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The Role of Agriculture in the Structural Adjustment Experience of Turkey. A General Equilibrium Analysis.

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Abstract. In this study we will investigate the adjustment processes of the macroeconomy and the role of the agricultural sector in the realization of such adjustment 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 macroeconomy is used to spell out the general developments and structural relationships of the overall economy; whereas at the second level, a detailed sectoral model of Turkish agriculture is utilized to implement a series of microdetail experiments. It is hypothesized that through this two-level approach, one can investigate simultaneously the role of, and the adjustment processes experienced by, agriculture within the domestic economy given its interactions in response to macropolicies, and obtain a more detailed description of adjustment within the agricultural economy itself.

For decades, Turkish agriculture has operated under severe government regulation. After the Reform, however, the sector has found itself in an entirely different environment with the competitive pressures of competing imports, market determined prices and reduced subsidies.

The study is organized as follows: in the first section a general overview of Turkish macroeconomic development and its agriculture is given. The analytical features of the CGE and agricultural sector models are discussed and policy simulation experiments are carried out in the second section. The third section is reserved for conclusions and summary comments.

It should be made explicit that the modelling approach used in this study is intended to supplement, not to substitute, the discussion of macroeconomic and agricultural sector specific issues.

The results of this study can be summarized in two main parts, parallel to the applications of the models. Comparative static experiments, such as fertilizer pricing policy, increase in irrigation investment in the southeastern region, and the exploration of medium-term growth prospects of Turkish agriculture, formed the first type of experiments. CGE analysis of the macroeconomy under alternative policy scenarios with respect to agriculture was the second type.

Comparative static experiments showed the importance of incorporating cross-supply effects with respect to both crops and regions. Phasing out the fertilizer subsidy had different effects with respect to both crops and regions.

The overall performance of the agricultural sector in the last two decades is not encouraging. Turkish agriculture has been unable to adjust to the new market environment with less government intervention in both input and output markets.

On the other hand, our results with CGE model experiments indicate that conflicting claims of various social classes on national output, and conflicting rates of intersectoral accumulation warranted by competing producer groups, are important sources of macrodisequilibrium in the domestic economy.

Introduction

In January 1980, Turkey embarked on an ambitious structural adjustment program to restore its macrobalances and revitalize its worn out production capacity. This program aimed to integrate the domestic economy into the world economy via a re-orientation of incentives in the traded goods sectors. All this was to be achieved through the logic of private capital accumulation under the auspices of the “unfettered” workings of the free market. Underpinning this program was the orthodox view that, in an economy

in which world prices were undistorted by trade restrictions and capital accumulation followed on the profit motive (which is yet to be privately internalized), one would achieve the optimum allocation of productive resources.

To restore macrobalances, this theoretical perspective has based its policies on the monetarist prescription of domestic credit restraint in order to control excess commodity demand. Thus it was envisaged that, following the reform program, the main source of macrodisequilibrium would be demand originating from excessive monetary expansion. Accordingly, in the post-1980 period, the Turkish authorities embarked on an adjustment program which, passing through various phases, primarily aimed at controlling the growth of the money supply and sought to restrict the absorption capacity of the economy via severe repression of wage incomes.

In this study we will investigate the adjustment processes of the macroeconomy and the role of the agricultural sector in the realization of such adjustment 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 macroeconomy is used to spell out the general developments and structural relationships of the overall economy; whereas at the second level, a detailed sectoral model of Turkish agriculture is utilized to implement a series of microdetail experiments. It is hypothesized that through this two-level approach, one can investigate simultaneously the role of, and the adjustment processes experienced by, agriculture within the domestic economy given its interactions in response to macropolicies, and obtain a more detailed description of adjustment within the agricultural economy itself.

For decades, Turkish agriculture has operated under severe government regulation. After the Reform, however, the sector has found itself in an entirely different environment with the competitive pressures of competing imports, market determined prices and reduced subsidies. As stated above, the main policy tool of the Reform was curtailment of domestic credit. The practical implementation of this policy has had dire implications for the agricultural product markets as the government's price support program has narrowed and price regulations have been largely eliminated. Surprisingly, although there are numerous accounts of the Turkish adjustment experience in the literature, the role of the agricultural economy, a sector employing more than half of the productive labor force, seems to have been overlooked. Agriculture is usually taken for granted and allotted the task of classic surplus extraction of cheap wage goods.

Turkish agriculture, however, displays the characteristics of a dynamic sector undergoing profound transformation in recent years. In particular, with large-scale public investment in the so-called Southeastern Anatolia Project (SAP) in the last quarter of the 1980s, one can expect an enormous transformation of the sector with strong affects on the rest of the economy. SAP covers the area between the Euphrates and Tigris Rivers, known as Mesopotamia. On completion of the project, the irrigated area in the Southeastern region is expected to increase by 1.6 million hectares. We have set out to capture this event along with its macro-interactions via the CGE model. As for the analysis of the effects of SAP within the agricultural product markets, a multimarket, multiregional construct based on quadratic optimization techniques is utilized. The models are externally linked through recursive independent solutions. Accordingly, the equilibrium values of certain 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.

Based on this agenda, the rest of this study is organized as follows: in the first section a general overview of Turkish macroeconomic development and its agriculture is given. The analytical features of the CGE and agricultural sector models are discussed and policy simulation experiments are carried out in the second section. The third section is reserved for conclusions and summary comments.

It should be made explicit that the modelling approach used in this study is intended to supplement, not to substitute, the discussion of macroeconomic and agricultural sector specific issues. The models can illustrate the possible responses of variables to specific scenarios in a more expeditious and systematic way than previously possible. Given the analytical boundaries of the models, they allow the policy analyst to evaluate policy effects and to trace the impact throughout the economy and the agricultural sector.

I – Overview of the Turkish Economy and its Agriculture

1. Recent Developments in the Turkish Economy

A. Turkish Macroeconomic Development, 1963-1979

The period 1963-79 marked an intensive import-substitution drive in Turkey, implemented through quantity rationing of imports and a deliberate policy of overvalued exchange rate administration. Growth, while rapid, was not uniform. Throughout this time, "planned development" had been the official doctrine of the state, and the industrialization strategy designed under direct control of interventionist/substitutionist policies represented a grand, yet delicate, alliance between the Kemalist bureaucratic elites, industrial producers, industrial workers, and the small-holding peasantry (Boratav, 1983; Keyder, 1984; Yeldan, 1989). Accordingly, the protectionist trade regime, as well as the existence of a public enterprise system whose role was to produce cheap intermediate inputs to the private sector through artificially low, regulated prices, guaranteed industrialists the monopoly profits and rents of a readily available protected domestic market. Industrialists, in turn, have "accepted" the conditions of a general rise in the real wages of manufacturing, and an agricultural price-support program which induced domestic terms of trade to favor agriculture. As observed from *Table 1.1*, both the real wage index and the agricultural terms of trade followed a secular rising trend, 1963-79.

