An empirical assessment of agricultural trade policies in the Mediterranean basin – regional effects on the EU Member States–

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Abstract

The objective of this paper is to provide deeper insights on the impacts of agricultural policy reforms in the Mediterranean basin focusing on regional effects in the EU. The empirical analysis has been undertaken using the partial equilibrium multi commodity, multi region world trade model AGRISIM. The simulation results indicated that the CAP Reform for the Mediterranean commodities seems to affect only the EU Mediterranean Member states and the enlargement with Bulgaria and Romania only this two countries. Moreover the impacts on the markets of typical Mediterranean commodities included in the modelling exercise are limited. The supply in the EU changes mainly for those commodities that are of high protection as beef, whereas the demand increases being highest for beef. The prices adjust to the world market prices resulting thus to negative changes for the producer's surplus, but to positive for the consumer's surplus. The effects for the EU budget are also positive and overall welfare gains are to be expected.

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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 southern EU Member States are at the north of the Mediterranean basin and in particular with the reform of the CAP for the Mediterranean commodities. As part of the liberalisation process in the region can be seen the inclusion of agricultural commodities in the Barcelona Agreement.

Consequently the levels and structure of trade flows are expected to change in the Mediterranean basin, affecting thus the competitiveness of the involved countries. From the side of the EU, because of the different areas of specialisation among the southern and northern Member States, the regional effects are expected to be different, beneficial for the northern countries where the competition with the non-EU Mediterranean countries is low and ambiguous for the Mediterranean Member States, where the competition with the non-EU Mediterranean countries is high. The producers of the EU's Mediterranean States fear a reduction of their production levels and thus of their income, accusing the EU's agricultural policy as being more supportive for the producers of the northern EU countries.

Within this content objective of this paper is to provide deeper insights on the impacts of agricultural policy reforms in the Mediterranean basin focusing on the regional effects in the EU. For this purpose the paper is structured in six parts. Following the introduction a brief overview of existing empirical assessments is given in the second part. A short model description comes in the third part. In the fourth part the simulation scenarios are explained.

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The simulation results are given in the fifth and main part of this report with emphasis on the EU-15 and in particular the EU Mediterranean Member States Italy, Greece and Spain. The paper closes with concluding remarks in the sixth and last part.

Existing empirical assessments

One could argue that already enough empirical studies exist. Indeed several models have been employed to analyse the impacts of the latest reform of the CAP on the EU-15. A wider view on modelling exercises of the Luxembourg Agreement gives BALKHAUSEN et al (2005).

Studies of the impacts of a future trade liberalisation focus mainly on the liberalisation between the EU and the non-EU Mediterranean countries. For most of the empirical studies multi-region or national applied general equilibrium models (GE) have been employed. For example AUGIER and GASIOREK (2003) examine welfare and price factor implications of trade liberalisation between Southern Mediterranean Countries and the EU with a 11 country – 10 sector computable general equilibrium model. MERCENIER and YELDAN (1997) focus on a customs union between Turkey and the EU and their implications due to trade liberalisation on the agricultural sector, whereas the same model, further extended and adjusted, is employed by DIAO and YELDAN (2001) to examine static and intertemporal effects of bilateral trade liberalisation between the EU, Turkey and non-EU Mediterranean countries. KUIPER (2006) using GTAP examined the effects of the Euro-Med Agreements on Morocco. A comparative static national GE has been developed by HOSOE (2001) to analyse the impact of the Uruguay Round and the Euro-Mediterranean Association Agreements on Jordan, by HOEKMAN et al (2001) to exploit the impacts of trade liberalisation scenarios between Egypt and the EU and Egypt and other Arab countries, by KONAN and MASKUS (2001) again with focus on Egypt, and by RUTHERFORD et al (1997) to examine the trade liberalisation between Morocco and the EU. CHEMINGUI and DESSUS (2001) have created a dynamic GE to model sequential tariff cuts due to liberalisation in the trade between Tunisia and the EU, LÖFGREN

et al (2001) have developed a dynamically recursive GE of Morocco.

