Turkish agriculture under structural adjustment

A general equilibrium analysis

Erol H. CAKMAK
A. Erinc YELDAN

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Erol H. CAKMAK and A. Erinc YELDAN**

L'agriculture turque confrontée à l'ajustement structurel. Analyse en termes d'équilibre général

Résumé – La Turquie s'est engagée en janvier 1980 dans un ambitieux programme d'ajustement structurel pour rééquilibrer ses comptes macroéconomiques et revitaliser un appareil productif à bout de souffle. Pendant des décennies, l'agriculture turque avait fonctionné sous un étroit contrôle de l'État. A la suite de la politique d'ajustement, le secteur s'est trouvé plongé dans un environnement économique devenu concurrentiel avec l'ouverture du pays aux importations, la détermination des prix par le marché et la baisse des subventions. La mise en œuvre de cette politique a eu des conséquences très dures pour le secteur agricole, où l'Etat a sérieusement réduit son intervention, tant en ce qui concerne le soutien des prix que leur contrôle.

L'évaluation des effets économiques du programme d'ajustement structurel sur l'agriculture turque est réalisée à l'aide d'un modèle d'équilibre général et d'un modèle micro-économique, multirégional et multimarché du secteur agricole. Ces modèles permettent de calculer le coût de l'ajustement pour le secteur et analysent les conséquences à moyen terme du projet "Anatolie Sud-Est", où l'État a engagé une politique d'investissements massifs.

Les simulations réalisées à l'aide du modèle d'équilibre général montrent l'importance des relations qui conditionnent la demande finale du pays. Ainsi, la demande finale agrégée baisse lorsque le gouvernement réduit son train de vie ou les transferts destinés aux ménages. Une telle situation entraîne des tensions inflationnistes, même si elle se traduit par l'effet inverse sur les marchés des produits et des facteurs. On peut aussi faire varier le taux de change pour rééquilibrer les comptes macroéconomiques. Avec les hypothèses faites, le modèle conclut à la nécessité d'une dévaluation. L'introduction de cette dévaluation dans le modèle sectoriel se traduit par une modification très nette de la répartition des productions en faveur des cultures d'exportation. La production de toutes les cultures diminue, sauf celle des cultures industrielles. De plus, il y a un développement des exportations au détriment de la consommation intérieure.

La modélisation montre que la politique d'ajustement structurel de la Turquie a été réalisée au prix d'une aggravation des disparités de revenu et d'une taxation de l'agriculture. D'autre part, elle met en évidence le conflit existant entre les objectifs de sécurité alimentaire et de promotion des exportations.

Mots-clés:
modèle d'équilibre général calculable, modélisation du secteur agricole, ajustement structurel, Turquie

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Abstract *– The economic effects of the post-1980 Turkish reform program on the agricultural sector are analysed using a two-level quantitative analysis : A CGE model of the domestic economy at the macro level is supplemented by a micro level, multi-market, multi-regional model of the agricultural sector. The modelling exercises investigate the burden of adjustment faced by the rural economy during the 1980s, and analyse the medium term consequences of a massive program of public investment known as the Southeastern Anatolia Project.*

The modelling analysis shows that the Turkish reform program relied heavily on a worsening income distribution and increased agricultural taxation and reveals that there was a significant trade-off between food security and the export promotion targets.

Key-words:
CGE modelling, agricultural sector modelling, structural adjustment, Turkey

* *Department of Economics, Bilkent University, 06533 Bilkent, Ankara, Turkey.*

TURKEY embarked upon an ambitious structural adjustment program in January, 1980 in an attempt to restore its macro balances and revitalize its worn out production capacity. The stated objective of this program was to integrate the domestic economy with the world economy at large through a reorientation of production incentives towards the export sector. The theoretical basis of the reform package is that in order to obtain the optimum resource allocation in an economy, the domestic price system should reflect undistorted world (efficiency) prices and furthermore, that capital accumulation should be based on private producers' profit maximization. To restore macro balances, the reform program was based on the orthodox prescription of domestic credit restraint in order to control excess commodity demand. Accordingly, after 1980, the Turkish authorities embarked upon an adjustment program, in several phases, aimed primarily at controlling the growth of the money supply and restricting the absorption capacity of the economy via reduction in wage incomes.

In this paper[1], we study the adjustment processes of the macro economy as a whole, and the role of the agricultural sector in particular during the post-reform period. To this end, the study employs a two-level quantitative analysis: at the first level, a computable general equilibrium (CGE) model of the macro economy is used to illustrate the general developments and structural relationships of the overall economy; whereas at the second level, a detailed sectoral model of Turkish agriculture is used to realise a series of micro-detail experiments. We make the hypothesis that under this two-level approach, we can simultaneously investigate the adjustment processes and the role experienced by the agricultural sector within the domestic economy, given its responses to macroeconomic policies, and obtain a more detailed description of adjustment within the agricultural economy itself.

For decades, Turkish agriculture operated under severe government regulation. After the Reform, however, the sector found itself in an entirely different environment with contending pressures from competing imports, market determined prices and reduced subsidies. In practice, the implementation of these policies had grave implications for the agri-

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cultural product markets since the coverage of the government's price support program was narrowed and price regulations were to a large extent eliminated. Surprisingly, even though there are numerous descriptions of the Turkish adjustment experience in the economic literature, the role of the agricultural economy, a sector employing more than half of the productive labor force, seems to be overlooked. Agriculture is generally taken for granted and is dressed with the tasks of the classic surplus extraction of cheap wage goods.