The state was both an investing and a producing agent during this period. However, with the exceptions of 1967 and 1977, the share of private investment remained above the 50% mark. This fact has been taken by many scholars as supporting the argument that public intervention in the industrialization process had been complementary to the private sector, rather than "crowding" it out (Boratav, and Türel, 1988).

State Economic Enterprises (SEEs) were the major tools of the state in pursuit of industrialization targets. They were strategically placed in such heavy ventures as basic chemicals, fertilizers, petroleum products, machine tools and machinery. Their primary role has been the supply of cheap raw materials and inputs to the private manufacturing sector and to agriculture. With a mandate to overemploy, they have also been instrumental in absorbing a significant portion of the domestic labor surplus. SEEs have suffered from continuous government price control, and have been in the focus of fierce political struggles as they have mostly been viewed "simply as departments of the state, rather than independent commercial operatives." (World Bank, 1983).

Furthermore, a dualistic pattern has gradually emerged within the industrial structure in which the average size of a public firm was estimated to be nine times larger than an average private firm. Operating within the constraints of low domestic absorption capacity, this structure has established limited backward linkages among industries (Kepenek, 1984)—a phenomenon also recognized in the Latin American context (Hirschman, 1968).

Agriculturally, Turkey displays a structure composed of small holdings with little available land for cultivation. This structure is in sharp contrast to the large latifundios of Latin America, where a strong rural aristocracy emerged along with a large mass of landless peasantry. Operating within this structure, Turkish political parties were severely cautious not to loose the electorate through unfavorable agricultural policies. In fact, the strength of electorate power based on small-holding peasantry has been cited as one of the primary reasons for the absence of an effective agricultural tax system in Turkey (Keyder, 1984).

The ISI strategy reached its limit beginning in 1976, when financing the balance of payments and the industrial investment strategy became increasingly difficult. In 1978-79, as the domestic inflation rate soared, the demand for domestic money fell dramatically. In the absence of any substitute assets, the result was increased consumer demand for tangible goods and services exceeding the country's absorption capacity. Within industrial manufacturing, organized labor increased its wage demands and succeeded in increasing its share of the industrial value added from 28% in 1975 to 37% in 1979. Clearly the economic base of the "grand alliance" had been broken. By 1980, this process had become a vicious circle culminating in both an economic and political crisis which could only be resolved by military intervention and the introduction of a "structural adjustment" reform program.

B. Turkish Macroeconomic Development, 1980-1990

The January 1980 Reform package aimed not only at short term stabilization, but also at changing the structure of the economy toward a more outward-looking orientation by providing an increased role for the private sector and market forces. Furthermore, a change in sectoral priorities had occurred, with greater emphasis being given to the export-oriented manufactures, such as processed food, textiles, clothing and light intermediates, and also to commercial services, especially overseas contracting.

It was hoped that this program, under the guidance of undistorted world prices, and with the leadership of private capital accumulation, would enable the Turkish economy to integrate into the world market, achieving the optimum allocation of resources in the sphere of domestic production. Based on this philosophy, the state declared a policy of privatization, removing itself from the sphere of production. This change in the economic role of the state is likely to have an adverse affect on the growth potential of the economy in the medium to long term, as in the first half of the 1980s private investments were not forthcoming, and the index of fixed investment recovered its 1979 level only after 1985. Even then, however, the share of fixed investment allocated to the productive sectors (agriculture and manufacturing) declined dramatically and consequently the unemployment ratio increased steadily over this period despite a significant drop in real wages *(Table 1.2)*.

Overall, the distribution indicators have shown a reversal of the trends observed in the ISI period. Agriculture was severely taxed as the input prices of SEEs were increased to cut their losses, and the growth rate of farm support prices was kept below the gross inflation rate. Real wages fell continually, and the share of labor in the industrial value added eroded to its lowest level of the planned development era.

With the liberalization of imports and increased orientation toward exports, internationalization of the domestic economy has been quite rapid. The share of industrial imports in the total import quota fell at first as quantitative restrictions on imports were eliminated, but then rose steadily through 1989. This phenomenon reveals that import dependence in Turkish industry continues to threaten Turkish industrialization. Furthermore, the trend of falling external terms of trade continued throughout the decade. This index gives a rough idea of the gross transfer of domestic resources to the external world through price movements, and reveals that in the 1980s Turkey had to export, on average, 20% more in real terms than it imported to bridge the trade gap.

Looking beyond the 1990s, many Turkish economists argue that the limits of the orthodox stabilization policy, based on price incentives and wage reduction, have been reached. As a recent OECD report on Turkey asserts (OECD, 1990), the shift in the composition of investment away from manufacturing is likely to affect overall productivity adversely, and can be cited as one of the main reasons for the faltering performance of the economy since the second half of 1988.

In the next subsection, there follows a more detailed analysis of the policies pertaining to agriculture, outlining the reasons for the performance of that sector.

2. Agricultural Policies and Performance of the Agricultural Sector in Turkey

Historically, agriculture has played a dominant role in the economic development of Turkey. As late as 1988, the agricultural sector contributed 22% to the GDP (slightly higher than average for middle income countries) and employed over 50% of the labor force. Turkey is one of the few countries in the world which has achieved self-sufficiency in foodstuffs. Agriculture has also been a major source of export income. Although the share of agricultural exports has been declining, the exports of raw and processed agricultural products still accounted for 60% of total exports in 1988. In addition, the sector provides raw materials for the consumption oriented agro-industries whose share in total exports has increased significantly since the late 1970s.

A. Structure of Agricultural Policies in Turkey

The Turkish government has a long history of involvement in agriculture. Although the structure of agricultural policies did not change significantly after the 1980 measures, the breadth and magnitude of government intervention did.