Studies focusing on the agricultural sector such as partial equilibrium studies, that could contribute to the future discussion of the Mediterranean agriculture are rather limited. GRETHE (2003) for example developed a partial equilibrium model named TURKSIM to analyse the extension of the customs union of Turkey with the EU with agricultural commodities, while M´BAREK (2002) using a spatial equilibrium model simulated trade liberalisation scenarios and examined their effects on Morocco and Tunisia.

The results focus mainly on the whole economy of the non-EU countries. The authors agree that liberalisation will result to welfare gains for the EU and to increase of the exports to non-EU Mediterranean countries, the magnitude of the effects varies based on the importance of the liberalised sectors for the EU markets (for example liberalisation in manufactures or/and services). Only Kuipper (2006) examines regional effects on the EU and finds that the northern EU countries would benefit from improved market access to North African Countries for cereals, animal and dairy products, while the Mediterranean EU countries are faced with increased imports of vegetable oils.

The agricultural sector is given a less significant place and is represented either aggregated or through a limited number of commodities. Looking at agriculture, there are further issues that should be taken into account. The EU enlargement with the New Member States results to expansion of the EU domestic market, which could contribute positive at narrowing the opposing positions for liberalisation of agricultural trade between the EU and the non-EU Mediterranean countries (GARCIA-ALVAREZ-COQUE, 2002). The CAP reform results into a new framework for the European farmers and depending on the reform and its implementation, this could work to break the north-south conflict of interests among the European farmers (GARCIA-ALVAREZ-COQUE, 2002).

Therefore proper for an empirical analysis would be a multi-commodity and multi-region

equilibrium model, focusing on the agricultural sector and on typical for the Mediterranean region commodities. So as to capture the interactions in the EU, it would be interesting to have the EU broken down to southern and northern Member States. Through this way the different regional effects on the EU could be shown better and generalisation problems could be avoided.

Overview of the empirical model AGRISIM

The empirical analysis has been undertaken using the partial equilibrium multi commodity, multi region world trade model AGRISIM. The model is a synthetic simulation model, comparative static and deterministic in nature, with non-linear, iso-elastic demand and supply functions. It is a net trade model with homogenous products. 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. Policy interventions are considered as changes of the nominal protection rate, price transmission elasticities, minimum producer prices, production quotas and subsidies. Through shift coefficients in the demand and supply functions, additional variables can be simulated, like population and income growth (for more details see PUSTOVIT, 2003; SCHMITZ, 2002).

Time series data of volumes of production, commodity balances and population dating from 1975 to 2001 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 subsidies from 1995 to 2001 are taken from the WTO secretariat.

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 at IAMO. After the later updates and extensions of the model additionally sources have been used as the database of FAPRI and the USDA. The supply elasticities (own and cross price) for oranges, apples and tomatoes for the Mediterranean Countries have been derived by GRETHE (2003). The model equations are given in the Annex.

The simulations focus on policy shocks that take place in the Mediterranean basin and affect the EU Member States. An overview of the simulated scenarios is given in Table 1. For the simulations a 17-region, 15-commodities aggregation scheme has been followed, as listed in Table 2 in the Annex.

The base year of the model is 2001, where in the EU the Agenda 2000 was implemented. In order to have a plausible representation of the agricultural policy scheme that is now active, a base run scenario is necessary. So as to include the reforms under Agenda 2000 for the years 2002 and 2003 the direct payments for oilseeds and the beef prices were decreased while the direct payments for beef were increased. In this scenario additionally to the full implementation of the Agenda 2000 the EU east enlargement and the Luxembourg Agreement are simulated. As far as the Luxembourg Agreement is concerned the option of full decoupling is chosen, since most of the Member States have chosen not to use the exemptions for coupled payments as provided by the Council Regulation (EC) 1782/2003 (Official Journal of the EU, 2003). It should be noted that the reform of the sugar sector in the EU, which followed in 2006, has not been taken into account.