Turkish agriculture presents the characteristics of a dynamic sector which has undergone profound transformation in recent years. With the large amounts of public money invested in the Southeastern Anatolia Project (GAP) in the last quarter of the decade, there was an enormous transformation of the agricultural sector which had strong effects on the rest of the economy. The GAP covers the area between the Euphrates and Tigris Rivers, known as the Mesopotamia region. Upon completion of the project, the irrigated area in this area is expected to increase by 1.6 million hectares. We expect to show this along with its macro interactions using the CGE model. A multi-market, multi-regional model based on quadratic optimization techniques is used to analyse the effects of the GAP within the agricultural product markets. The modelling strategy is based on innovations on the positive quadratic methodology at the micro-sectoral level. This is implemented parametrically according to the endogenous "directives" of the computable general equilibrium approach at the macro-aggregate level[2]. The equilibrium values of various policy variables, such as the foreign rate of exchange, or the volume of public investment are solved endogenously in the CGE model, to be used as inputs in the agricultural sector model. One important caveat of our approach here is that the integration process is unidirectional *i.e.* the policy implementation affects the macro equilibrium first, which is then "zoomed" into disaggregated agricultural activity: macro equilibrium comes before agricultural sector equilibrium. Although potential inconsistencies may remain under this approach we nevertheless observed that most of our policy conclusions were accurate.

The paper is organized as follows. Firstly, we present the analytical features of the CGE; this is followed by a description of the agricultural sector models and related policy simulation experiments. The last section is reserved for conclusions and summary comments.

[2] For theoretical underpinnings of this approach, see de Janvry *et al.* (1992), Bauer and Kasnakoglu (1990) and Dervis *et al.* (1983). A detailed algebraic documentation of the methodology is provided in Cakmak, Yeldan and Zaim (1993).

THE CGE MODEL OF THE MACRO ECONOMY

The structure of the CGE model

The CGE model is based on a static Walrasian macroeconomic model for 4 production sectors (agriculture, industry, commercial and public services); 3 households (rural, urban labor, urban capitalist); 5 socio-economic classes (rural and urban labor, rural, industrial and commercial capitalist); and a government. The model integrates the structuralist (Taylor, 1981 and 1990) and the Walrasian (Dervis, de Melo and Robinson, 1983) adjustment mechanisms.

The distinguishing feature of the model is a series of macro adjustments for income distribution, foreign exchange and fiscal expenditures which creates a savings pool which can be used to finance a predetermined level of exogenous investment expenditure. In order to sustain the required level of savings within this adjustment process, three mechanisms are at work: (i) there is an income transfer from the low saving propensity/low income households to high-saving/high income capitalists, (ii) a significant portion of private savings is absorbed by the government as coercive, forced savings for the financement of its fiscal deficit; and finally, (iii) any insufficiency of the aggregate domestic funds is compensated either by alignments in the foreign rate of exchange or additional external borrowing. Such a specification enables the model to depict the conflicting claims and inflationary consequences of fiscal deficits. Government investment is given as a fixed ratio of GDP, while government savings are set at a given proportion of total budget revenue. Consequently, the government's room for manœuvre to reach a balance in its investment-savings gap is limited in the short run. The only way the macro side can adjust is through price inflation.

Given this setting the underlying mode of adjustment in the commodity markets becomes one of Keynesian demand-determined production adjustment. In industry and commerce, where there is a high degree of concentration and monopolization, prices are set by producers through flexible mark-ups over variable costs. Consequently, in these sectors supply is determined by aggregate final demand, given the mark-up based production price:

$$P_i^x = (1 + \tau_i) AVC_i$$

where P^x is the producer price, τ is the (nominal) mark-up; and AVC_i is the average variable costs of production in sector i. It is composed of the sectoral wage bill and intermediate input expenditures per unit of

output. For agriculture and public services, given the lack of empirical evidence on market structure about these sectors, we assume that marginal cost pricing rules coupled with a neoclassical production function to determine the output supply. The functional production form is represented by CES technology function between capital and labor. We assumed an elasticity of substitution of 0.5 in agriculture, 0.5 in commerce and 0.2 in the public sector between these two factors. Intermediate input demand according to Leontieff input-output coefficients are derived from the 1987 input-output table.

Consumption demand is given by fixed sectoral shares with the implicit assumption that the underlying preferences are Cobb-Douglas type. Hence, the price and income elasticities of demand are assumed to be unity, which is a plausible assumption given the comparative static setting of the model.

Both the price level and the employment level are treated as fully endogenous. Wages are assumed to be fixed **nominally**, given the non-economic mechanisms of class conflict. Further, given *a priori* rules for mark-up determination, the level of producer prices becomes an endogenous variable which responds to pressures of aggregate final demand. Consequently, the model is able to capture an endogenous price inflation based on structural rigidities and the conflicting claims of various social classes on national output. Since nominal wages are fixed, the level of urban employment becomes endogenous, which thereby enables perturbations on output supply. Firms employment decisions depend upon real wage costs and profit maximization rules.

