Project no. **SSPE-CT-2004-502457**

Project acronym : : **EU-MED AGPOL**

Project full name :

Impacts of agricultural trade liberalization between the EU and Mediterranean countries

Instrument type : Specific Targeted Project

Priority name : 8.1 Policy-oriented research

Deliverable D22

Impacts of EU integration on Turkish Agriculture

Due date of deliverable: June 2006

Actual submission date: October 2006

Start date of project: 01 March 2004 Duration: 36 months

Organisation name of lead contractor for this deliverable :

Middle East Technical University (METU) Ankara, Turkey

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
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CO	Confidential, only for members of the consortium (including the Commission Services)	

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ABSTRACT

Turkey's membership to the EU will involve full liberalization of agricultural trade with the EU. The effects of liberalization are bound to depend on the path of agricultural policies in Turkey and in the EU during the accession negotiations. In order to evaluate the possible impacts of a variety of policy alternatives and scenarios, an economic modeling approach based on non-linear mathematical programming is appropriate. In this framework, the major purpose of this paper is to evaluate the impact of Turkish integration to the EU on agriculture using an *agricultural sector model* for Turkey. The basic approach undertaken supplements the past efforts by incorporating *Maximum Entropy* to the positive mathematical programming, together with updated base period and including recent policy changes. Following the integration with EU, the net exports in agro-food products decline mainly due to the expansion of trade in livestock products. Overall welfare effects of including agro-food products in the customs union and membership are small. However, efficiency gains are worth to notice. Consumers benefit from declining prices. CAP supports are determinative for producers' welfare. The results of the simulations provide also updated estimates about the possible size of CAP expenditures for Turkish agriculture.

Keywords: *Turkish Agricultural Sector Model, Turkey's Membership of EU, Positive Mathematical Programming (PMP), Maximum Entropy Based Positive Mathematical Programming (ME-PMP), Turkey, EU.*

I. INTRODUCTION

The EU integration path of Turkey started in 1963 with the Association Agreement (also known as the Ankara Agreement). Customs Union agreement between Turkey and EU was formed in 1995. It eliminated all custom duties and charges having equivalent effect on the trade of industrial products. However, it covered only manufacturing component of the processed agricultural products containing cereals, sugar and milk along with industrial products. Turkey was officially recognized as a candidate state on an equal footing with other candidate states at the Helsinki European Council of December 1999. Eventually, the European Council defined the perspective for the opening of accession negotiations with Turkey in 2004, and the screening process concerning the analytical examination of the *acquis* started in 2005. The accession, *if any*, seems unlikely to happen before 2015 since the European Commission stated that the EU will need to define *its financial perspective for the period from 2014 before negotiations can be concluded.*[1]

The membership will involve full liberalization of agricultural trade with the EU. However, the liberalization of trade in agro-food products is bound to start before the membership. Even without any customs union agreement, double-zero agreements in specific products are necessary to ease the transition towards membership. Expanding the coverage of the customs union agreement to the agro-food products is natural. The costs and benefits of liberalization are bound to depend on the path of agricultural policies both in Turkey and in the EU, and also on the process of accession negotiations (CAKMAK AND KASNAKOGLU, 2002). In order to evaluate the possible impacts of a variety of policy alternatives and scenarios, an economic modeling approach based on non-linear mathematical programming is appropriate. In this framework, the main purpose of this study is to evaluate the impact of EU integration of Turkey on agriculture using the new version of *Turkish Agricultural Sector Model* (named as TAGRIS). The basic approach undertaken involves *Positive Mathematical Programming* with *Maximum Entropy* following PARIS AND HOWITT (1998), particularly HECKELEI AND BRITZ (1999). The agricultural sector model is based on a static optimization algorithm.

[1] Commission document COM(2004) 656 final: Recommendation of the European Commission on Turkey's progress towards accession, p.10.
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2004:0656:FIN:EN:DOC

II. PROBLEM STATEMENT

EU is a major trading partner of Turkey in agricultural products. Further expansion of integration with the EU would imply changes in the structure of production in Turkey and trade flows with the EU and the rest of the world. The agricultural components of agro-food products are excluded in the current customs union agreement between EU and Turkey. The possible results of the abolition of trade barriers between EU and Turkey in agriculture have the outmost importance for the policy makers both in EU and Turkey. The impacts of the shift in policy structure coupled with trade implications will be crucial both in the determination of the exceptions and derogations in agriculture during the membership negotiation process, and eventually in the estimation of net burden of Turkey's membership to the EU budget.

The main research question of this paper is "*what are the potential effects of trade liberalization with the EU, including the membership, on Turkish agriculture?*" The results of the study provide updated estimates about the possible CAP costs of Turkish agriculture to the EU Budget. The ongoing agricultural policy reform processes both in the EU and Turkey imply that most of the domestic supports will shift to less price-distortionary income payments. However, the trade and to a limited extent domestic intervention may remain as the major policy tools. Considering this policy framework, a new version of the regional and static partial equilibrium agricultural sector model for Turkey is constructed.

The base period of the model is 2002-2004 averages. The model is used to discuss the impacts of three scenarios in 2015. First one is the baseline scenario which may be called as "business as usual" scenario. The policy framework[2] of Turkey remains as it was in the base period (EU-OUT). The current Customs Union agreement with the EU is extended to cover all agro-food products in the second scenario (*EU-CU*). The third scenario simulates the impact of full membership of Turkey to the EU (*EU-IN*).

[2] including the import tariffs and export subsidies implemented in the base period. The coverage of export subsidies is limited, but the tariff protection is high. The import tariffs for the base base period and for 2006 are presented in the Annex Table A5.

III. STRUCTURE OF THE MODEL

The structure of the model permits a comprehensive analysis of the crop and livestock production. The model is a non-linear programming model. It maximizes the *Marshallian surplus* (consumer plus producer surplus). Our model represents the *third* generation of policy impact analysis using sector models, following TASM (KASNAKOGLU AND BAUER, 1988) and TASM-EU (CAKMAK AND KASNAKOGLU, 2002).

The basic features of the model may be summarized as:

i) The production side of the model is disaggregated into four regions for the exploration of interregional comparative advantage in policy impact analysis. These are: *Coastal Anatolia*, *Central Anatolia*, *East Anatolia*, and *Southeastern Anatolia Project (GAP)* Regions (Figure 1).
ii) The crop and livestock sub-sectors are integrated endogenously, i.e., the livestock sub-sector gets inputs from crop production.
iii) Foreign trade is allowed in *raw* and in *raw equivalent* form for processed products and trade is differentiated for the *EU*, *USA* and the rest of the world (*ROW*).

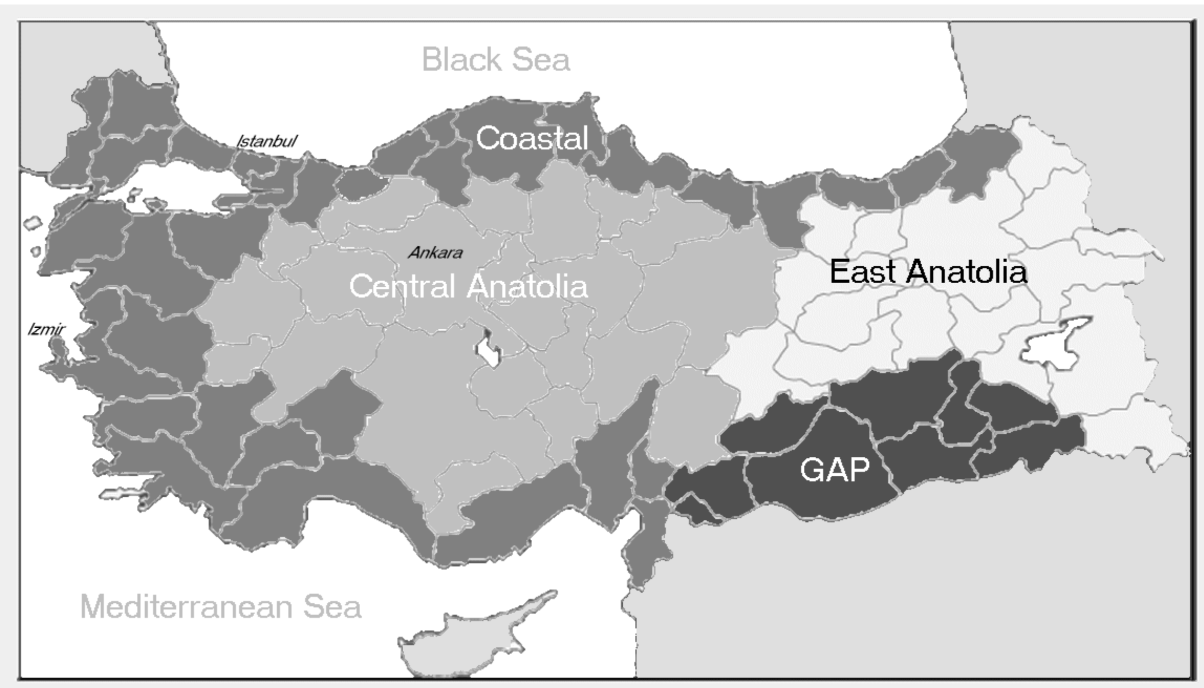

Figure 1 Regions of the Model

The model contains more than 200 activities to describe the production of about 55 commodities with approximately 250 equations and 350 variables. The agricultural products of model cover 96.3 % of Turkey's total harvested area (2003-2004 average). The products included in the model can be grouped as follows:

(1) *CEREALS*: Common wheat, Durum wheat, Barley, Corn, Rice, Oats, Rye, Spelt, Millet.
(2) *PULSES*: Chick pea, Dry bean, Lentil.
(3) *INDUSTRIAL CROPS*: Tobacco, Sugar beet, Cotton.
(4) *OILSEEDS*: Sesame, Sunflower, Peanut, Soybean.
(5) *VEGETABLES*: Melon-Watermelon, Cucumber, Eggplant, Fresh Tomato, Processing Tomato, Green Pepper.
(6) *TUBERS*: Onion, Potato.
(7) *FRUITS AND NUTS*: Apple, Apricot, Peach, Table Olive, Oil Olive, Citrus, Pistachio, Hazelnut, Dry Fig, Table Grape, Raisin Grape, Tea.
(8) *FODDER CROPS*: Cow vetch, Wild vetch, Alfalfa, Sainfoin.
(9) *LIVESTOCK AND POULTRY PRODUCTS*: Beef and Veal, Mutton and Lamb, Goat Meat, Poultry Meat, Cow Milk, Sheep Milk, Goat milk, Egg, Cow hide, Sheep Hide, Goat Hide, Wool, Hair.