The reform of the CAP for the Mediterranean products cotton, olive oil and tobacco is simulated on SC1, so as to allow the reader to see separately the effects of decoupling the direct payments of those commodities on the Mediterranean agriculture.

In SC2 additionally the planned enlargement of the EU with Bulgaria and Romania is simulated. The assumptions of this scenario are taken over in the rest of the scenarios.

In SC3 to 5 various options of liberalisation are simulated. In SC3 a unilateral liberalisation of 50 % of the markets of the EU-25 and the non-EU Mediterranean countries is examined, in SC4 a 50 % and in SC5 a 100 % multilateral liberalisation. Although the latest scenario has very limited practical use, it is necessary for checking the plausibility of the model results and for understanding and further explaining the results obtained from the scenarios that follow. SC3 could serve as an approximation of possible inclusion of the agricultural sectors in the Barcelona Agreement and SC4 to compare and understand the magnitude of the effects i.e. the impact on the EU regions of the opening of the markets round the Mediterranean versus opening of the whole world.

Table 1: Base run and simulated scenarios

Base run	Agenda 2000, EU-East Enlargement and Luxembourg Agreement
SC1	Base run + CAP Reform for Mediterranean Products (cotton, olive oil, tobacco)
SC2	SC1 + EU enlargement with Bulgaria & Romania
SC3	SC2+ 50 % unilateral liberalisation of markets round the Mediterranean (i.e. of ESP, GRE, ITA, E12, CEC, BUR, MOR, TUR and MPC)
SC4	SC2+ 50 % multilateral liberalisation of the whole world
SC5	SC2 + 100 % multilateral liberalisation of the whole world

Source: own compilation

Effects on the EU-25

The results concern changes from the Base run (BA) of supply, demand, prices, net trade and social welfare measured using the surplus concept.

The most obvious changes in the commodity balances, trade and welfare are observed in the liberalisation scenarios and the highest effects are in SC5. The reform of the CAP for the Mediterranean commodities and the EU enlargement with Bulgaria and Romania affect only slightly the agricultural markets in the EU. It should be noted though that changes in the

cotton, tobacco and olive oil markets are mainly due to the CAP Reform and not due to liberalisation. This is to be expected since the EU has already opened this markets and the only distortion to free trade are the domestic direct subsidies within the EU. Interesting is also the observation that the differences between SC3 and SC4 are minor, meaning that the reason for the changes is the liberalisation only from the EU's side and not from the rest of the world.

The effects of the second wave of the CAP Reform (reform for the Mediterranean commodities i.e. cotton, olive oil and tobacco) and the potential enlargement with Bulgaria and Romania seem to affect only minor the supply in the existing EU Member States.

Liberalisation of the EU markets leads to changes in the product balances for the commodities with high protection, whereas for commodities with less significance for the EU as a whole the effects are again minor.

Commodity balances

Looking separately at impacts on supply and demand for each commodity one could come to the following observations. The supply of tomatoes rises by 1 to 2 % due to liberalisation, whereas for oranges and apples there is a decline of about 2 to 5 %. As expected the changes due to SC5 are double as high as for SC4.

For cotton in Spain and in Greece, the most important supplier countries in the EU, the supply falls by 4 %. For tobacco the fall varies between 1 % in Spain and 7 % in Italy

The marginal changes in the cereals and livestock products due to the second wave of the CAP reform are attributed mainly to cross price effects.

The consumption on the other side seems to increase due to liberalisation and only the food demand for olive oil decreases by about 1 % due to the reform of the olive oil market and by about 2 to 4 % due to liberalisation. The increase varies between 8 to 20 % for sugar, 2 to 4 % for milk, 14 to 44 % for beef, 1 to 2 % for pork, 9 to 28 % for poultry, 1 to 2 % for wheat and

4 to 11 % for coarse grains. In the CEECs the increase in SC5 for beef demand is of about 115 %.