An important mode of adjustment in the commodity and factor markets can be traced out through a stimulus in final aggregate demand. As pressures build up in the commodity markets, mark ups increase, which raises producer prices. An increase in the price level reduces **real** wages, since wages are fixed nominally. Employment and output supply both increase. This process is true to the classic Keynesian motto: *"output is supplied (labor is employed) because it is demanded"*; in contrast to the (neo)-classical motto, Say's law: *"output is demanded, because it is supplied"*. We admit that the current CGE is designed, in effect, to highlight the fiscal consequences of investment decisions on the **real** economy. Thus, it is natural to expect the demand effects to play a leading role in such a setting. Since there are no financial adjustment mechanisms, the model adjusts on the real side via Keynesian multiplier mechanisms.

On the foreign trade side, the model adopts the traditional treatment of foreign economic relations as in many CGE applications: the Armingtonian commodity system for determining import demands; the constant elasticity of transformation specification in the allocation of export and domestic sales, external closure rules through changes in nominal exchange rate (experiment *E-INV-ER* below), or through

endogenous flows of external finance (experiments *E-INV-GBOR* and *E-INV-FIS*).

The model is calibrated to 1987, a year in which the domestic economy is considered to be in relative macroeconomic equilibrium. We now turn our attention to the CGE analysis of macroeconomic alternative policy scenarios with respect to agriculture.

The CGE analysis of the macro economy

The post-1980 adjustment of the Turkish economy placed a heavy burden on agriculture. The sector was severely troubled by adverse movements in the domestic terms of trade, through elimination or reduction of input subsidies and through the loss of traditional income sources. As incentives were directed away from agriculture towards export oriented manufacturing and as the government initiated a process of denationalisation in the production sphere, the agricultural economy began to suffer and became heavily dependant on the unpredictable weather conditions.

In the second half of the decade, however, with the start of the Southern Anatolia Project, there was renewed optimism about the future of Turkish agriculture. The project was totally dependent upon domestic sources for its financing, and this placed significant pressure on the macro economy for generation of the necessary funds. In this first series of quantitative analyses, we try to simulate the macro linkages of agriculture with the rest of the economy, given the financial requirements of the GAP. The sectoral implications of the GAP are then analyzed in greater depth with the aid of the multi-market model of Turkish agriculture.

To this end, the CGE policy scenarios are conducted in two steps: *first*, the macroeconomic balances are obtained for the historical base run (1987). Next, the level of public investment is increased and reorientated to agriculture. At this first stage, funds for increased investment are acquired through internal and external borrowing. During the *second* stage, the mode for funds acquisition and the rules of external adjustment are changed in order to search for alternative methods of financing the increased investments. Here, the purpose is to evaluate alternative policy scenarios for financing GAP investments, and to trace out the global effects on the macro economy.

The simulation scenarios can be summarized formally as follows:

Scenario E-INV-GBOR: Increase aggregate public investments by 20% over their base-run values. This brings the public investment – *GDP* ratio to 14%, which was the figure realised for 1988 and 1989. The increased financial claims are met through flexible government bor-

rowing, the main mode of adjustment used by the government during that period.

Scenario E-INV-ER: The above scenario is duplicated in its investment targets, but the macro balance is obtained by flexible exchange rate adjustments.

Scenario E-INV-FIS : The same scenario is implemented, and additional investment is met by fiscal restraint. Agricultural subsidies are eliminated, and transfer payments to private households are reduced by 25%. In this experiment, the burden of adjustment falls heavily on private income. The elimination of agricultural subsidies is a widely advocated policy in World Bank circles, and was an integral part of the fiscal austerity program of the Turkish reform program during the 1980s.

Both these experiments are considered to be alternatives to the *E-INV-GBOR*. To facilitate comparisons, Table 1 displays both the absolute levels of the 1987 values and the percentage deviations of the simulation experiments.

A general overview of Table 1 reveals that, as compared to a direct financing of governments expenditure, exchange rate adjustment is growth oriented, yet inflationary and that adjustment by fiscal restraint is severely deflationary. In the *E-INV-ER* economy, the overall price level is influenced by two sources: first, increased public expenditures squeeze financial markets and crowd out private funds in real terms, then the increased domestic costs of imported intermediates lead to classic cost push inflation. Since the model operates with fixed nominal wages, the increased price level simultaneously reduces real wages (at the rate of 3%) and consequently both employment and production expand. The only factor inhibiting a further expansion in output is the falling effective final demand as a result of reduced urban labor incomes. These static results should also be complemented by dynamic considerations. In the long run, maintaining the levels of real investment under an inflationary environment may prove to be difficult. This opens a dilemma (a trade-off) between the current gains anticipated from a policy of devaluation against the future costs of inflationary pressures that it leads to.

We observed that agriculture favoured the exchange rate adjustment over the fiscal restraint scenario. Under *E-INV-FIS*, rural household incomes fall by 3%. This outcome is realised in spite of a rapid rise in the domestic terms of trade which favoured agriculture by 20%. This is due to the massive contraction observed under the *E-INV-FIS* scenario. Even though in **relative** terms, agricultural prices are favoured, the scale of contraction in the rest of the economy provokes a reduction in agricultural demand, reducing rural employment by 3.6% and output by 2%.

