Bio-based and Applied Economics 6(2): 209-227, 2017
DOI: 10.13128/BAE-16395

Full Research Article

Analysing the impact of targeted bio-ethanol blending ratio in Turkey

Selim Çağatay[1,*], Celal Taşdoğan[2], Reyhan Özeş[1]

[1] Akdeniz University, Department of Economics, 07058, Antalya, Turkey
[2] Gazi University, Ankara, Turkey

Date of submission: 2015 7th, July; accepted 2017 16th, May

Abstract. In Turkey, a legal requirement of blending bio-ethanol with conventional fuels has been imposed, and this is likely to increase in the future. The blending target policy is multi-dimensional as it has direct and indirect impacts on agricultural and factor markets, trade and budget deficit, income distribution, food security and on environment. In this study, policy analyses are carried out to investigate whether the blending target is feasible and sustainable in terms of the economic structure of Turkey. Analyses were carried out by employing an agricultural bilateral trade model and agriculture focused social accounting matrix. Findings suggest that target rate can be feasible and harmless on food security, if the extra required supply is provided through tariff reduction particularly on imports of wheat and maize rather than promoting their production through price premiums. For achieving sustainability of the target blending rate, new supportive policies have to be implemented to create alternative job opportunities in the rural areas and/or to shift farmers for alternative crops.

Keywords. Bio-ethanol, agricultural trade model, social accounting matrix, price multiplier.

JEL codes. C61, C67, Q11, Q18, Q42.

1. Introduction

In order to reduce oil dependence that adversely affects national economies especially in oil importers, recently, use of bio-fuel is encouraged especially in transportation sector in many countries. While transportation sector's share in the global fuel use is 30 percent, of this, 99 percent is covered by fossil fuels and it is known that approximately 21 percent of the global emission is sourced by fossil fuels (Rajagopal and Zilberman, 2007). Therefore, reduction of the use of fossil fuel in the transportation sector is thought to make some contribution to the solution of environmental problems on global scale as well as reducing the dependence of those countries that have energy deficit. Additionally, because

*Corresponding author: selimcagatay@akdeniz.edu.tr

ISSN 2280-6180 (print)
ISSN 2280-6172 (online)

bio-fuels are mainly produced from agricultural products, their possibility to create an increase in agricultural revenues, their potential to create new employment opportunities and their provision of efficiency of use similar to that of fossil fuels lead to the expectation that the use of bio-fuel shall become more widespread in the future (Rajagopal and Zilberman 2007). Nevertheless, one should never forget the possible negative impact of rising bio-fuel use on food security especially in countries which have limited agricultural production and especially if big agricultural producers increasingly shift their production to provide input for energy sector rather than food industry. This would obviously put upward pressure on food prices and might create deteriorating impacts on budgets of low income and poor people.

A vast empirical literature that analyzes the impacts of bio-fuel use from various angles and in various countries has been accumulated since the beginning of 2000s. Fonseca *et al.* (2010), Timilsina *et al.* (2010), Demirbaş (2009), Banse *et al.* (2008) and Birur *et al.* (2008) provide a comprehensive review particularly of the applied ones and at the same time inform the researchers about alternative methodologies used in these studies. Some studies also investigated the pros and cons of bio-fuel use from the sustainability point of view such as Diaz-Chavez (2011), Janssen and Rutz (2011), Ravindranath *et al.* (2011) and Walter *et al.* (2011).

However the literature with regard to Turkey is quite limited, although the importance of transportation industry, energy demand, fossil fuel use and food security in Turkey is not different from that of most of the other countries. One of the limited numbers of empirical studies carried out on the impacts of bio-fuel production and consumption in Turkey is that of Hatunoglu (2010). This study has searched for the potential effects of mandatory blending rate applied on bio-diesel use on the agricultural sector. In the analysis, it has been found out that in cases of the application of 2 and 5 percent mandatory blending, respectively 300 and 750 million litres of bio-diesel should be produced, considering the existing gasoline and diesel oil consumption. The study claims that the degree of sufficiency of the plants with oilseeds is rather low in Turkey, that external dependence on these products continues, that the mandatory blending rate may not be possible in agricultural terms and that danger of food safety shall be faced.

Considering the developments in the World and Turkish bio-energy markets Çağatay *et al.* (2012) has intended to establish alternative bio-energy policy proposals for Turkey. Two empirical models have been used in the study. The first one is a multi-country, multi-product partial equilibrium agricultural net trade model which statically and comparatively measures the effects of foreign trade policies on the domestic and world markets; and the second one is the Turkish Agricultural Policy Analysis Model which is a multi-crop econometric model with a focus on the Turkish agricultural sector. In the empirical part, under the assumption that Turkey has not changed its existing crop varieties to a great extent, it is determined that bio-fuel (bio-diesel and bio-ethanol) production shall require more sunflower and sugar beet supply for which the former should be satisfied by rising imports and the latter by rising domestic production. In addition, soybeans and rapeseed are found as alternative crops to provide bio-diesel however their production should be promoted by government support in order to be used for bio-diesel production.

Based on the methods used in the above very limited literature on Turkey, the methodology employed in this study is more comprehensive as it partially allows simulating on macroeconomic variables such as income distribution and policy cost. In addition, the empirical framework provides information regarding the changes in bilateral trade.

When one considers the matter from Turkey's standpoint, it is observed that approximately 70 percent of the energy demand in Turkey is satisfied through imports (TMMOB, 2012). It may be said for Turkey that dependence on foreign energy sources in a country which continuously faces external deficit, bears serious risks for a sustainable growth. Lowering external dependence on energy and activating renewable energy sources to be able to reduce emission percentages have been an issue significantly discussed in Turkey (www.eie.gov.tr). There are three crops that might be used in the production of bio-ethanol; wheat, maize, sugar beet. The current production is realised by provision of price premiums while protecting them with high import tariffs. Therefore, one side of the issue is the policy front where Turkey hardly keeps her World Trade Organization (WTO) commitments. In addition, the budget burden and/or burden on tax payers and consumers should not be forgotten. On the other side of the issue, there are alternative uses of these raw materials such as feed and food industry. When Turkey's self-sufficiency statistics are considered we may conclude that to sustain the food security in the country the required bio-ethanol raw material demand should be achieved through extra supply rather than shifting some raw materials from food/feed use to energy production. Apparently this extra supply would either require extra agricultural land, for which the country has reached the boundary of its fertile land; otherwise this extra would be imported. While the former would necessitate provision of more premiums (keeping in mind budget burden, WTO constraint), the latter would necessitate lower tariffs (keeping in mind reduced tariff revenues, negative impact on the current trade balance deficit); the impacts of domestic agricultural markets are also another side to be dealt with. Last but not the least, shifting from fossil fuel to bio-ethanol would obviously create positive impacts on environment as well.