Historically, the principal instruments of agricultural policy have been financial subsidies to guarantee higher product prices and low cost inputs and cheap credit to stimulate agricultural production and investment. The domestic budgetary measures were accompanied simultaneously by strict control of foreign trade in agricultural products. Apart from traditional exports, the domestic market was highly protected to achieve self-sufficiency in food crops. Public agencies were responsible for foreign trade in major food commodities.

Until the mid-1970s these policies were successful in achieving growth and self-sufficiency in foodstuffs. Agricultural GDP grew at an annual average rate of 4.7% from 1972 to 1975, and sectoral fixed investment grew at an average rate of 17.9% per year. Since the arable land frontier was reached in the late 1960s, this increase was primarily achieved by intensified production. This was mainly due to the increase in yields brought about by the increase in fixed investment and technological development programs.

Looking at the nature of the agricultural policies implemented, we observe that the government has been active both in setting output (support) prices and declaring prices of strategic inputs, such as fertilizer. Its role is actively sought out by various state controlled institutions. In the output market, three ministries, about 20 semi-autonomous agencies (SEEs, state monopolies and sales and credit cooperatives) are directly involved in the formulation and administration of agricultural price policies. Except for tea, sugar beet and poppy, for which the state is the only buyer, the farmers are free to sell to private traders. The shares of public and private sector purchases vary from year to year depending on the declared support price levels compared to market prices. The support purchases of the government peaked in 1977 when 22% of agricultural GDP was purchased. The tasks of SEEs include storage, sale and export of commodities subject to government control. All of the support purchases are financed by the Ministry of Finance and the Agricultural Bank which is a SEE.

On the input side, we observe fertilizer to be the most important input affected by government price policies. Even though the private sector is in the fertilizer market both in production and distribution, almost all (95%) of the fertilizer was distributed by a SEE, the Agricultural Supply Organization, until 1990. The distribution of fertilizer was left to private companies in 1991. Fertilizer has priority in the allocation of foreign exchange, and is the second largest import item after oil. Although the subsidy on fertilizer was gradually decreased after the austerity measures, its price was subsidized generously until 1980.

Three separate mechanisms existed for subsidizing fertilizer prices. Firstly, fertilizer was distributed directly to individual farmers or farmers' cooperatives at below procurement cost. In 1979, the fertilizer subsidy reached approximately 70% of the production and import cost. Secondly, credit was provided at a subsidized rate for the purchase of agricultural inputs including fertilizer. Thirdly, fertilizer producers were also subsidized. The procurement price was based on the production cost estimated by the manufacturers and was generally higher than border prices for fertilizer imports. The official price of fertilizer remained fixed from 1975 to 1980 in spite of rapidly devaluing currency. In 1980, the retail price of fertilizer was raised five to ten times but the subsidies were still 30% of the domestic production cost. It is estimated that the fertilizer price is around 40% of the import cost.

In the credit market, the government sets the interest rates for agricultural credit. In general, the interest rates for agriculture are at least five percentage points less than the interest rates for other sectors. Ordinarily, the interest rate paid for loans is much less than the prevailing inflation rate, so that the real rate of interest is negative.

Agricultural credit is mainly provided by the Agricultural Bank. To obtain credit, the farmer must supply the deed for his land to serve as collateral, and a certificate to show that he has no outstanding loans. The system favors large farmers because most of the small farmers do not have a clear title to their land. The small farmers often end up paying positive real interest rates in the informal credit market (Cakmak, 1987).

During the 1960s and 1970s, agricultural policies encouraged the development of near self-sufficiency. The agricultural sector turned in a reasonable investment performance until the mid-1970s. Following the 1973-77 period, the foreign exchange balance changed from positive to negative, and the success story of high growth rate in agriculture started to fade around the late 1970s with the culmination of the general economic crisis. The continuation of agricultural support policies in the economy became unbearable. By

1980, the annual increase in support prices and the financial claim of support policies placed a heavy burden on the economy.

Accelerated inflation combined with an increasing trade deficit led to a series of austerity measures. The government devalued the Turkish Lira (TL) in 1979 and eliminated the overvaluation of the exchange rate. However, a multiple exchange rate system was introduced simultaneously. A lower exchange rate ($1=TL 35 instead of $1=TL 47) was set for imported oil and fertilizer and for the exports of agricultural products subject to support purchase schemes. In January 1980, the introduction of the comprehensive structural adjustment program led to the dismantling of the incentive system of output support prices and input subsidies for the agricultural sector. There was a sharp reduction in input subsidies, particularly for fertilizer. By the end of 1983, the number of supported agricultural commodities had been reduced from 25 to 13. Instead of incentive pricing, where support prices were set substantially higher than the domestic cost of production, a system of floor pricing was introduced. This shift in policy can be seen in *Table 1.3* which shows the price structure for two typical years before and after the 1980 stabilization measures. For most commodities (especially wheat and barley) the prices received by farmers were much higher than export prices in 1979. Yet, nominal protection coefficients indicate that production incentives for the production of the same group of commodities declined sharply in 1982.

In 1983, the scheme of fixing support prices and financing support purchases was also changed. Most of the procuring agencies were allowed to determine the procurement prices and they became financially responsible for the costs of the floor price system. In 1984, the responsibility for all support purchase advances to the procuring agencies was given to the Central Bank.

In the credit market, the subsidy on agricultural interest rates was reduced with a slight increase in the total agricultural credit availability due to restraint on monetary policy to halt the inflation rate. The subsidy for chemical materials was eliminated in 1980, but reintroduced in 1987. Seed prices were deregulated in 1984 which encouraged foreign firms to enter the seed market, and the prices of agricultural machinery were left to market forces.

With the 1980 structural adjustment program, the overall performance of the agricultural sector showed typical transition period characteristics. The shift in development strategy resulted in considerable disarray. The crop specific production and yield growth rates were not encouraging for continuing future self-sufficiency in foodstuffs. Apart from barley, the increase in major cereals stayed below the population growth. Almost all of the growth in production can be attributed to increased irrigation, land improvement and autonomous technological improvement, since there are no yield improvement programs except for maize. The figures for gross fixed investment in agriculture indicate that due to budgetary constraints the average growth rate of public investment in agriculture (including large infrastructural investments) was 3.5% per year for 1982-1988, whereas private fixed investment which includes agricultural machinery and equipment and small irrigation and drainage work declined by 0.5% per year during the same period. The positive growth rate in public investment in agriculture was mainly due to SAP which includes large irrigation projects, a detailed analysis of which will be given with the comparative static simulation experiments of section II below.