Table 1. **Production, Employment and Income Generation**

	Base-Run[a]	*E-INV-GBOR*[a]	*E-INV-ER*[b]	*E-INV-FIS*[b]
Price Level	100.0	101.5	103.2	98.9
Real Output				
Agriculture	13,824.8	13,871.6	2.8	– 2.1
Industry	57,908.6	59,067.9	1.7	2.4
Commercial Services	18,391.1	17,468.7	– 2.7	– 2.6
Public Services	13,822.0	13,977.2	0.4	1.3
Employment[c]				
Rural	8,735.0	8,796.0	4.8	– 3.6
Urban	7,215.0	7,239.0	0.8	4.9
Distribution of Total Value Added				
Rural Capital	7.6	7.6	8.1	7.3
Industrial Capital	27.4	27.4	30.1	18.3
Commercial Capital	16.6	15.6	11.4	11.5
Rural Labor	10.4	10.5	11.1	10.1
Urban Labor	22.3	22.3	22.4	22.6
Government	15.7	16.6	16.9	30.2
Real Wages[d]				
Rural	0.632	0.630	– 3.1	1.2
Urban	1.640	1.637	– 3.1	1.2
Average Profit Rate (%)	16.6	16.7	17.3	22.4
Mark-up (%)				
Industry	34.8	34.2	33.9	21.8
Commercial Services	103.1	102.5	102.2	102.1
Average Variable Costs				
Agriculture	0.709	0.711	1.7	0.4
Industry	0.742	0.739	0.5	– 7.1
Commercial Services	0.492	0.492	0.2	1.2
Public Services	0.379	0.386	0.8	2.6
Exchange Rate	854.6	854.6	17.9	0.0
Agricultural TOT[e]	100.0	101.1	102.1	119.5
Real Household Income				
Rural	10,783.3	10,851.1	6.2	– 3.3
Urban Labor	14,518.3	14,489.4	– 1.6	– 1.1
Urban Capitalist	31,059.0	31,042.0	1.5	– 0.8

Notes: [a] 1987 Billion TL
[b] Percentage change over *E-INV-GBOR*
[c] 1000*person-years
[d] 1987 Million TL
[e] Index, 1987 Base-Run=100

The income distribution consequences of the policy scenarios are thus mixed. In the resolution of income distribution shares, the model is driven by two mechanisms: the first is the inflationary pressure of the fiscal deficit resulting from the savings-investment gap in the public sector (see Table 2). The deficit leads to price inflation and those who have nominally-fixed incomes (wage-workers) suffer a loss. The second mechanism is the classic Kaldorian mode of adjustment. Since the economy is driven by exogenously set (public) investment targets, the resulting public savings gap should be filled by the private sector savings surplus. With fixed marginal saving propensities, income has to be accumulated by those who have larger propensities to save. Our estimates applied in the model are 0.110 for the rural household, 0.129 for the urban worker household, and 0.241 for the urban capitalist household. The oligopolistic power of the industrialists, as reflected by mark-up pricing, enables industrialists to sustain their average profit margins under *E-INV-ER*, but under the deflationist environment of *E-INV-FIS*, the fall in aggregate final demand causes a significant reduction in mark ups. As a consequence, industrialists power base erodes and their share of value added falls. We observe that the government achieved a significant increase in its share of total value added, a result which contrasts with the announced stand of the post-1980 governments towards de-statization.

Both scenarios reveal the importance of final demand linkages in the domestic economy. Under *E-INV-FIS* for instance, reduced government expenditure and austerity in private transfers cause a reduction in aggregate final demand. Although this outcome is valuable in easing inflationary pressure, it nevertheless has deflationary consequences for the product and factor markets. Such a deflationary environment threatens urban incomes, especially those of urban capitalist groups whose production is heavily dependent on domestic demand. This outcome provides possible reasons which would explain why macro adjustments based on fiscal restraint and on austerity measures are so unpopular in many developing nations.

Exchange rate adjustment seems to offer yet another plausible alternative for achieving macroecnomic balance in the economy. With the given assumptions, the model solutions suggest a domestic currency depreciation rate of around 17 % compared to is initial value (this depreciation rate is to be used again in the sector model simulation below). Here, agricultural income rises benefitting from improved terms of trade and falling real wages. Urban workers and commercial capitalists, on the other hand, lose out in this environment, a result which follows directly from the inflationary consequences of the adjustment process.

Table 2. Savings, Investment and Fiscal Balances

	E-INV-GBOR[a]	*E-INV-ER*[b]	*E-INV-FIS*[b]
Investment			
Private	7033.0	0.0	0.0
Public	7790.0	0.0	0.0
Savings			
Private	9156.8	– 0.5	0.8
Public	4825.9	2.0	– 1.5
Government Budget			
Revenues	17079.9	2.1	– 1.6
Expenditures	20244.0	1.2	– 1.0
Government Borrowing Requirement			
Domestic	2123.8	– 2.3	2.6
External[c]	1.217	– 19.2	0.0

Notes: [a] 1987 Billion TL
[b] Percentage change over *E-INV-GBOR*
[c] 1987 Billion US$

THE MULTI-MARKET, MULTI-REGIONAL MODEL OF THE AGRICULTURAL SECTOR

The Turkish Agricultural Regional Model (TARP) is designed to provide a means of investigating policy related "what if" scenarios in the partial equilibrium, static optimization model. It is designed to "zoom-in" on the agricultural economy in order to complement models used in the previous section. To achieve the maximum flexibility in policy analysis between the two models, we separate various government instruments into three categories: those pertaining to the macro-CGE only; those pertaining to the sector model; and intermediate (linkage) instruments which are relevant to both. Table 3 below lists the categories used in the models:

Table 3. Policy Instruments of the CGE and Agricultural Sector Modelling Approaches

Macro-model Specific Variables	Integration Variables	Agricultural Sector Specific Variables
• Public Savings, Investment Rates • Income Tax Rates • Sectoral Shares of Public Investment • Mark-up Ratios • Wage Rates	• Exchange Rate • Commercial Policy Instruments (tariffs, subsidies, etc.) • Agricultural Terms of Trade • Agricultural Tax Rates	• Techniques of Production • Regional Input Availability • Input Prices

The TARP is a sector-wide model in the sense that it describes total national supply (production and imports) and its use (domestic demand for food, feed, and exports). The production side of the model can be separated into submodels for each of three geographical areas. On the demand side, consumer behavior is regarded as price dependent, and thus market clearing commodity prices are endogenous to the model.