Recently, targets have been identified for mandatory bio-fuel blending ratios in order to reduce external dependence on energy and bio-ethanol blended fuel sales have started as of 2013. Accordingly, the Energy Market Regulatory Authority (EMRA) has targeted the minimum ethanol content, made from domestic agricultural products, of gasoline to be 2 percent for 2013 and 3 percent for 2014 through modifications made in the technical regulatory communication related to the types of gasoline and diesel oil in Turkey (EMRA 2009). Additionally, just to see the impacts in the extreme case that could become a target in the medium to long run, we assumed the ethanol content of gasoline to reach 10% in 2020.

Based on the importance of bio-ethanol use in the world and in Turkey, this study aims at analysing effects of the imposed bio-ethanol blending rates by the EMRA on the agricultural products' markets, household income, factor markets and policy costs. Depending on the findings, the main aim is actually to discuss the sustainability and feasibility of this recent bio-ethanol blending rate target. The analyses are carried out in two stages. At the first stage, effects of the bio-ethanol raw material demand created by the mandatory blending rates on the agricultural products market are investigated. At the second stage, impacts of changes in agricultural markets on household income and factor markets are discussed. The next section explains the empirical methods used to carry out the analyses. Section three provides empirical findings and relevant discussion. Finally the research concludes in section four.

2. The modelling framework

The impact analysis in our study necessitates both a decomposition at product level and a modelling framework which shall reveal the interaction between sectors/markets and their distributional impacts. As the impact analysis has both partial and general equilibrium characteristics, the study has been designed in two stages. At the first stage, various scenarios are simulated in order to calculate the impacts the bio-ethanol blending targets in Turkey have on wheat, maize and sugar beet markets by using the Mediterranean World Agricultural Trade Model (MWATM). At the second stage price multipliers from agriculture focused Social Accounting Matrix (SAM) are used to measure the effects on household income and factor markets. To link both empirical methodologies, in other words, to analyse the impacts of partial equilibrium findings on macro accounts, empirical outputs provided by simulations of MWATM are used as inputs to start simulations with SAM[1].

2.1 The Mediterranean World Agricultural Trade Model2

MWATM is a multi-commodity, multi-country, agriculture-focused partial equilibrium trade model utilized specifically to model bilateral trade. The base year of the modelling platform is 2008 and it simulates till 2020. In this dynamic framework, each year is solved to reach equilibrium by using the current year's levels of exogenous variables and equilibrium findings of the previous year. Thus, a connection is established between consecutive time frames. MWATM falls into the class of the "price-equilibrium" models. Newton's Global algorithm (Kehoe, 1991; Wooldridge, 2002) is used to solve the price set which shall equalize excess supply and demand occurring in the country/product markets in the world market. Products are assumed to be heterogeneous between countries and therefore the platform individually models imports and exports between two countries rather than modelling the net trade on a country/product basis. In other words, domestic and imported products are differentiated and modelled by the Armington method (Armington, 1969).

[1] Actually, MWATM is a sequential dynamic model which provides empirical solutions until year 2020 and on year-by-year basis. The SAM employed is a static one. However, we would not see this as a major problem in terms of modelling because the inputs used in static SAM for year 2020 simulations are obtained through dynamic simulations solved for 2020 in MWATM. In MWATM Cobb-Douglas type supply functions are used whereas the SAM has Leontief production function. However, we ignored this fact because we only use prices derived in MWATM as inputs in SAM.

[2] MWATM finds its roots in LTEM (Lincoln University Trade and Environment Model) which is founded on SWOPSIM (Static World Policy Simulation Model) and VORSIM (Vernon Oley Roningen Simulation Model) modelling frameworks. MWATM is directly derived from LTEM. The country composition of the MWATM is expanded to include BRIC countries and "trade modelling" part is modified from net trade to Armington type. The base year of the model was upgraded to 2008 (from 2004) and the simulation period was extended to 2020 (from 2012). For more technical details about LTEM and MWATM see Çağatay *et al*. (2013), (2012); Saunders *et al.* (2008), (2006); Saunders and Çağatay (2003); Çağatay and Saunders (2003a; 2003b).

MWATM includes 25 agricultural products, and of this number, 10 belong to the livestock sector and 15 to crop products[3]. In the platform, 12 countries[4] including Turkey, 3 country groups and the rest of the world are endogenously modelled. Equations used to connect each country/region to each other and to world market have a standard form. Within this standard form only substitute product properties in the agricultural sector may create a difference with respect to the country. The theoretical underpinnings of the model are of an *ad hoc* nature (Colman, 1983). Coefficients used in the equations are synthetically specified and are taken from relevant literature, obeying to symmetry and homogeneity conditions[5].

In general, there are 36 equations, of which 35 are behavioural and one is identity for each country/product. Therefore, the whole platform has 13,500 equations. The system in which there are 35 endogenous variables per country/product is simultaneously solved by finding an equilibrium price for each pair of bilateral-country foreign trade in an optimization algorithm. Behavioural equations represent trade prices, domestic supply, imports, domestic demand for food, demand for animal feed and demand by processing industry for country pairs. The identity equation solves for exports[6].

2.2 Price multiplier analysis: Social Accounting Matrix

In order to analyse the distributional impacts of policy changes regarding the agricultural sector, the input-output table and the SAM that employs it are modified to better focus on the agricultural sector. First of all the year 2002 I-O table (the latest when the paper was written) was updated to year 2008[7] (base year of the MWATM). Then, by using shares in production value the agriculture sector was re-specified to endogenously include wheat, maize, cotton, sugar beet, sunflower and soya. The rest of the agriculture sector consisted of other cereals and annual crops, vegetables, fruits, livestock, agricultural services, forestry, fisheries and 13 agri-food industries including beverages and tobacco. The rest of the economy was grouped under 7 manufacturing, construction, and 3 services industries. In the factor markets, labour use was reclassified according to skills based on education level as unqualified, less qualified and qualified. The same shares of qualifications are used in each agricultural production activity. Similarly only for bio-fuel inputs (cereals, maize, sugar beet, soya, sunflower), land was included in 4 different scales based

---

[3] Wheat, maize, rice, other cereals, sugar, cotton, sunflower, sunflower flour, sunflower oil, soybeans, soyaoil, soya flour, other oilseeds, other oils, other flour, raw milk, liquid milk, butter, cheese, milk powder, beef, pork meat, sheep meat, poultry, eggs.