3. Performance and Structure of the Agricultural Sector

Performance in the Turkish agricultural sector has closely followed that of the global economy. The 1980 shift in development strategy, however, initially resulted in considerable disarray in the agricultural sector. The growth of agricultural real GDP fell to 1.7% in 1980 and to 0.1% in 1981. In 1982, however, there were indications that the sector was adjusting to the new policy environment: aided by a good harvest, real growth in agricultural GDP recovered. The depressed growth rates of 1983 and 1989 emphasize the significant effect of weather conditions: the drought of 1983 reduced the growth of agricultural GDP to -0.1%. The decline in 1983 occurred despite government efforts to prevent low output by postponing the increase in fertilizer prices until the end of the year. In 1988, the agricultural output expanded (8.0%) again due to favorable weather conditions.

From 1985 to 1989, the real agricultural GDP increased at an average rate of 2.0% per year which is less than the population growth rate of 2.3% per year. Such population growth rates constitute an obvious constraint on the expansion of agricultural exports. However, the most significant physical resource constraint is that of arable land. In the 1960s, the frontier of arable land was reached as a result of exten-

sive lateral expansion in cultivation. According to the 1980 Agricultural Census (SIS, 1983a), 42% of Turkey's total agricultural land was occupied by pastures and meadows. The remaining agricultural land constituted crop land occupied by field crops (68%), fallow (19%), vegetable gardens (2.2%), and vineyards and orchards (11%) (SIS, 1990b).

During the period 1975-1988, the total crop area remained almost constant, principally due to the substantial decline in fallow land at an average annual rate of 3.8%. Part of the marginal land which was under cultivation was either left idle or used to increase the grazing area.

The government began specific measures to decrease the fallow area by recommending that pulses be planted instead of leaving the land idle, in the early 1980s. The increase in cultivated area has been realized mostly in field crops (2.7 million hectares), and to a lesser extent in fruit trees and vegetable gardens (1.2 and 2.2 million hectares respectively). Vegetable gardens, however, experienced the highest growth in area due to expanding export possibilities. As a result, fruits and vegetables together represented 14% of the total cultivated area in 1988 as opposed to 12% in 1975.

Developments in area, production, and yields of selected crops are presented in *Tables 1.4-1.6*. In order to eliminate possible distortions due to considering one year only, the average for 1975-77 is compared to the average for 1986-88. In the same tables, total growth between the two periods is also given as the simple division of the latter average into the former. Annual growth rates, estimated from growth rate regression estimates, are also given.

In contrast to cereals, the relative share of all the major field crops except industrial crops increased during this period *(Table 1.4)*. In particular, pulses experienced the fastest growth rate in area, while the share of sown area for oil seed crops increased only marginally due to the expansion of sunflower cultivation. Area under industrial crops remained constant. Declines in the cotton and tobacco area were made up by the nationwide expansion in sugar beet cultivation.

With regard to developments in crop production and yields, one can observe only modest growth in the area under cultivation, although steady intensification of production occurred *(Table 1.5)*. This was manifested principally through increased yields which, for most major crops (except pulses) and some fruits, generally accounted for far more of the realized growth in physical production than did expansion in cultivated area *(Table 1.6)*. Some intensification was also due to the decline in fallow which accounted for almost all the expansion in cultivated area.

The share of agricultural and related exports and their growth rates since the mid-1970s are presented in *Figure 1.1* and *Table 1.7* respectively. In addition to the rapid expansion, significant diversification of commodity composition in exports occurred from 1978 to 1989. The share of agricultural products in total exports declined from the 1977/79 average of 62.3% to 20.0% in 1989.

Two important developments related to agricultural exports are worth mentioning. Firstly, a significant part of the increase in export of manufactured products may be attributed to the increase in processed agricultural products. But, as shown in *Figure 1.1*, the most important growth occurred in the textile and clothing industries. Secondly, the share of traditional export products in total agricultural exports steadily declined from 70% in 1977-1979 to 50% in 1988. Agricultural exports became more diversified after 1980 due to the increase in fresh fruit (apples and citrus) and vegetable exports to the Middle East.

The overall performance of exports in the two years following the 1980 austerity measures was outstanding. But, despite the expansion of export incentives in 1983 and 1985, the momentum of export expansion could not be maintained in subsequent years. This was principally due to structural difficulties within the Turkish economy toward increased exports, combined with stagnant market conditions in the world economy.

The annual growth rates for export of agricultural commodities, however, were not encouraging. After a good performance in 1980-82, the growth rate of agricultural products showed no significant increase until 1988. Although partly due to bad weather conditions, a major factor in this poor performance was the dwindling market share of Turkey in Middle Eastern markets (OECD, 1984). The initial positive impact of easy market access to Middle Eastern countries, due to political unrest in the region, has eroded. The export of livestock products and pulses, which are mainly exported to the Middle East, has shown no significant increase since 1982.

Livestock exports could not keep up the 1980-82 performance and the share of livestock products in total exports declined to pre-1980 figures.

The growth rates of processed products and especially textile exports were encouraging up to 1985. However, processed agricultural products and textile exports have not increased significantly since 1986.

The drive to increase exports has been mostly in the area of industrial commodities. The effects of changes in policy regarding agricultural products has been mainly due to the relative liberalization of foreign trade compared to the pre-1980 era. According to 1984 regulations, tax rebates apply only to some processed agricultural commodities, fresh fruit, and vegetables (IGEME, 1985). In fact, raw agricultural products and traditional export crops have been taxed by being subject to export support and stabilization fund. An encouraging development has been realized in the export of agricultural products in the form of diversified commodities due to significant increases in the export of barley, pulses, fruit and vegetables. A major part of the increase in these commodities was due to the sudden expansion of exports to Middle Eastern oil producing countries in 1981 and 1982. But since then, Turkey has been unable to increase her market share in the area.