Structure of the model

The production structure and supply and demand interactions in the model are summarized in Figure 1 and 2 respectively. Its most important features are as follows :

i) The production side of the model is disaggregated to 3 regions (the GAP region, the Aegean-Mediterranean coastal region, and the rest of Turkey) for the exploration of interregional comparative advantage for the policy impact analysis.

ii) The crop and livestock sub-sectors are integrated endogenously. The livestock sub-sector receives inputs from crop production.

iii) Foreign trade is allowed for raw and as well as for processed goods for limited number of commodities.

The regions in the model are aggregated from provincial data to minimize the aggregation error. In total, the model is based on 22 single annual crops, 9 perennial crops, and 6 livestock activities. With three producing regions and several techniques of production for most of the crops, the total number of activities specified in the model is 123. Activity is distributed among the regions depending on the dominant cropping pattern in the base year.

The model's basic equation is quadratic for both revenue and cost. It maximizes the area between the demand and supply curves. The maximand is equal to the sum of consumers' and producers' surplus plus net export revenue. The optimal solution entails equating supply to domestic plus foreign demand and prices to marginal costs for all commodities. The model considers the sector as the price maker, but implicitly assumes that producers and consumers are price takers, and hence they operate in perfectly competitive markets both in output and factor markets[3].

The supply side of the model incorporates Positive Quadratic Programming (PQP) methodology[4]. The underlying assumption is that

[3] For models with alternative market forms see Duloy and Norton (1983), Takayama and Judge (1971).

[4] See Howitt and Mean, 1985.

Figure 1. Input-Output Structure of the Model

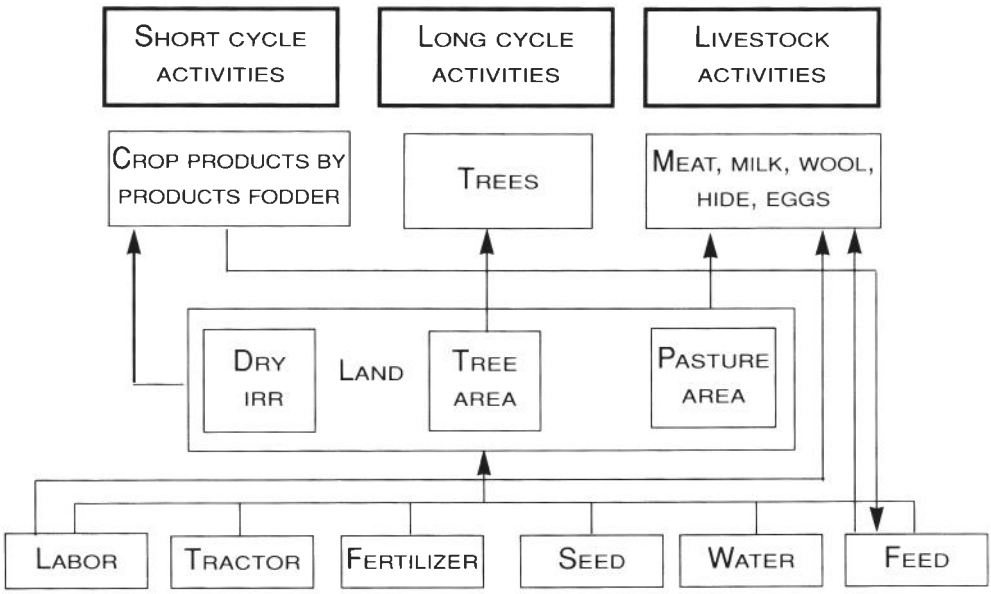
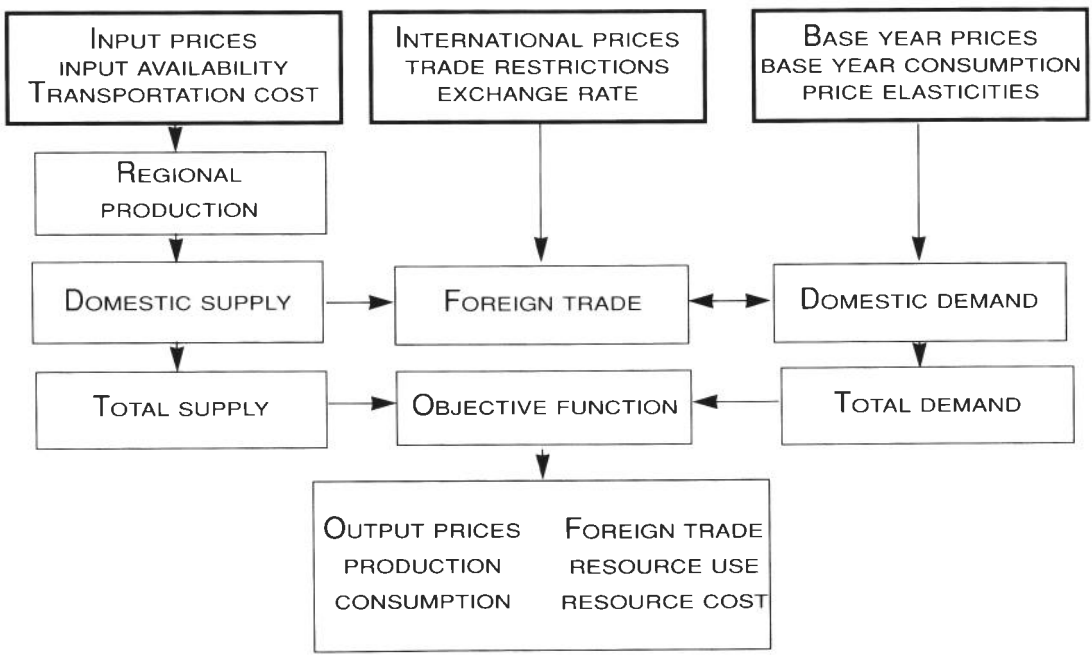


