Preliminary draft
please, do not quote

TRADE IMPLICATIONS OF EXTENDING THE TURKEY-EU CUSTOMS UNION TO AGRICULTURAL PRODUCTS *

H. Ozan ERUYGUR

Middle East Technical University,
Department of Economics,
Ankara 06531 Turkey

Erol H. CAKMAK

Middle East Technical University,
Department of Economics,
Ankara 06531 Turkey

ABSTRACT

Turkey's membership of EU will lead to the enlargement of already established customs union between EU and Turkey to the agro-food products. This involves not only a full liberalization of agricultural trade within the EU but also the implementation of a common external tariff. Trade diversion and creation effects for agro-food trade will emerge. According to the article XXIV of GATT, the possible results of these counteracting effects are important. In this paper, the trade diversion and creation effects of the membership of Turkey to the EU for the agro-food trade will be calculated and analyzed using the Armington assumption.

Keywords: Elasticities of Substitution, Armington Elasticities, Fixed and Random Effect Panels, Trade Creation, Trade Diversion, EU Membership of Turkey.

JEL Codes: C50, F15, F17, Q17

***** *The authors are grateful to the EU-MED AGPOL (Impacts of Agricultural Trade Liberalization between the EU and Mediterranean Countriest) Project funded by the European Commission, 6th Framework Programme on Research, Technological Development and Demonstration.*

I. INTRODUCTION

Extending Turkey-EU customs union agreement to agricultural products will imply the adoption of a common external tariff (CET) and abolition of trade barriers between Turkey and EU. The bilateral full liberalization of trade in agro-food products and the establishment of common external tariff will have trade implications not only for Turkey and EU, but also for the non-EU trading partners of Turkey. In this new situation, trade diversion and creation effects for agro-food trade will emerge. According to the article XXIV of GATT, the possible results of these counteracting effects are important.

The estimation of the Armington elasticities is described in the following section. The third section reports the simulation results about trade diversion and creation due to the application of CET. The final section is reserved for concluding remarks.

II. ARMINGTON MODEL AND ESTIMATION OF ELASTICITIES

The Armington model assumes imperfect substitution among goods from different geographical areas. The model uses a CES aggregation function which implies that the substitution of imports between any two pairs of importing partners are identical. According to the choice of the CES functional form, two different specifications can be considered. The *non-nested* specification (Shiells C. R. and Reinert K. A., 1993, p.303) assumes that imports from regions or countries, as well as competing domestic production all enter in the sub-utility function for a sector:

$$\mathrm{U_i} = \left[\sum_k b_{ki} M_{ki}^{-\rho_i} \right]^{-\frac{1}{\rho_i}} \qquad \text{(Eq.1)}$$

where $\sum_k b_{ki} = 1$, ρ_i is a constant greater than -1, and $\rho_i = \frac{1-\sigma_i}{\sigma_i}$. Note that, ρ_i is the CES exponent and σ_i is the elasticity of substitution where $0 < \sigma_i < \infty$.[1] In this CES functional form, M_{ki} includes the quantity of domestic production for good *i*, as well. Traditionally, CGE modelers assume that domestic production substitutes with an aggregate of imports from all sources.

The second alternative that Shiells *et al* (1993) called *nested* specification assumes that imports from different sources are differentiated products. In other worlds, in this alternative formulation, M_{ki} does not include the quantity of domestic production for good *i*. This second form is generally used in order to analyze the preferential trade arrangements and/or customs unions. This nested specification is exactly what has been used in this study.

Hence our model has the utility function of:

$$\mathrm{U_i} = \left[\sum_k b_{ki} M_{ki}^{-\frac{1-\sigma_i}{\sigma_i}} \right]^{-\frac{\sigma_i}{1-\sigma_i}} \qquad \text{(Eq.2)}$$

Notice that in Eq.2, k represents the trading partner, M_{ki} is the quantity of imports of product "*i*" originating from "*k*", b_{ki} is a constant representing the level of preference for imports originating from "*k*".

