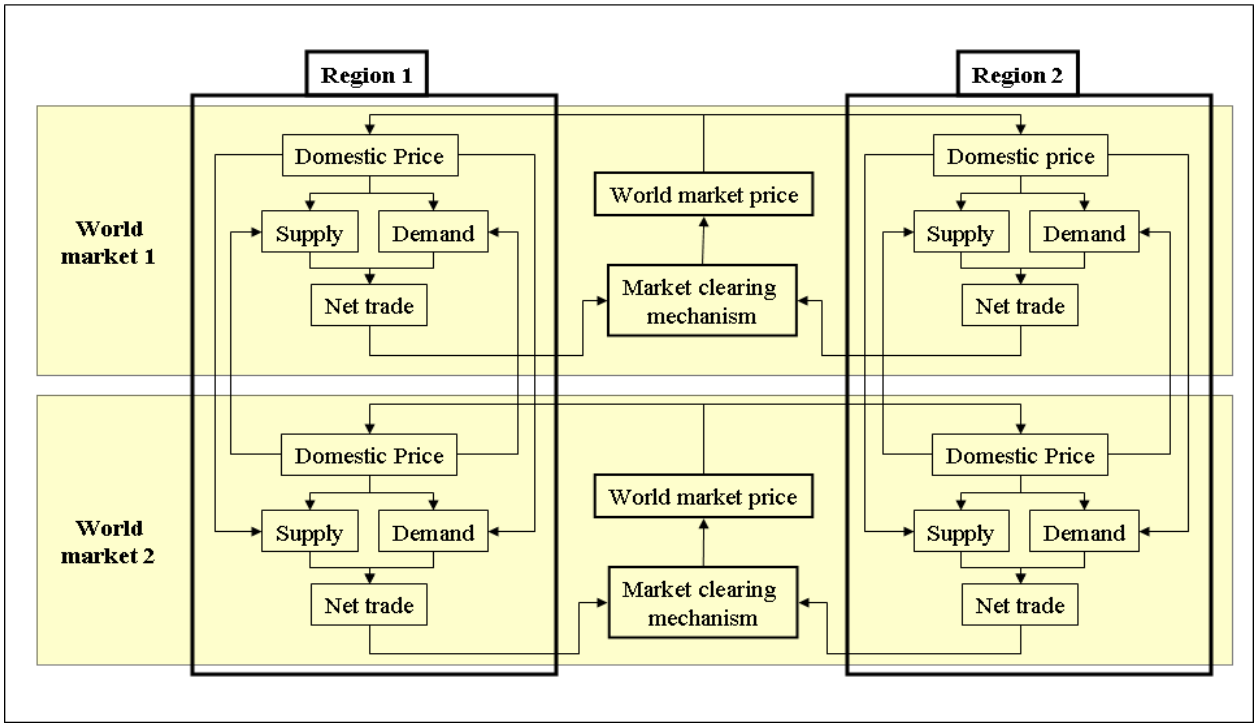


Figure 1: Simulations- routine in AGRISIM; example of 2 markets – 2 commodities

Source: Own illustration based on Roningen (1997) []

Policy interventions are in general considered as changes of nominal protections rate, price transmission elasticities, minimum producer prices, production quotas and subsidies, whereas through shift coefficients in the demand and supply functions additional variables can be simulated, like population and income growth.

In the rest of this section the main equations of the model are introduced in detail, whereas:

r = all regions

m(r) = x(r) = Mediterranean regions with modelled bilateral trade

i,j = all markets

s(i) = markets without modelled bilateral trade

t(i) = markets with modelled bilateral trade

Supply function

The supplied quantity is given by an iso- elastic function. Cross price effects between the markets are considered through the cross price elasticities. The price that influences the supply is the producer incentive price (eq. 1a). Nevertheless when production quotas are applied the relevant price is the quota equivalent price (see eq. 1b).