Figure 2. Supply and Demand Interactions in the Model



farmers operate in competitive markets and maximize profits. An important implication of this assumption is that the regional cropping pattern in the base year represents a global optimum of the maximization problem. It is consistent with the main goal of the sector models: to simulate producers' response to changes in market environments, resource endowments and production techniques.

The core of the model is composed of production activities and resource constraints. The input and output coefficients for crop production are specified for each unit of land. The commodity production activities in the model also constitute factor demand activities. Some factor supply functions are perfectly elastic (such as fertilisers), some are perfectly inelastic (*e.g.*, categories of land). In the former category, factor prices are exogenous; in the latter they are endogenous in the model. Livestock Production is an integrated part of the model. The input structure of livestock activities is more detailed and more flexible than previous models of Turkish agriculture[5]. It is similar in form to that used by Kasnakoglu and Bauer (1988). The feed supply is disaggregated into different categories. The model ensures that the minimum feed composition requirements are fulfilled. The explicit production cost for animal husbandry is labor. Other required inputs are cereals, crop by-products, pasture land for grazing.

The data used in the model were collected from various sources such as the State Institute of Statistics, the State Planning Organization, and the Land and Water Development Agency. FAO and World Bank sources were also used to complement and cross check the Turkish data.

Agricultural sector model simulations

Four additional scenarios were investigated using the model:

Scenario A-FP: As it was previously mentioned, the most significant government intervention in the factor markets occurs via fertiliser pricing. Despite the initial decrease in the fertiliser subsidy in the early 1980s, there was a compensating increase in the fertiliser subsidy towards the end of the decade. Here, the effects of increasing the price of fertiliser by 50%, corresponding to the full elimination of the subsidy on fertiliser were investigated.

Scenario A-GAP : It is assumed that the irrigated area in the GAP region will increase by 600,000 hectares. The purpose of this experiment is to find out the effects of a significant increase in the irrigated area in one region on the national and regional crop pattern given that the base year demand and supply structure remain intact. This model is

[5] *i.e.* World Bank, 1983 and Cakmak, 1987.

similar to the *E-INV-GB0R* scenario with the CGE model. The global effects of the increase in public investment are investigated using the CGE model, whereas TARP gives sectoral effects assuming that a significant portion of the increase in public investments is directed to the GAP. According to the GAP Master Plan (SPO, 1990), the total increase in the irrigated area in the GAP region was estimated to be 1.6 million hectares, but given the present of the Project it will not be possible to reach this target in the medium term.

Scenario A-GAP-DV : The result of the *E-INV-ER* scenario with the CGE model of the exchange rate adjustment for the financement of the increase in public investment is incorporated into the TARP.

Scenario A-1995 : In addition to these comparative static experiments, we further implement a projection of the TARP to trace out the medium term developments expected within the agricultural economy. The projection of the model to 1995 is carried out by expanding resource endowments and by permitting some growth in yields, with appropriate adjustments made on the demand side to reflect income and population growth. The historical international trade limits are released to reflect export market penetration. Here we aim to trace productivity effects in the sector.

The overall results of the simulations are presented in Table 4. The impact of the increase in the price of fertiliser is relatively high on food crop production. The decrease in net exports is mainly due to the decline in the export of pulses which showed a significant increase in the early 1980s. The increase in the irrigated area in the GAP region will mainly affect the production of export oriented crops. The projected currency depreciation to finance the GAP project has a major impact on net exports. The overall results obtained are not optimistic for the growth prospects of Turkish agriculture. The increase in the volume of total production is approximately equal to the increase in population, but net exports decline due to hesitant growth in the production of food crops.