Each production activity defines a yield per hectare for crop production, and a yield per head for livestock and poultry production. Crop production activities use fixed proportion of labor, tractor power, fertilizers, seeds or seedlings. The livestock and poultry activities are defined in terms of dry energy requirements. The input-output structure used in the production of model is sketched in Figure 2.

Crop production activities are divided into three categories: crop yield for human consumption, crop yield for animal consumption and crop by-product yield[3] for feed. Five groups of input: land, labor, tractor power, fertilizer and seed, for the crop production are incorporated. Land is classified into four classes: (1) Dry and (2) Irrigated land for short cycle

[3] Forage, straw, milling by-products, oil seed, cotton and sugar beet processing by-products.

activities, (3) Tree land for long cycle activities, and (4) Pasture land includes range-land and meadow.

Labor and tractor power requirements are specified quarterly. The labor input is measured in man-hour equivalents and shows actual time required on the field or per livestock unit. The tractor hours correspond to the usage of tractors in actual production and transportation related activities. Two types of fertilizers, namely nitrogen and phosphate, are measured in terms of nutrient contents. They are considered to be traded goods and are not restricted by any physical limits. The costs of labor, tractor and fertilizer, seed and seedlings (for vegetables and tobacco) are included as production costs for annual crops. Fixed investment costs are assigned for perennial crops.

Livestock production is an integrated part of the model. In fact, it is difficult to incorporate livestock production in a static sector model because of its dynamic character. Static models, however, can throw light on a number of interesting questions related to the links with the production of feed crops and to alternative equilibrium states of the livestock sub-sector due to policy changes.

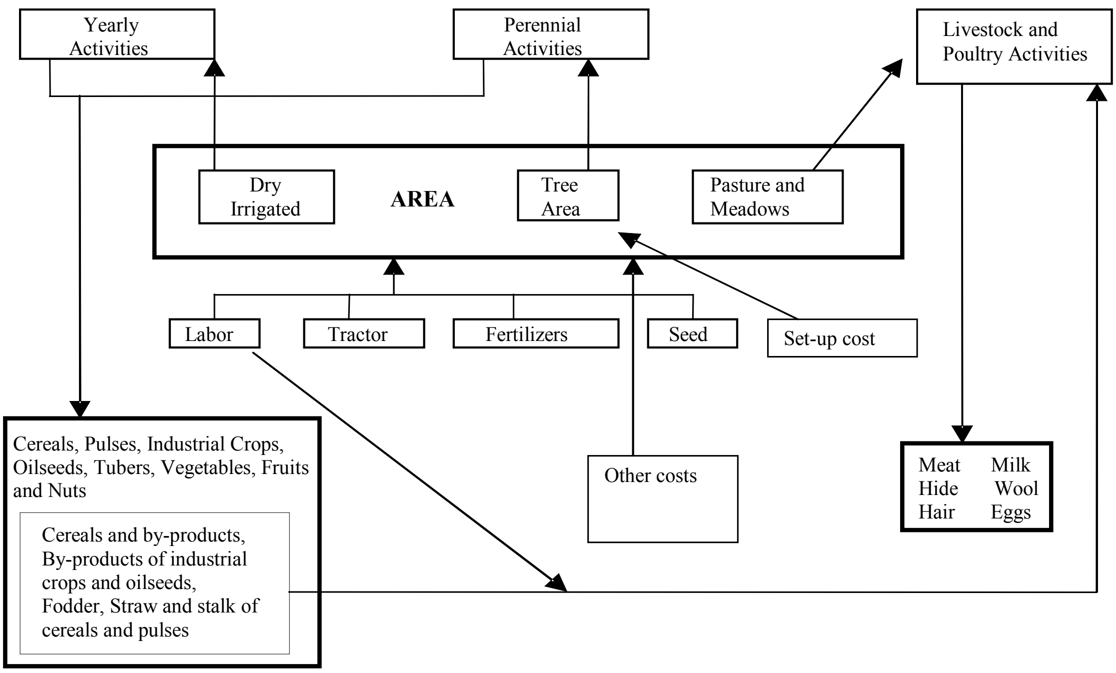

Figure 2 Input Output Structure in Production

The feed supply is provided from the crop production sector, and disaggregated into six categories: (1) Direct or raw equivalent commercial feed consumption of cereals[4], (2-3) Two categories of processing by-products: milling by-products[5] and oil seed by-products[6], (4) Straw or stalk by-products from the crop production[7], (5) Fodder crops[8], and (6) Range land and meadow.

The model makes sure that the minimum feed composition requirements are fulfilled. The explicit production cost for animal husbandry is labor. The outputs of the livestock and poultry production activities are expressed in terms of kg/head for livestock production.

On the demand side, consumer behavior is regarded as price dependent, and thus market clearing commodity prices are endogenous in the model. Demand, supply and policy interactions at the national level are sketched in Figure 3.

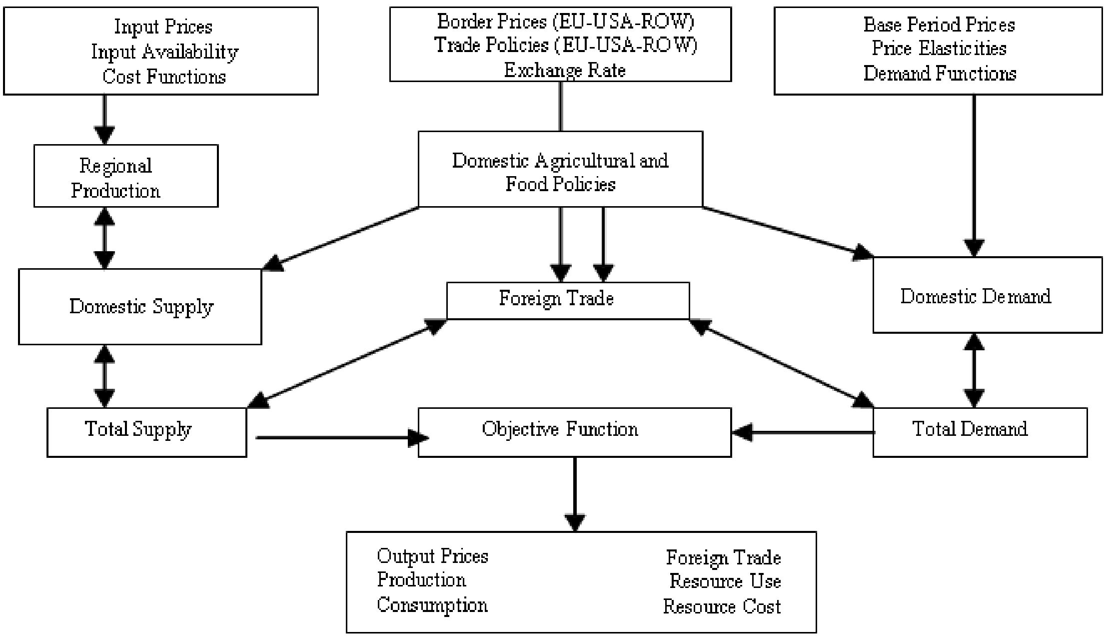

Figure 3 Demand and Supply Interactions

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[4] Wheat, barley, corn, rye, oats, millet and spelt.
[5] Wheat, rice, sugar beet.
[6] Cotton, sunflower, groundnut, and soybean.
[7] Wheat, barley, corn, rye, oats, millet, spelt, rice, chickpea, dry bean, lentil.
[8] Alfalfa, cow vetch, wild vetch, and sainfoin.

IV. CALIBRATION METHODOLOGY OF THE MODEL

The main drawback of using linear or nonlinear programming models in policy analysis is the fact that, unless any fixed factor becomes binding the average and marginal cost curves are horizontal due to the fixed input-output proportions. Early applications in the literature used the *flexibility constraints* with put upper and lower bounds for the activity levels. Later, the concept of *risk* aversion was incorporated in these models. However, both of these approaches may be problematic for policy impact analyses.[9]

The *calibration* of any model to the base period observations is a crucial step for policy impact analysis. The use of positive approach in the calibration of agricultural sector models has been rather recent. . The first study on the use of calibration in economic models is the seminal working paper of HOWITT in 1985 (HOWITT, 1985). This study is then followed by HOWITT (1995a) and HOWITT (1995b). The proposed calibration method with the name of Positive Mathematical Programming (PMP) is also consistent with microeconomic theory[10]. TASM[11] of KASNAKOGLU AND BAUER (1988) and TASM-EU[12] of CAKMAK AND KASNAKOGLU (2002) represent two applications using the PMP methodology for calibration purposes.

The PMP method suggests a two-stage procedure to calibrate the models to the observed values. First, the model is run with regional production constraints and with a small perturbation to prevent degeneracy. The shadow prices of the regional production constraints thereby obtained reflects the unaccounted portion of the cost function. Second, the shadow prices of the regional constraints are normalized with the actual production figures and integrated into the objective function as a quadratic penalty term. The calibration constraints are then removed and the model has been adjusted for the validation exercise in the second-step run.

PMP method explained above was then developed further with the integration of *Generalized Maximum Entropy* (GOLAN, JUDGE AND MILLER, 1996) formalism by PARIS AND HOWITT

[9] See Cakmak and Kasnakoglu (2002) for the potential problems.
[10] See Hecklei and Britz (1999), Howitt (1995a and 1995b), and Cakmak (1992, July) for a detailed discussion about the consistency with micro theory and about the cost terms.
[11] Turkish Agricultural Sector Model.
[12] Turkish Agricultural Sector Model-European Union.

(1998). Later on, this approach was extended to more than one *cross sectional* framework by HECKELEI AND BRITZ (1999), and used in the construction of CAPRI (Common Agricultural Policy Impact) model of the EU. Our model follows HECKELEI AND BRITZ (1999) and uses a *Maximum Entropy* integrated PMP method for the calibration to the observed values. The model was written in GAMS (1998) and solved using the non-linear programming solver CONOPT 3 on a Pentium-IV PC.

TAGRIS is a price endogenous partial equilibrium agricultural sector model. The objective function is given by the Marshallian surplus (sum of consumers' and producers' surplus) as illustrated in Figure 4. The idea behind the maximization of Marshallian surplus which is originated by SAMUELSON (1952) and then improved by TAKAYAMA AND JUDGE (1964) is simple: in a competitive equilibrium economy, the sum of consumers' and producers' surplus is maximized when the market equilibrium is achieved. Hence, if we maximize the sum of Marshallian surplus, the solution values of price and quantity variables that the model chose as optimal are the competitive equilibrium solutions. In this way, apart from quantity, the variable of price is also endogenized.