[4] Argentina, Australia, Blacksea Economic Cooperation countries (group), Brazil, Canada, China, European Union, Indonesia, India, Mediterranean countries (group), Mexico, New Zealand, Russia, Turkey, USA, Rest of the World.

[5] See Çağatay *et al.* (2013), (2012); Saunders *et al.* (2008), (2006); Saunders and Çağatay (2003); Çağatay and Saunders (2003a; 2003b).

[6] As the Armington approach is used to differentiate imports and domestic products, bilateral imports are endogenously determined and hence in most of the country/products exports are "closing variable" solved as a residual of the difference between total supply and domestic demand.

[7] The 2002 I-O table was updated to 2008 in two steps. First macroeocomic balances and aggregates in 2008 were installed in SAM. Then, by keeping the technology matrix of 2002 constant (in other words by keeping the intermediate demand constant), the elements of final demand and value added in the I-O matrix were adjusted proportionally to become equal to those in the SAM.

on size as less than 2 ha, between 2-5 ha, between 5-10 ha and more than 10 ha. Finally, in the SAM, based on household budget survey, both urban and rural households were grouped according to their status in the job as unemployed, regularly paid labour, labour on daily payment, employer, self-employed and unpaid family labour (previously used in Taşdoğan *et al.*, 2010; Bhutto and Çağatay, 2010).

In the SAM multiplier models, income and expenditure elasticities are assumed to have unit elasticity. Relaxation of this assumption leads us to flexible prices and derivation of price multipliers in flexible price SAM is presented in Roland-Host and Sancho (1995). Decomposition of the SAM income multipliers into transfer, open loop and closed loop effects are presented in Stone (1985). In the flexible price model first, endogenous accounts (production activities, goods, production factors and households) and second, exogenous accounts (public, capital and rest of the world accounts) are identified and ordered in accordance with the desired/required policy shocks. Then price indices that represent endogenous accounts are replaced by the raw sums in the last column of the SAM. Finally, effects of an exogenous price shock on the economic system (defined in the endogenous accounts) are simulated through price multiplier analysis to derive the new set of prices that equalize industrial demand and supply (Defourny and Thorbecke, 1984).

Derivations of price multipliers are shown in Pyatt and Round (1979) and Roland-Host and Sancho (1995). A matrix A_{ij}[8] is created by dividing the endogenous accounts (T_{ij}) -defined as activities, input demand, factor use and household income- column-cells contained in the SAM by the column-sums (Y_j) corresponding to them ($A_{ij} = T_{ij}Y_j^{-1}$). A new set of prices is explained as a function of output vector (X) and value of endogenous accounts ($P_i = A_{ij}P_i + X_i$). To solve price equation Leontief inverse is introduced to the equation ($P_i = (1 - A_{ij})^{-1} X_i$). $(1 - A_{ij})^{-1}$ is defined as the price transmission matrix and it is used in the derivation of different multiplier effects of a change in exogenous accounts on the endogenous accounts. These multiplier effects include the transfer effect representing the net multiplier effect of a transfer to the exogenous accounts; the open-loop effect revealing the cross effects between different accounts; the closed-loop effect which calculates the last round effects and return back to account where the simulation has started.

Once the base year of MWATM is updated to the same year with the SAM, feedstock equilibrium prices derived from simulation of MWATM were used to create percentage changes in the related feedstock cells of the last "price" column of the SAM (Çağatay *et a*l., 2013). Then the price multipliers were calculated to derive distributional impacts.

3. Policy scenarios

Some presumptions and pre-calculations were made before running the scenarios (Table 1). First, gasoline and road fuel consumption forecasts for 2013-2020 period were made by using the past consumption trends in Turkey. Then, by considering the bio-ethanol blending targets set by the EMRA, the bio-ethanol equivalent of this forecasted road fuel consumption (over 2013-2020) were calculated. In the next step, corresponding agricultural raw material equivalents were calculated separately for wheat, maize and sugar beet. This calculation is done in order to compare findings when extra bio-ethanol demand

[8] This is a *38x38* inter-industry (technology) matrix with *i* representing outputs and *j* representing inputs.

Table 1. Required bio-ethanol and agricultural raw product equivalents.

	Road Fuel Consumption[a] (million lt.)	Blending Target[b]		Agricultural Equivalent[c, d]		
		(%)	(million lt.)	Wheat (000 t)	Maize (000 t)	Sugar beet (000 t)
2013	2,506	2	50	147	125	456
2014	2,408	3	72	212	181	657
2015	2,309	3	69	204	173	630
2016	2,210	3	66	195	166	603
2017	2,112	3	63	186	158	576
2018	2,013	3	60	178	151	549
2019	1,915	3	57	169	144	522
2020	1,816	10	182	534	454	1,651

[a]: Values over the 2013-2020 period were estimated by using the relevant data before 2013.
[b]: Blending rate in 2017, 2018 and 2019 were assumed to be same with the rate in 2016.
[c]: Production volumes represent the values in the case the bio-ethanol demand is satisfied with only one agricultural raw material at each time.
[d]: Conversion coefficients from agricultural production to bio-ethanol: each ton of wheat, maize and sugar beet is equal to 340, 400 and 110 litres of bio-ethanol respectively (Ertaş, 2010).

is compensated by one feedstock. The EMRA's blending rates for bio-ethanol in 2016 were assumed to be valid until 2019 and the extreme target case of 10% was assumed to be valid in Turkey in 2020, in order to respond to the need for an extreme point calculation.

An expectation is that the bio-ethanol blending rates which suddenly emerge in the market may increase the demand for relevant agricultural (food) raw materials and this might increase their prices due to temporary excess demand. The question here is whether or not this assumption is valid for each food-raw material and if so, how much the price change will be. The current production of bio-ethanol raw materials in Turkey is higher than the required extra quantity by the mandatory blending rates. In this case, new bio-ethanol demand in the market is not expected and assumed to create a huge effect on the market prices. However, the use of the current supply of bio-ethanol raw materials (domestic production and imports of either of wheat, maize, sugar beet) in the production of extra bio-ethanol might create a fall in availability of feed, oil, etc. Therefore, during simulations, the model is not allowed to disturb the current consumption[9] patterns of bio-ethanol raw materials. This setting might affect the empirical findings, however it is set to maintain the food security. Therefore the extra raw material should be obtained either through planting on new agricultural land or through extra imports, or both. In other words, such recognition prevents the present condition of food security from getting worse. Whether the extra supply shall be achieved at home or from abroad, or in other words, whether this will be achieved through a relaxation in the border policies or through a rise in the domestic incentive policies is an important problem and to see their impacts two policy instruments are used in the analyses: import tariffs and price premiums.