Table 4.
Overall Results of the Alternative Scenarios with TARP Model

Experiments	Total Output		Food Crops		Net Exports
	Volume [a]	Value [b]	Volume [a]	Value [b]	
Base-Run ($ m.)	12,725		4,382		1,045
A-FP [c]	-0.60	1.30	– 1.40	3.70	– 1.3
A-GAP [c]	0.26	0.04	– 0.04	– 0.54	1.3
A-GAP-DV [c]	0.27	– 8.60	-0.84	– 11.3	13.6
A-1995 [c]	24.80	44.70	19.30	28.1	– 0.7

Notes : [a] Base-run equilibrium prices*scenario equilibrium output
[b] Scenario equilibrium prices* scenario equilibrium output
[c] Percentage change over the base-run

The results in relation to resource use indicate that, eliminating the fertiliser subsidy does not significantly affect the demand for inputs. The use of nitrogen and phosphate fertiliser declines by 1.7% and 1.6%, respectively. Overall agricultural employment declines by an insignificant amount, only 0.3%. The relative effect on all types of land is negligible. The exception is dry land; its relative profitability declines and dry land cultivation decreases by 1.8%.

The results of the simulations for the major commodity groups are presented in Tables 5, 6 and 7. The immediate effect of increasing fertiliser prices is an upward shift in the supply curves of crops. The costs of production increase, and given the constancy of the crops' demand curves, the cultivated area and production decrease, along with fertiliser use. However, the rate of decline in production is slower than that of the decline in the cultivated area. This outcome is mainly the result of the change in the relative profitability of production techniques and crops. An overall reduction in production reduces the competition for the most scarce resource, in this case irrigated land, and therefore its opportunity cost decreases. The result is a downward shift in the crops' implicit supply curves.

Two types of supply curve shift occur. The first is a technological shift: the production of crops which can be cultivated using both dry and irrigated technologies move from dry to irrigated land in most cases. The second effect, somewhat weaker, is the crop shift. The production of some crops actually increases because of the decline in total production costs. The consumption of all commodity groups, except cereals (especially wheat), is not highly affected by the increase in fertiliser price.

Table 5.
Changes in Production under Alternative Scenarios

	Base-Run ($ m.)	*A-FP*	*A-GAP*	*A-GAP-DV*	*A-1995*
		(% change over the base-run)			
Grains	2,711	– 1.50	0.10	– 1.40	2.00
Wheat	1,710	– 1.90	0.20	– 1.20	2.00
Others	1,001	– 0.80	– 0.10	– 1.90	2.00
Pulses	787	– 1.90	– 0.80	– 1.40	1.60
Tuber Crops	621	– 0.30	0.00	– 2.10	2.80
Vegetables	1,571	– 0.06	0.00	– 2.30	3.00
Oil Crops	783	– 0.60	0.10	– 1.90	3.30
Industrial Crops	1,427	– 0.70	2.50	14.20	3.20
Fruits and Nuts	2,567	– 0.08	0.00	– 1.50	2.90
Livestock Products	2,258	– 0.20	0.00	– 0.70	3.30
Total	12,725	– 0.60	0.30	0.30	2.30

Table 6. **Changes in Consumption under Alternative Scenarios**

	Base-Run ($ m.)	A-FP	A-GAP	A-GAP-DV	A-1995
		(% change over the base-run)			
Grains	1,869	– 1.80	0.20	– 1.10	2.10
Wheat	1,277	– 2.10	0.20	– 1.00	2.10
Others	593	– 1.20	0.00	– 1.50	2.30
Pulses	570	– 0.50	0.20	– 2.60	3.80
Tuber Crops	620	– 0.30	0.00	– 2.10	2.80
Vegetables	1,533	– 0.06	0.10	– 2.30	3.30
Oil Crops	724	– 0.60	0.10	– 1.90	3.30
Industrial Crops	983	– 0.80	0.00	– 2.50	3.30
Fruits and Nuts	2,211	– 0.10	0.05	– 1.70	3.20
Livestock Products	2,295	0.20	0.00	– 0.70	3.30
Total	12,806	– 0.50	0.06	– 1.60	3.00

Table 7. **Changes in Net Trade under Alternative Scenarios**

	Base-Run ($ m.)	A-FP	A-GAP	A-GAP-DV	A-1995
		(% change over the base-run)			
Grains	– 19.2	0.0	0.0	0.0	2.2
Wheat	1.8	0.0	0.0	0.0	2.5
Others	– 17.4	0.0	0.0	0.0	2.2
Pulses	226.7	– 5.9	– 2.7	1.7	– 3.9
Tuber Crops	1.4	0.0	0.0	0.0	-100.0
Vegetables	41.0	0.0	0.0	0.0	– 8.9
Oil Crops	3.4	0.0	0.0	0.0	– 3.6
Industrial Crops	267.5	0.0	7.7	51.9	2.2
Fruits and Nuts	84.5	0.0	0.0	0.0	– 0.9
Livestock Products	39.0	0.0	0.0	0.0	1.6
Processed Products	401.3	0.0	0.0	0.0	1.6
Total	1,045.4	– 1.3	1.3	13.6	0.08

Substitution possibilities would indicate that the negative production effects of eliminating the fertiliser subsidy initiate a chain of effects starting from the fertiliser price and leading to production costs and hence to production levels. At the sectoral level, this chain of effects appears to be significant. The result is a rather small decline in both fertiliser use and production. The most significant decline in production occurs in cereals. This is principally due to the decrease in wheat production by 1.9%.

Historical export limits are still binding except for pulses. The production of pulses has been historically promoted by the government to replace fallow. The increase in the price of fertiliser has a significant

effect on the export of these crops. It seems that the promotion of pulse production is heavily dependent on the fertiliser subsidy, and with the production of pulses expanding on less suitable land it would not be beneficial.