However in all simulated scenarios and for all the commodities the shares in the EU production of all EU regions are maintained (compared to the Base Run). For example Greece remains throughout the simulations the most important cotton producer in the EU and Spain the biggest olive oil producer. About 82 % of the EU's cotton production and about 58 % of the EU's olive oil production take place in Greece and Spain respectively, whereas for example about 86 % of oilseed production and 75 % of beef and pork meat production take place in the rest of EU-15 countries. The picture is the same looking at the shares of the Mediterranean and non Mediterranean EU Member States in the world production. For example almost 77 % of olive oil in the world is produced by Greece, Italy and Spain together under all scenarios, while the shares for oranges, tomatoes, cotton and tobacco are about 9 %, 11 %, 2.6 % and 6 % respectively. The relative competitiveness in the production of the southern and northern EU states is thus not affected by the simulated policies.

Prices

The CAP Reform results to a slight rise of the farm gate prices, varying from 1 to 3 %, whereas the liberalisation, both unilateral and multilateral leads to a decrease of the farm gate prices for animal commodities and sugar of about 6 to 30 % and of about 1 to 8 % for cereals. One should expect these changes, since due to the high protection the farm gate prices for livestock products and sugar lie under the BA much higher than the world market prices. Similar changes to the cereals are observed for apples and oranges. On the other side the farm gate prices for tomatoes increase by about 1 to 2 %, for cotton by about 1 to 2 %, for tobacco by about 4 to 12 % and for olive oil by about 4 to 10 %.

More important though for the supply is the producer incentive price, which is estimated as the farm gate price and the part of direct subsidies that affects the production (equation 12 of

the Annex). It is this price that the farmer actually receives and therefore is this price that determines the decisions of the farmers of what and how much to produce. The decoupling of direct subsidies for cotton, tobacco and olive oil leads to lower producer incentive prices in the Spain, Greece and Italy, about 6 to 14 % for olive oil, 20 to 39 % for cotton and 19 to 27 % for tobacco. For the rest of the commodities the changes in the producer incentive prices are the same as for the farm gate prices, since in the simulated scenarios no further domestic policy reform of the EU has been modelled. Due to cross price effects changes in the producer incentive prices are observed in SC1 in the EU Mediterranean countries for other commodities as well. For example in Greece the producer incentive price for milk rises up to about 20 %. The same trends are observed in the new Member States.

The border prices for all commodities apart from cereals increase in the event of liberalisation. Interesting is the observation that the differences between SC3 and SC4 are only marginal i.e. when only an opening of the markets round the Mediterranean take place and when an opening of the markets of the entire world takes place. Because of the protective current policy regime in the EU (base run) the domestic prices in the EU are kept high and thus the supply and the exports, leading to low world market prices. Opening of the EU markets leads to adjustments of the domestic prices to the world market ones and results to decrease of the EU producer incentive prices and farm gate prices and to increase of the border prices.

The revenue of the producers is adjusted to the new price and supply level. Since the productions costs are assumed to be constant the changes in the revenue can be seen as changes in the farmers income. The changes in income are minor (between .2 and 2 % increase and decrease for coarse grains respectively) and are of the same magnitude between the northern and the southern EU farmers of typically northern crop commodities as, wheat, coarse grains and oilseeds, whereas liberalisation (SC3 and SC4) results to income reductions by about 15 % for milk, sugar, pork and poultry meat and by about 30 % for beef in all EU

regions. The Spanish and Greek cotton farmers are faced with an income reduction of 4 and 3.5 % respectively. The reduction of the tobacco producers' income is of the same level in Greece as for cotton, about 6 % in Italy and only about .5 % in Spain. Unilateral liberalisation results to about 11 % reduction of the orange farmers' income. The olive oil producers on the contrary seem to enjoy increase of their income by .1 to .7 % in the three Med. EU countries due to the CAP Reform and about 3 % due to unilateral liberalisation. The effects in scenarios 1 to 3 are almost the same, but in the case of multilateral liberalisation (SC4 and SC5) the income reduction is much lower and the income increase higher.