[9] In the model only consumption of bio-fuel feedstock is fixed, not the consumption of other products.

To compensate for the extra bio-ethanol demand presented in column 4 of Table 1, more than one scenario could have been simulated involving various policy and feedstock mixtures. However, it was decided to stick to two main scenarios, and two criteria were used to give the final decision on scenarios. First, we have checked the self-sufficiency ratios of wheat, maize and sugar beet in Turkey and found that these ratios are very close to each other, and all are about 90%; so we decided to compensate the extra bio-ethanol demand equally from the three products. Secondly; the main question raised by policy makers was whether it was possible and feasible economically and in terms of food security to meet the extra bio-ethanol demand by sole domestic production and if not what would be the outcome if all the extra demand was imported. Therefore, we have not simulated policies' combinations and instead the decision was between increasing price premiums (to promote production using deficiency payment instrument within the limits allowed by WTO) and reducing import tariffs[10].

From the above perspective only two different scenarios were run. First, to meet the required supply domestically, simultaneous price premiums were introduced on wheat, maize and sugar beet; second, the extra supply was met by simultaneous tariff reductions on imports of wheat, maize and sugar. The current rates of tariffs, price premiums and changes made in the scenarios are summarized in Table 2. Table 3 presents extra supply amount of wheat, maize and sugar beet to compensate for the policy driven bio-ethanol demand.

In the first part of the simulations supply, demand, price and foreign trade effects of the scenarios within the agricultural sector are derived by employing the MWATM model. Then empirical findings from the first part are used as inputs to derive the price multipliers in SAM, to calculate the impacts on household income and factor markets. In the SAM it is not technically possible to simultaneously model the premium increase and the tariff reduction applied on the same product. In other words, it is not possible in the SAM to decompose the effects of the shocks in question by policy instruments and only net effects are derived. Therefore, effects of the premium and tariff changes in the products are separately modelled in the SAM[11] and as the SAM represents a static accounting framework, price multipliers are calculated for 2013 and 2020 separately.

The modelling platform includes a multi sectorial part and a multi-commodity, multi-country part which make it possible to provide numerous empirical findings just after one scenario. However, trying to give more results would have the risk of moving away from the focus and missing the main messages. Therefore we decided just to focus on what policy makers were curious about, that is, on findings regarding rural areas, specifically agricultural sector and budget burden.

---

[10] Knowing exactly domestic/international price elasticity of supply/imports we refrain from providing outcomes of sensitivity analyses due to limited space and to already existing plenty of empirical findings to present. Nevertheless, we would like to mention two aspects that are quite influential on the empirical findings and create the main difference with regard to findings for grains (wheat and maize) and sugar beet. Sugar beet is more effective/productive in terms of bio-ethanol yield. However, response to tariff and price change is lower compared to wheat and maize, resulting in higher policy cost in comparison to grains.

[11] Transformation of tariff reductions to the SAM accounts are presented in Annex.

Table 2. Policy assumptions.

	Current Policy-%			Scenario 1			Scenario 2		
	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet
Premium									
2013	5.9	6.3	0.0	6.2	7.0	4.0	no change		
2014	5.9	6.3	0.0	6.2	7.0	5.0			
2020	5.9	6.3	0.0	7.0	10.0	11.0			
Import Tariff									
2013	130.0	125.0	135.0	no change	110.0	100.0	80.0		
2014	130.0	125.0	135.0		110.0	100.0	80.0		
2020	130.0	125.0	135.0		110.0	100.0	80.0		

Table 3. Required supply.

	Blending Rate-%	Blending amount (mil lt.)	In both scenarios required extra amount either through domestic production or imports (000 ton)		
			Wheat	Maize	Sugar beet
2013	2	50	49	42	20
2014	3	72	71	60	29
2020	10	182	178	151	73

*: Required bio-ethanol is assumed to be equally supplied by wheat, maize and sugar beet.

4. Empirical findings

Table A1 presents the findings from the simulation of bilateral trade model MWATM. Due to the rise in price premiums (1^{ST} Scenario) an increase both in producer prices and production amounts compared to the base scenario is experienced for the whole period. The increase in production ranges between 0.5%-3% and therefore we may say that these findings are quite feasible considering Turkey's agricultural land. There is a slight fall in imports of wheat and maize and no change in imports of sugar beet. This fall in imports is also expected as the extra domestic production compensates for the domestic demand. There is almost no change in exports of these products which shows that the rise in supply is used in domestic market to satisfy the rising demand. In Table A2 the change in bilateral imports are presented. Turkey mainly imports wheat from the European Union and Russia. The fall in imports from each market is about 0.5%. Maize is mainly imported from Argentina, Canada and USA and again there is a fall of about 0.5% from each market. Total imports of sugar beet are negligible and there is no change.

Tariff reductions (2^{nd} Scenario) are expected to create a fall in domestic prices (due to increase in imports and total supply) as they represent the difference between world and domestic prices. To convert tariff reductions and incorporate them in SAM we referred to Sigwele (2007: 231-232)[12]. As the producer prices are not changed exogenously only slight falls occur in producer prices, and the resulting changes in production, feed demand and export amounts are quite small through the period (Table A1). A major change is expected in imports and the increase in imports ranges between 2%-3.2%, 3%-8.5% and 32%-100% in wheat, maize and sugar markets, respectively. Although the percentages in sugar market are quite high in absolute terms, their absolute value is lower than that of wheat and maize. The rise in wheat imports from the two main markets - the European Union and Russia - is about 3% each (Table A2). Maize imports rise between 3%-10% from Argentina and USA while they fall about 1% from Canada. Although lower in absolute terms, imports from the European Union also rise about 7%. Sugar is imported mainly from Brazil and it shows an increase of about 30%-100%.

The budget burden of the two alternative scenarios is given in Table 4. The cost of rising the price premium is larger than the lost tariff revenue and it is observed that in the second scenario gains in terms of imported supply for per unit tariff reduction are greater compared to domestic supply increase for per unit premium increase. One should be careful about interpreting import rise in sugar beet. Although the percentage is high it is quite small in absolute value (Table A2).

Table 4. Budget Burden.

	Scenario 1				Scenario 2			
	Budget Burden (000 $)	Change in Production -%			Budget Burden (000 $)	Change in Imports -%		
		Wheat	Maize	Sugar beet		Wheat	Maize	Sugar beet
2013	216,583	1.26	1.31	0.79	64,678	2.13	3.05	32.5
2014	274,235	1.49	1.50	1.06	78,318	2.12	4.12	50.0
2020	546,511	2.07	2.95	2.22	144,883	3.26	8.50	100.0

Distributional impacts of scenarios are calculated by using price multipliers derived from agriculture focused SAM and findings are given through Tables 5, 6, 7 and A3. While Tables 5 and A3 provide empirical findings regarding the changes in agricultural land, Table 6 presents the effects due to the change in production and finally Table 7 shows income effects due to changes in labour income. As SAM is a static platform we run simulations in years 2013 and 2020, and present the results for rural areas only[13].