Another performance indicator for the agricultural sector is the level of efficiency. If production is technically inefficient, then an increase in the output can be achieved by better use of existing resources. Changes in the level of relative efficiency can be identified. The overall technical efficiency can be decomposed into scale efficiency, congestion and purely technical efficiency (Fare, Grabowski, and Grosskopt, 1985). The estimated efficiency measures for 1967-87 are presented in *Table 1.8*. The average of overall technical efficiency indicates that 8.3% of potential output had not been achieved. It is interesting to note that inefficient production was exclusively confined to the post-1980 era, except for the years 1969, 1972 and 1977. The loss in output was principally due to deviations from optimal scale and congestion. The scale inefficiency was of the increasing returns variety. This does not imply that farms were too small, resulting in increasing returns to scale. It implies that the growth in output was proportionally more than the growth in the use of inputs. Congestion, on the other hand, measures the loss of output caused by producing on the backward-bending part of the isoquant. Congestion seems to be an important factor prohibiting the attainment of potential levels of output. If land and tractor inputs are considered to be indivisible in the short run, the loss of output due to congestion is inevitable since there is systematic increase in all input variables except fertilizer.

In terms of pure technical efficiency, which measures the lost output caused by producing in the interior of the upper level set, the sector has performed excellently. The results of the efficiency measures indicate that the 1980 stabilization program had a significant effect on the use of resources in the agricultural sector. The sudden change of environment with less government intervention in both input and output markets has left the sector in disarray. As indicated by the efficiency measures of recent years, adjustment of the sector to new market structures might take time.

The overall performance of the agricultural sector within the Turkish economy clearly manifests the faltering performance of a lagging sector. With the evasion of incentives and a heavy burden of adjustment, Turkish agriculture has suffered significant productivity losses. The Southeastern Anatolia Project is still seen as an important step toward revitalizing the sector. In the next section, we turn out attention to the economic and quantitative analysis of this venture within the context of a general equilibrium/multimarket framework.

II – Economic Policy Analysis

1. The CGE Model of the Macroeconomy

A. The Structure of the CGE Model

The Computable General Equilibrium (CGE) model is based on a static Walrasian macromodel built around four production sectors (agriculture, industry, commerce and public services); three households (rural, urban labor, urban capitalist); five socio-economic classes (rural and urban labor, rural, industrial

and commercial capitalist); and a government. The model is based on a cointegration of structuralist (Taylor, 1981) and Walrasian (Dervis, de Melo, and Robinson, 1983) adjustment mechanisms.

Based on this synthesis, the distinguishing feature of the macro-closure utilized in the model is a series of macro adjustments on income distribution, foreign exchange and fiscal expenditures so as to create a necessary pool of aggregate savings to finance a predetermined level of exogenous investment expenditures. Within this adjustment process, in order to sustain the required level of savings, three mechanism are at work: (i) there occurs an income transfer from the low-saving/low income households to high-saving/high income capitalists; (ii) a significant portion of private savings is claimed by the government as forced savings in order to finance its fiscal deficit; and finally, (iii) any insufficiency of the aggregate domestic funds is closed either by alignments in the foreign rate of exchange or additional external borrowing. Such a specification enables the model to portray the conflicting claims and inflationary consequences of fiscal deficits.

Thus, at the last resort the underlying mode of adjustment in the commodity markets becomes that of Keynesian style demand-determined production. In industry and commerce, where a significant degree of concentration and monopolization is prevalent, prices are set by producers by fixed mark-ups over variable costs. Consequently, in these sectors level of supply is determined by aggregate final demand, given the mark-up based market price. For agriculture and public services, given the lack of empirical evidence on market structure about these sectors, marginal cost pricing rules are assumed along with a neoclassical production function to determine the output supply.

Both the price level and level of employment are treated as fully endogenous. Wages are assumed to be fixed nominally, given non-economic mechanisms of class conflict. Furthermore, given the a priori rules for mark-up determination, the level of producer prices becomes an endogenous variable responding to the pressure of aggregate final demand. Consequently, the model is able to capture an endogenous price inflation story 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, enabling perturbations on levels of output supply. Company decisions on labor hire depend on real wage costs along profit maximization rules.

Accordingly, an important mode of adjustment in the commodity and factor markets can be traced out through a stimulus in aggregate final demand. As pressures build up in the commodity markets, mark-ups are bidden up, raising producer prices. An increase in the price level reduces real wages, as wages are fixed nominally. Consequently labor employment, and hence output supply, both increase. This process portrays the classic Keynesian motto: “output is supplied (labor is employed) because it is demanded;” in contrast to the neoclassical motto, or the well-celebrated Say’s law, “output is demanded, because it is supplied.”

On the foreign trade side, the model adopts the traditional treatment of foreign economic relations as utilized in many CGE applications: the Armingtonian commodity system for determining import demands; the constant elasticity of transformation specification in allocation of export and domestic sales; external clause rules through changes in nominal exchange rate or through endogenous flows of external finance, etc.

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

B. CGE Analysis of the Macroeconomy

Post-1980 adjustment of the Turkish economy has placed a heavy burden an agriculture. The sector has been severely taxed through adverse movements in domestic terms of trade; through elimination or reduction of input subsidies; and through evasion of traditional income sources. As incentives were directed away from agriculture towards export oriented manufactures, and as the government initiated a process of privatization in the production sphere, the performance of the agricultural economy began to falter, depending heavily on unpredictable weather conditions.

In the second half of the 1980s, however, with the initiation of the Southern Anatolia Project, there was renewed optimism about the future of Turkish agriculture. The project is totally dependent on domestic sources of finance, and puts significant pressure on the macroeconomy to generate the necessary funds. In the following quantitative analysis, we will try to simulate the macrolinkages between agriculture and the rest of the economy, given SAP's financial requirements. The sectoral implications of SAP will be analyzed in greater depth with the aid of the multimarket model of the Turkish agriculture in the next subsection.

The CGE experiments are conducted in two stages: firstly, the macrobalances of the economy are obtained for the historical base run (1987), and then the level of public investment is increased and reoriented to agriculture. In this first stage, funds for increased investment are acquired through internal and external borrowing. At the second stage, the mode for funds acquisition and rules of external adjustment have been changed in order to search for alternative methods of financing the increased investments. Here, the purpose is to evaluate alternative policy scenarios for financing SAP, and to trace out the global effects on the macroeconomy.

2. The simulation experiments can be summarized formally as follows:

Experiment E-INV-GBOR: Aggregate public investment is increased by 20% over its base-run value. This brings the public investment/GDP ratio to 14%, the actual value for 1988 and 1989. Increased financial claims are met through flexible government borrowing, the main mode of adjustment adhered to by the government during that period.

- **Experiment E-INV-ER:** The above experiment is replicated in its investment targets, but the macrobalance is obtained by flexible exchange rate adjustments.