$$S_{i,r} = s_{i,r} \cdot \prod_j \left(p_{i,r}^{P} \right)^{\varepsilon_{i,j,r}^{S}} \cdot \Delta_{i,r}^{S} \qquad (1a)$$

$$S_{i,r} = s_{i,r} \cdot \prod_j \left(p_{j,r}^{Quo} \right)^{\varepsilon_{i,j,r}^{S}} \cdot \Delta_{i,r}^{S} \qquad (1b)$$

$S_{i,r}$ = Domestic Supply of product i in region r

$s_{i,r}$ = Calibration parameter of supply function

$p_{i,r}^{P}$ = Producer incentive price

$p_{j,r}^{Quo}$ = Quota equivalent price

$\varepsilon_{i,j,r}^{S}$ = Own and cross price elasticity of supply

$\Delta_{i,r}^{S}$ = Supply shifter (yield and other shifts)

Food consumption

Food consumption or demand for human consumption is determined again by an iso-elastic Cobb- Douglas function. Although the model is static in nature, through the shifter of this function it is possible to take into consideration dynamic effects as changes of income or population.

$$D_{i,r}^{NA} = d_{i,r}^{NA} \cdot \prod_j \left(p_{j,r}^{C} \right)^{\varepsilon_{i,j,r}^{NA}} \cdot \Delta_{i,r}^{NA} \qquad (2)$$

$D_{i,r}^{NA}$ = Food consumption of product i in region r

$d_{i,r}^{NA}$ = Calibration parameter of domestic non agricultural demand function

$\varepsilon_{i,j,r}^{NA}$ = Own and cross price elasticity of non agricultural demand

$\Delta_{i,r}^{NA}$ = Non agricultural demand shifter (e.g. change in income, population)

Other components of demand are feed and seed demand, waste and stock.

There are four price definitions in the model, namely border price, domestic price, producer incentive price and consumer price.

Border price

The border price is defined in relation to a reference price. As reference country serves in the model USA and thus the reference border prices are the USA border prices. Therefore the border price of a region for a certain commodity is determined by the USA border price and the difference between the border price of the region and the reference border price in the base year.

$$p_{i,r}^{B} = p_{i,ref}^{B} + \left(p_{i,r}^{BY} - p_{i,ref}^{BY} \right) \quad (3)$$

$p_{i,r}^{B}$ = Border price of product i in region r

$p_{i,ref}^{B}$ = Reference border price of product i (USA border price)

$p_{i,r}^{BY}$ = Border price in base year for product i in region r

$p_{i,ref}^{BY}$ = Reference border price in base year of product i

Domestic price

The domestic price is determined by the nominal protection coefficient i.e. the relationship between border and domestic prices and the price reaction of the border prices. The price transmission elasticity gives the grade of the relationship between the border and the domestic price. When $\varepsilon_{i,r}^{p} = 0$, then changes of the world market price (and thus of the border price) do not affect the domestic prices and when $\varepsilon_{i,r}^{p} = 1$, then changes of the world market prices are transmitted fully to the domestic market. Depending on how high the nominal protection coefficient and the price transmission elasticity are, various trade policies can be simulated. In the application of AGRISIM for MEDFROL it is assumed that $\varepsilon_{i,r}^{p} = 1$

$$p_{i,r}^{D} = NPC_{i,r} \cdot \left(p_{i,r}^{B} \right)^{\varepsilon_{i,r}^{p}} \quad (4)$$

$p_{i,r}^{D}$ = Domestic price of product i in region r

$NPC_{i,r}$ = Nominal protection coefficient

$\varepsilon_{i,r}^{p}$ = Price transmission elasticity

Producer incentive price

The producer incentive price is calculated endogenous and is equal to the domestic price and the part of the subventions that influence the production, as given in equation (5). Through the coefficient “production effectiveness” are modelled the effects of decoupling i.e. how much the introduction of decoupled payments acts as an incentive for the production, influences the produced quantity and thus the prices the farmers actually receive

$$p_{i,r}^{P} = p_{i,r}^{D} + \sum_{Sub} \alpha_{Sub} Z_{Sub} \quad (5)$$

α_{Sub} = Production- effectiveness

Z_{Sub} = Subsidy per ton

Consumer price

The consumer price due to lack of data is considered to be the same with the domestic price. Theoretically and if the data exist, it is possible to add retail margins as a further factor that affects the consumer price.