[12] Conversion of tariff reductions to reflect their impact on price vector in the SAM: t_m in $P_d = P_w(1 + t_m)$ gives us the tariffs as the difference between domestic and world price, P_d and P_w. Domestic and imported products are assumed to be homogenous and P_w is assumed to be 1. Hence world price is derived as $P_w = P_d/(1 + t_m)$ and change in domestic price due to a tariff change is given as in $\Delta P_d = \left(\frac{1}{1+t_m}\right) - 1$.

[13] In general a significant change in technology matrix in the I-O is not expected in short-term. Therefore, an income and/or price multiplier analysis through the use of SAM is not appropriate and we prefer to derive long-term simulation effects due to the fact inter-industry relations are adopted from I-O matrix.

Table 5. Income effect sourced by agricultural lands-transfer effect (million TL)*.

Rural	2013						2020					
	Scenario 1			Scenario 2			Scenario 1			Scenario 2		
	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet
Land Payments < 21 da	0,08	0,34	1,58	-0,79	-2,41	-	0,40	1,38	4,36	-1,19	-4,13	-
Land Payments < 51 da	0,17	0,74	3,41	-1,71	-5,17	-	0,85	2,96	9,36	-2,56	-8,87	-
Land Payments < 101 da	0,06	0,28	1,27	-0,64	-1,93	-	0,32	1,10	3,49	-0,95	-3,30	-
Land Payments > 100 da	0,01	0,03	0,16	-0,08	-0,24	-	0,04	0,14	0,44	-0,12	-0,41	-

* Annual average exchange rate (TL/USD) is 1.90 and it is assumed to stay constant till 2020.

After the increase in price premiums (1st Scenario), in both years the main production increase is experienced in sugar beet followed by maize and wheat (Table 6). These findings are consistent with those regarding the change in agricultural lands, given in Table 5. It is observed that majority of the farms sown for wheat, maize and sugar beet are between 2 ha and 5 ha, followed by farm sizes smaller than 2 ha and then sizes between 5 ha and 10 ha. Therefore the main income rise occurs for the farmers producing wheat, maize and sugar beet who own farm areas between 2 ha and 5 ha. In Table 6 we also observe the distribution of agricultural income created by the production rise. For all products income mainly goes to low qualified labour while the share accruing to unqualified labour is very small. The remaining part goes to qualified labour force.

After the fall in tariffs (2nd Scenario), in both years we expect a fall in domestic prices due to two reasons. First, rising imports would create a rise in excess supply and this might put downward pressure on domestic prices. However, this might not be the case if the import rise is just enough to compensate for the rising bio-ethanol demand. Secondly, tariffs maintain the difference between word and domestic prices and lowering tariffs might also lower domestic prices as well. Rising imports causes a fall in domestic production yielding a further fall in incomes (Table 5). The income loss mostly accrues to maize producers and to farmers whose area is in the range of 20%-50% ha. This is followed by the farmers whose area is less than 2 ha. The distribution of income fall among household classes is provided in Table A3. In both years, among the income groups, the farmers work for their own account and wage/salary earners loose the most, followed by unemployed. As expected the majority of losers plant area between 2-5 ha. In Table 6 we also observe the change in incomes of various labour classes due to the fall in production. For all products income loss mainly accrues to low qualified labour and the share of unqualified labour is very small, while the rest accrues to qualified labour force as in the 1st Scenario.

Table A3 and 7 summarizes the distributional impacts among household groups after the increase in land use and labour demand respectively. As explained before in Scenarios 1/2 main income gain/loss is experienced by farmers whose production area is between 2 ha and 5 ha and among these households the ones who work on their own account and the group work on wages get the majority of the income gain/loss. These two groups

Table 6. Payments to labour force sourced by production increase-Open loop effect (million TL)*.

Rural	2013						2020					
	Scenario 1			Scenario 2			Scenario 1			Scenario 2		
	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet	Wheat	Maize	Sugar beet
Unqualified	0,00	0,01	0,04	-0,02	-0,05	-	0,01	0,03	0,11	-0,02	-0,09	-
Low Qualified	0,03	0,13	0,72	-0,29	-0,92	-	0,14	0,53	1,99	-0,43	-1,58	-
Qualified	0,02	0,07	0,40	-0,16	-0,52	-	0,08	0,30	1,11	-0,24	-0,90	-
Total	0.05	0.21	1.16	-0.47	-1.49	-	0.23	0.86	3.21	-0.69	-2.57	-

* Annual average exchange rate (TL/USD) is 1.90 and it is assumed to stay constant till 2020.

Table 7. Household income effect sourced by labour income-Open loop effect (million TL)*.

Rural	2013		2020	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Unemployed	0,09	-0,13	0,28	-0,21
Wages/Salaries	0,16	-0,22	0,49	-0,37
Daily Paid	0,03	-0,04	0,09	-0,06
Employer	0,03	-0,04	0,09	-0,07
Own Account	0,21	-0,29	0,64	-0,49
Unpaid Family Workers	0,00	-0,00	0,01	-0,01

* Annual average exchange rate (TL/USD) is 1.90 and it is assumed to stay constant till 2020.

are followed by unemployed workers. Labour income is also distributed in the same way in both years. Given the fact that majority of agricultural production is done on areas between 2-5 ha (TUIK, 2004) and about 40% and 23% of agricultural income in rural areas accrues to the ones who work on his/her own account and to paid labour force respectively (TUIK, 2011), we think it is quite likely that an increase/decrease in agricultural income should affect more small land owners/farmers and the mentioned income groups.

5. Conclusion and policy implications

Bio-ethanol blending target was introduced mostly to cope with the rising gas emissions and energy bill in Turkey; however the area of influence of this target is multi-dimensional. Hence, discussing the sustainability and feasibility of this target requires a deeper look into all dimensions.

In Turkey the agricultural sector has been supported and subsidized in significant amounts for the last 60 years and beginning in 2000s main policy instruments used to support the sector have shifted towards more decoupled policies aligned with the impositions of the WTO agreements. However, the financial burden of this support especially on government budget has been always questioned and criticized by policy makers and sometimes by academics. Another long lasting problem for Turkish economy is the growing overall trade deficit and recently the agricultural sector contributed increasingly to this deficit in spite of the wide range of products grown on large agricultural lands in Turkey. Moreover, rising rural unemployment and dominance of small scale producers are also important factors in Turkey yielding fluctuations in rural income and low agricultural productivity. Last but not the least rising imported energy demand and cost, and rising difficulty in achieving food security are also problems highly related to the overall economy and population growth.