- **Experiment E-INV-FIS:** The same experiment is implemented, and the financial claims of additional investment are met by fiscal restraint. Agricultural subsidies are eliminated, and transfer payments to private households are reduced by 25%. Therefore in this experiment, the burden of adjustment falls heavily on private incomes. The elimination of agricultural subsidies is a widely advocated policy in World Bank circles, and is considered to be an integral part of the Turkish fiscal austerity program of the 1980s.

The last two experiments follow possible alternative scenarios to E-INV-GPOR, and facilitate comparisons. *Table 2.1* displays both the absolute levels of historical base-run (1987 values) and the percentage deviations of the simulation experiments.

A general overview of *Table 2.1* reveals that, as compared to direct financing of governments outlays, adjustment via exchange rate is growth oriented, yet inflationary; and that adjustment by fiscal restraint is severely deflationary. With the E-INV-ER economy, the overall price level is influenced through two sources: first, increased public expenditure squeezes financial markets and crowds out private funds in real terms; and second, increased domestic costs of imported intermediates lead to classic cost-push inflation. As the model operates under fixed nominal wages, increased price levels simultaneously reduce real wages (at the rate of 3%) and consequently both employment and production expand. The only factor that inhibits further expansion in output is the falling effective final demand as a result of reduced urban labor incomes.

We observe that agriculture favors the exchange rate adjustment over the fiscal restraint experiment. Under E-INV-FIS, rural household incomes fall by 3% and output by 2%. This outcome is realized despite rapid increases in domestic terms of trade, which favor agriculture by 20%.

The income distribution consequences of the experiments are also mixed. Due to their economic power in setting mark-ups, the industrialists are able to sustain their average profit incomes under E-INV-ER, but in the deflationist environment of E-INV-FIS, the fall in aggregate final demand causes a significant reduction in mark-ups. Consequently, the power base of industrialists erodes and their share in value added falls. The government achieves a significant increase in its share of total value added, however, a result which contrasts with the announced stand of post-1980 governments towards de-statization.

Both experiments 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 reduction in aggregate final demand. This outcome, although conducive to easing the pressures of inflation, has nevertheless deflationary consequences in the product and factor markets. Such a deflationary environment provides an imminent threat to urban incomes, especially those of urban capitalist groups whose products are heavily dependent on domestic demand. This outcome indicates why macro-adjustments based on fiscal restraint and on austerity measures are so unpopular is many developing nations.

Exchange rate adjustment seems to offer yet another alternative for achieving macrobalances of the economy. Under the given assumptions, the model solutions suggest a domestic currency depreciation rate of around 17% over its base run value. (This depreciation rate is to be further utilized in the TARP Model simulations below). In this economy, agricultural incomes are strictly better off as they capitalize on increasing terms of trade and falling real wages. Urban workers and commercial capitalists, on the other hand, are the losers in this experiment, a result which follows directly from the inflationary consequences of the adjustment process.

3. The Multimarket, Multiregional Model of the Agricultural Sector

The Turkish Agricultural Regional Model (TARP), designed to provide a means of investigating policy related "what if?" scenarios, is a partial equilibrium, static optimization model. It augments classical producer-consumer surplus models by using the Positive Quadratic Programming (PQP) (Howitt, and Mean, 1985) method to overcome the over-specialization problems.

TARP is a sector-wide model in the sense that it describes total national supply (production and imports) and use (domestic demand for food, feed, and exports). It is a single period model: the base year is 1987. The production side of the model is decomposable 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.

Figures 2.1 and *2.2* summarize the flow of input and outputs at the regional and national level respectively. The objective function is defined as the maximization of producers' and consumers' surplus plus net trade revenue. The most important features of the model are the following:

1 The production side of the model is disaggregated to three regions for the exploration of interregional comparative advantage for policy impact analysis.
2 Crop and livestock subsectors are integrated endogenously. The livestock subsector gets inputs from crop production.
3 Foreign trade is allowed in raw as well as processed form 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, nine perennial crops, and six livestock activities. With three producing regions and several techniques of production for most crops, the total number of activities specified in the model is 123. The activities are distributed among the regions depending on the dominant cropping pattern in the base year. The model has been solved using the linear and non-linear programming software GAMS-MINOS7 on a PC.

A. Structure of the Sector Model

The assumptions under which the model was constructed are given below:

1. The agricultural sector, as a producing unit, can be partitioned into discrete and divisible regions.

2. Inputs and outputs of every production activity are in constant proportion for all levels at which the activity is operated.

3. Commodities can be divided as follows:
   a. Resources used in production.

b. Endogenous intermediate inputs emerging from a farm level production process as an output and entering some other process as an input.
c. Intermediate outputs which are produced commodities emerging from a farm level production process as output and entering the processing activities as an input.
d. Final commodities which are produced commodities desirable in their current state.

4. Consumption occurs at the national level.

5. There is a processing sector for converting intermediate outputs into consumable form. The cost of processing is uniform for the whole sector.

6. The availability of resources in a region is known and fixed, except for the fertilizers which have infinitely elastic supply curves.

7. The level of income in other sectors of the economy for any time is given.

8. The demand for final commodities is presented by known linear price dependent functions.

9. Competitive behavior is assumed for all participants in the system and all commodities are traded in competitive markets.

The objective function is quadratic in revenue and cost because it maximizes the area between linear demand and supply curves. The maximum consists of 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.

By incorporating linear demand curves, it is possible to solve the model for prices and quantities endogenously and simultaneously. 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.

The incorporation of demand curves into the model means that the programming solution will correspond to market equilibria. The sector-wide effects of various policies and exogenous changes, for example subsidizing or taxing inputs or output prices, or varying the exchange rate, can be investigated. Furthermore, the inclusion of demand curves makes it possible to identify the distribution of benefits from changes in agricultural output. For example, if the domestic demand is price inelastic, then the economic return to producers from an increase in output is negative whereas the effect on consumers' welfare is positive.

For the regional models, it is possible to incorporate demand functions at the regional level if it is possible to estimate the demand function of commodities for each region. This approach requires extensive consumer expenditure data which are not readily available for most less-developed countries, including Turkey. An alternative is to assume that the demand system in a region is proportional to the national demand matrix. This approach adds little to the formulation of the model because it ignores the regional differences in consumer preferences. In TARP, except for a few feed crops, the commodities can be moved between regions without cost and consumption occurs at the national level. Although a restraining assumption, national demand curves make it possible to keep the size of the model at a manageable level and help to disaggregate the production side of the model. The intention is not to diminish the importance of understanding of consumer responses. Rather, the primary purpose of the model, at this stage of development, is to evaluate the response of farmers to new technologies, greater resource endowments, and changes in relative prices.