Armington model imposes a *two-step budgeting* procedure. In the first stage, the importer decides how much of a particular commodity to import. In this stage the decision is determined according to the *import demand function*, M_i, of the importer country, in other words, by the *price elasticity for total import* demand for product *i*; η_i.

In the second stage given the total amount imported, the importer decides how much to import from each supplier. This decision is based on the elasticity of substitution, σ_i. Solving the consumer utility function given in Eq.2 produces the following equation which

[1] If σ_i =0, then the products are perfect complements, if $\sigma_i = \infty$ then the products are perfect substitutes.

determines import volume by sector and region of origin, M_{ki}, where P_{ki} is the partner specific import price including tariffs, $P_{ki} = \widehat{P}_{ki}(1+t)$ where t is tariff rate.

$$M_{ki} = \alpha_{ki}^{o} M_i \left[\frac{p_{ki}}{P_i}\right]^{-\sigma_i} \qquad \text{(Eq.3)}$$

where $P_i = \sum_k \alpha_{ki}^0 P_{ki}$ is the index of import prices representing a price for total imports from all origins, and α_{ki}^0 is the quantity market share of country k in the base year. Note that Hickman and Lau (1973, p.351) showed that if we normalize our prices to unity in the base period, then, one can show that $\alpha_{ki}^0 = \frac{M_{ki}^0}{M_i^0}$. In this case the Eq.3 can be rewritten as

$$\left[\frac{\alpha_{ki}}{\alpha_{ki}^{o}}\right] = \left[\frac{p_{ki} / p_{ki}^0}{P_i / p_i^0}\right]^{-\sigma_i} \qquad \text{(Eq.4)}$$

where $\alpha_{ki} = M_{ki} / M_i$.

Armington (1969, p.174) showed that taking the differential of both sides of $P_i = \sum_k \alpha_{ki}^0 P_{ki}$ will lead to:

$$\frac{dP_i}{P_i} = \sum_k S_{ki}^{o} \frac{dP_{ki}}{P_{ki}} \qquad \text{(Eq.5)}$$

where $S_{ki}^{o} = \frac{M_{ik}^0}{M_i^0} . \frac{P_{ik}}{P_i}$. Note that in this study, it is assumed that the price changes will result from tariff changes[2], so it is possible to write $\frac{dP_{ki}}{P_{ki}} = \frac{t_{ki}^{new} - t_{ki}^{old}}{1 + t_{ki}^{old}}$. In addition, taking the differential of Eq.3, Armington (1969, p.174) showed also that

$$\frac{dM_{ki}}{M_{ki}} = \underbrace{\frac{dM_i}{M_i}}_{(Effect1)} + \underbrace{\sigma_i \left[\frac{dP_i}{P_i} - \frac{dP_{ki}}{P_{ki}}\right]}_{(Effect2)} \qquad \text{(Eq.6)}$$

[2] When Turkey enters to EU, a Common External Tariff (CET) of EU will be applied by Turkey instead of Turkey's current tariff rates.

where $\frac{dM_i}{M_i} = -\eta_i \frac{dP_i}{P_i}$. The first term represents the growth of the market for M_{ki} because of the price change. Following Unguru and Lozza (2001, p.12), this effect implies that the change in total imports will be distributed according to the initial share of each partner. The second term represents the effect of relative price changes, or in other words the *substitution effect*. The substitution effect allows to estimate the trade diversion and to determine the winners and losers of the CET across the trading partners. This is the *effect of substitutions* between partner countries.

Eq. 4 has been used for the estimation. We will get the following equation by taking the natural logarithm of Eq.4.

$$\ln\left[\frac{\alpha_{ki}}{\alpha_{ki}^{o}}\right] = -\sigma_i . \ln\left[\frac{p_{ki} / p_{ki}^{0}}{P_i / p_i^{0}}\right] \qquad \text{(Eq.7)}$$

In order to estimate this equation, we used the *fixed* and *random effect models* of *panel data*. We performed Hausman tests in order to choose the preferred model for each product, *i*. Our approach is similar to that of Unguru and Lozza (2001). The main difference is the fact that we performed Hausman tests in order to decide to *fixed* or *random effect models* of panel data, since in some cases random effect model can be much more preferred to fixed model. Unguru and Lozza (2001, p.26) used fixed effect model for all products. Notice that the estimations are performed adding a *trend term* (*trend*) to (Eq.7) both in Fixed Effect and Random Effect specifications.

