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A Game Theoretic Analysis of Turkey's Integration into the European Union

INTRODUCTION

Turkey's quest for membership of the European Union (EU) has a long history, dating originally from the first application in 1959. The resulting negotiations led to the Ankara Agreement, creating an association between Turkey and the EC. The aim was to promote continuous commercial and economic relations between the two economies. To achieve this objective, the agreement established three stages: preparatory, transitional and final. The first stage, which included the provision of concessions from the EC to Turkey, began in 1964 and ended in 1969. From 1970, the second stage covered a 12-year transitional period, during which reciprocal concessions were made. Although the final stage was planned to start in 1995, the outcome of this process is still problematic (GATT, 1994).

While the political and economic conditions necessary for Turkey's accession have not yet been satisfied, the Luxembourg summit reaffirmed Turkey's eligibility to join the EU on the same basis as the other applicant states (Eurecom, 1998). To this end, the European Council has specified three areas it considers necessary for Turkish admittance to the Union: (a) intensification of the EU–Turkey Customs Union, (b) implementation of financial cooperation, and (c) approximation of Turkish laws to those of the EU (ibid.). The EU–Turkey Customs Union, which came into effect in January of 1996, guarantees the free circulation of industrial goods and *processed* agricultural products. Although basic agricultural products are excluded from the treaty, Turkey is progressively adopting many aspects of the Common Agricultural Policy (Republic of Turkey, 1994). The future inclusion of agriculture would increase the intensity of the EU–Turkey Customs Union and contribute towards Turkey's meeting the necessary conditions for EU admittance.

International agricultural trade negotiations, such as those between the EU and Turkey, reflect the linkages between domestic farm policies and agricultural protection. The recent agricultural negotiations conducted within the Uruguay Round of GATT highlighted several interdependencies. As Turkey and various other countries lobbied to form agreements with the EU, the potential trade effects were seen to influence the decisions of agricultural

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policy makers around the world. EU officials had to consider increased possibilities for production, shifts in consumer demand and preferences, and the potential interest group coalitions that might result from Turkish accession.

Scenarios of this type are examples of the problems that exist in analysing agricultural trade negotiations as the result of trade policy interdependence (Kennedy *et al.*, 1996). Countries considering the ratification of both bilateral and multilateral trade agreements must consider the results of their choices with respect to the policies of other countries. In addition, countries weighing the prospects of regional trade agreements must consider the reaction of cooperating countries and the rest of the world as they negotiate with prospective partners.

The impact of these interrelationships between countries raises questions as to how agricultural policies are formulated, given the reactions of other countries. Policy makers often have some knowledge of the response their new policies will induce among other nations. Rational countries will formulate agricultural policy based on the expected reactions of other relevant countries. As a result, game theory can provide a useful framework for analysing agricultural policy decisions, given the interdependence of agricultural policy.

In an interdependent world, agricultural policies affect both domestic and international markets. As a result, it is beneficial to know both the desired goal and potential consequences of various policy stances. The objective of the research presented here is to examine the effects of liberalized trade combined with Turkish accession to the European Union. Particular emphasis is placed on the impact of these policy changes on trade in agricultural products. The empirical analysis will involve ten agricultural products which play a significant role in Turkey and the European Union in terms of production or consumption. They are corn, cotton, oilseeds, rice, sugar, tobacco, wheat, dairy milk, lamb and poultry.

To accomplish these objectives use is made of a partial equilibrium trade simulation model, Modèle International Simplifié de Simulation (MISS) (Mahé *et al.*, 1988). MISS is a partial equilibrium trade model that simulates, in a comparative static framework, the effects of various policy decisions. In order to initialize the MISS model, data, composed of prices, protections, quantities and elasticities, were gathered from a number of sources, including the European Commission (1995), FAO (1996a, 1996b), OECD (1999), Turkish Ministry of Agriculture (1999) and USDA (1989, 1996).

Once the model is initialized, simulations are conducted that mirror the effects of the Uruguay Round agricultural agreement, Agenda 2000, and alternative levels of Turkish integration into the European Union. To mirror the policy decisions of the respective governments, consumer, producer and government budget weights, as components of a political preference function (PPF), are estimated, based on 1995 producer and consumer subsidy equivalents. These weights, when combined with the net gains or losses to producers, consumers and government, reflect the net gains or losses to the economies as perceived by policy makers. The PPFs resulting from the various scenarios are then evaluated in a game theoretic framework to determine a Nash equilibrium solution.