$$p^{C}_{s,r} = p^{D}_{s,r} \tag{6}$$

$p^{C}_{s,r}$ = Consumer price

Net trade in markets without modelling of bilateral trade

Net trade is calculated as the difference between the supplied quantities and the stock and all the components of demand i.e. seed demand, feed demand, non agricultural demand and waste.

$$NT_{s,r} = S_{s,r} + ST^{BY}_{s,r} - D^{S}_{s,r} - D^{F}_{s,r} - D^{NA}_{s,r} - W_{s,r} \tag{7}$$

$NT_{s,r}$ = Net trade of product s in region r

$ST^{BY}_{s,r}$ = Change in stocks of product s in region r in base year (constant)

$D^{S}_{i,r}$ = Seed demand of product i in region r

$D^{F}_{i,r}$ = Feed demand of product i in region r

$W_{i,r}$ = Waste of product i in region r

Market clearing mechanism

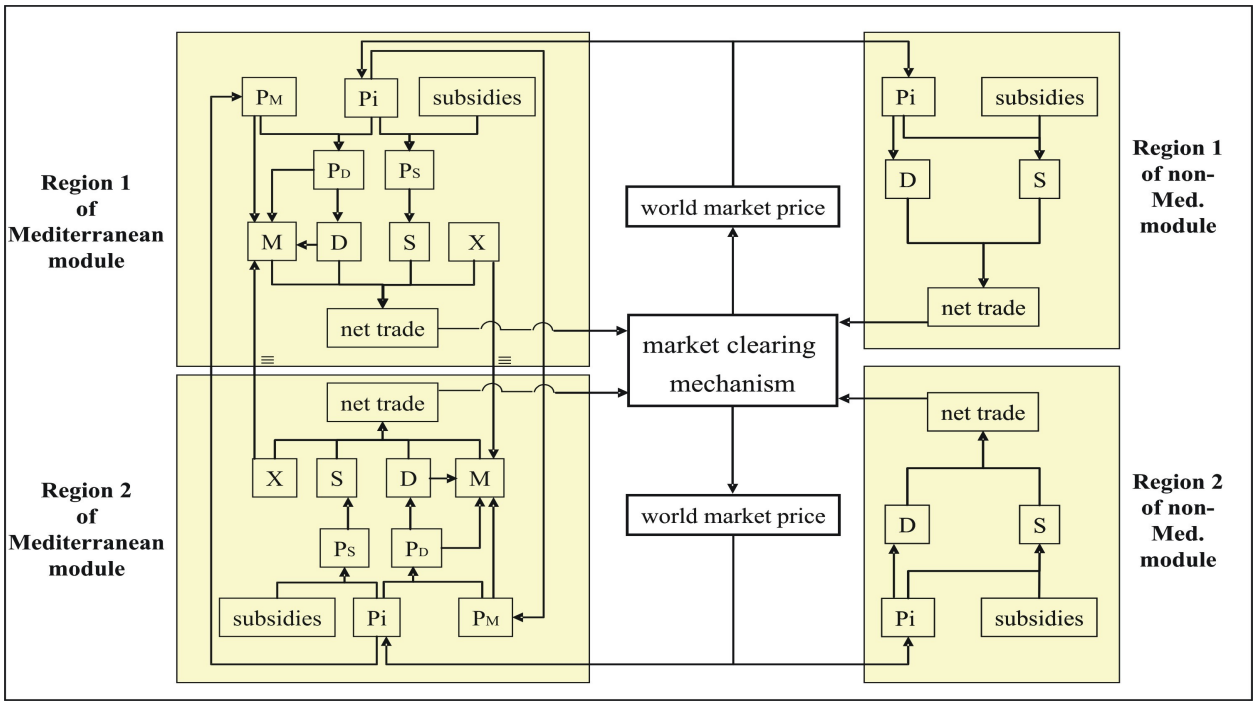
The equilibrium conditions are given in equations 8 and 9. The market is cleared when the sum of the net trade for all regions and for all commodities is equal to zero.