For the panel data estimation, the cross section dimension is regions, *k*, in other worlds country groups submitted to the same duty regime. The cross section elements used in our study are *k*=EU15, EU10, USA, China, Latin America, MENA and Rest of the World (ROW). The time series dimension is *t*, that is years from 1992 until 2003. The model is estimated for each agro-food product group of our study, *i*=1,2,…14 (for details, see the Appendix). Following Unguru and Lozza (2001), in addition to the 14 different agro-food products, we defined also the *product groups* such as *Raw* and *Processed* products. This extra classification, in fact, doubles the number of products.

For the definition of raw and processed products, we followed the definition of EU.[3] The definitions are based on the Harmonized System Combined Nomenclature since the tariff data (Common External Tarif of EU) is based on this coding system.[4] The ad-valorem equivalents of the CET (Common External Tariff) data are obtained from UNCTAD database at 8 digits of the Combined Nomenclature. The Turkish tariff data is obtained from the Undersecretariat of Foreign Trade.

The price elasticities of import, η_i, are estimated using the simple specification of:

$$\ln M_i = \text{constant} - \eta_i \ln P_i \qquad \text{(Eq. 8)}$$

The estimated Armington elasticities and elasticities of imports can be seen in Appendix. The values for these elasticities used in our simulation study are provided in Table 1. All of the regressions are performed by Stata 8 ™ and 2003 is our base year.

Table 1. Values for Elasticities of Substitution and Price Elasticities of Import.

	Elasticity of Substitution, σ_i		**Price Elasticity of Import, η_i**	
Product Codes[a]	**Raw**	**Processed**	**Raw**	**Processed**
1	0.922475		1.062360	
2	0.84898		1.158311	
3	1.247402		1.158311	
4	0.579521		1.982507	
5	1.479229		0.504372	
6	1.430463		1.492812	
7	2.55914		1.158311	
8	1.207758	1.239984	1.158311	1.407466
9	0.681448	0.526173	0.254448	1.407466
10	1.312761	1.353257	1.158311	1.407466
11	1.312761	1.091098	1.158311	1.407466
12	1.788322	1.24498	1.158311	
13	1.695643		1.158311	
14	1.312761		1.653367	

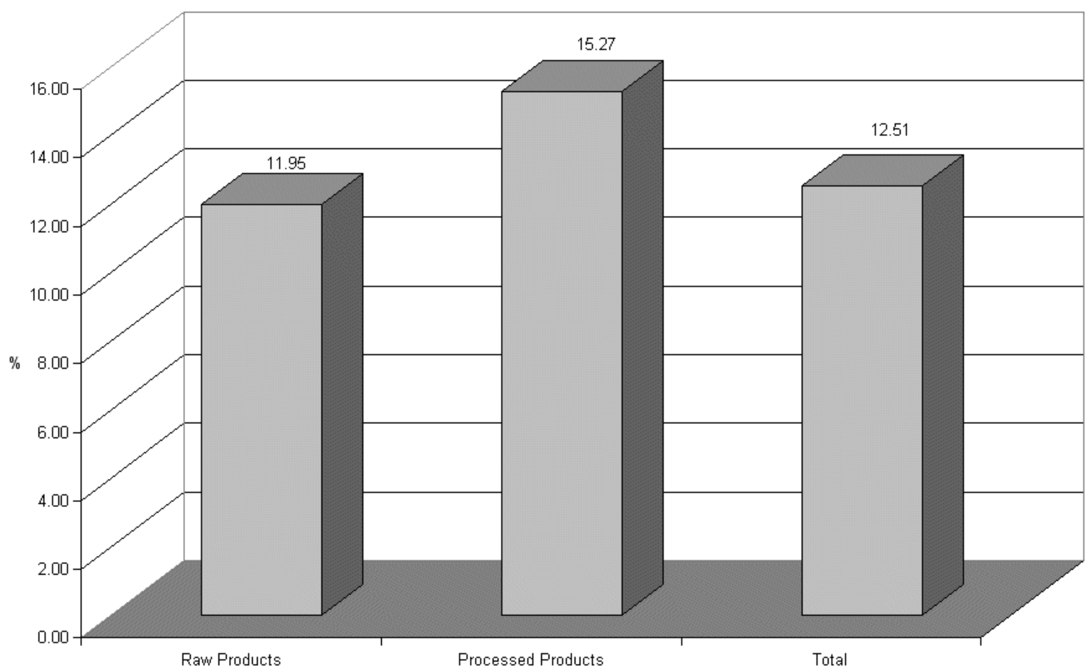
Notes: [a] See Appendix Table A1 for the product names. The confidence interval for all the elasticities in the table is 0.05. In the case that the estimated elasticity did not fulfill this requirement, we used the average elasticity obtained from group of products.
Source: Authors' calculations.