THEORETICAL FRAMEWORK

This analysis is based on a multi-commodity model of agriculture first developed by Mahé *et al.* (1988). Subsequently, a political economic submodel was added (Johnson *et al.*, 1993) and other modifications were made (Kennedy *et al.*, 1996). In the model, N commodities are produced, consumed and traded by two main countries, Turkey and the European Union, and the rest of the world. Governments intervene in domestic markets either through the use of price (π) or supply/demand shift (θ) instruments. Price instruments, denoted as $A_{ik}^{\pi S}$ for producers and $A_{ik}^{\pi Q}$ for consumers of commodity i in country k, affect the prices observed by the supply and final demand sectors. With the world price of commodity i represented as P_i^W, the domestic price functions for country k are:

$$P_{ik}^S = P_{ik}^S\left(A_{ik}^{\pi S}, P_i^W\right) \text{ and } P_{ik}^Q = P_{ik}^Q(A_{ik}^{\pi Q}, P_i^W), \text{ for } i = 1,2,\ldots,N \qquad (1)$$

Supply/demand shift instruments, denoted as $A_{ik}^{\theta S}$ for producers and $A_{ik}^{\theta Q}$ for consumers of commodity i in country k, are implicit elements of exogenous variable vectors X_k^S and X_k^Q.

Throughout the process of agricultural policy formulation the welfare effects of various actions are taken into account by the government. Policy makers behave as though they are using a weighting system to compare the gains of certain groups versus the losses of others. In order to model this behaviour, a political preference function (PPF) is used. The PPF, a weighted, additive function of producer quasi-rents, consumer utility and budget costs, is the objective function which, through their policy choices, policy makers behave as though they seek to maximize. The weights are based on observed policies.

Several studies have estimated PPF weights for game theoretic analyses of this type. Rausser and Freebairn (1974) apply the PPF method to the case of US beef imports. Johnson *et al.* (1993) conduct an empirical analysis using the PPF, measuring the role of special interests in the USA and the EU. Similarly, Kennedy *et al.* (1996) modelled agricultural trade policy interdependence using a game theoretical framework and PPF. Their model distinguishes between the EU, the USA and a politically passive rest of the world. More recently, Abler and Sukhatme (1998) modelled the determinants of Indian wheat and rice policy using the PPF. They then examined policies towards international trade, grain procurement, public grain distribution and production inputs.

However, for this game to be well defined in extensive form, a number of conditions must hold (Bullock, 1994; von Cramon-Taubadel, 1992). These include knowledge of the welfare functions which map instruments to well-being, that the observed strategies be Pareto optimal for the given weights, and that the set of feasible welfare outcomes be compact and convex over the domain of policy instruments. To minimize these problems, the current analysis uses PPF weights based on the producer and consumer subsidy equivalents observed in the base period, 1995. Interest group weights for producers and consumers are calculated as percentage PSEs and an aggregate weighted CSE, respectively.

Let $-k$ denote the other main country while the actions of country k are represented by $A_k = \{A_k^{\pi S}, A_k^{\pi Q}, A_k^{\theta S}, A_k^{\theta Q}\}$. Producers are grouped according to commodities with their welfare defined as the profit obtained through the production and marketing of that commodity. Producer quasi-rents, consumer utility and the budget of country k are expressed as functions of government policies in the following equations:

$$_{-k}(A_k, A_{-k}) = \Pi_k\{P_k^S[A_k^{\pi S}, P^W(A_k, A_{-k})], A_k^{\theta S}\} \tag{2}$$

$$U_k(A_k, A_{-k}) = U_k\{P_k^Q[A_k^{\pi Q}, P^W(A_k, A_{-k})], A_k^{\theta Q}\} \tag{3}$$

$$B_k(A_k, A_{-k}) = B_k\{P_k^S[A_k^{\pi S}, P^W(A_k, A_{-k})], P_k^Q[A_k^{\pi Q}, P^W(A_k, A_{-k})] \tag{4}$$

$$P^W(A_k, A_{-k}), A_k^{\theta S}, A_k^{\theta Q}\}$$

The budget weight is normalized to one and the PPF, expressed as a function of government policies, is shown as

$$V_k(A_k, A_{-k}) = {}_{-k}(A_k, A_{-k}) \cdot \lambda_{Sk} + U_k(A_k, A_{-k}) \cdot \lambda_{Qk} + B_k(A_k, A_{-k}) \tag{5}$$

where λ_{Sk} is a strictly positive, $N \times 1$ vector that represents the relative political weights of the producer groups in country k, and λ_{Qk} is a strictly positive scalar representing the relative political weight of the consumer group in country k.