$$\sum_{r} NT_{i,r} = 0 \tag{8}$$

$$\sum_{i}\sum_{r} NT_{i,r} = 0 \tag{9}$$

4.2 Mediterranean Module

In order to make AGRISIM a suitable tool to analyse the trade flows in the Mediterranean basin, important adjustments and modifications are required. A major modification is the transformation of the model as far as modelling bilateral trade flows in the Mediterranean is concerned. For this purpose a special module – so-called Mediterranean Module – is built for the regions of Mediterranean basin. As seen in detail in Figure 2 between two regions of the Mediterranean Module the products are distinguished according to the origin of their production. This assumption collaborates favourably with Armington (1969)[].



* with PM: import price, Pi: domestic price, PD: demand price, PS: producer incentive price, M: imports (volume), D. demand, S: supply, X: exports

Figure 2: Structure of the Med. Module and connection between the Regions of the Med. Module with the rest of the regions in the model / Illustration for one market

Source: own illustration

The demand in one region of the Med. Module is comprised of demand for domestically produced commodities and demand for imported commodities, form other regions of the Med. Module and from the rest of regions of the model.

The imported quantity into one region is determined by the supplied quantity (i.e. domestic production), a calibration and a share parameter and the price reaction (equation 10).

$$M_{t,m,x} = m_{t,m,x} \cdot \left(b_{t,m,x}\right)^{\sigma_{t,m}} \cdot D_{t,m}^{NA} \cdot \left(\frac{p_{t,m,x}^{M}}{p_{t,m}^{C}} \right)^{-\sigma_{t,m}} \qquad (10)$$

$M_{t,m,x}$ = Imported quantity of product t in region m from region x

$m_{t,m,x}$ = Calibration parameter of import function

$b_{t,m,x}$ = Share Parameter

$\sigma_{t,m}$ = Elasticity of substitution

$p_{t,m,x}^{M}$ = Price of imported quantity of product t in region m from region x

The bilateral trade flows must be consistent, i.e. the quantity one region/country imports from another must be equal to the quantity the second country exports to the first one.

$$X_{t,m,x} = M_{t,x,m} \qquad (11)$$

$X_{t,m,x}$ = Exported quantity of product t in region m from region x

The consumer price is determined by the relationship of the import price and quantity plus the domestic price multiplied by demanded quantities for nationally produced commodities to the aggregated demand.

$$p^{C}_{t,m} = \frac{\sum_{x}\left(p^{X}_{t,m,x} \cdot M_{t,m,x}\right) + p^{D}_{t,m} \cdot \left[\left(D^{S}_{t,m} + D^{F}_{t,m} + D^{NA}_{t,m} + W_{t,m}\right) - \sum_{x} M_{t,m,x}\right]}{D^{S}_{t,m} + D^{F}_{t,m} + D^{NA}_{t,m} + W_{t,m}} \qquad (12)$$

The export price is determined by the domestic price, ad- valorem export subsidies or taxes and specific export taxes.

$$p^{X}_{t,m,x} = p^{D}_{t,x} \cdot (1 + tx^{av}_{t,m,x}) + tx^{sp}_{t,m,x} \qquad (13)$$

$tx^{av}_{t,m,x}$ = Ad- valorem export tax or subsidy

$tx^{sp}_{t,m,x}$ = Specific export tax or subsidy

Similarly is given the import price.

The net trade in each region is given as before (equation 8) by the difference of the quantities produced domestically, the existing stocks and the imported quantities from all regions and the various components of demand and the exports to all regions.

$$NT_{t,m} = S_{t,m} + ST^{BY}_{t,m} - D^{S}_{t,m} - D^{F}_{t,m} - D^{NA}_{t,m} - W_{t,m} + \sum_{x} M_{t,m,x} - \sum_{x} X_{t,m,x} \qquad (13)$$

The regions involved in the Med. Module are connected to the rest of regions modelled through a market clearing mechanism.