The minor differences in the changes of the farmers' income of the northern and of the southern EU Member States could be seen as an indication that the EU's Mediterranean countries farmers are not discriminated compared to their colleagues in other EU regions due to the followed agricultural policy. It should be noted that the magnitude of the effects is higher for the typical Med. Commodities as cotton, olive oil and tobacco if the producer's incentive prices are used for the calculation of the revenue and this due to the reduction of the direct payments.

Trade

In the model net trade is calculated as the difference between supply and demand. Therefore when the supply is higher than the demand, a country or a region is considered to be a net exporter and when the demand is higher than the supply, a net importer.

The Mediterranean CAP Reform and the enlargement of the EU with Bulgaria and Romania do not change the net trade status quo of the EU countries. The Mediterranean EU Member States are net exporters of the typical regional commodities with some exceptions. Spain is a net importer of tobacco, Italy net importer of cotton and of olive oil. In Figure 1 the net trade effects of the CAP Reform for the Mediterranean commodities on Spain, Greece and Italy are shown.

In SC3 to SC5 because of the more intense changes in the supply and demand than the ones under SC1 and SC2, the effects on net trade are more obvious. For example in Spain the trade balance for poultry meat changes significantly and the country from net exporter of 1000 t becomes net importer of 0.189 to 0.5 mio t in SC3 and SC5 respectively. Italy becomes a net importer of 43,000 t in SC3 from net exporter of 70,000 t oranges, whereas a multilateral opening of the orange market by 50 % (SC4) leads to imports of only 380 t. In the rest of the EU-15 countries there is a change of the status of trade balance for poultry meat, where from exports of about 1 mio t a 50 % unilateral liberalisation (SC3) leads to imports of about 137,000 t and a 50 % multilateral liberalisation (SC4) to imports of about 600,000 t. Finally it is worth mentioning that for typical for the Mediterranean region commodities the changes in the trade balance are only marginal.

Figure 1: Net trade effects in Spain, Greece and Italy due to CAP Reform for Mediterranean commodities

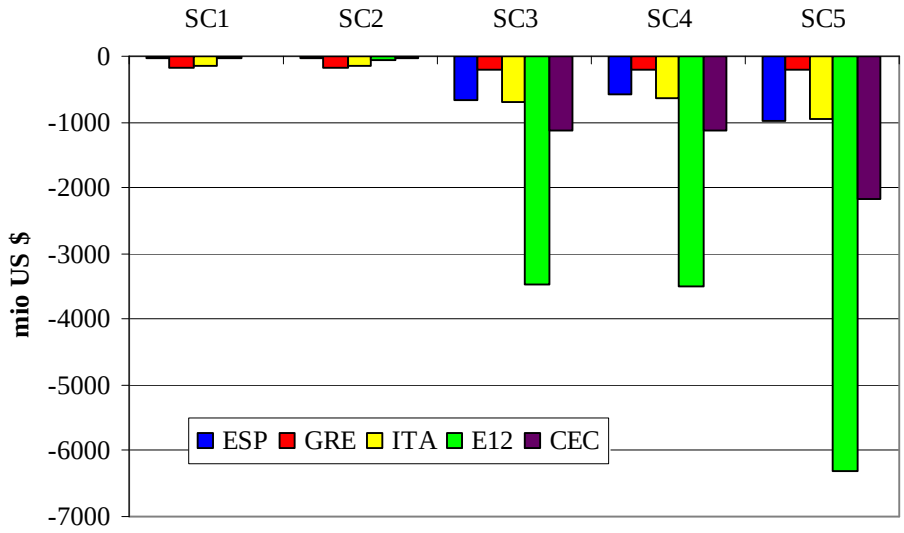
Source: own compilation based on AGRISIM simulations

Welfare effects

The first two scenarios affect only marginally the welfare of the EU countries. On the contrary liberalisation leads to welfare losses for the producers and the quota owners but to gains for the consumers, the EU taxpayers and the society as a whole.

The EU producers are by far the most negatively affected group of the society due to the liberalisation of the agricultural sector, as Figure 2 shows. With the current policy regime they benefit from high domestic prices and are motivated to produce more. An opening of the markets means for them lower prices, lower production in terms of quantity and thus losses in the producer surplus.