If the policy decision process of interdependent countries is to be modelled, a Nash equilibrium occurs where each country chooses its policy which maximizes its PPF, given the policy choice of the other. This equilibrium is defined using a *best response correspondence*. For a given A_{-k}, government k chooses A_k^*, one possible best response to A_{-k}, such that

$$V_k(A_k^*, A_{-k}) \geq V_k(A_k, A_{-k}), \text{ for all } A_k \in \mathbf{A}_k \tag{6}$$

where $\mathbf{A}_k$ is the set of all possible actions which can be employed by government k. Every A_{-k} element of $\mathbf{A}_{-k}$ has at least one A_k^* element of $\mathbf{A}_k$ which is a best response for country k. A Nash equilibrium is defined as the set of actions (A_k^*, A_{-k}^*) where A_k^* is a best response to A_{-k}^* for country k, and A_{-k}^* is a best response to A_k^* for country $-k$.

In this two-player, normal-form, non-cooperative game, defined by $G = \{\mathbf{A}_{TUR}, \mathbf{A}_{EU}; \mathbf{P}_{TUR}, \mathbf{P}_{EU}\}$, each country k chooses some action $A_k \in \mathbf{A}_k$ in order to maximize its PPF, given the action choices of the other country. The policy strategies analysed here are several different degrees of trade liberalization. The action space is defined by $\mathbf{A}_{TUR} = \{SQ_{TUR}, WTO_{TUR}, INT_{TUR}\}$ for Turkey and $\mathbf{A}_{TUR} = \{A2K_{EU}, WTO_{EU}, FT_{EU}\}$. Actions of Turkey are 'status quo' (SQ_{TUR}), protection reductions agreed to in the Uruguay Round of GATT (WTO_{TUR}) and integration into the European Union (INT_{TUR}). Actions of the European Union

TABLE 1 *Political pay-off function weights and their ranking by interest group for Turkey and the European Union, 1995*

	Turkey		European Union	
	Rank	Weight	Rank	Weight
Lamb	7	1.28	1	1.77
Milk	1	1.46	3	1.53
Corn	8	1.18	8	1.46
Wheat	10	1.04	5	1.49
Rice	6	1.30	7	1.47
Oilseeds	5	1.33	2	1.54
Cotton	9	1.08	6	1.48
Sugar	4	1.34	4	1.50
Tobacco	2	1.39	10	1.20
Poultry	3	1.36	9	1.29
Consumers	11	0.98	11	0.71

Source: OECD (1999).

are adoption of its Agenda 2000 policies ($A2K_{EU}$), protection reductions agreed to in the Uruguay Round of GATT (WTO_{EU}), and free trade (FT_{EU}). Two sets of game simulations are conducted, with the difference being the PPF weights used. The first utilizes PPF weights all equal to one, while the second uses PPF weights based on 1995 producer and consumer support levels (see Table 1).

The base solution for 1995 using PPF weights all equal to one is presented in Table 2. Within this bimatrix, each pair of numbers represents the pay-off for Turkey and the European Union, respectively, corresponding to a specific action. For example, the pay-off associated with both countries adopting their

TABLE 2 *PPF values for Turkey and European Union protection reductions using PPF weights of one, 1995*

	Turkey actions		
EU Actions	SQ_{TUR}	WTO_{TUR}	INT_{TUR}
$A2K_{EU}$	–5,386	55,398	–159,332
WTO_{EU}	–10,1066	49,1075	–24,1036
FT_{EU}	–42,1182	7,1171	85,1149*

Notes: The pair (P_{TUR}, P_{EU}) are the PPF for Turkey and the EU, respectively, measured in million $US. *The unique Nash equilibrium occurs at (INT_{TUR}, FT_{EU}).