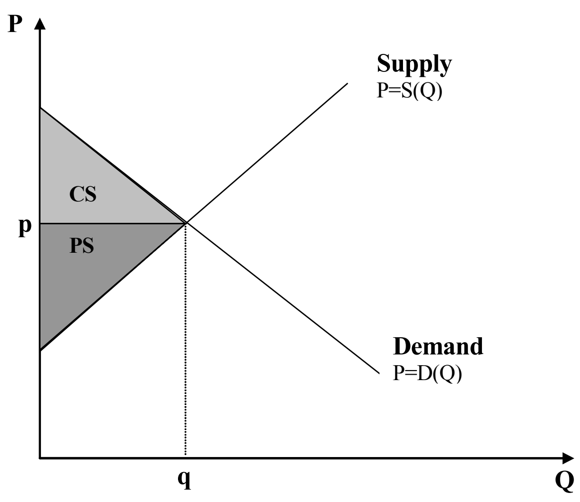

Figure 4 Maximization of Marshallian Surplus

Hence, the value of objective function Z can be written as:

$$Z = \int_0^q D(Q)dQ - \int_0^q S(Q)dQ \tag{1}$$

where S(Q) and D(Q) are the inverse supply and demand functions, respectively, P is prices and Q is quantity.

Note that, the area below the supply curve given in Figure 4 is nothing but *total variable cost* of production, *TVC(Q)*. Hence, the objective function for *i* goods can be rewritten as follows:

$$Z = \sum_i \left[\int_0^{q_i} D(Q_i)dQ_i - TVC(q_i) \right] \tag{2}$$

HOWITT (1995a) proposes to use the total variable cost function in order to calibrate the model to the observed levels (Positive Mathematical Programming). Usually a quadratic form is preferred for the TVC function. The general version of this total variable cost function in matrix form can be written as follows:

$$\mathbf{TVC} = \mathbf{d}'\mathbf{q} - \frac{1}{2}\mathbf{q}'\mathbf{D}\mathbf{q} \tag{3}$$

which implies the following marginal cost[13] function in matrix form:

$$\mathbf{MC} = \mathbf{d} + \mathbf{D}\mathbf{q} \tag{4}$$

where **d** is a (N×1) vector of parameters associated with the linear term and, **D** is a (N×N) symmetric[14] positive definite[15] matrix and **q** is a (Nx1) vector of activity levels..

[13] Since marginal variable cost and marginal costs are same we use the notation marginal cost (MC).

[14] Notice that the second cross derivatives of the total variable cost function, TVC, are symmetric by Young's theorem. Therefore, we can directly assume symmetry of the Q-matrix ($Q_{i,j} = Q_{i,j}\ \forall$ i,j).

[15] Mathematically, given the profit function of π(q)=Pq-TC(q), profit maximization requires π'(q)=Pq-MC(q)=0 and π''(q)=-MC'(q)<0. Hence, it is required that MC'(q)>0; marginal cost must be increasing.

For calibration of the model, PMP methodology of HOWITT (1995a) proposes to equate this marginal cost to the *sum* of *observed* variable cost (**c**) plus *dual values* (λ) associated with the calibration constraints[16] at the *observed base year activity levels*, **q***. In this case, marginal cost relation becomes $\mathbf{MC} = \mathbf{d} + \mathbf{Dq}^* = \mathbf{c} + \boldsymbol{\lambda}$. Here, note that the **d** vector has N unknowns and the symmetric **D** matrix has $N.(N+1)/2$ different unknown parameters whereas **c** and λ vectors has only N known values. In the "*standard*" PMP methodology, the problem of estimating $N + \left[N.(N+1)/2\right]$ parameters from 2N known values is usually solved by equating **d** to **c** and setting all off-diagonal elements of **D** to zero. Then, the N diagonal elements of **D** matrix can be calculated as $D_{ii}=\lambda_i/q_i^* \ \forall\ i$.

In order to estimate the parameters of **d** and **D** matrices individually, in 1998, PARIS and HOWITT (1998) suggested using Maximum Entropy (ME) estimation since Maximum Entropy methodology is applicable in negative degrees of freedom problems (GOLAN *et al*, 1996). Their approach is then extended by HECKELEI AND BRITZ (1999) with multiple data points taking into account the cross sectional information coming from regional differences in profitability and production patterns. Our model follows HECKELEI AND BRITZ (2000) using maximum entropy approach to PMP based on cross sectional sample. Below we present the Positive Mathematical Approach with Maximum Entropy based on cross sectional sample that TAGRIS uses in the calibration process.

Our objective here is to estimate a quadratic cost function with cross cost effects (full **D** matrix) between *crop production activities* and the intercept matrix of **d.** Suppose one can generate *R* (1×N) vectors of marginal costs from a set of *R* regional programming models by applying the first step of PMP. In order to exploit this information for the specification of regional quadratic cost functions, we need to define appropriate restrictions on the parameters across regions. Otherwise no informational gain is achieved (HECKELEI AND BRITZ, 1999, p.8). Consider the following suggestion for a "scaled" regional vector of marginal cost applied to crop production activities:

[16] For details, see HOWITT (1995a).

$$\mathbf{MC}_r = \mathbf{d}_r + \mathbf{D}_r \mathbf{q}_r^* \;\; \forall\, r, \tag{5}$$

$$\mathbf{D}_r = (cpi_r)^g \mathbf{S}_r \mathbf{B} \mathbf{S}_r^{/} \;\; \forall\, r, \tag{6}$$

where $\mathbf{d}_r$ is a (Nx1) vector of linear cost function parameters in region *r*, $\mathbf{D}_r$ represents a (NxN) matrix of quadratic cost term parameters in region *r*, cpi_r stands for a regional "*crop profitability index*" defined as regional average revenue per hectare relative to average revenue per hectare over all regions such as $cpi_r = AR_r \big/ AR$ where $AR_r = \sum_{i=1}^{M} q_{ir}^* p_i yl_{ir} \Big/ L_r$ and $AR = \sum_{r=1}^{R} AR_r \Big/ \sum_{r=1}^{R} L_r$. Note that p_i denotes the price of crop *i*, yl_{ir} represents the yield of crop *i* in region *r*, and L_r is the total arable land in region *r*. The parameter *g* is the exponent of crop profitability index to be estimated and it determines the influence of crop profitability index. Lastly, s_{rii} represent the elements of (NxN) diagonal scaling matrices $\mathbf{S_r}$ and it is given by $s_{rii} = \sqrt{1/q_{ir}^*}$.

This algorithm involves two important elements which improves the Maximum Entropy based PMP of PARIS AND HOWITT (1998). First one is *crop profitability index* and the second one is the *scaling mechanism*. The crop profitability index for each region is estimated separately reflecting the regional differences in the production of associated crop. The inclusion of the exponent of crop profitability index in the calculation of marginal cost matrix is important since it captures the economic effect of differences in soil, climatic conditions etc for each regions. Second, scaling mechanism improves the responses of the model to the changes in acreage of any crop. To stress the effect of scaling, HECKELEI AND BRITZ (1999) give an example for two regions with identical total area but different shares of crop land. According to the example, assume that there is 10 ha increase in the acreage of a crop. If the total acreage of this crop in region one is 1 ha and 100 hectares in region two prior to the change of the acreage, then 10 hectare increase in the acreage of this crop would imply 1000 percent relative increase for the first region but only 10 percent for the second region. Hence, the scaling of B matrix assures the same marginal cost increases in both regions for the same percentage increase in crop acreage. Using this scaling mechanism it is possible to take into account this difference in the calculation of marginal costs depending on the differences in crop acreage for different regions.

The general formulation of the corresponding ME problem is as follows:

$$Maximize\ \ H(\mathbf{p}) = -\sum_{k=1}^{K}\sum_{i=1}^{N}\sum_{r=1}^{R} pd_{kir} \ln pd_{kir} - \sum_{k=1}^{K}\sum_{i=1}^{N}\sum_{j=1}^{N} pb_{kij} \ln pb_{kij} - \sum_{k=1}^{K} pg_k \ln pg_k \quad (7)$$

Subject to

$d_{ir} + cpi_r^g \cdot \sum_{j=1}^{N} s_{rii} s_{rjj} b_{ij} q^*_{jr} = c_{ir} + \lambda_{ir},\ \ \forall\, i, r$ Data consistency constraint [17] (8.i)

$d_{ir} = \sum_{k=1}^{K} pd_{kir} zd_{kir}$, $\forall\, i, r$ Marginal cost intercept term. (8.ii)

$b_{ij} = \sum_{k=1}^{K} pq_{kij} zb_{kij}$, $\forall\, i\ \ and\ \ \ j \geq i$ Marginal cost slope term. (8.iii)

$b_{ij} = b_{ji},\ \ \forall\, i < j$ Symmetry of **B** matrix. (8.iv)

$g = \sum_{k=1}^{K} pg_k zg_k$ Exponent of crop profitability index. (8.v)

$\sum_{k=1}^{K} pd_{kir} = 1,\ \ \forall\, i, r$ Adding up property. (8.vi)

$\sum_{k=1}^{K} pb_{kij} = 1,\ \ \forall\, i\ \ \ and\ \ \ j \geq i$ Adding up property. (8.vii)

$\sum_{k=1}^{K} pg_k = 1,$ Adding up property. (8.viii)

$l_{ii} = \sqrt{b_{ii} - \sum_{h=1}^{i-1} l_{ih}^2}\ \ \ \forall i, j$ Cholesky decomposition restriction. (8.ix)

$l_{ij} = \dfrac{b_{ji} - \sum_{k=1}^{i-1} l_{jh} l_{ih}}{l_{ii}}\ \ \ \forall i, j$ and $j>i$ Cholesky decomposition restriction. (8.x)

$l_{ii} > 0$, Cholesky decomposition restriction. (8.xi)

Note that restrictions (8.ix) and (8.x) are included in order to guarantee that a positive (semi) definite matrix **B** and consequently positive (semi) definite matrices $\mathbf{D_r}$ will be recovered.

[17] Information from the first phase of PMP, and cross sectional (regional) information from base year data.

These are known as *curvature restrictions* and they are resulting from a classic Cholesky decomposition of the form $\mathbf{B} = \mathbf{L}.\mathbf{L}'$. A violated curvature property might result in a specification of the objective function that does not calibrate to the base year, since in this case only first order but not second order conditions for a maximum are satisfied at the observed activity levels (HECKELEI AND BRITZ, 1999, p.10). The l_{ii} must always be positive and real, (8.xi), since **B** is supposed to be a symmetric and positive (semi) definite matrix,.