4.3 Database

The update and extension of the comprehensive AGRISIM database is the second crucial modification of the model and at the same one of the most time intensive tasks. Basically the database contains raw information for primary and processed commodities and feeds the model with all necessary exogenous parameters.

The model covers the whole world, aggregated into regions, depending on the focus of the simulations, whereas 56 counties can be modelled as separate regions. It also covers 29 commodities, which are also aggregated into commodity markets (for example all oilseeds are aggregated together to build one commodity market), again depending on the focus of the analysis to be carried.

Time series data from 1975 to 2001 of volumes of production, commodity balances and population are derived from FAOSTAT, whereas time series from 1986 to 2001 containing information on trade policies are taken from the PSE and CSE database of the OECD. For counties and/or commodities not included in the PSE databases other sources are used. Ad- valorem applied tariffs are derived from TRAINS. From the same source are taken – when existing – specific tariffs, compound tariffs, mixed tariffs and technical tariffs that are first converted to ad- valorem equivalents and then fed into the model, whereas export subventions from 1995 to 2001 are taken from the WTO secretariat.

Especially for the Mediterranean module the bilateral trade flows (volumes and prices of exports and imports) from 1995 to 2001 between the EU and the non- EU Mediterranean countries are taken from the COMTRADE, whereas the bilateral applied tariffs are derived again by TRAINS.

The elasticities are derived mainly from three sources. Initially they were taken from SWOPSIM and regarding the Central and East European Countries from the CEEC-ASIM model developed in IAMO. After the later updates and extensions of the model additionally sources have been used as the database of FAPRI and the USDA.

Table 2: Commodities and country list

Commodities	Apples* Coarse grains (barley, maize, millet, oats, rye, sorghum, triticale, other cereals) Beef Cotton Milk	Rice Oilseeds (rape and mustard seed, soybeans, sunflower seed) Sugar Olive oil* Oranges*	Pig meat Poultry meat (chicken, duck, goose, turkey meat, other poultry) Tobacco Tomatoes* Wheat
Countries	Australia Algeria* Brazil Belarus Bulgaria Canada China Cuba Cyprus* Czech Republic Egypt* Estonia EU-15 (data for each country) Hungary	Iceland India Israel* Japan Jordan* Korea, Republic of Latvia Lebanon* Libya* Lithuania Malta* Mexico Morocco* New Zealand Norway	Norway Poland Romania Russian Federation Slovakia Slovenia South Africa Switzerland Syria* Thailand Tunisia* Turkey Ukraine USA Rest of World

* new commodities and countries added in AGRISIM for the purposes of the MEDFROL Project

Source: AGRISIM database

5 Conclusions- Outlook

The liberalisation of trade round the Mediterranean basin and the preferential relationships among the Mediterranean countries is already a reality and is expected to alter the organisation and development of agriculture of this region. Profits due to the granted preferences are so far received for typical export commodities of the MPCs into the EU such as fruits and vegetables and these profits are expected to become higher with an intensification of the Euro-Med Association Agreements mostly due to trade diversion effects. So far most of the existing studies on trade liberalisation round the Mediterranean focus on analysing the Euro-Med Association Agreements by applying CGE models and thus providing only limited insights on the effects on the agricultural sector. Due to the lack of proper empirical studies and due to the need to base the future negotiations between the EU and the MPCs regarding the implementation of the Association Agreements on the trade of agricultural commodities on sound empirical research, in this paper the adjustments of the partial equilibrium model AGRISIM have been introduced.

Even though a lot of effort and attention has been given to the transformation of the model, there are still certain limitations that need to be taken into account.