[3] http://europa.eu.int/comm/agriculture/agrista/tradestats/2003/annexes/annex4.htm.
[4] http://europa.eu.int/comm/taxation_customs/customs/customs_duties/tariff_aspects/combined_nomenclature/index_en.htm

III. SIMULATION RESULTS

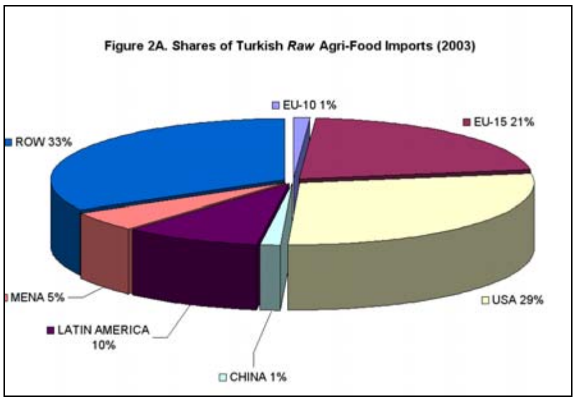
The adoption of the CET increases the total agro-food imports of Turkey by 12.5 percent (Figure 1). The surge in processed products are higher with 15.3 percent, compared to the raw products that remains around 12 percent.

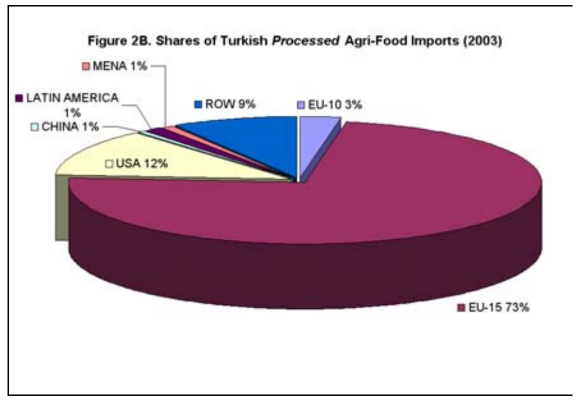
Figure 1. Impacts on Turkey's Imports

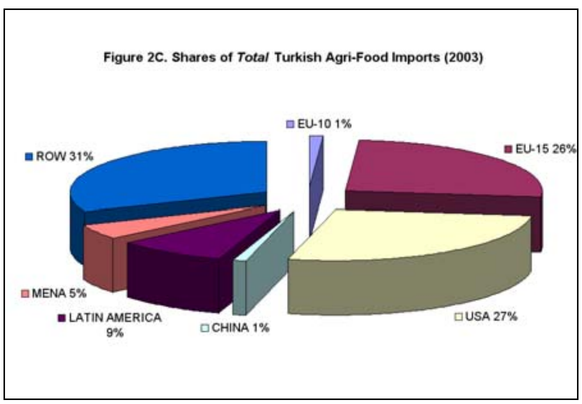


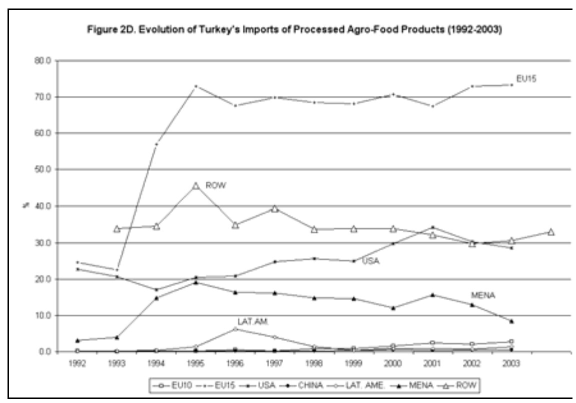
At this point, it may be informative to look at the recent distribution (with 2003 data) of Turkey’s total agro-food product imports by their country of origin. Figure 2A, 2B, 2C and 2D are prepared for this purpose. Figure 2C represents that the two major import partners of Turkey are USA and EU-15 with similar percentages (26-27 %). Although a similar pattern can be seen in raw agro-food products (Figure 2A), the picture for processed agro-food products is highly different and reveals an important feature of Turkey’s current agro-food import structure (Figure 2B). In the case of processed products, we see that EU15 is the leading importer with 73 % while the share of USA drops drastically to 12 %. In Figure 2D, one can see the evolution of the import structure of Turkey for processed agro-food products from 1992 until 2003. After 1993 there is a drastic increase in the share of EU15 and from 1994 till 2003 we see a stationary fluctuation around 70 percent.

In fact, returning back to Figure 1, the total increase of 12.51 % obtained from our simulations for the agro-food products used in this study is distributed unequally according to the origins of importation.









The change in Turkey's imports of agro-food products according to the country of origin is presented in Figure 3. It is clear from the figure that the EU countries would gain the most. The results indicate that the EU-15 countries would increase their exports of agro-food products to Turkey by 22.3 percent compared to the year 2003. According to the product type (Raw or Processed), the Turkey's imports of processed products will increase by 25 percent. Within the EU member countries, the new members (EU10) countries would increase their exports the most. The overall increase of 27 percent reveals this situation. However, the main difference between the EU15 and EU10 countries' performance is the fact that the main share of EU15's increase would be due to the processed products (24.9 percent) whereas for EU10 countries this increase will result mainly from raw agro-food products (27.7 percent). This result reveals the difference of the structure of the agro-food sectors in EU15 and EU10 countries. EU15's 24.9 percent increase in processed agro-food products is really striking, considering the fact that the share of the EU15 in processed products imports of Turkey has been 73 percent despite rather low base for the processed products imports. These results disclose the fact that these sectors in Turkey should improve their competitiveness in order to survive with the increasing foreign competition which would result from the enlargement of Turkey-EU customs union agreement to agro-food products.