The supply side of the model incorporates PQP methodology. The underlying assumption of this methodology is that 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 the response of the producers to changes in market environments, resource endowments, and production techniques. Hence, although the models are optimization models mathematically, they become simulation models by incorporating the behavior of the agents (maximization of economic surpluses) into the models' structure.

The acceptability of the models in the literature depends on whether or not they can approximate the observed values in the base year. At the sector level, normative statements are difficult to support and provide little help for policy analysis in decentralized economies, but the identification of interdependencies and causal relations can help to answer production-related policy questions. Approximating the actual cropping pattern in regional models is difficult to achieve with an unconstrained model, because it is not possible to estimate all the costs and benefits of growing a specific crop. In addition, given the quantifiable resource constraints, the production function used in linear programming implies constant returns to scale. But agricultural production, by its nature, exhibits diminishing returns to scale, mainly due to risk and land quality. Increasing production of a specific crop may be realized by expanding its production to less suitable soil and then the benefit of diversification would be diminished. The revenue is linear in output, and hence the concavity of the profit function is contained in the cost function. The unknown Hessian of the cost function is estimated by using the dual values of production constraints on crop production activities.

The implementation of the methodology for the sector model can be described in two stages. The first stage is similar to the validation step of the programming models. The model is calibrated and reproduces exactly the observed output levels of the base year by running the model with calibration constraints. In the second stage, the dual values obtained from the crop production constraints are incorporated as quadratic terms in the crop-wise objective function of the problem, and the upper bound constraints on the output levels are removed. Without any upper and lower bounds and rotational activities, the model's reaction to policy changes is a smooth trade-off based on changing comparative advantage.

It can be shown that quadratic non-linearity in the objective function results from a quadratic production function and/or mean-variance risk specification. The quadratic term can be called the implicit cost since it is implied, in a positive sense, by the farmers' crop allocations. The algebraic form of the objective function for this study is equation 27 in Appendix B.

TARP contains more than 120 activities to describe the production of 53 commodities. Each production activity defines a yield per hectare for crop production and yield per head for livestock production. The activities use fixed proportions of labor, tractor power, fertilizers, seeds and seedlings. The relation between inputs and outputs is that observed in each region, and not necessarily biological or economic optima.

The core of the model consists of production activities and resource constraints. The input and output coefficients for crop production are specified for each unit of land. All the activities are listed in *Table B.1* of Appendix B.

Output from crop production activities is divided into three categories: crop yield for human consumption, crop yield for animal consumption and crop by-product yield (such as forage, straw, concentrate and oil cake) for feed.

Commodty production activities in the model also constitute factor demand activities. Some factor supply functions are perfectly elastic (such as fertilizers), some are perfectly inelastic (for example, categories of land). In the former category, factor prices are exogenous; in the latter they are endogenous in the model.

Five groups of inputs (land, labor, tractor power, fertilizer and seed) are incorporated in TARP.

Land is classified into four classes: dry, irrigated, tree, and pasture.

Labor and tractor power constraints are specified on a quarterly basis. The labor input is measured in man-hour equivalents and shows actual time required on the field. The tractor hours correspond to the usage of tractors in actual production and transportation-related activities.

The two kinds of fertilizer, namely nitrogen and phosphate, are measured in terms of nutrient contents. They are considered to be traded goods and are not restricted by any physical limits.

In addition to the costs of labor, tractors and fertilizer, seed and seedlings (for vegetables and tobacco) are included as production crops for annual crops. Fixed investment costs are assigned for perennial crops.

Livestock production is an integrated part of the model. It is difficult to incorporate livestock production in a static sector model because of its dynamic character. Static models, however, can throw light on a number of interesting questions related to links with the production of feed crops and to alternative equilibrium states of the livestock subsector due to policy changes. Due to the limitation of data available on livestock production in Turkey, historical upper limits for herd sizes are incorporated in the model, and livestock production is assumed to be at the national level. The input structure of livestock activities is more detailed and more flexible than the previous models built for Turkish agriculture (World Bank, 1983). It is similar to the form used in Kasnakoglu and Bauer (Kasnakoglu, and Bauer, 1988). The feed supply is disaggregated into different categories. The model makes sure that the minimum feed composition requirements are fulfilled. The explicit production cost for animal husbandry is labor. Other required inputs are cereals and crop by-products. Pasture land is also required for grazing.

The commodities produced are distributed between different production selling activities at the national level. Firstly, there are domestic demand activities which are generated by linear demand curves. Domestic demand includes the domestic consumption of processed commodities in raw equivalent form. Secondly, there is a demand for cereals used for feed in the livestock sector. Thirdly, the model allows export of commodities at exogenous prices both in raw and, for some commodities, in processed form. It is possible to augment the supply of commodities through import activities at exogenously determined prices.

There are three agricultural production regions (SAP region, Aegean-Mediterranean coastal region, and the rest of Turkey) in the model. The regional division for the model is presented in *Figure 2.3*.

The provincial data base was used to select regional cropping activities, which are listed in *Table B.1.* The area and production of provinces were aggregated according to regional definitions.

The data can be grouped into two main clusters: (a) microlevel production coefficients which form the core of the model, and (b) regional and national data such as the regional area, production, national consumption, factor prices and international trade statistics.

The data were put together from various sources such as the State Institute of Statistics (SIS), State Planning Organization (SPO), and Land and Water Development Agency (TOPRAKSU). FAO and World Bank sources were also used to complement and cross check the data from Turkey.

B. Agricultural Sector Model Experiments

Sectoral programming models like TARP are most useful in comparative static analysis. Two types of comparative static analysis may be conducted using the model. The first type is the simulation of alternative static equilibria without reference to time. The second type of experiment, which may be called comparative static projection, aims to identify the medium term growth prospects of Turkish agriculture.

Given the framework of the study, four different experiments have been conducted with the model. The structure and reasons for conducting the experiments are summarized as follows:

Experiment A-FP. As mentioned previously, the most significant government intervention in factor markets occurs through the pricing of fertilizer. Despite the decrease in the fertilizer subsidy in the early 1980s, towards the end of the decade there has been an increase in the fertilizer subsidy. In this experiment the effects of increasing the price of fertilizer by 50% which corresponds to the full elimination of the subsidy, is investigated.