The increase in irrigated land in the GAP region causes significant changes in the production pattern. This outcome can be explained mostly by the shift in the regional comparative advantage in crop production which causes changes in the cropping pattern of other regions. The land released as a result of the shift in production is distributed to crops whose production was unprofitable prior to the experiment.

An interesting result is that, for some crops, production increases in both the GAP and some other regions. This is because of shift in crops' relative prices, with changes being driven by the final demand effects. Demand elasticity and crops' export potential are the main determinants of the observed shifts in relative prices. For instance, the price of cotton relative to other higher valued crops increases, although its absolute price declines. Additional cotton production, which was unprofitable in the original situation, becomes profitable after changes in the implicit marginal costs of production. In general, for the exported commodities, either the rent accruing to the exporters (defined as the difference between the shadow price of the trade constraint and exogenous export price) goes up, or the traded quantity increases, due to the decline in the domestic price of the commodities (except for pulses), where quantity is limited fo both commodities.

As expected, the employment impact of the project shows the potential to curb the existing unemployment (or underemployment) prevalent in the region. In addition, the indirect positive effect of the project on cotton production in the Mediterranean region further improves employment prospects for the southern regions of Turkey.

The crop specific effects of the scenario indicate a substantial increase in the production of high value crops. The increase in cotton production necessitates additional investment in storage, transportation, and processing facilities in the region. In addition, since most cotton and textile importing countries apply zero% tarifs on cotton and cotton products, Turkey needs to identify new international marketing strategies.

The incorporation of currency depreciation in the CGE model shows that the production structure in agriculture shifts drastically in favor of export oriented crops. Except for industrial crops, the production of all crop groups declines, and furthermore, there is a shift from domestic consumption to exports.

The growth prospects of Turkish agriculture are analyzed using a projection of the model to 1995. The results highlight the importance of irrigated land. All additional irrigated land is used without any decline in the regional shadow prices of the irrigated land. Slight

increases in the use of dry land are observed in the poorly irrigated regions. Industrial crops and oil crops gain the most from the increase in irrigated land.

The structure of production is fairly responsive to structural and policy changes. In crop production, the greatest growth occurs in oil crop production (3.3%) and the lowest in pulse production (1.6%). Without any intervention in the output markets, the growth rates reflect the effects of income elasticities and the export possibilities of the commodity groups. In case of cereals, for instance, part of the increase in production is absorbed by livestock production as feed. The results indicate that livestock production has greater potential for expansion than crop production. A significant portion of the growth in cereal production can be attributed to the need for feed crops for the growing livestock inventory, which underlines a fierce food-feed competition. The projected growth rates of consumption according to the major commodity groups point out that considerable changes will occur in the composition of the consumption bundle. The consumption of commodities with high income elasticities are expected to grow faster than the others. The relatively low growth rate in the consumption of cereals is mainly due to the food-feed competition.

As mentioned earlier, export limits are released to some extent to reflect the government's trade liberalization policies. Nevertheless, the projected export quantities still have upper bounds to reflect realistic market penetration in exports. The average growth rate per year during the period 1980-85 (2.5%), which overlaps with the liberalization era, is taken as the basis for the potential increase in exports. According to the projection results, total exports will decline slightly. With a 2.5% annual growth in population, it is not possible to increase the exports of agricultural commodity exports if growth remains at its historical levels.

CONCLUSIONS

The results of this study can be summarized under two main headings. Comparative static analysis of areas, such as fertiliser pricing policy, increased investment in irrigation in the Southeastern region, and the exploration of medium-term growth prospects of Turkish agriculture and on one hand a CGE analysis of the macro economy under alternative policy scenarios with respect to agriculture on the other.

Comparative static analysis showed the importance of incorporating cross-supply effects with respect to both crops and regions. Phasing out the fertiliser subsidy had different effects with respect to both crops and regions. High value cash crops and regions with a relatively high endowment of irrigated land were affected the least by the elimination

of the fertiliser subsidy. The overall negative effect on production was modest. The increase in irrigated land in the Southeastern region caused the production of some crops to increase not only in this region, but in other regions as well. The medium-term growth prospects revealed the development of more market and export oriented policies. Given the high population growth rate, there is a significant trade-off between food security and export earnings. The exclusion of agriculture from export oriented policies in the past decade attests that the government was more concerned to remain self-sufficient in major food stuffs. The overall performance of the agricultural sector in the last two decades is not encouraging. Turkish agriculture has not been able to adjust to the new market environment with less government intervention in both input and output markets.

On the other hand, the results of the CGE model experiments indicated that conflicting claims of various social classes on national output and conflicting rates of intersectoral accumulation warranted by competing producer groups were important sources of macro disequilibrium in the domestic economy. The Turkish mode of adjustment in the early 1980s relied heavily on a worsening income distribution and on agricultural taxation. The surge in manufacturing exports and economic growth could have been financed by transferring real income away from urban workers and the rural economy towards urban industrial and commercial private capital ventures.

By the end of the decade, however, the limits of such "primitive" accumulation seem to have been reached. Rising wage demands from urban workers and the increasing need to revitalize the agricultural performance are the two most visible signals of this. Both the recent Turkish development experience and a quantitative analysis of our models medium term forecasts reveal the importance of the final demand linkages within the domestic market, and underscore the pressing need for reinvigorating the rural economy. Clearly, the benefits of direct incentives and outright liberalization have been exhausted, and further increases in exports and in overall national income will only come from future increases in productivity resulting from a careful and integrated investment program both in industry and in agriculture.

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