Figure 2: Producer surplus effects in the EU Member States



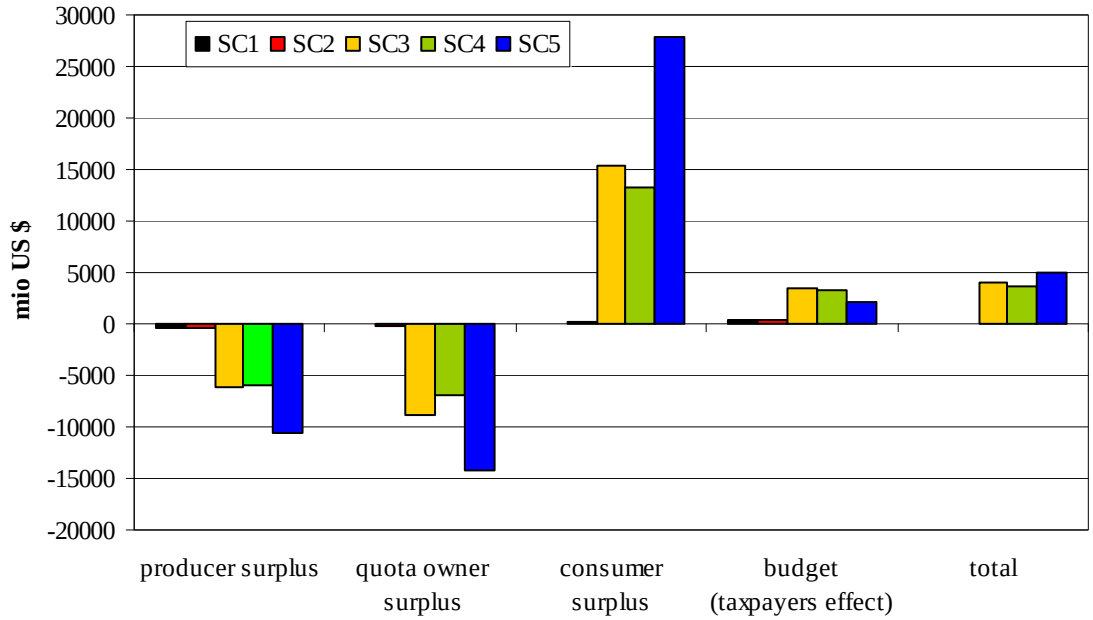
Source: own compilation based on AGRISIM simulations

The consumers on the other side benefit from the lower prices and the higher demand and enjoy welfare gains (Figure 3).

The effects for the EU budget are also positive, since the reduction of trade distorting policies means less expenditure. It should be noted that because the CAP is financed according to the principle of financial solidarity, the budget effects will not occur in the different Member States but only in the EU budget. Nevertheless, combining the low contribution of Greece, Italy and Spain to the EU budget with the positive budget effects in the EU, makes evident the positive effects for the welfare of those three countries

In Figure 3 the changes in the welfare of the EU-25 are illustrated.

Figure 3: Welfare effects in EU-25



Source: own compilation based on AGRISIM simulations

Conclusions – Outlook

In this report the focus is laid on agricultural policy reforms taking place in the Mediterranean basin that affect the EU markets. Emphasis is given on the regional effects on the EU countries and in particular in the southern EU Member States Greece, Italy and Spain versus the northern EU Member States.

The simulation results indicated that the CAP Reform for the Mediterranean commodities seems to affect only the EU med. Member States and the enlargement with Bulgaria and Romania had almost no impact on the existing EU Member States. The results obtained from a 50 % unilateral liberalisation have only marginal differences from the ones obtained from a 50 % multilateral liberalisation, whereas a simulation of free trade in the world (100 % multilateral liberalisation) gives effects of the double magnitude. Moreover the impacts on the markets of typical Mediterranean commodities included in the modelling exercise are limited.

The supply in the EU changes mainly for those commodities that are of high protection as beef, whereas the demand increases and the increase is the highest for beef.