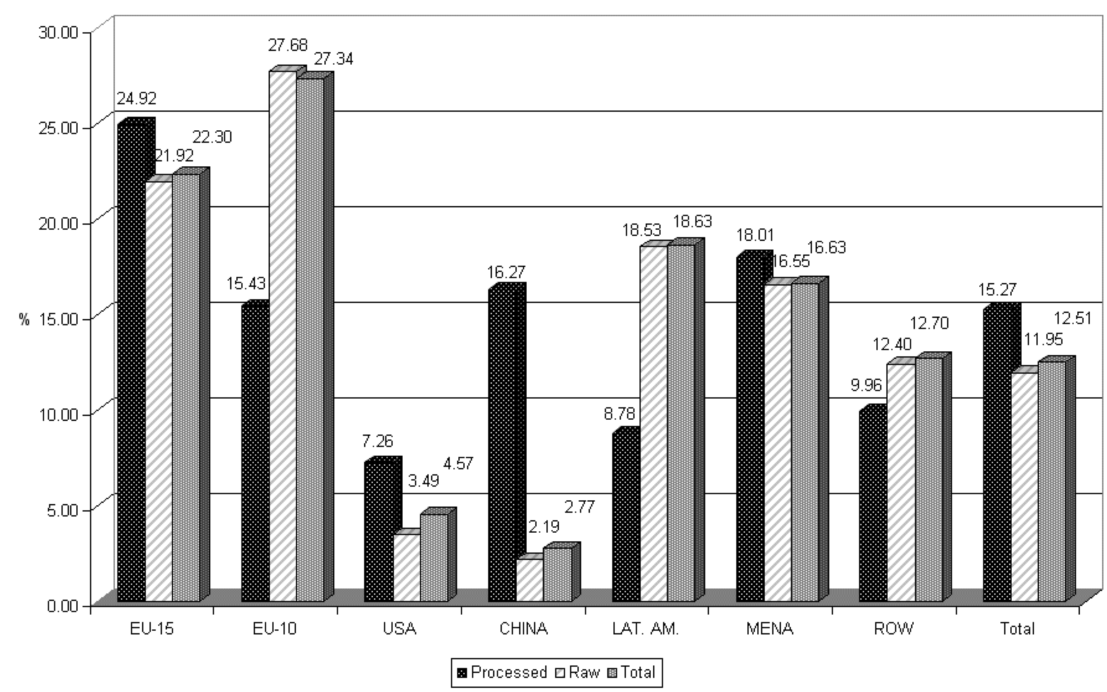
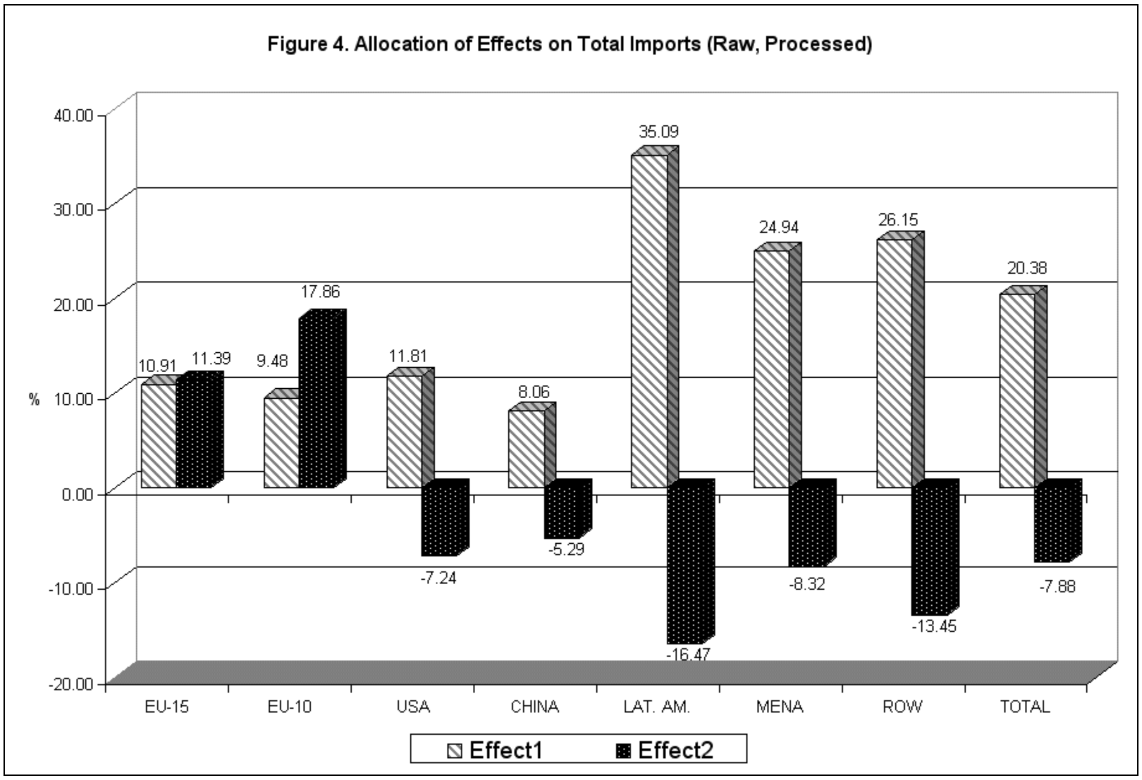


Figure 3. Change in Import Volumes by Regions (Processed, Raw, Total)

From Figure 3, it can be observed that the two least beneficiaries of a possible EU accession of Turkey would be USA and China. Latin American and MENA countries arise as the medium beneficiaries. Another interesting finding of the simulation results is the fact that although China would not benefit too much in total the increase in their exports of processed agro-food products is really high with an increase of 16.3 percent compared to its overall increase of 2.8 percent.