V. MODEL SCENARIOS AND RESULTS

The model is used to conduct three scenario analyses for the year 2015. First one is the baseline scenario which simulates the status quo. The policy framework of Turkey remains as it was in the base period *(EU-OUT)*. The current Customs Union Agreement with the EU is expended to cover all agro-food products in the second scenario (*EU-CU*). The third scenario simulates the impact of full membership of Turkey to the EU (*EU-IN*).

The *base period* of the model is the average of 2002, 2003 and 2004. All parameters including deficiency payments for some selected crops, tariffs, and export subsidies reflect period averages. The actual position of the EU indicates that 2015 may be earliest date for the accession of Turkey to the EU. All of the exogenous parameters of the model are projected to 2015 to be able to compare the results of the various scenarios.

It is assumed that Turkey is neither a member of EU in 2015 nor extends the customs union agreement with the EU to agricultural products in *EU-OUT*. There is no change from the current trade policy. Turkish annual population growth rate is determined according to the FAOSTAT (2005) estimates: 1.4 percent annual population growth rate is imposed. GDP per capita series with 1987 prices are used to estimate the per capita annual real GDP growth for Turkey. Using a simple trend regression, annual real GDP growth rate is estimated as 1.3 percent. Trade prices in 2015 are obtained from the estimates of FAPRI (2005) with the necessary FOB and CIF adjustments. Technological improvement in crop and animal product yields is estimated by a two-step procedure. In the first step, using the 1961-2005 data (FAOSTAT, 2005) for each product yields, a linear *OLS* trend estimation is performed. In the second stage, these large sample (1961-2005) estimates are used as *a priori* information in the *Generalized Maximum Entropy* (GME) estimation[18] using the data of last 10 years (1996-2005). Hence, the future ten-year yield growth estimates are based on the last ten-year period, but the information contained in the long historical data from 1961 to 2005 are incorporated in the yield growth estimation of each product. The results of the GME estimation for all commodities in the model are presented in the Annex (Table A4) and they are incorporated as the net technological improvement for the projection of the model to 2015. In addition, it is assumed that irrigated area in the GAP Region will increase by 150,000 ha and by 60,000 ha in the rest of Turkey by 2015. The level and the coverage of deficiency payments in 2015 will be the same as 2005. Area restrictions on tea, tobacco and hazelnut are expected to remain unchanged. Similar assumption is made for the quantity restriction on sugar beet production.

In the second scenario (*EU-CU*), the customs union agreement between EU and Turkey is extended to cover the agricultural products. All trade measures are removed for the EU-Turkey trade in agricultural products. The restrictions on tea, tobacco, hazelnuts and sugar beet production are operational. Trade measures of Turkey for the third countries are similar to the EU.

Turkey is a member of EU in the third scenario (*EU-IN*). The compensatory direct payments for cereals, oilseeds and protein crops and compulsory set-aside regulations of EU apply fully to Turkey. Turkey is also eligible for other subsidies implemented in the EU, i.e. payments for durum wheat, tobacco, olive oil, cotton, milk, beef and sheep meat. Apart from the product specific payments, all subsidies are assumed to be decoupled. All trade measures are removed for the EU-Turkey trade in agricultural products. EU intervention purchases and restrictions on tea, tobacco, hazelnut and sugar-beet productions are operational. There are no input subsidies and deficiency payments for Turkey. Trade measures of Turkey for the third countries are similar to the EU.

[18] Statistically significant OLS parameter estimates are used as central points for symmetric parameter support spaces in the GME estimation. The suppot spaces are symmetrically centred around zero if the OLS estimates are not statistically significant.

General Results

The general results, including the welfare measures, are presented in Table 1. Total, producers' and consumers' surplus measures are the aggregate measures used to evaluate the impact of the various scenarios. Producers' surplus roughly indicates the return from all production factors excluding variable costs, and consumers' surplus is the additional benefit to non marginal consumers.

Table 1 shows that the total surplus is expected to increase by 5.1 percent in 2015 independent of the EU membership. More than half of this increase can be attributed to the growth in income and increase in agricultural resources. The impact of extending Customs Union to agricultural products on total surplus is negligible (EU-CU). On the other hand, being a member of EU in 2015 will bring an additional 2 percentage point increase in total surplus. However, this basically results from the full application of CAP supports to producers. If CAP is not applied then the *additional* increase drops to 0.1 percentage point as in the case of customs union.

Table 1 General Results (USD million)

	2002-04	2015			CHANGE[b] (%)	
	BASE	EU-OUT	EU-CU	EU-IN	EU-CU	EU-IN
Total Surplus (Index)	**100.0**	**105.1**	**105.2**	**105.2**	**0.1**	**0.1**
With Full CAP Support	-	-	-	*107.1*		*1.9*
Producers' Surplus	100.0	101.7	100.8	100.8	-0.9	-0.9
With Full CAP Support	-	-	-	*102.9*		*1.1*
Consumers' Surplus	100.0	141.6	153.0	153.1	8.0	8.1
Total Production						
Volume [a]	33,997	42,951	40,795	40,461	-5.0	-5.8
Value	33,997	43,343	37,696	37,739	-13.0	-12.9
Crop Production						
Volume [a]	23,191	29,536	27,941	27,616	-5.4	-6.5
Value	23,191	28,152	26,121	26,172	-7.2	-7.0
Livestock Production						
Volume [a]	10,806	13,415	12,854	12,845	-4.2	-4.2
Value	10,806	15,192	11,575	11,568	-23.8	-23.9
Total Consumption						
Volume [a]	29,441	37,376	40,335	40,276	7.9	7.8
Value	29,441	37,870	36,222	36,079	-4.4	-4.7
Crop Consumption						
Volume [a]	18,368	23,713	23,849	23,790	0.6	0.3
Value	18,368	22,366	21,873	21,730	-2.2	-2.8
Livestock Consumption						
Volume [a]	11,073	13,663	16,486	16,486	20.7	20.7
Value	11,073	15,505	14,349	14,349	-7.5	-7.5
Net Exports	**2,264**	**3,564**	**77**	**-306**	**-97.8**	**-108.6**
Crop Products	2,537	3,909	2,889	2,512	-26.1	-35.7
Livestock Products	-273	-346	-2,811	-2,818	713.6	715.6
Price Index (Laspeyres)	**100.0**	**102.0**	**91.3**	**91.3**	**-10.5**	**-10.5**
Crop Products	100.0	94.6	92.1	92.0	-2.7	-2.7
Livestock Products	100.0	114.3	90.1	90.1	-21.2	-21.2

Notes: See text for the scenarios

[a] Model results at the base period prices.

[b] Change over baseline model (EU-OUT).

Source: Authors' calculations.

In membership, we observe 1.1 percent increase in producers' surplus and 8.1 percent increase in consumers' surplus. However, without the CAP supports producers' surplus decreases by about 1 percent. Thus, the consumers' surplus increases with membership but the impact on producers' surplus depends on the application of CAP support. If full CAP support is obtained, increase in producers' surplus is higher than non membership case, if not; it is lower. Hence, CAP payments are important for the welfare of producers.

Relatively higher increases in the consumers' surpluses in the customs union and membership scenarios are due to the changes in the price structure. In customs union and membership situations, the prices of livestock products decline sharply by about 21 percent. This is accompanied with a 2.7 percent decrease in the price level of crop products (Table 1, Price Index). These results explain rather high increases in the consumers' surplus in the customs union and membership scenarios. Hence, assuming that the prevailing EU and Turkish agricultural policies remain intact, the customs union and membership will be definitely beneficial to the consumers. However, the impact on producers depends on CAP implementation.

The values of production and consumption in Table 1 are calculated in two different ways: First with the 2002-2004 prices, and second with the model's prices. Both values are in US dollars and the impact of inflation is limited with the depreciation of the US dollars. The *volumes* calculated with *constant prices* correspond to changes in the quantities. The *values* are found by multiplying the model's prices with the corresponding quantities, and reflect the changes in both quantities and prices.

From Table 1, it can be seen that the *volume* of agricultural production decreases by 5.0 and 5.8 percent under customs union and membership, respectively. The values of production in the baseline scenario (EU-OUT) seem to reflect the increase in the prices of agricultural products.

The volume of crop production declines by 5.4 and 6.5 percent in customs union and membership, respectively. Trade liberalization with the EU brings about 7.0-7.2 percent decreases in the value of crop production. The volume of livestock production decreases by 4.2 percent, and the value of livestock production records a 24 percent decrease in both scenarios.

Total, crop and livestock consumption volumes increase in both scenarios. However the impact on consumption expenditures (value of total consumption) is quite different. Total consumption expenditures decline by 4.4 and 4.7 percent in customs union and membership, respectively. The livestock consumption expenditure posts a 7.5 percent decrease while the decrease in crop consumption expenditure is 2.2 and 2.8 percents in customs union and membership, respectively. Hence, in terms of both the crop and livestock consumption, relatively high consumption levels are achieved at much lower expenditures under membership and customs union.

It is obvious that net exports will be affected intensively from the change in production and consumption conditions (Table 1). Trade liberalization with EU combined with the expansion of demand brings about more favorable conditions for livestock products imports compared to exports. There is an important deterioration in the net exports of Turkey. In customs union net exports of Turkey fall to USD 77 million. Under membership Turkey becomes a net importer, totaling USD 306 million. This situation basically results from the sharp increase in the imports of livestock products. While in the base period Turkey was a net importer of only USD 273 million worth of livestock products mainly due to high tariff and non tariff protection. In case membership, net imports jump to USD 2,818 million. This result highlights the necessity of a structural improvement in the Turkish livestock sector. If the production capabilities of the sector are not improved until 2015, Turkey will become a significant net importer of livestock products in the case of EU membership. Membership to EU causes Turkey to become a significant net importer in total agricultural products. However, in the case of non-membership, although the net import of livestock products increases to about USD 346 million from USD 273 million, with the improvement in net export position of crop products to USD 3,909 million from USD 2,537 million, Turkey stays as a net exporter in the total of agricultural products (USD 3,564 million).

Laspeyres price indices are calculated for all simulations using the base period production as weights. The overall price level is expected to fall by 10.5 percent when Turkey becomes a member. Under membership, crop prices post a 2.7 percent fall and livestock products prices tumble by 21.2 percent. On the other hand, the overall price level is expected to increase by 2.0 percent when Turkey is out of EU compared to base period. In this case, crop prices record a 5.4 percent fall but livestock products prices go up remarkably by 14.3 percent.