The prices adjust to the world market prices. Both the farm gate and the producer incentive prices drop. The border prices on the other side rise, since the reduction of the domestic EU prices leads to an increase of the world market prices.

The fears of the farmers in the southern EU countries that on the one side the reform of the CAP for the Mediterranean products and the opening of the EU markets on the other side will reduce their income and will have negative impacts on them are only partly understandable. Although the simulations confirm negative changes of the producer surplus due to liberalisation, their income is not reduced more than the one of the northern EU countries' farmers and they do maintain their shares in the EU's production and looking at typical Mediterranean commodities they keep their strong positions in the supply chain. The farmer's welfare though can be enhanced through policies supporting efficiency in the production systems, the logistics and marketing so as to obtain the highest profits from a well functioning supply chain.

The consumers on the other side benefit from the lower prices and the higher demand and enjoy welfare gains. In fact the magnitude of the changes in the consumer rent is the highest among the various welfare components. The effects for the EU budget are also positive, since the reduction of trade distorting policies results to lower expenditure. Although in the model the budget effects occur in the EU-25, taking into account the low contribution of Greece, Italy and Spain to the EU budget reveals positive effects for the taxpayers of those three countries. Overall the policy reforms in the Mediterranean basin result to welfare gains for the society and therefore should be seen as positive for the development of the local economies and the prosperity of the population. The positive welfare effects could compensate for the reduction of the producer surplus and thus through a re-allocation policy all welfare components could benefit.

A limitation of the study is the static nature of the model. 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. The model is not suited for prognosis and the results should be interpreted more as possible trends and less as absolute changes. Still the model is suitable for a with and without policy analysis, depending on the formulation of the simulation scenarios. Moreover, because of its static nature the model underestimates the true gains from trade and from liberalisation, since it is commonplace that in the reality these gains are much higher than the static results. Trade liberalisation is not a static procedure, but a dynamic one, offers opportunities and can be thus a catalyst for changes in the structure of the production, the evolution of employment in the sector and the organisation of the supply chains.

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Annex

Model equations

Supply equations

Supply $S_{i,r} = s_{i,r} \cdot \prod_j \left(p^P_{i,r} - p^{Quo}_{j,r}\right)^{\varepsilon^S_{i,j,r}} \cdot \Delta^S_{i,r}$

Yield $Y_{i,r} = y_{i,r} \cdot \left(p^P_{i,r}\right)^{\varepsilon^Y_{i,j,r}} \cdot \Delta^Y_{i,r}$

Area $A_{i,r} = \frac{S_{i,r}}{Y_{i,r}}$

Price equations

Border price $p^B_{i,r} = p^B_{i,ref} + \left(p^{BY}_{i,r} - p^{BY}_{i,ref}\right)$

Domestic price $p^D_{i,r} = NPC_{i,r} \cdot \left(p^B_{i,r}\right)^{\varepsilon^p_{i,r}}$

Producer incentive price $p^P_{i,r} = p^D_{i,r} + \sum_{Sub} \alpha_{Sub} Z_{Sub}$

Demand equations

Seed Demand $D^S_{i,r} = d^S_{i,r} \cdot S_{i,r} \cdot \Delta^{SD}_{i,r}$

Feed Demand $D^F_{i,r} = d^F_{i,r} \cdot \prod_j \left(p^C_{j,r}\right)^{\varepsilon^{DF}_{i,j,r}} \cdot \Delta^{FD}_{i,r}$

Food Demand $D^{NA}_{i,r} = d^{NA}_{i,r} \cdot \prod_j \left(p^C_{j,r}\right)^{\varepsilon^{NA}_{i,j,r}} \cdot \Delta^{NA}_{i,r}$