WTO commitments for Turkey and the European Union (WTO_{TUR}, WTO_{EU}) are 49 and 1075, respectively. Within this game the European Union's action choice results in its choosing the row, while Turkey chooses the column through its actions. In determining the equilibrium solution to this game the concept of *iterative elimination of strictly dominated strategies* is utilized. Regardless of the action chosen by Turkey, through choosing the Agenda 2000 ($A2K_{EU}$) strategy the EU receives pay-offs that are strictly greater than what it could acquire by choosing an alternative strategy. Thus the dominated strategies, WTO_{EU} and $A2K_{EU}$, can be eliminated from consideration. This simplifies the selection process for Turkey. It now maximizes its pay-off given the remaining alternatives and will choose INT_{TUR}. Thus the unique Nash equilibrium solution to this game is found at the point (INT_{TUR}, FT_{EU}).

The second game simulation is similar to the first, with the exception that the PPF weights are no longer equal to one; they are based on 1995 producer and consumer subsidy equivalents. In this case, the European Union, once again, has a strictly dominant strategy (Table 3). However, in this case $A2K_{EU}$ is the strictly dominant scenario. Based on this, Turkey evaluates the pay-offs of 9, –36 and 117, choosing 117 which corresponds with the Integration (INT_{TUR}) scenario. Thus, in this case, the unique Nash equilibrium solution is found at the point (INT_{TUR}, $A2K_{EU}$).

TABLE 3 *PPF values for Turkey and European Union protection reductions using PPF weights derived from producer and consumer support levels, 1995*

	Turkey actions		
EU Actions	SQ_{TUR}	WTO_{TUR}	INT_{TUR}
$A2K_{EU}$	9, 972	–36, –958	117, –1049*
WTO_{EU}	30, –3741	–17, –3730	148, –3782
FT_{EU}	148, –16108	81, –16091	–410, –15951

Notes: The pair (P_{TUR}, P_{EU}) are the PPF for Turkey and the EU, respectively, measured in million $US. *The unique Nash equilibrium occurs at (INT_{TUR}, $A2K_{EU}$).

CONCLUSIONS

Through their actions, policy makers reveal their preferences with respect to various interest groups. This study utilizes these revealed preferences, in the form of producer and consumer subsidy equivalents, and uses them in weighting producer and consumer welfare as part of a political preference function. Since Turkey may join the EU, the economic integration of Turkey into the EU is modelled to measure the agricultural welfare change. Given this, the results

of this analysis are consistent with trade theory, which suggests that the benefits from trade will be maximized with free trade, provided that all sectors are weighted equally. The real world, however, appears to be more consistent with the second game, in which interest groups possess differing weights from the perspective of the polity, revealed through the amount of protection interest groups are able to garner through the political process. The resulting choice of Agenda 2000 ($A2K_{EU}$) as the optimal strategy of the EU lends credence to this choice of weights, given the recent ratification of Agenda 2000 by the EU.

The results have several welfare implications for producers, consumers, the government and Turkey–EU relations. It is clear that the WTO and further trade liberalization will have unfavourable impacts on several producer groups in Turkey. However, producer welfare increases when Turkey joins the EU. The reason for this increase is most likely the higher level of producer protection in the EU. This is reinforced given that, with integration, if the EU chooses free trade, Turkish producer welfare will decrease, owing to lower protection. With integration, however, the welfare of several producers, such as those growing wheat, increases significantly. But Turkish consumers will experience a dual impact. Since they depend heavily on wheat, increased support for the producer group assures an adequate supply of a strategic commodity. At the same time, if the increase in protection in the sector is transmitted to consumers, their real income will decrease.

A noticeable welfare increase in a traditional crop such as cotton may increase production and assure an adequate supply for the textile industry, which is a significant contributor to the Turkish economy and export market. On the other hand, another traditional product, tobacco, loses with integration because protection in the EU is lower than that of Turkey. This change in protection will have a negative effect on the welfare of producers, influence export markets and decrease export earnings.

Turkish consumers gain from trade liberalization. Since they spend a great deal of their income on food, liberalization increases their real income. However, with integration, consumers experience a loss in welfare due to the higher level of agricultural protection in the EU. This loss is eliminated only if the EU implements free trade. The optimal agricultural policy should account for the needs of low-income consumers as well as influential producer groups. In order to compensate consumers for the harm of increased food prices and other income-distorting policies, a welfare system could be introduced that is aimed at low-income consumers and subsidizes their food expenditures.