The budgetary outlays for CAP calculated[19] from the model simulations for membership scenario show that the total CAP support (if the current structure is kept and fully

[19] In the calculation we followed the assumptions of GRETHE (2005). These are: direct payments for milk fully implemented, 5% modulation fully implemented, beef premiums/ton 50% above EU level as most payments are made per animal and Turkey has a higher number of animals/ton of meat produced, direct payments for sugar

implemented for Turkey) will be around 8,801 million US dollars. About USD 3,192 million are paid for *compensatory area payments* of cereals, oilseeds and protein crops. About USD 3,427 million is for *other crop payments*. That is for durum wheat, tobacco, olive oil, hazelnuts and cotton productions. For *livestock products*, a budgetary outlay about USD 2,182 million is calculated. This amount includes the payments for milk, beef and sheep meat. Taking into account 1.5 percent annual inflation in the Euro area, these amounts are equivalent to EUR 2,130 million (2004 €) for compensatory area payments; EUR 2,287 million (2004 €) for other crop payments; EUR 1,456 million (2004 €) for livestock products. However, CAP is bound to change. In addition, the recent expansion of EU to Central and Eastern European countries indicates that the CAP payments are phased in to attain full payments. Hence, the budgetary cost calculations of agricultural support of Turkey to Turkey should be considered as the upper limits.

Impact on Production Volume

The levels and changes of production volumes for product groups and for selected products are presented in Table 2. All of the model results are evaluated at the base period average prices.

The sector when faced with a different relative price structure in the case of membership shows different responses depending on the type of product. The volume of crop production falls by 5.4 and 6.5 percents in customs union and membership, respectively. Individual products in the product groups display different responses to EU membership. The production of wheat declines by a significant proportion of 28.3 percent. On the other hand, the impact on barley production is very small. Corn production posts a 41.6 percent decline in membership scenario.

Industrial crops seem to benefit most from the membership, with 3.0 percent increase in the production volume. EU may become one of the major producers of cotton in the world when Turkey becomes a member. Pulses also benefit from the liberalization of trade with the EU, posting a 2.0 percent increase in their production volumes. Fruits and nuts production volume goes up by 0.7 percent. Vegetable production records a 0.4 percent increase with

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not yet included, direct payments fixed in nominal values, inflation in EU area between 2004 and 2015 assumed 1.5 % annually.

liberalization. Oil seeds appear as the crop *product group* that will have the highest production decline in all cases. Regarding the livestock products, Table 2 reports that in both scenarios livestock production declines by 4.2 percent compared to the baseline scenario.

Table 2 Production Volumes (million USD at 2002-2004 prices)

	BASE	EU-OUT	EU-CU	EU-IN	CHANGE[b] (%)	
	2002-04	2015	2015	2015	EU-CU	EU-IN
Crop Products	***23,191***	***29,536***	***27,941***	***27,616***	***-5.4***	***-6.5***
Cereals	**6,509**	**7,989**	**6,560**	**6,193**	**-17.9**	**-22.5**
Wheat	4,348	5,401	4,201	3,873	-22.2	-28.3
Barley	1,400	1,648	1,644	1,647	-0.3	-0.1
Corn	560	668	420	390	-37.1	-41.6
Pulses	**942**	**1,195**	**1,219**	**1,219**	**2.0**	**2.0**
Chickpea	400	493	509	509	3.1	3.1
Industrial Crops	**2,370**	**3,068**	**3,068**	**3,161**	**0.0**	**3.0**
Oilseeds	**558**	**753**	**482**	**430**	**-36.0**	**-43.0**
Tubers	**1,511**	**1,959**	**1,959**	**1,959**	**0.0**	**0.0**
Vegetables	**4,854**	**6,329**	**6,352**	**6,352**	**0.4**	**0.4**
Melon & Waterm.	1,222	1,599	1,602	1,602	0.2	0.2
Cucumber	493	664	669	669	0.8	0.8
Eggplant	283	372	373	373	0.2	0.2
Fresh Tomato	1,870	2,404	2,409	2,409	0.2	0.2
Processing Tomato	324	402	395	395	-1.9	-1.9
Green Pepper	661	889	905	905	1.8	1.8
Fruits And Nuts	**6,448**	**8,243**	**8,301**	**8,301**	**0.7**	**0.7**
Apple	959	1,247	1,259	1,259	1.0	1.0
Apricot	242	300	316	316	5.6	5.6
Peach	246	332	332	332	0.0	0.0
Table Olive	383	466	466	466	-0.1	-0.1
Oil Olive	509	570	533	533	-6.6	-6.6
Citrus	818	1,134	1,141	1,141	0.6	0.6
Pistachio	180	221	222	222	0.3	0.3
Hazelnut	625	693	744	744	7.4	7.4
Fig	89	99	104	104	4.6	4.6
Table Grape	1,743	2,355	2,358	2,358	0.1	0.1
Raisin Grape	421	529	531	531	0.4	0.4
Tea	233	296	296	296	0.0	0.0
Livestock & Poul.	***10,806***	***13,415***	***12,854***	***12,845***	***-4.2***	***-4.2***
Meat	**4,777**	**5,549**	**5,279**	**5,275**	**-4.9**	**-4.9**
Milk	**3,482**	**4,460**	**4,176**	**4,172**	**-6.4**	**-6.5**
Hide, Wool & Hair	**249**	**256**	**248**	**248**	**-3.0**	**-3.1**
Poultry	**2,297**	**3,149**	**3,150**	**3,150**	**0.0**	**0.0**
Total	***33,997***	***42,951***	***40,795***	***40,461***	***-5.0***	***-5.8***

Notes: See text for the scenarios

[a] Model results at the base period prices.

[b] Change over baseline model (EU-OUT).

Source: Authors' calculations.

Net Exports

Table 3 reports the net exports of Turkey according to the results of different scenarios. The tariffs in the baseline scenario (EU-OUT) are close to the base period levels. The structure of trade in the model allows for the expansion of exports and imports. Turkey's net exports of the products included in the model in the base period are about 2,250 million US dollars, with a negligible trade in livestock products (273 million US dollars).

Under customs union there is a significant expansion in the imports of livestock products. The net livestock imports reach to USD 2,811 million. The net crop exports decreases as well, and hence, Turkey's total net exports drop to USD 77 million. Almost all of the livestock imports originate from the EU. Almost non-existing level of trade in livestock products in the base period does not allow identifying any change in the direction of trade. However, the impact of trade liberalization on the livestock production points out that the shares of EU will be high in imports. Under membership Turkey becomes a net importer in the total agricultural product trade. The net imports reach to USD 306 million.

Table 3 Net Exports (USD million)

	2002-04	EU-OUT (2015)				EU-CU (2015)				EU-IN (2015)			
	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL
Crop Products	***2537***	***-590***	***3042***	***1457***	***3909***	***-594***	***2048***	***1435***	***2889***	***-597***	***1659***	***1450***	***2512***
Cereals	-240	-233	4	43	-187	-229	-1054	54	-1229	-231	-1284	51	-1464
Pulses	190	2	47	201	249	2	53	209	263	2	53	209	263
Industrial Crops	615	69	756	97	922	69	795	97	961	69	672	115	856
Oilseeds	-747	-632	3	-293	-922	-632	-176	-293	-1100	-633	-210	-293	-1136
Tubers	55	0	4	84	88	0	4	80	85	0	4	80	85
Vegetables	598	60	360	453	874	58	413	431	902	58	413	431	902
Fruits And Nuts	2064	145	1868	872	2885	138	2013	856	3007	138	2013	856	3007
Livestock & Poul.	***-273***	***7***	***-124***	***-229***	***-346***	***7***	***-2589***	***-230***	***-2811***	***7***	***-2596***	***-230***	***-2818***
Meat	11	0	0	2	2	0	-1980	11	-1969	0	-1983	11	-1972
Milk	-14	1	1	23	24	1	-490	24	-466	1	-494	24	-470
Hide, Wool & Hair	-290	7	-250	-275	-518	7	-248	-286	-527	7	-248	-286	-527
Poultry	19	0	125	21	146	0	129	21	150	0	129	21	150
Total	***2264***	***-582***	***2918***	***1228***	***3564***	***-587***	***-541***	***1205***	***77***	***-590***	***-936***	***1220***	***-306***

Note: See text for the scenarios
Source: Authors' calculations.

The effects of customs union and membership on the net vegetable and fruit exports between the EU and Turkey are presented in Table 4. It is seen that the impacts of customs union and membership is the same. With the exception of tubers and oil olive, net exports of most Turkish vegetable and fruit products to the EU are up from the baseline levels. Under customs union or membership, Turkey's total net vegetable exports to the EU post a 14.5 percent rise to USD 413 million, up from USD 360 of the baseline level. Turkey's net exports of fruits & nuts record a 7.8 percent increase to USD 2,013 million, from USD 1,868 million. Hence, the simulation results show that customs union or membership increases Turkey's total net vegetable and fruit exports to the EU by about USD 200 million.

Green pepper records the largest increase, up 20 percent to USD 169 million. Apricots rank second behind green pepper, posting a 16.7 percent increase. The third highest expansion is seen in net cucumber exports of Turkey. The other vegetables and fruits whose net exports are expanding with the liberalization of agricultural trade between Turkey and the EU are as follows: table grapes (14.2 %), peaches (13.6 %), pistachios (13.4 %), eggplants (13.0 %), table olives (10.9 %), hazelnuts (10.8 %), fresh tomatoes (10.6 %), citrus (10.2 %), melons & watermelons (9.1 %), dry figs (8.6 %), processing tomatoes (6.3 %), apples (5.7 %), tea (3.4 %) and raisin grapes (1.1 %).

Table 4 Turkey's Net Exports to the EU for Selected Products (USD million)

	2002-04	EU-OUT (2015)		EU-CU (2015)		EU-IN (2015)		CHANGES[a] (%)	
	TOTAL	EU	TOTAL	EU	TOTAL	EU	TOTAL	EU-CU	EU-IN
Tubers	**55**	**4**	**88**	**4**	**85**	**4**	**85**	**-1.7**	**-1.7**
Onion (Dry)	30	4	44	4	40	4	40	-1.7	-1.7
Potato	26		44		44		44		
Vegetables	**598**	**360**	**874**	**413**	**902**	**413**	**902**	**14.5**	**14.5**
Melon & Waterm.	8	7	12	8	13	8	13	9.1	9.1
Cucumber	43	52	66	60	74	60	74	15.4	15.4
Eggplant	5	6	7	7	8	7	8	13.0	13.0
Fresh Tomato	231	112	327	124	332	124	332	10.6	10.6
Proc. Tomato	202	41	283	44	269	44	269	6.3	6.3
Green Pepper	110	141	177	169	206	169	206	20.0	20.0
Fruits And Nuts	**2064**	**1868**	**2885**	**2013**	**3007**	**2013**	**3007**	**7.8**	**7.8**
Apple	249	324	340	342	358	342	358	5.7	5.7
Apricot	227	149	338	174	359	174	359	16.7	16.7
Peach	18	4	27	4	27	4	27	13.6	13.6
Table Olive	38	17	48	19	49	19	49	10.9	10.9
Oil Olive	134	101	183	97	171	97	171	-3.2	-3.2
Citrus	292	111	471	123	483	123	483	10.2	10.2
Pistachio	15	9	15	10	16	10	16	13.4	13.4
Hazelnut	635	653	795	724	862	724	862	10.8	10.8
Fig	89	83	115	90	122	90	122	8.6	8.6
Table Grape	84	56	128	64	134	64	134	14.2	14.2
Raisin Grape	283	361	422	365	425	365	425	1.1	1.1
Tea	1	1	1	1	1	1	1	3.4	3.4

Note: See text for the scenarios
[a] Change over baseline model (EU-OUT).
Source: Authors' calculations.