The bio-ethanol blending targets planned to decrease the CO_2 emissions particularly sourced by transportation sector in Turkey seem to be influential without any doubt. In the last 25 years, the average share of transportation in overall CO_2 emissions is about 17% and more than 90% belongs to land transportation[14]. When the average annual road fuel consumption is considered, it is observed that 17% of total emissions is caused by the use of more than 2 million liters of road fuel. Therefore, both policy scenarios create at least a decrease between 2% and 3% in transportation based CO_2 emissions. However, a more significant decrease (about 8%) requires a more rigid target such as the one in the extreme target case (10% in 2020). This shift to bio-ethanol also creates a fall in road fuel imports between 300.000-500.000 thousand tons (when the target is set between 2%-3%) which rises almost to 1.5 million tons with the rising blending rate up to 10%[15]. In terms of the impact on import bill and trade deficit, this shift might cause a fall between 1.1%-7% in total cost of road fuel imports and a fall of about 30% in trade deficit[16].

When it comes to the cost of the blending target, significance of suggesting different policy scenarios and/or policy instruments is seen. If price premiums are used as the main policy instrument, the additional cost changes between 1.5%-3.5% of total agricultural support depending on the target blending rate. In addition extra premiums create an additional 0.02%-0.07% rise on the share of total agricultural support in government central budget outlays (Demirdöğen *et al.*, 2012). However if import tariff reductions are used as policy instrument, agricultural support and its share in government budget do not change but instead a decrease in tariff revenues is experienced between 1/3-1/4 of the extra premium payments in the first scenario depending on the target blending rates. Apparently, the reduction of tariff rate is less costly to the government but deteriorates agricultural and overall trade deficit. The rise in sugar beet imports is ignorable in both scenarios, but the increase in imports of wheat and maize especially in second scenario creates a rise between 2%-15% in cereals trade deficit, depending on the blending rate. Nevertheless, because the simulations do not allow for current consumption pattern to change we do not expect a significant change in food security in the country.

The other variable that the two scenarios affect in opposite direction is the agricultural income created through the use of both land and labour. While there is an increase in transfers to producers with the rise in price premiums, there is negative transfer after the tariff reduction due to the rising imports and total supply. Therefore, unless there is

---

[14] http://www.tuik.gov.tr/PreHaberBultenleri.do?id=10829.
[15] http://www.tuik.gov.tr/PreTablo.do?alt_id=1046.
[16] http://www.tuik.gov.tr/PreTablo.do?alt_id=1046.

a policy precaution in place, the second scenario might create an excess capacity in rural areas both in the form of unemployed labour and unused fertile land. However, the first scenario has the opposite impact both on agricultural land use and rural labour force. The trade-off is between a relatively higher transfer from government budget to agricultural producers in the first scenario, and a lower transfer both from rural households and government to importers of agricultural products, in the second.

To conclude, based on the current domestic production capacity in wheat, maize and sugar beet, decreasing the imported energy bill and CO_2 emissions through bio-ethanol blending ratio as policy instrument seems to be feasible. However, to make it sustainable, first the blending rates should be reached by reducing import tariffs rather than providing price premiums and second new policies should be in place to promote alternative job opportunities in the rural areas. Otherwise with the reduction in tariffs there will be an excess of land and labour in rural areas indicating an inefficient economic situation. For example, social security can be provided for a certain period to those who become unemployed and farmers can be moved to produce alternative crops, and/or development of agriculture related processing industries could be promoted. In fact shifting this excess labour to alternative job opportunities might increase productivity in the agricultural sector. While tariff reductions are not contradictory to the WTO impositions, food security would not deteriorate from these reductions. In addition, it is possible that first small scale producers would exit the market due to rising imports. In any case putting a sole blending rate target would not solve problems automatically. Because the issue is multi-dimensional a fundamental policy package that deals with all dimensions is needed.

6. Acknowledgements

This research was funded by Agricultural Economics and Policy Development Institute, Ministry of Food, Agriculture and Livestock, Turkey. The authors are grateful to the Institute for providing this opportunity.

References

Armington, P.S. (1969). A Theory of Demand for Products Distinguished by Place of Production. IMF Staff Papers 16(1): 159-178.

Banse, M., van Meijl, H., Tabeau, A. and Woltjer, G. (2008). Impact of EU Bio-fuel Policies on World Agricultural and Food Markets. Paper presented at the 107th Seminar, Seville, Spain, January 30-February 1.

Bhutto, N. and Çağatay, S. (2010). Measuring Sectorial Share of Green House Gases (Ghgs) Emissions from Fossil Fuel Consumption and Offering Solutions: The Case of Turkey. In Maria Llop (ed.), The Air Pollution: Economic Modeling and Control Policies, Chapter 2, Bentham Books.

Birur, D.K., Hertel, T.W. and Tyner, W.E. (2008). Impact of Bio-fuel Production on World Agricultural Markets: A Computable General Equilibrium Analysis. GTAP Working Paper. No. 53, Purdue Uni.

Çağatay, S. and Saunders, C. (2003a). Lincoln Trade and Environment Model (LTEM): Linking Trade and the Environment. Agribusiness and Economics Research Unit Research Papers No: 263, New Zealand, Lincoln University, Commerce Division.

Çağatay, S. and Saunders, C. (2003b). Lincoln Trade and Environment Model (LTEM): An Agricultural Multi-Country, Multi-Commodity Partial Equilibrium Framework. Agribusiness and Economics Research Unit Research Papers. No: 254 New Zealand, Lincoln University, Commerce Division.

Çağatay, S., Taşdoğan, C. and R. Özeş, R. (2013). Türkiye'nin Yakıt Tüketiminde Biyo-dizel Kullanım Hedeflerinin Etki Analizi (Impact Assessment regarding Bio-Diesel Consumption Targets in Turkey). Ekonomik Yaklaşım 24(87): 37-68.

Çağatay, S., Taşdoğan, C. and Özeş, R. (2012). Türkiye Akaryakıt Tüketiminde Biyo-Yakıt Kullanım Hedeflerine Yönelik Etki-Değerlendirme Analizi: Sektörel ve Bölüşüm Etkileri (Impact Assessment regarding Bio-Fuel Consumption Targets in Turkey: Sectoral and Distributional Impacts). TEPGE, Gıda, Tarım ve Hayvancılık Bakanlığı, Ankara.