In Figure 4, we see the allocation of effects that are discussed in (Eq.6) on total (raw and processed) imports of agro-food products of our study. Recall that the Effect 2 representing the substitution effect because of the change in the relative prices between partner countries whereas the Effect 1 represents the change (enlargement or shrinkage) in market because of the price change. In Figure 4, the most important point is that, except EU10 and EU15, the substitutions between partner countries will negatively affect exports to Turkey. In other words, all countries except EU members would experience a really high negative substitution effects due to the change in Turkey's import prices in favor of EU agro-food products in the case of a possible accession of Turkey to EU. Effect 2 allows us to estimate the trade diversion and to determine the losers and winners of trade substitution (Unguru and Lozza, p.12). The simulation results indicate that the most important trade diversion would take place for Latin American countries (with 16.5 percent). If there is no change in relative prices, the increase of Turkey's imports from Latin American countries would be 35.1 percent, however, because of the change in relative prices of partner countries in favor of EU the substitution effect would moderate this increase at a rate of 18.63 percent. This rate is representing, in fact, the total net trade creation. Similar situations can be seen for all importer regions except EU in Figure 4. USA will experience a trade diversion at a degree of

7.24 % but end up with a net positive trade creation of 4.57 %. MENA countries would likely experience a trade diversion at a rate of 8.32 % with a total net trade creation of 16.63 %. If we look at the sum of imports from all countries to Turkey, for the agro-food products of our study, a trade diversion of 7.88 % with a 20.38 % trade creation will likely result in a total net trade creation at a rate of 12.51 %. The winners of the substitution effect, not surprisingly, would be the EU countries. EU10 countries would be the most winners of this substitution effects with a rate of 17.86 percent while EU15 countries would be the second winners of the substitution effect resulting from reaching Turkish agro-food market without any tariffs. Lastly, rest of the world (ROW) would also experience a trade diversion at a rate of 13.45 percent with a final total net trade creation of 12.70 percent.

IV. CONCLUSION

Turkey's membership of EU will lead to the enlargement of already established customs union between EU and Turkey for the agricultural products. This involves not only a full liberalization of agricultural trade within the EU but also the implementation of a Common external tariff. In this new situation, trade diversion and creation effects for agro-food trade will emerge. In terms of article XXIV of GATT, the possible results of these counteracting effects are important. In the first part of the paper, we estimated the Armington elasticities for Turkey for agro-food products of our study. Then, using the Armington assumption, the trade diversion and creation effects of Turkey's membership for the agricultural trade are calculated and analyzed. Our simulation findings show that the winners of a possible enlargement of Turkey-EU customs union to agricultural products are, not surprisingly, EU countries. Turkey's imports for agro-food products of our study will increase by 12.51 percent in total. The other countries will also increase their exports to Turkey, however, except EU, all of these countries will be subject to some degrees of substitution effects implying trade diversions for these regions.

REFERENCES

Armington P. S (1969), " A Theory of Demand for Products Distinguished by Place of Production", *IMF Stuff Papers*, 16:1.

Hickman B. G., and Lau L. J., (1973), "Elasticities of Substitution and Export Demands in a World Trade Model", *European Economic Review*, vol.4, pp.347-380.

Shells C. R, and Reinert K. A., (1993), "Armington Models and terms of Trade Effects: Some Econometrics Evidence for North America", *Canadian Journal of Economics*, 26, pp.299-316.

Unguru M., and Lozza E. C., (2001), "The EU enlargement to the CEECs: Impacts on agri-food Trade with Third Countries", *ECOMOD Conference Paper*.