More detailed results on net exports, production and human consumption can be found in the Annex Tables A1, A2 and A3.

VI. CONCLUSION

Agriculture is expected to be one of the toughest areas of membership negotiations between EU and Turkey. The major difficulty in the negotiations will arise from the size and state of agriculture in Turkey. The main purpose of this study was to evaluate and assess the impact of EU integration on Turkish agricultural sector using a regional agricultural sector model for Turkey.

Membership to EU may be perceived either as a “threat” or an “opportunity” for the sector as a whole. The comparison of the institutional and technological level of EU with Turkey may lead to see it as a “threat”. However, it is possible to start paving the way towards an “opportunity” by the taking the proper policy measures until the accession. After all, EU also has to share responsibilities to diminish the divergence in the development levels among the members of the Union. The weight of support tilted to second pillar policies - mainly targeted to regional development and structural change – in the recent enlargement process provides a clear signal in that direction. The candidates have also responsibilities that may go well beyond the adoption of the Acquis Communitaire. In general, the basic responsibility of the candidates at the start of the accession negotiations may be summarized as the “adjustment of mentality” to become a proper member, rather than concentrating on the possible flow of funds from the Union (CAKMAK AND KASNAKOGLU, 2002).

Same attitude is valid for agriculture. Clear objectives should be set, and the appropriate policy tools should be selected to keep at least the competitiveness level of the sector, independent of membership. Agricultural policies can be divided into two groups. The first group is called as “productive policies” since it aims at the improvement of efficiency in the use of resources both in production and consumption. Areas such as, research, reduction of transaction costs, infrastructural services, quality and standard control, crop insurance, and extension services, all geared towards increasing the economic growth, are included in this group. Second group which can be named as “distributional policies”, on the other hand, consists of policies such as price supports, deficiency payments, interventions at the border, input subsidies, subsidized credits, by which wealth and income are transferred to agricultural producers from the rest of the economy (RAUSSER, 1992).

Economic and political returns of the policies embodied in the first group are paid back throughout time, and especially during the initial periods, it requires transforming the institutional structure and use of public resources for effective organization. On the other hand, political returns of the policies that only include transfers are recouped in the short run; yet according to the preferred tool, the burden of the transfers on consumers and budget could reach to unaffordable levels. With an historical perspective, governments in Turkey tended to choose the second group in order to strengthen their political returns. The long-term objectives of agricultural policies obviously need to be the improvement of productivity in the sector. Otherwise, given the ongoing developments, the sector will face a challenging international competition, especially from EU. Major policies to accomplish the change are technological development, improvement of productive resources, and more market-friendly policy environment in agriculture.

The major obstacle in making the agricultural policies more market friendly is the absence of markets or the existence of imperfections in some input and output markets. Clear definition of property rights in land combined with the missing rural credit markets are the major issues in the rural areas. The lack of effective cadastral works prevents agricultural land markets to work, and it also limits the access of small farmers to credit. In the output markets, at least in some relatively less developed regions of Turkey the transaction costs are still high due to the lack of well developed exchange markets (CAKMAK AND KASNAKOGLU, 2002). The seasonal volatility in the prices remains high in the major crops despite the high rates of protection due to the shortage of operating capital of the farmers. Most farmers dealing with "grand cultures" are required to sell at the harvest season. The prevailing conditions of the markets hinder structural transformation. In addition, it constrains the set of policy tools or decreases the chances for success of the new policies. Regulation of the markets, correction of the externalities, and the provision of public goods are the major duties of the state. Hence, it is necessary to upgrade the capacity of agricultural policy environment to handle the policy reforms. Furthermore, the membership results of the model support the necessity to change the attitude towards agriculture.

The overall results of the model for the membership case when compared to the non-membership situation may be summarized as follows. The producers at the aggregate levels will not be affected much from the integration with the EU, assuming that EU policies will not change drastically till the date of accession. However, as it is the even for all non-agricultural sectors, the producers of some products will not be able to remain competitive. Increased consumption will be realized with a lower level of expenditure. Livestock production does not seem to be competitive even at the EU prices. Net imports may increase drastically compared to both the base period and the baseline. The net exports of crop products will be far from compensating the change in the net imports of livestock products. Almost all imports of livestock products will be from the EU. While the exports of crop products to the rest of the world increase only slightly, the volume of trade with EU expands significantly. In membership, the CAP supports are important for the welfare of producers. Customs Union without EU membership and CAP supports can be more problematic for some Turkish producers. Compared the with results of CAKMAK AND KASNAKOGLU (2002), it is seen that there is an improvement in the competitiveness of livestock sector due to the increase in their yields experienced in the recent years. However, the livestock module, although endogenously integrated with the crop sector is rather compact. Further enrichment of the module taking into account the actual herd structure and plausible changes in the future is necessary for a better representation of the livestock sector.

Naturally, the results of the model are dependent on the policy set-up, growth possibilities, and the estimated levels of world prices. The model allows to make various kinds of sensitivity analyses related to possible changes in the all parameters incorporated in the model structure.

REFERENCES

BROOKE, A., KENDRICK, D., MEERAUS, A., & RAMAN, R. (1998). *GAMS: A User's Guide*, Washington D.C.: GAMS Development Corporation.

CAKMAK, E. H. (1992, July). Medium-Term Growth Prospects for Turkish Agriculture: A Sector Model Approach. *The Developing Economies, 30(2),* 132-153.

CAKMAK, E. H., & KASNAKOGLU, H. (2002). *Interactions between Turkey and EU in Agriculture: Analysis of Turkey's Membership to EU.* Ankara: Agricultural Economics Research Institute of Turkish Ministry of Agriculture and Rural Affairs.

FAPRI (FOOD AND AGRICULTURAL POLICY RESEARCH INSTITUTE). (2005). *U.S. and World Agricultural Outlook 2005.* Iowa: Center for Agricultural and Rural Development, Iowa State University.

GOLAN, A., JUDGE, G., & MILLER, D. (1996). *Maximum Entropy Econometrics: Robust Estimation with Limited Data.* New York: John Wiley & Sons.

GRETHE, H. (2005). Turkey´s Accession to the EU: What Will the Common Agricultural Policy Cost? *Agrarwirtschaft*, 54 (2), 128-137.

HECKELEI, T. & BRITZ, W. (1999). Maximum Entropy Specification of PMP in CAPRI. *CAPRI Working Paper, 99-08*, Bonn: Bonn University.

HOWITT, R. E. (1985). Positive Quadratic Programming Models. *Working Paper, 85-10.* California: University of California, Davis.

HOWITT, R. E. (1995a). Positive Mathematical Programming. *American Journal of Agricultural Economics, 77(2),* 329-342.

HOWITT, R. E. (1995b). A Calibration Method for Agricultural Economic Production Models. *Journal of Agricultural Economics, 4(2),* 147-159.

KASNAKOGLU, H. & BAUER, S. (1988). Concept and Application of an Agricultural Sector Model for Policy Analysis in Turkey. In W. Henrichsmeyer & S. Bauer (Eds.), *Agricultural Sector Modelling* (pp.71-84). Bonn: Wissenschaftsverlag Vauk Kiel KG.

PARIS, Q. & HOWITT, R. E. (1998). An Analysis of Ill-Posed Production Problems using Maximum Entropy. *American Journal of Agricultural Economics, 80(1),* 124-38.

RAUSSER, G. C. (1992). Predatory versus Productive Government: The Case of U.S. Policies. *Journal of Economic Perspectives, 6 (3),* 133-58.

SIS (STATE INSTITUTE OF STATISTICS). (2005). *Agricultural Structure and Production: Production, Area and Value.* Various files obtained from SIS. Ankara: SIS.

UFT (UNDERSECRETARIAT OF FOREIGN TRADE). (2006). Import Regime of Turkey, http://www.dtm.gov.tr/ithalat/mevzu/ithmevzu/ithrejkarari/listeler%20onsayfa.htm.

ANNEX TABLES

Table A1. Net Exports of Turkey (USD million)