The model is static in nature and although through shift factors and through the possibility to model a population growth some dynamic aspects can be captured, the

results must be seen as static. For example non-trend changes in the prices and quantities or in the behaviour of the consumers and the producers observed in the reality can only be reproduced in the model by assumptions.

The second limitation has to do with the exogenous parameters of the model. Several data sources have been used, which are not always consistent with each other. Although it is rather easy to obtain time series of quantitative data, it is very difficult to find reliable data regarding time series of domestic prices or of world market prices making it thus necessary to use different data sources. It is assumed that the domestic prices are determined by a reference world market price, applied tariffs and export subsidies. Nevertheless, there can be other barriers to trade, as so-called non tariff barriers and negative protection, which are difficult to quantify and measure and are not taken into consideration.

Nevertheless the existence of limitations does not make AGRISIM a less valuable tool for analysing empirically the effects of the altered policy regime for the Mediterranean countries. Compared to other partial equilibrium multi-commodity and multi-region models, it covers typical commodities for the Mediterranean region and countries in a non-aggregated level and takes into account the bilateral trade flows of the Mediterranean countries with their major trade partner, the EU, elements that make it suitable for the purposes of MEDFROL AGRISIM is thus an appropriate tool to project future trends and to provide the policy makers with valuable insights of changes that can occur, whereas a sensible and careful formulation of scenarios is recommended for the production of sensible results.

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Appendix

Table A: Value of Preference Margins resulting from the Euro- Med. Association Agreements in '000 US $ (1999)[1]

Commodity \ Country (HS 1996)		Algeria	Egypt	Israel	Jordan	Lebanon	Libya	Morocco	Syria	Tunisia	Turkey
0201	Meat of bovine animals	n.a[2]	n.a	0.00	n.a	n.a	n.a	n.a	n.a	n.a	0.00
0203	Meat of swine	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
0207	Meat of the poultry	n.a	n.a	309.42	n.a	n.a	n.a	55.20	0.00	n.a	7.60
0401	Milk and cream, not concentrated	n.a	n.a	0.00	n.a	n.a	n.a	0.00	n.a	n.a	0.00
0402	Milk and cream, concentrated	0.00	n.a	0.00	n.a	0.00	0.00	n.a	n.a	0.00	0.00
0702	Tomatoes	n.a	0.00	0.00	0.00	n.a	0.00	0.00	0.00	0.00	0.00
080510	Oranges	n.a	21112.29	204797.80	n.a	7.65	n.a	589590.74	7.65	90354.46	7.65
080810	Apples	1.08	1.14	7.50	n.a	n.a	n.a	49.47	9.82	5.40	7.50
1001	Wheat and meslin	n.a	15.20	15.20	n.a	n.a	n.a	n.a	n.a	n.a	15.20
1003	Barley	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
1005	Maize (corn)	n.a	0.00	0.00	n.a	n.a	n.a	0.00	n.a	0.00	0.00
1006	Rice	n.a	0.00	0.00	0.00	9.10	0.00	n.a	n.a	n.a	9.10
1007	Grain sorghum	n.a	7.60	n.a	n.a	n.a	n.a	n.a	n.a	7.60	n.a
1008	Other cereals	n.a	n.a	n.a	n.a	n.a	n.a	0.00	n.a	0.00	0.00
1201	Soya beans	n.a	0.00	0.00	n.a	n.a	n.a	n.a	n.a	n.a	0.00
1204	Linseed	n.a	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.00
1206	Sunflower seeds	n.a	0.00	0.00	n.a	n.a	n.a	0.00	n.a	n.a	0.00
1207	Other oil seeds	n.a	0.00	0.00	0.00	0.00	n.a	0.00	0.00	n.a	0.00
1507	Soya- bean oil	n.a	n.a	n.a	n.a	6.02	n.a	871.92	n.a	n.a	n.a
1509	Olive oil	n.a	0.00	0.00	n.a	0.00	n.a	0.00	0.00	0.00	0.00
1512	Sunflower- seed, safflower or cotton- seed oil	n.a	n.a	9.63	n.a	n.a	n.a	n.a	n.a	n.a	6.68
2401	Unmanufactured tobacco	0.00	n.a	n.a	n.a	0.00	n.a	0.00	0.00	0.00	0.00
5201	Cotton, not carded or combed.	n.a	0.00	0.00	n.a	n.a	n.a	0.00	0.00	0.00	0.00
17011	Cane sugar	n.a	n.a	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a