Çağatay, S., Kıymaz, T., Koç, A., Bölük, G. and Bilgin, D. (2012). Dünya'da ve Türkiye'de Biyo-enerji Piyasalarına İlişkin Gerçekleşen Gelişmelerin ve Olası Değişikliklerin Türk Tarım ve Hayvancılık Sektörleri Üzerindeki Etkilerinin Modelenmesi ve Türkiye Biyo-enerji Piyasaları için Politika Önerileri Geliştirilmesi (Modeling the Impact of Developments and Potential Changes in World and Turkey's Bioenergy Markets on Turkey's Crop and Livestock Sectors and Producing Alternative Bioenergy Policies for Turkey). TEPGE, Gıda, Tarım ve Hayvancılık Bakanlığı. No: 204, June, Ankara.

Colman, D. (1983). A Review of the Arts of Supply Response Analysis. *Review of Marketing and Agricultural Economics* 51(3), December.

Defourny, I. and Thorbecke, E. (1984). Structural Path Analysis and Multiplier Decomposition within a Social Accounting Matrix Framework. *Economic Journal* 94: 111-136.

Demirbaş, A. (2009). Political, Economic and Environmental Impacts of Bio-Fuels: A Review. *Applied Energy* 86: 108-117.

Demirdöğen, A., Ören, M.N. and Alemdar, T. (2012). Agricultural Support in Turkey and Rural Poverty (in Turkish). Paper presented at the 10th National Agricultural Economics Congress, Konya, 5-7 September.

Diaz-Chavez, R.A. (2011). Assessing Bio-Fuels: Aiming for Sustainable Development or Complying with the Market? *Energy Policy* 39(10): 5763-5769.

Dufey, A. (2006). Bio-Fuels Production, Trade and Sustainable Development: Emerging Issues. International Institute for Environment and Development, London.

EİE. (2011). Renewable Energy (in Turkish). www.eie.gov.tr_. Accessed after October 1, 2012.

Ertaş, M. (2010). Biyoetanol Üretimi için Tarımsal Atıkların Enzimatik Hidroliz Yöntemi ile Şekerlere Dönüştürülmesi, Bursa Teknik Üniversitesi, http://depo.btu.edu.tr/dosyalar/sanayi/Dosyalar/MURAT_ERTAS.pdf.

Fonseca, M.B., Burrell, A., Gay, S.H., Henseler, M., Kavallari, A., M'Barek, R., Domínguez I.P. and Tonini, A. (2010). Impacts of the EU Bio-Fuel Target on Agricultural Markets and Land Use: A Comparative Modeling Assessment. Institute for Prospective Technological Studies, EUR 24449 EN.

Hatunoğlu, E. (2010). Biyo-yakıt Politikalarının Tarım Sektörü Üzerine Etkileri. Expert dissertation, The State Planning Office. Ankara.

Janssen, R. and Rutz, D.D. (2011). Sustainability of Bio-Fuels in Latin America: Risks and Opportunities. *Energy Policy* 39(10): 5717–5725.

Kehoe, T.J. (1991). Computation and Multiplicity of Equilibria. In W. Hildenbrand and H. Sonnensschein (eds.), Handbook of Mathematical Economics Volume IV, North-Holland.

PMBD. (2013). Regulation, Board Decisions, Petroleum Law, Petroleum Market Board Decisions (in Turkish). http://www.epdk.gov.tr/mevzuat/kurul/petrol.htm . Accessed after October 1, 2012.

Pyatt, G. and Round. J. (1979). Accounting and Fixed Price Multipliers in a Social Accounting Matrix Framework. *Economic Journal* 89: 850-873.

Rajagopal, D. and Zilberman, D. (2007). Review of Environmental, Economic and Policy Aspects of Bio-fuels. Policy Research Working Paper. World Bank.

Ravindranath, N.H., Lakshmi, C.S., Manuvie, R. and Balachandra, P. (2011). Bio-Fuel Production and Implications for Land Use, Food Production and Environment in India. *Energy Policy* 39(10): 5737-5745.

Roland-Host, D.W. and Sancho, F. (1995). Modelling Prices in a SAM Structure. *Review of Economics and Statistics* 77 (2): 361-371.

Saunders, C. and Çağatay, S. (2003). Commercial Release of GM Food Products in

New Zealand: Using a Partial Equilibrium Trade Model to Assess the Impact on Producer Returns in NZ. *Australian Journal of Agricultural and Resource Economics* 47 (2): 233-259.

Saunders, C., Wreford, A. and Çağatay, S. (2006). Trade Liberalization and Greenhouse Gas Emissions: The Case of Dairying in the EU and New Zealand. *Australian Journal of Agricultural and Resource Economics* 50(4): 538-555.

Saunders, C., Kaye-Blake, W. and Çağatay, S. (2008). Genetic Modification Technology and Producer Returns: The Impacts of Productivity, Preferences and Technology Uptake. *Review of Agricultural Economics* 30(4).

Stone, R. (1985). The Disaggregation of the Household Sector in the National Accounts. In Pyatt, G. and Round, J.I. (eds.), The Social Accounting Matrices: A Basis for Planning, The World Bank, Washington, 145-185.

Sigwele, K.H. (2007). The effects of International Trade Liberalization on Food Security and Competitiveness in The Agricultural Sector of Bostwana. Ph.D. dissertation. Faculty of Natural and Agricultural Sciences, University of Pretoria, South Africa.

Taşdoğan, C., Çağatay, S. and Şahinöz, A. (2010). 2001-2008 Yıllarında Türkiye'de Uygulanan Alternatif Tarım Politikalarının Gelir Çarpan Analizi ve Politika Önerileri (Income Multiplier Anaylsis regarding Alternative Agricultural Policies Applied in Turkey over 2001-2008 Period and Police Suggestions. Akdeniz University Economics and Administrative Sciences Journal 19.

Timilsina, G.R., Beghin, J.C., van der Mensbrugghe, D. and Mevel, S. (2010). The Impacts of Bio-fuel Targets on Land-Use Change and Food Supply. The World Bank Policy Research Working Paper No. WPS5513.

TMMOB (Chamber of Mechanical Engineers in Turkey). (2012). Türkiye'nin Enerji Görünümü (An Overview of Energy in Turkey), Research Report No: MMO/588, April.

TÜİK. (2004). 2001 Genel Tarım Sayımı (General Agricultural Census). www.tuik.gov.tr. Accessed after October 1, 2012.

TÜİK. (2011). Hanehalkı Bütçe Anketi Mikro Veri Seti 2010 (Household Bedget Survey-Micro Data Set). www.tuik.gov.tr. Accessed after October 1, 2012.