	2002-04	EU-OUT (2015)				EU-CU (2015)				EU-IN (2015)			
	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL
CROP PRODUCTS	***2537***	***-590***	***3042***	***1457***	***3909***	***-594***	***2048***	***1435***	***2889***	***-597***	***1659***	***1450***	***2512***
CEREALS	**-240**	**-233**	**4**	**42.6**	**-187**	**-229**	**-1054**	**54**	**-1229**	**-231**	**-1284**	**51**	**-1464**
Common Wheat	-54				0		-845		-845		-1050		-1050
Durum Wheat	29	1	3	34	39	1	3	36	41	1	3	36	41
Barley	39		0	54	54		0	57	57		0	57	57
Corn	-183	-210			-210	-210	-213		-422	-210	-238		-448
Rice	-65	-25		-46	-70	-21		-39	-59	-23		-42	-65
Rye	-6	0			0	0			0	0			0
PULSES	**190**	**1.5**	**47**	**201**	**249**	**1.6**	**53**	**209**	**263**	**1.6**	**53**	**209**	**263**
Chickpea	97	1	25	95	121	1	30	100	131	1	30	100	131
Drybean	7		7	2	9		7	2	9		7	2	9
Lentil	86	1	15	104	120	1	15	107	123	1	15	107	123
INDUSTRIAL CROPS	**615**	**69**	**756**	**97**	**922**	**69**	**795**	**97**	**961**	**69**	**672**	**115**	**856**
Tobacco	237	69	128	44	241	69	128	44	241	69	128	44	241
Sugarbeet	69	0	0	52	53	0	0	52	53	1	1	70	72
Cotton	309		628		628		667		667		544		544
OILSEEDS	**-747**	**-632**	**3.0**	**-293**	**-922**	**-632**	**-176**	**-293**	**-1100**	**-633**	**-210**	**-293**	**-1136**
Sesame	-46	0	3	-89	-86	0	3	-89	-85	0	3	-89	-85
Sunflower	-183			-204	-204		-179	-204	-383		-214	-204	-418
Groundnut	-1	0	0		0	0	0		0	0	0		0
Soybean	-517	-632			-632	-632			-632	-633			-633
TUBERS	**55**	**0.0**	**4.3**	**84**	**88**	**0.0**	**4.3**	**80**	**85**	**0.0**	**4.3**	**80**	**85**
Onion (dry)	30	0	4	40	44	0	4	36	40	0	4	36	40
Potato	26			44	44			44	44			44	44
VEGETABLES	**598**	**60**	**360**	**453**	**874**	**58**	**413**	**431**	**902**	**58**	**413**	**431**	**902**
Melon & Waterm.	8		7	4	12		8	5	13		8	5	13
Cucumber	43	2	52	12	66	2	60	12	74	2	60	12	74
Eggplant	5	0	6	1	7	0	7	1	8	0	7	1	8
Fresh Tomato	231	46	112	169	327	44	124	163	332	44	124	163	332
Processing Tomato	202	1	41	241	283	1	44	224	269	1	44	224	269
Green Pepper	110	11	141	26	177	11	169	26	206	11	169	26	206
FRUITS AND NUTS	**2064**	**145**	**1868**	**872**	**2885**	**138**	**2013**	**856**	**3007**	**138**	**2013**	**856**	**3007**
Apple	249	5	324	11	340	4	342	11	358	4	342	11	358
Apricot	227	68	149	121	338	67	174	118	359	67	174	118	359
Peach	18	0	4	23	27	0	4	23	27	0	4	23	27
Table Olive	38	4	17	28	48	4	19	27	49	4	19	27	49
Oil Olive	134	38	101	44	183	34	97	40	171	34	97	40	171
Citrus	292	1	111	359	471	1	123	359	483	1	123	359	483
Pistachio	15	2	9	4	15	2	10	4	16	2	10	4	16
Hazelnut	635	20	653	122	795	19	724	118	862	19	724	118	862
Fig	89	7	83	26	115	7	90	26	122	7	90	26	122
Table Grape	84	0	56	72	128	0	64	70	134	0	64	70	134
Raisin Grape	283	0	361	61	422	0	365	60	425	0	365	60	425
Tea	1	0	1	0	1	0	1	0	1	0	1	0	1
LIVESTOCK & POUL.	***-273***	***7.5***	***-124***	***-229***	***-346***	***7.4***	***-2589***	***-230***	***-2811***	***7.4***	***-2596***	***-230***	***-2818***
MEAT	**11**	**0.0**	**0.0**	**2.1**	**2**	**0.0**	**-1980**	**11**	**-1969**	**0.0**	**-1983**	**11**	**-1972**
Cow Meat	2			0	0		-971	1	-970		-973	1	-972
Sheep Meat	9			2	2		-867	9	-858		-868	9	-859
Goat Meat	0			0	0		-142	1	-141		-142	1	-141
MILK	**-14**	**0.5**	**0.5**	**23**	**24**	**0.5**	**-490**	**24**	**-466**	**0.5**	**-494**	**24**	**-470**
Cow Milk	-19	**0.0**		19	19	**0.1**	-456	20	-436	**0.1**	-461	20	-441
Sheep Milk	6	**0.4**	1	4	5	**0.4**	1	4	5	**0.4**	1	4	5
Goat Milk	0	**0.0**		0	0	**0.0**	-34	0	-34	**0.0**	-34	0	-34
HIDE, WOOL & HAIR	**-290**	**7.0**	**-250**	**-275**	**-518**	**6.9**	**-248**	**-286**	**-527**	**6.9**	**-248**	**-286**	**-527**
Cow Hide	-20	**0.3**	13	-45	-32	**0.3**	13	-50	-37	**0.3**	13	-51	-37
Sheep Hide	-253		-275	-172	-447		-275	-175	-450		-275	-175	-450
Goat Hide	-4		-3	-5	-8		-3	-5	-8		-3	-5	-8
Sheep Wool	-13	**7.2**	16	-53	-30	**7.2**	17	-55	-31	**7.2**	17	-55	-31
Goat Hair & Mohair	1	**-0.5**	0	0	0	**-0.6**	0	0	0	**-0.6**	0	0	0
POULTRY	**19**	**0.0**	**124.8**	**21**	**146**	**0.0**	**129**	**21**	**150**	**0.0**	**129**	**21**	**150**
Poultry Meat	14		51	16	66		55	15	70		55	15	70
Egg	5		74	6	80		74	6	80		74	6	80
TOTAL	***2264***	***-582***	***2918***	***1228***	***3564***	***-587***	***-541***	***1205***	***77***	***-590***	***-936***	***1220***	***-306***

Source: Authors' calculations.

Table A2. Net Exports of Turkey (1 000 Tons)

	2002-04	EU-OUT (2015)				EU-CU (2015)				EU-IN (2015)			
	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL	USA	EU	ROW	TOTAL
CROP PRODUCTS	***2,224***	***-4,321***	***3,371***	***3,524***	***2,575***	***-4,315***	***-3,367***	***3,486***	***-4,195***	***-4,326***	***-5,031***	***3,803***	***-5,555***
CEREALS	**-1,928**	**-1,995**	**14**	**177**	**-1,804**	**-1,977**	**-6,637**	**229**	**-8,386**	**-1,986**	**-8,099**	**214**	**-9,872**
Common Wheat	-380				0		-5,429		-5,429		-6,745		-6,745
Durum Wheat	124	5	13	133	151	5	13	139	157	5	13	139	158
Barley	207		2	254	256		2	268	270		2	270	271
Corn	-1,555	-1,886			-1,886	-1,886	-1,224		-3,109	-1,886	-1,369		-3,255
Rice	-277	-114		-211	-325	-97		-178	-275	-106		-195	-301
Rye	-48	0			0	0			0	0			0
PULSES	**316**	**2**	**65**	**301**	**368**	**2**	**72**	**312**	**386**	**2**	**72**	**312**	**386**
Chickpea	150	1	34	127	162	1	41	134	176	1	41	134	176
Drybean	7		6	2	8		6	2	8		6	2	8
Lentil	160	1	25	172	198	1	25	176	203	1	25	176	203
INDUSTRIAL CROPS	**1,640**	**25**	**777**	**972**	**1,773**	**25**	**822**	**972**	**1,819**	**28**	**690**	**1,303**	**2,021**
Tobacco	66	16	31	11	58	16	31	11	58	16	31	11	58
Sugarbeet	1,226	8	12	961	981	8	12	961	981	11	24	1,293	1,328
Cotton	349		734		734		780		780		635		635
OILSEEDS	**-2,396**	**-2,634**	**4**	**-690**	**-3,320**	**-2,634**	**-362**	**-690**	**-3,685**	**-2,639**	**-432**	**-690**	**-3,761**
Sesame	-65	0	3	-108	-104	0	4	-108	-104	0	4	-108	-104
Sunflower	-457			-582	-582		-366	-582	-949		-437	-582	-1,019
Groundnut	-1	0	0		0	0	1		1	0	1		1
Soybean	-1,873	-2,634			-2,634	-2,634			-2,634	-2,639			-2,639
TUBERS	**222**	**0**	**15**	**286**	**301**	**0**	**15**	**275**	**289**	**0**	**15**	**275**	**289**
Onion (dry)	117	0	15	134	149	0	15	122	136	0	15	122	136
Potato	105			152	152			153	153			153	153
VEGETABLES	**1,725**	**110**	**676**	**1,277**	**2,063**	**106**	**764**	**1,205**	**2,076**	**106**	**764**	**1,205**	**2,076**
Melon & Waterm.	27		21	13	33		23	13	35		23	13	35
Cucumber	89	3	89	22	114	3	103	22	128	3	103	22	128
Eggplant	7	0	7	1	8	0	7	1	9	0	7	1	9
Fresh Tomato	497	85	204	299	588	82	225	289	597	82	225	289	597
Processing Tomato	913	5	160	905	1,069	4	170	842	1,016	4	170	842	1,016
Green Pepper	192	16	196	38	251	17	236	38	290	17	236	38	290
FRUITS AND NUTS	**2,646**	**171**	**1,820**	**1,202**	**3,193**	**163**	**1,959**	**1,184**	**3,306**	**163**	**1,959**	**1,184**	**3,306**
Apple	484	8	533	20	562	8	564	20	591	8	564	20	591
Apricot	342	85	186	150	421	83	217	146	446	83	217	146	446
Peach	31	0	5	34	39	0	6	33	39	0	6	33	39
Table Olive	39	3	15	25	43	3	17	24	44	3	17	24	44
Oil Olive	257	57	150	66	273	51	145	59	255	51	145	59	255
Citrus	665	1	214	688	903	1	236	688	925	1	236	688	925
Pistachio	4	1	2	1	4	1	3	1	4	1	3	1	4
Hazelnut	432	12	387	73	472	12	429	71	511	12	429	71	511
Fig	49	3	38	12	53	3	41	12	56	3	41	12	56
Table Grape	137	1	75	96	171	1	85	94	180	1	85	94	180
Raisin Grape	203	0	213	36	249	0	215	36	251	0	215	36	251
Tea	3	1	2	1	4	1	2	1	4	1	2	1	4
LIVESTOCK & POUL.	***-235***	***6***	***-30***	***-92***	***-116***	***6***	***-1,942***	***-94***	***-2,030***	***6***	***-1,955***	***-94***	***-2,043***
MEAT	**4**	**0**	**0**	**1**	**1**	**0**	**-556**	**5**	**-552**	**0**	**-557**	**5**	**-552**
Cow Meat	0			0	0		-322	0	-321		-322	0	-322
Sheep Meat	3			1	1		-197	4	-194		-198	4	-194
Goat Meat	0			0	0		-37	0	-37		-37	0	-37
MILK	**-56**	**1**	**1**	**71**	**73**	**1**	**-1,359**	**74**	**-1,283**	**1**	**-1,371**	**74**	**-1,296**
Cow Milk	-69	0		62	62	0	-1,286	66	-1,219	0	-1,298	66	-1,231
Sheep Milk	13	1	1	9	11	1	1	8	10	1	1	8	10
Goat Milk	0	0		0	0	0	-75	0	-75	0	-75	0	-75
HIDE, WOOL & HAIR	**-198**	**5**	**-124**	**-179**	**-299**	**5**	**-123**	**-188**	**-307**	**5**	**-123**	**-188**	**-307**
Cow Hide	-26	0	13	-49	-35	0	14	-55	-40	0	14	-55	-40
Sheep Hide	-158		-145	-90	-235		-145	-92	-237		-145	-92	-237
Goat Hide	-5		-4	-6	-10		-4	-6	-10		-4	-6	-10
Sheep Wool	-10	5	10	-34	-19	5	11	-36	-20	5	11	-36	-20
Goat Hair & Mohair	1	-1	0	0	0	-1	0	0	0	-1	0	0	0
POULTRY	**15**	**0**	**93**	**16**	**109**	**0**	**97**	**15**	**112**	**0**	**97**	**15**	**112**
Poultry Meat	11		37	11	48		40	11	51		40	11	51
Egg	4		57	5	61		57	5	61		57	5	61
TOTAL	***1,989***	***-4,315***	***3,341***	***3,432***	***2,458***	***-4,309***	***-5,308***	***3,392***	***-6,225***	***-4,321***	***-6,986***	***3,709***	***-7,598***

Source: Authors' calculations.