Waste $W_{i,r} = w_{i,r} \cdot S_{i,r} \cdot \Delta^W_{i,r}$

Market clearing

$\sum_r NT_{i,r} = 0$

$\sum_i \sum_r NT_{i,r} = 0$

Net trade $NT_{s,r} = S_{s,r} + ST^{BY}_{s,r} - D^S_{s,r} - D^F_{s,r} - D^{NA}_{s,r} - W_{s,r}$

sets

r	all regions	i,j	all markets

parameters

$\Delta^S_{i,r}$	Supply shifter (yield and other shifts)	$\varepsilon^{NA}_{i,j,r}$	Own and cross price elasticity of non agricultural demand
$s_{i,r}$	Calibration parameter of supply function	$\Delta^{NA}_{i,r}$	Non agricultural demand shifter (e.g. change in income, population)
$\varepsilon^S_{i,j,r}$	Own and cross price elasticity of supply	$w_{i,r}$	Calibration parameter of waste function

$y_{i,r}$	Calibration parameter of yield function	$\Delta_{i,r}^{W}$	Waste shifter (e.g. technical progress)
$\varepsilon_{i,j,r}^{Y}$	Price elasticity of yield with respect to own price	$ST_{s,r}^{BY}$	Change in stocks of product s in region r in base year (constant)
$\Delta_{i,r}^{Y}$	Yield shifter (e.g. annual yield growth trend, technical progress)	$p_{i,ref}^{B}$	Reference border price of product i (USA border price)
$d_{i,r}^{S}$	Calibration parameter of seed demand function	$p_{i,r}^{BY}$	Border price in base year for product i in region r
$\Delta_{i,r}^{SD}$	Seed demand shifter (e.g. technical progress)	$p_{i,ref}^{BY}$	Reference border price in base year of product i
$D_{i,r}^{F}$	Feed demand of product i in region r	$NPC_{i,r}$	Nominal protection coefficient
$d_{i,r}^{F}$	Calibration parameter of feed demand function	$\varepsilon_{i,r}^{p}$	Price transmission elasticity
$p_{j,r}^{C}$	Consumption price	$p_{j,r}^{Quo}$	Difference between producer incentive price and quota equivalent price
$\varepsilon_{i,j,r}^{DF}$	Own and cross price elasticity of feed demand	α_{Sub}	Production-effectiveness
$\Delta_{i,r}^{FD}$	Feed demand shifter (e.g. changes of animal numbers)	Z_{Sub}	Subsidy per ton
$d_{i,r}^{NA}$	Calibration parameter of domestic non agricultural demand function		

Variables

$S_{i,r}$	Domestic Supply of product i in region r	$NT_{s,r}$	Net trade of product s in region r
$Y_{i,r}$	Yield of product i in region r	$p_{i,r}^{B}$	Border price of product i in region r
$A_{i,r}$	Area (or number of animals) of product i in region r	$p_{i,r}^{D}$	Domestic price of product I in region r
$D_{i,r}^{S}$	Seed demand of product i in region r	$p_{i,r}^{P}$	Producer incentive price
$D_{i,r}^{NA}$	Domestic non agricultural demand of product i in region r	$p_{s,r}^{C}$	Consumer price
$W_{i,r}$	Waste of product i in region r		

Table 2: Aggregation scheme of the AGRISIM Database for the simulations

Regions		Products	
GRE	Greece	APPL	Apples
ITA	Italy	ORAN	Oranges
ESP	Spain	TOMA	Tomatoes
E12	Rest of EU-15	OLIO	Olive Oil
MOR	Morocco	COTT	Cotton Lint
TUR	Turkey	TOBA	Tobacco
MPC	Rest of MPC	WHEA	Wheat
CEC	New Member States of the EU (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia)	COAR	Coarse grains (barley, maize, triticale, oats, rye, sorghum, other cereals)
BUR	Bulgaria and Romania	RICE	Rice
RUA	Russia and Ukraine	SUGA	Sugar
ANZ	Australia and New Zealand	OILS	Oilseeds
MEX	Mexico	MILK	Milk
USA	United States	BEEF	Beef and Veal
BRA	Brazil	PORK	Pig meat
CHI	China	POUL	Poultry meat
ROE	Canada, Iceland, Japan, Norway, South Korea, Switzerland		
ROW	Rest of World		

Source: own compilation