APPENDIX TABLES

A1. Products used, and definitions

Our Codes, *i*	**Descriptions**	**Harmonized System Codes**
1	Live animals, meat & edible meat offal	01+02
2	Dairy, eggs, honey, & ed. Products	04
3	Edible Vegetables	07
4	Ed. Fruits & Nuts, Peel Of Citrus/Melons	08
5	Cereals and Milling Industry Products	10+11
6	Oil Seeds/Misc. Grains/Med. Plants/Straw	12
7	Animal Or Vegetable Fats, Oils & Waxes	15
8	Sugars & Sugar Confectionery	17
9	Preps. Of Cereals, Flour, Starch Or Milk	19
10	Preps Of Vegs, Fruits, Nuts, Etc	20
11	Tobacco & Manuf. Tobacco Substitutes	24
12	Other Foodstuffs	16+18+21+22+23
13	Raw Hides & Skins & Leather	41
14	Cotton, Inc. Yarns & Woven Fabrics Thereof	52

A2. Estimation Results for Elasticities of Substitution (-σ) by Product Groups

	Raw			Processed		
i	**Fixed Effect Model**	**Random Effect Model**	**Haussman Test**	**Fixed Effect Model**	**Random Effect Model**	**Haussman Test**
1	-.8973717 (-4.87)	**-.9224748 (-5.30)**	0.9196			
2	**-.8489801 (-4.65)**	-.7681831 (-4.14)	0.028			
3	-.8596542 (-3.11)	**-1.247402 (-6.76)**	0.1727			
4	-.6112683 (-4.25)	**-.579521 (-4.12)**	0.3326			
5	**-1.479229 (-7.61)**	-1.656002 (-9.11)	0.0377			
6	-1.432075 (-6.40)	**-1.430463 (-6.66)**	0.9997			
7	**-2.55914 (-8.99)**	-2.398587 (-8.60)	0.0202			
8	-1.146992 (-3.81)	**-1.207758 (-4.41)**	0.7662	-1.19222 (-2.94)	**-1.239984 (-3.51)**	0.9046
9	-.7757594 (-3.60)	**-.6814476 (-3.66)**	0.6858	**-.5261737 (-2.64)**	-.5506384 (-2.79)	0.0141
10	-.4773368 (-1.17)	-.6095287 (-1.73)	0.6973	-1.297197 (-4.39)	**-1.353257 (-5.52)**	0.9571
11	-.6968264 (-1.38)	.5020997 (1.02)	0.0000	-.5530628 (-1.52)	-.1733515 (-0.65)	0.017
12	**-1.788322 (-9.71)**	-2.135752 (-14.88)	0.0109	**-1.24498 (-5.21)**	-1.275651 (-5.49)	0.034
13	**-1.695643 (-9.64)**	-1.62876 (-8.29)	0.041			
14	-.3671566 (-0.60)	-.3287746 (-0.60)	0.9734			

**Values in parenthesis are t values. The bold values are used in the simulations of our study since they are significant and theory consistent. In order to decide between fixed effect and random effect models, we performed Hausman tests. The values in the Hausman test column are the prob. values. Hence if these values are less than 0.05 (a significance level), then according to the test the fixed effect model is proffered.*

A3. Estimation Results for Price Elasticities of Imports (-η) by Product Groups

i	RAW	PROCESSED
1	**-1.06236** **(-2.63)**	
2	-.1028952 (-0.22)	
3	-.121545 (-0.17)	
4	**-1.982507** **(-4.28)**	
5	**-.5043715** **(-2.09)**	
6	**-1.492812** **(-2.61)**	
7	-.343755 (-1.84)	
8	-16.93904 (-0.69)	1.015575 (1.11)
9	**-.2544475** **(-2.53)**	-1.696033 (-1.49)
10	-.6027999 (-0.91)	1.538852 (1.20)
11	-.0063906 (-0.01)	**-1.407466** **(-7.27)**
12	-.6061369 (-1.89)	-.2784262 (-0.18)
13	.8611577 (1.46)	
14	**-1.653367** **(-4.32)**	

**Values in parenthesis are t values. The bold values are used in the simulations of our study since they are significant and theory consistent. Note that, degrees of freedom is low for the estimation of these elasticity values since we can not use panel data models.*