Table A3. Production and Human Consumption (1 000 Tons)

	PRODUCTION (1 000 TONS)				CONSUMPTION (1 000 TONS)			
	BASE	EU-OUT	EU-CU	EU-IN	BASE	EU-OUT	EU-CU	EU-IN
	2002-04	2015	2015	2015	2002-04	2015	2015	2015
CROP PRODUCTS	***90,278***	***113,955***	***106,808***	***106,683***	***71,535***	***91,806***	***92,572***	***93,476***
CEREALS	**32,029**	**39,144**	**32,373**	**30,690**	**20,069**	**24,854**	**25,673**	**25,687**
Common Wheat	14,377	17,727	11,961	10,418	9,747	11,844	12,419	12,419
Durum Wheat	5,544	7,005	7,155	7,164	4,591	5,803	5,924	5,931
Barley	8,641	10,171	10,144	10,164	1,827	2,395	2,448	2,454
Corn	2,660	3,170	1,994	1,850	3,249	3,965	4,029	4,029
Rice	246	351	404	378	523	676	679	679
Rye	562	719	715	716	132	171	175	175
PULSES	**1,417**	**1,804**	**1,840**	**1,840**	**1,101**	**1,436**	**1,454**	**1,454**
Chickpea	623	768	792	792	473	606	616	616
Drybean	250	318	321	321	243	310	313	313
Lentil	544	719	727	727	385	520	524	525
INDUSTRIAL CROPS	**16,783**	**20,934**	**20,934**	**22,595**	**12,753**	**16,010**	**15,964**	**16,855**
Tobacco	141	128	128	128	75	70	70	70
Sugarbeet	14,218	17,238	17,238	18,899	11,572	14,533	14,533	15,681
Cotton	2,424	3,568	3,568	3,568	1,107	1,407	1,361	1,104
OILSEEDS	**1,025**	**1,368**	**852**	**749**	**3,180**	**4,358**	**4,343**	**4,342**
Sesame	22	19	22	22	88	123	125	125
Sunflower	849	1,194	675	580	1,086	1,466	1,448	1,448
Groundnut	85	119	120	120	78	107	107	107
Soybean	69	35.2	35.1	28.2	1,929	2,661.8	2,661.8	2,661.8
TUBERS	**7,045**	**9,133**	**9,136**	**9,136**	**6,824**	**8,832**	**8,847**	**8,847**
Onion (dry)	1,947	2,598	2,590	2,589	1,830	2,448	2,453	2,453
Potato	5,099	6,535	6,547	6,547	4,994	6,383	6,394	6,394
VEGETABLES	**19,944**	**25,911**	**25,963**	**25,963**	**18,220**	**23,848**	**23,887**	**23,887**
Melon & Waterm.	5,973	7,816	7,832	7,832	5,946	7,783	7,797	7,797
Cucumber	1,725	2,322	2,340	2,340	1,636	2,208	2,212	2,212
Eggplant	930	1,221	1,224	1,224	924	1,213	1,215	1,215
Fresh Tomato	7,450	9,578	9,599	9,599	6,953	8,990	9,002	9,002
Processing Tomato	2,119	2,627	2,578	2,578	1,206	1,559	1,561	1,561
Green Pepper	1,746	2,347	2,390	2,390	1,555	2,096	2,100	2,100
FRUITS AND NUTS	**12,034**	**15,661**	**15,710**	**15,710**	**9,388**	**12,468**	**12,404**	**12,404**
Apple	2,300	2,991	3,019	3,019	1,817	2,429	2,428	2,428
Apricot	365	452	477	477	23	31	31	31
Peach	432	585	585	585	401	545	545	545
Table Olive	400	487	487	487	361	444	443	443
Oil Olive	1,017	1,139	1,064	1,064	760	867	810	810
Citrus	2,563	3,551	3,572	3,572	1,898	2,648	2,647	2,647
Pistachio	52	63	64	64	48	60	59	59
Hazelnut	477	528	568	568	45	57	56	56
Fig	62	69	72	72	13	16	16	16
Table Grape	3,123	4,218	4,223	4,223	2,986	4,047	4,044	4,044
Raisin Grape	322	404	406	406	118	155	155	155
Tea	922	1,173	1,173	1,173	918	1,170	1,170	1,170
LIVESTOCK & POUL.	***12,560***	***16,102***	***15,222***	***15,209***	***12,795***	***16,218***	***17,252***	***17,252***
MEAT	**907**	**1,054**	**1,002**	**1,002**	**903**	**1,053**	**1,554**	**1,554**
Cow Meat	499	630	587	586	499	630	908	908
Sheep Meat	350	364	357	357	347	364	551	551
Goat Meat	58	59	58	58	58	59	95	95
MILK	**9,900**	**12,713**	**11,892**	**11,880**	**9,956**	**12,640**	**13,175**	**13,175**
Cow Milk	8,918	11,594	10,793	10,781	8,987	11,532	12,012	12,012
Sheep Milk	733	858	842	841	720	847	831	831
Goat Milk	249	261	257	257	249	261	332	332
HIDE, WOOL & HAIR	**205**	**212**	**204**	**204**	**403**	**511**	**511**	**511**
Cow Hide	71	76	71	71	97	111	111	111
Sheep Hide	78	79	77	77	235	314	314	314
Goat Hide	9.8	9.9	9.7	9.7	15.1	20.0	20.0	20.0
Sheep Wool	44	44	43	43	53	63	63	63
Goat Hair & Mohair	3.0	3.0	3.0	3.0	2.2	2.9	2.9	2.9
POULTRY	**1,548**	**2,123**	**2,123**	**2,123**	**1,533**	**2,014**	**2,011**	**2,011**
Poultry Meat	813	1,075	1,075	1,075	802	1,027	1,024	1,024
Egg	735	1,048	1,048	1,048	731	987	987	987
TOTAL	***102,837***	***130,057***	***122,030***	***121,892***	***84,330***	***108,024***	***109,824***	***110,728***

Source: Authors' calculations.

Table A4. Annual Yield Growth Estimates using GME

	Yield Growth (percent)	Probability Values
Wheat	0.69	0.011
Barley	0.81	0.015
Corn	0.78	0.016
Rice	1.56	0.010
Rye	0.90	0.019
Chick Pea	*-0.08*	0.010
Dry Bean	0.32	0.012
Lentil	0.78	0.015
Tobacco	*-0.44*	0.013
Sugar beet	0.88	0.012
Cotton	1.77	0.016
Sesame	0.03	0.010
Sunflower	0.56	0.014
Groundnut	1.44	0.011
Soybean	0.00	-
Onion (dry)	0.94	0.015
Potato	1.05	0.010
Melon and Watermelon	0.29	0.012
Cucumber	0.62	0.018
Eggplant	0.10	0.014
Fresh Tomato	*-0.04*	0.011
Processing Tomato	*-0.04*	0.011
Green Pepper	0.60	0.010
Apple	0.32	0.011
Apricot	0.74	0.016
Peach	0.65	0.014
Table Olive	0.74	0.011
Oil Olive	0.74	0.011
Citrus	1.49	0.018
Pistachio	0.32	0.011
Hazelnut	0.79	0.012
Dry Fig	*-0.16*	0.010
Table Grape	0.56	0.018
Sultana Grape	0.56	0.018
Tea	1.10	0.022
Sheep Meat	0.22	0.020
Sheep Milk	1.29	0.022
Sheep Wool	0.00	-
Sheep Hide	0.00	-
Goat Meat	0.13	0.010
Goat Milk	0.34	0.010
Goat Hair	0.00	-
Goat Hide	0.00	-
Cow Meat	1.50	0.021
Cow Milk	1.78	0.010
Cow Hide	0.00	-
Poultry Meat	2.56	0.010
Hen Egg	3.27	0.010
Fodder (Vetches)	*-1.46*	0.011

Source: Authors' calculations.

Table A5. Applied Tariffs of Turkey, Average of 2002-2004 and 2006

	2002-2004 Average	2006
Soft Wheat	0.40	1.30
Durum Wheat	0.30	1.00
Barley	0.85	1.00
Corn	0.50	1.30
Rice	0.45	0.45
Rye, Oats, Spelt, Millet	0.47	1.07
Chickpea	0.20	0.19
Dry Bean	0.20	0.19
Lentil	0.20	0.19
Tobacco	0.25	0.25
Sugarbeet	0.20	0.19
Cotton	0.00	0.00
Sesame	0.24	0.23
Sunflower	0.15	0.26
Groundnut	0.33	0.32
Soybean	0.00	0.00
Onion	0.50	0.50
Potato	0.20	0.19
Melon & Watermelon	0.87	0.86
Cucumber	0.30	0.30
Eggplant	0.20	0.20
Fresh Tomato	0.49	0.49
Processing Tomato	0.49	0.49
Pepper	0.20	0.20
Apple	0.61	0.60
Apricot	0.55	0.55
Peach	0.55	0.55
Table Olive	0.20	0.39
Oil Olive	0.20	0.20
Citrus	0.55	0.54
Pistachio	0.44	0.43
Hazelnut	0.44	0.43
Fig	0.46	0.46
Table Grape	0.56	0.55
Raisin Grape	0.56	0.55
Tea	1.45	1.45
Sheep Meat	2.27	2.25
Sheep Milk	1.50	1.50
Sheep Wool	0.00	0.00
Sheep Hide	0.00	0.00
Goat Meat	2.27	2.25
Goat Milk	1.50	1.50
Goat Hair	0.00	0.00
Goat Hide	0.00	0.00
Cow Meat	2.27	2.25
Cow Milk	1.50	1.50
Cow Hide	0.00	0.00
Poultry Meat (Chicken)	0.65	0.65
Egg	0.77	0.77

Source: Authors' calculations from UFT (2006).