TUIK. (2014). http://www.tuik.gov.tr/PreHaberBultenleri.do?id=10829. Accessed after October 1, 2012.

Walter, A., Dolzan,P., Quilodrán, O., de Oliveira, J.G., da Silva, C., Piacente, F. and A. Segerstedt. (2011). Sustainability Assessment of Bio-Ethanol Production in Brazil Considering Land Use Change, GHG Emissions and Socio-Economic Aspects. *Energy Policy* 39(10): 5703–5716.

Wooldridge, J.M. (2002). Econometric Analysis of Cross Section and Panel Data, MIT Press.

Annex

Table A.1. Producer price ($/ton), production, feed demand, total imports, total exports (quantities are in 000 tons).

	Base Scenario					Scenario 1					Scenario 2				
	2013	2014	2015	2016	2020	2013	2014	2015	2016	2020	2013	2014	2015	2016	2020
ppWH	404	398	393	388	371	410	406	401	397	384	403	398	393	388	371
ppMZ	307	303	299	295	281	317	314	310	307	302	307	303	299	295	281
ppSU	481	481	481	481	481	501	506	506	506	534	481	482	482	482	482
qpWH	19,275	19,578	19,908	20,243	21,559	19,519	19,871	20,221	20,572	22,005	19,283	19,606	19,917	20,251	21,559
qpMZ	5,021	5,154	5,288	5,422	5,964	5,087	5,231	5,372	5,512	6,139	5,021	5,154	5,292	5,425	5,960
qpSU	2,858	2,890	2,923	2,956	3,087	2,880	2,921	2,955	2,988	3,156	2,858	2,890	2,923	2,956	3,087
qfWH	982	1,005	1,030	1,054	1,146	986	1,011	1,035	1,060	1,154	983	1,008	1,031	1,055	1,149
qfMZ	2,684	2,750	2,820	2,889	3,145	2,680	2,747	2,816	2,883	3,144	2,689	2,762	2,826	2,895	3,167
qmWH	4,036	4,196	4,355	4,516	5,159	4,024	4,181	4,339	4,497	5,135	4,122	4,285	4,448	4,612	5,327
qmMZ	1,443	1,504	1,564	1,625	1,870	1,430	1,488	1,547	1,606	1,846	1,487	1,566	1,628	1,692	2,029
qmSU	59	60	60	61	64	59	60	60	61	64	78	90	91	92	128
qxWH	13	13	14	14	16	13	13	14	14	15	13	13	14	14	16
qxMZ	19	19	20	21	23	19	19	20	20	23	19	19	20	21	23
qxSU	7	7	7	8	9	7	7	7	8	9	7	7	7	8	9

WH: wheat; MZ: maize; p SU: sugar beet; p: producer price; qp: production; qf: feed demand; qm: total imports; qx: total exports.

Table A.2. Bilateral imports (000 tons).

	Base Scenario					Scenario 1					Scenario 2				
	2013	2014	2015	2016	2020	2013	2014	2015	2016	2020	2013	2014	2015	2016	2020
qcCANWH	197	205	212	220	252	196	204	212	219	250	196	204	212	219	250
qcCHNWH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
qcEURWH	1,015	1,055	1,095	1,136	1,297	1,012	1,051	1,091	1,131	1,291	1,038	1,079	1,120	1,161	1,342
qcRUSWH	1,884	1,958	2,033	2,108	2,408	1,878	1,951	2,025	2,099	2,396	1,927	2,003	2,079	2,156	2,492
qcUSAWH	31	32	33	35	40	31	32	33	35	39	31	32	33	35	39
qcROWWH	910	946	982	1,018	1,163	907	942	978	1,013	1,157	930	967	1,004	1,041	1,203
qcARGMZ	417	434	452	470	540	413	430	447	464	533	432	455	473	492	593
qcCANMZ	149	155	162	168	193	148	154	160	166	191	148	154	160	166	190
qcEURMZ	43	45	47	49	56	43	45	47	48	56	45	47	49	51	62
qcRUSMZ	13	13	14	14	16	13	13	14	14	16	13	13	14	14	16
qcUSAMZ	505	526	547	568	654	500	520	541	562	646	523	551	573	595	718
qcROWMZ	316	329	342	356	409	313	326	339	352	404	327	345	358	373	449
qcBRASU	44	45	45	46	48	44	45	45	46	48	62	72	73	74	106
qcEURSU	5	5	5	5	5	5	5	5	5	5	7	8	8	8	11
qcINDSU	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
qcROWSU	7	7	8	8	8	7	7	8	8	8	7	7	7	8	8

ARG: Argentina; BRA: Brazil; CAN: Canada; CHN: China; EUR: European Union; IND: India; ROW: Rest of the World; RUS: Russia; USA: United States of America

Table A3. Household income effect sourced by agricultural lands-Open loop effect (million TL).

Rural	2013							
	Scenario 1				Scenario 2			
	Lands < 2.1ha	Lands < 5.1ha	Lands < 10.1ha	Lands > 10.0ha	Lands < 2.1ha	Lands < 5.1ha	Lands < 10.1ha	Lands > 10.0ha
Unemployed	0,10	0,21	0,08	0,01	-0,15	-0,33	-0,12	-0,02
Wages/Salaries	0,17	0,36	0,13	0,02	-0,27	-0,58	-0,21	-0,03
Daily Paid	0,03	0,06	0,02	0,00	-0,05	-0,10	-0,04	-0,00
Employer	0,03	0,07	0,03	0,00	-0,05	-0,11	-0,04	-0,01
Own Account	0,22	0,48	0,18	0,02	-0,35	-0,76	-0,28	-0,04
Unpaid Family Workers	0,00	0,01	0,00	0,00	-0,01	-0,01	-0,00	-0,00
Rural	2020							
	Scenario 1				Scenario 2			
	Lands < 2.1ha	Lands < 5.1ha	Lands < 10.1ha	Lands > 10.0ha	Lands < 2.1ha	Lands < 5.1ha	Lands < 10.1ha	Lands > 10.0ha
Unemployed	0,10	0,21	0,08	0,01	-0,25	-0,55	-0,20	-0,03
Wages/Salaries	0,17	0,36	0,13	0,02	-0,44	-0,96	-0,36	-0,04
Daily Paid	0,03	0,06	0,02	0,00	-0,08	-0,17	-0,06	-0,01
Employer	0,03	0,07	0,03	0,00	-0,09	-0,19	-0,07	-0,01
Own Account	0,22	0,48	0,18	0,02	-0,59	-1,26	-0,47	-0,06
Unpaid Family Workers	0,00	0,01	0,00	0,00	-0,01	-0,02	-0,01	-0,00