Turkish budgetary costs will increase as it joins the EU owing to the high level of budget expenses for producers, but decrease with the EU's free trade action. Turkey's high level of budget expenditures could result in further inflation. However, if Turkey is compensated by the EUs fund for agriculture for these expenses, the pressure can be lightened.

In designing agricultural policies, the welfare of both producer and consumer must be considered. In addition to seeking policies that are Pareto optimal between countries, policies can be designed that are optimal within them. Since agricultural policies often have multiple goals, multiple measures are also needed. The overall consistency of various measures must be moni-

tored to ensure they work as intended. In determining the domestic support levels, international markets must be considered. Changing world trade conditions and liberalization due to globalization put pressure on agricultural support and trade barriers. In the determination of policies, producer and consumer interests are critical. Subsidized food could be provided for low-income consumers. The selectivity of food subsidies is essential for both budgetary and equity considerations.

It is interesting to note that the Turkish choice of integration (INT_{TUR}) is not dependent on the weights used. In order to determine the dominance of this strategy, future simulations could be conducted over a broader range of weights and EU scenarios. It is also important to note that the EU does have a say regarding whether or not Turkey joins. Given the scenarios analysed here, the EU would improve its welfare if Turkey could be excluded. Thus future analyses should attempt to develop scenarios that would allow for this behaviour.

In considering multilateral trade agreements and integration with the EU, Turkey's policy decisions will affect manufacturing and services sectors in addition to agriculture. Future studies should consider other sectors in addition to agriculture in order to evaluate more completely Turkey's various policy actions. In addition, income distribution effects should be evaluated in these types of analyses, given that trade policies affect the distribution of welfare within an economy as it affects the welfare of various interest groups.

This study utilized a static partial equilibrium trade model to research the impacts of various agricultural trade policy actions of Turkey on producer and consumer welfare. However, it has limitations that must be considered in interpreting the results. One is that this analysis uses a partial equilibrium model, which considers the effects of various policy actions only in a specific sector. The interaction between sectors, such as agriculture, manufacturing and services, does not appear. General equilibrium studies consider the interaction between the sectors of an economy, such as factor mobilization, multisectoral input and output use and the overall welfare of an economy. Future studies can employ general equilibrium analyses to better understand these interactions.

An additional factor to be considered involves the theory of the model. This study uses a neoclassical approach in modelling. Recent advances involving new trade, new growth and economic geography theories offer many advantages over the neoclassical view, such as the benefit of free trade for developing countries and the role of trade restrictions on development. One of the most striking implications of new trade theory is that free trade can actually be damaging for developing countries because of the non-competitive nature of the international market. The implication of new trade theory shows itself in the determination of producer and consumer surpluses and choice of optimal trade policies in a game theoretical framework. On this basis, we could expect that, as Turkey chooses freer trade, its welfare could actually decrease.

Krugman's (1987) new theory of economic geography has interesting implications for Turkish agriculture. According to Krugman's assertions, we can expect that, in Turkey, traditional crops which have specific geographic and climatic requirements, such as cotton, tobacco and fruits, will have higher

production when Turkey joins the EU. This would occur because producers of these products in other European countries will give up production and producers in Turkey will supply most of the needs for the EU. On the other hand, it could be expected that, in animal products, such as beef, lamb and dairy, other EU countries that are more efficient in the production of these products will replace Turkish production. Therefore, from a geographic perspective, it is implied that production of cotton, tobacco and fruits in the new EU would be concentrated in Turkey. At the same time Turkey's animal production would migrate to other EU countries. It could also be the case that Turkey will be a significant centre for textile production in the new EU. The incomes of traditional crops, therefore, will increase relative to animal production. These changes would shift income among producer groups in Turkish agriculture.

When making political decisions, economic studies can help policy makers to review and choose various policy actions. However, it must be kept in mind that empirical analyses are not the only criteria that are considered in the policy-making process. That is increasingly more complex and includes demands by various interest groups. In making decisions, political, social and environmental factors must be considered in addition to economic factors. Future studies can address these issues and provide various perspectives that can be used in the policy process.

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