EU INTEGRATION OF TURKEY: IMPLICATIONS FOR TURKISH AGRICULTURE

Eruygur H.O. and Cakmak E.H.

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Eruygur H.O.[1] and Cakmak E.H. [2]

[1] Gazi University/Department of Economics, Assist. Prof. Dr., Ankara, Turkey
[2] METU/Department of Economics, Prof. Dr., Ankara, Turkey

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 modelling 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. 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 (TAGRIS), Maximum Entropy Based Positive Mathematical Programming, Turkey's Membership of 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. In order to evaluate the possible impacts of a variety of policy alternatives and scenarios, an economic modelling 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 [2], particularly Heckelei and Britz [3]. The agricultural sector model is based on a static optimization algorithm.

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[1] 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*).

III. Structure and Calibration of the Model

TAGRIS is a price endogenous partial equilibrium agricultural sector 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). 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 *South-eastern Anatolia Project (GAP)* Regions. The crop and livestock sub-sectors are integrated endogenously, i.e., the livestock sub-sector gets inputs from crop production. 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*). 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). On the demand side, consumer behaviour is regarded as price dependent, and thus market clearing commodity prices are endogenous in the model.

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 [4]. This study is then followed by Howitt's 1995 studies [5][6]. The proposed calibration method with the name of Positive Mathematical Programming (PMP) is also consistent with microeconomic theory[2]. TASM[3] of Kasnakoglu and Bauer [8] and TASM-EU[4] of Cakmak and Kasnakoglu [9] represent two applications using the PMP methodology for calibration purposes. PMP method was then developed further with the integration of *Generalized Maximum Entropy* [10] formalism by Paris and Howitt [2]. Later on, this approach was extended to more than one *cross sectional* framework by Heckelei and Britz [3], and used in the construction of CAPRI (Common Agricultural Policy Impact) model of the EU. Our model follows Heckelei and Britz [3] and uses a *Maximum Entropy* integrated PMP method for the calibration to the observed values. The model was written in GAMS [11] and solved using the non-linear programming solver CONOPT 3 on a Pentium-IV PC.

IV. 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 [12] 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 [13] 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 [12] 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*

[1] 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.

[2] See Heckelei and Britz [3], Howitt [5] [6], and Cakmak [7] for a detailed discussion about the consistency with micro theory and about the cost terms.

[3] Turkish Agricultural Sector Model.

[4] Turkish Agricultural Sector Model-European Union.

information in the *Generalized Maximum Entropy* (GME) estimation[5] 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 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.

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.

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.

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

Table 1 General Results (USD million)

	2002-04	2015			CHANGE* (%)	
	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.

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 favourable 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, totalling 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.

Table 2 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	42.6	-187	-229	-1054	54	-1229	-231	-1284	51	-1464
Pulses	190	1.5	47	201	249	1.6	53	209	263	1.6	53	209	263
Industrial Crops	615	69	756	97	922	69	795	97	961	69	672	115	856
Oilseeds	-747	-632	3.0	-293	-922	-632	-176	-293	-1100	-633	-210	-293	-1136
Tubers	55	0.0	4.3	84	88	0.0	4.3	80	85	0.0	4.3	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
LIVEST.& POULTRY	***-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
Milk	-14	0.5	0.5	23	24	0.5	-490	24	-466	0.5	-494	24	-470
Hide, Wool & Hair	-290	7.0	-250	-275	-518	6.9	-248	-286	-527	6.9	-248	-286	-527
Poultry	19	0.0	124.8	21	146	0.0	129	21	150	0.0	129	21	150
TOTAL	***2264***	***-582***	***2918***	***1228***	***3564***	***-587***	***-541***	***1205***	***77***	***-590***	***-936***	***1220***	***-306***

Source: Authors' calculations.

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[6] from the model simulations for membership scenario show that the total CAP support (if the current structure is kept and fully 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.

Table 2 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.

[6] In the calculation we followed the assumptions of Grethe [14]. 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 not yet included, direct payments fixed in nominal values, inflation in EU area between 2004 and 2015 assumed 1.5 % annually.

V. Conclusions

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.

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 [9], 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 making various kinds of sensitivity analyses related to possible changes in the all parameters incorporated in the model structure.

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Corresponding author:

- Author: Eruygur, H.O.
- Institute: Gazi University, Dep. of Economics
- Street: 06500 Besevler
- City: Ankara
- Country:Turkey
- Email: eruygur@gmail.com