1												

[1] for the period 1998- 2003 import duties (into the EU) where reported only for 1999 and 2003, whereas for Libya only for 1999; [2] n.a= non-available import duty for this commodity

Source: own calculations based on reported import duties derived from TRAINS and bilateral trade flows derived from Comtrade

Table B: Value of Preference Margins resulting from the Euro- Med. Association Agreements in '000 US $ (2003)[1]

Commodity \ Country (HS 1996)		Algeria	Egypt	Israel	Jordan	Lebanon	Libya	Morocco	Syria	Tunisia	Turkey
0201	Meat of bovine animals	0.00	n.a[2]	0.00	n.a	n.a	n.a	n.a	0.00	n.a	n.a
0203	Meat of swine	n.a	n.a	0.00	n.a	0.00	n.a	0.00	n.a	n.a	n.a
0207	Meat of the poultry	n.a	n.a	1.24	n.a	n.a	n.a	n.a	n.a	n.a	25.60
0401	Milk and cream, not concentrated	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.00
0402	Milk and cream, concentrated	0.00	n.a	0.00	n.a	n.a	n.a	n.a	n.a	n.a	0.00
0702	Tomatoes	28.46	5968.47	10.90	1588.78	46.46	n.a	1198125.88	10.90	17435.60	275802.70
080510	Oranges	n.a	217633.55	149112.20	n.a	538.67	n.a	1587488.50	n.a	146692.74	167785.02
080810	Apples	n.a	- 0.02	2.83	n.a	n.a	n.a	- 0.13	- 0.12	n.a	1734.79
1001	Wheat and meslin	n.a	n.a	12.80	n.a	98.48	n.a	n.a	0.00	n.a	120422.40
1003	Barley	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.00
1005	Maize (corn)	n.a	n.a	0.00	n.a	n.a	n.a	0.00	n.a	n.a	0.00
1006	Rice	n.a	7.70	n.a	n.a	n.a	n.a	n.a	0.00	0.00	3049.20
1007	Grain sorghum	n.a	6.40	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
1008	Other cereals	n.a	0.00	n.a	n.a	0.00	n.a	n.a	0.00	n.a	n.a
1201	Soya beans	n.a	n.a	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a
1204	Linseed	n.a	0.00	n.a	n.a	n.a	n.a	0.00	n.a	n.a	0.00
1206	Sunflower seeds	n.a	0.00	0.00	n.a	n.a	n.a	n.a	0.00	n.a	0.00
1207	Other oil seeds	n.a	0.00	0.00	0.00	0.00	n.a	0.00	0.00	n.a	0.00
1507	Soya- bean oil	n.a	n.a	n.a	n.a	n.a	n.a	269.50	n.a	n.a	19.63
1509	Olive oil	n.a	0.00	0.00	n.a	0.00	n.a	0.00	0.00	0.00	0.00

1512	Sunflower- seed, safflower or cotton- seed oil	n.a	171.50	n.a	n.a	n.a	n.a	208.62	n.a	n.a	9900.01
2401	Unmanufactured tobacco	n.a	0.00	n.a	n.a	0.00	n.a	n.a	0.00	0.00	0.00
5201	Cotton, not carded or combed.	n.a	0.00	0.00	n.a	n.a	n.a	0.00	0.00	0.00	0.00
170111	Cane sugar	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.00

[1] for the period 1998- 2003 import duties (into the EU) where reported only for 1999 and 2003, whereas for Libya only for 1999; [2] n.a= non-available import duty for this commodity

Source: own calculations based on reported import duties derived from TRAINS and bilateral trade flows derived from Comtrade