Experiment A-SAPI. It is assumed that the irrigated area in the SAP region will increase by 600,000 hectares. The purpose of this experiment is to find the effects of a significant increase in the irrigated area of one region on the national and regional crop pattern, given that the base year demand or supply structure remains intact.

This experiment is related to the experiment E-INV-GBOR 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 investment is directed to the SAP pro-

ject. According to the SAP Master Plan (SPO, 1990) the total increase in the irrigated area of the SAP region has been estimated to be 1.6 million hectares, but given the present phase of the project it will not be possible to reach this target in the medium term.

- **Experiment A-SAPI-DEV.** The result of Experiment E-INV-ER with the CGE model concerning the exchange rate adjustment to finance the increase in public investment is incorporated into TARP.

- **Experiment A-1995.** Projection of the model to the year 1995 is carried out by expanding resource endowments and permitting some yield growth, with appropriate adjustments made to reflect income and population growth. Historical international trade limits are released to reflect export market penetration.

The overall results of the simulations are presented in *Table 2.2*. The impact of increasing the price of fertilizer is relatively high on food crop production. The decrease in net export is mainly due to the decline in the export of pulses which has shown a significant increase since the early 1980s. The increase in irrigated area in the SAP region will mainly affect the production of export oriented crops. Devaluation to finance the SAP project has a major impact on net export. According to the overall results, the growth prospects for Turkish agriculture do not present an optimistic picture. The increase in volume of total production is approximately equal to the increase in population, but net export declines due to low growth in the production of food crops.

The results of the experiments at the crop level and related to resource use indicate that eliminating the fertilizer subsidy does not significantly affect the use of inputs. The uses of nitrogen and phosphate fertilizer decline 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 aggregate effects of the increase in the price of fertilizer according to major commodity groups are presented in *Table 2.3*. The immediate effect of increasing fertilizer prices is an upward shift in the supply curves of the crops. The cost of production increases, and given a constant demand for the crops, the cultivated area and production decreases, along with fertilizer use. However, the decline in the production is much less than the decline in cultivated area due to the change in relative profitability of production techniques and crops. Overall reduction in production reduces competition for scarce resources, in this case irrigated land, and therefore the opportunity cost for irrigated land decreases. The result is a downward shift in the implicit supply curves of the crops.

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 for all commodity groups, except cereals (especially wheat), is not highly affected by the increase in fertilizer price.

Substitution possibilities in the production structure indicate that the negative production effects of eliminating fertilizer subsidy result in a chain of effects starting from the fertilizer price and leading to production costs and hence to production levels. At the sectoral level, this chain of effects appears to be significant, so that the result is a rather small decline in both production and fertilizer use. 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 promoted by the government to replace fallow. The increase in the price of fertilizer has a significant effect on the export of these crops. It seems that the promotion of pulses production is heavily dependent on the subsidy of fertilizer, and with the production of pulses expanding on less suitable land it would not be beneficial.

The effects of the experiment regarding the increase of irrigated land in the SAP region on the sector are presented in *Table 2.4*. The national and regional impacts indicate significant changes in the production pattern. Since the domestic demand for agricultural products remains unchanged, the shift in the regio-

nal comparative advantage in crop production causes changes in the cropping pattern of the other regions. The land released as a result of the shift in production is distributed to those crops which were unprofitable to produce prior to the experiment.

An interesting result of the experiment is that, in some crops, production increases in both SAP and some other regions as well. This effect works through the shift in relative price of the crops. The changes are driven by final demand effects. Demand elasticity and export potential of crops are the main determinants for the shift in relative prices. For instance, the price of cotton relative to other higher valued crops increases, although its absolute price declines. The additional cotton production, which was not profitable in the original situation, becomes profitable after the changes in implicit marginal costs of production. In general, for exported commodities, which are restricted to historical quantities in both situations, 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 if the constraint is binding, or the traded quantity increases due to the decline in the domestic price of commodities (except for pulses).

As expected, the employment impact of the project shows the potential to curb the unemployment or underemployment in the region. In addition, the indirect positive effect of the project on cotton production in the Mediterranean region further ameliorates the employment problems in the southern part of the country.

The crop-specific effects of the experiment indicate substantial increase in the production of high value crops *(Table 2.5)*. In particular, the increase in cotton production indicates the need for additional investment in storage, transportation, and processing facilities in the region. In addition, since most of the cotton and textile importing countries apply non-protection measures for cotton and cotton products, it is compulsory to identify new international marketing strategies.

Incorporation of devaluation as indicated in the related experiment by the CGE model indicates that the production structure in agriculture shifts drastically to export-oriented crops. Except for industrial crops, production of all crop groups declines, and furthermore, there is a shift from domestic consumption to exports *(Table 2. 6)*.

Growth prospects for Turkish agriculture are analyzed using a projection of the model to 1995. The results of the projection experiment are presented in *Table 2.7*. These results highlight the importance of irrigated land. All the additional irrigated land is used without any decline in the regional shadow prices of irrigated land. Slight increases in the use of dry land are observed in the relatively irrigation-scarce regions. Industrial crops and oil crops gain 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 crops production (3.3%) and the lowest in pulses production (1.6%). Without any intervention in the output markets, the growth rates reflect the effects of income elasticities and export potentials of the commodity groups. In the case of cereals, for instance, part of the increase in production is absorbed by livestock production as feed.

The interpretation of changes in livestock production requires great caution because the model does not incorporate fixed investment costs or any other overhead costs for expanding the livestock inventory. But if the livestock inventory is assumed to follow the historical rate of expansion then it is possible to say that with increasing demand, livestock production has greater potential to expand than crop production. Part of the growth in cereal production can be attributed to the need for feed crops for the growing livestock inventory, which points to a fierce food/feed competition.

The projected growth rates of consumption according to major commodity groups signify that considerable changes will occur in the consumption package. Consumption of commodities with high income elasticities is 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.

It is not possible to detect the income distributive effect of the change in consumption structure because the lack of data makes it impossible to specify demand functions according to income groups.

As mentioned earlier, export limits are released to some extent from the base period magnitudes to reflect government trade liberalization policies. However, projected export quantities are given upper limits reflecting realistic market penetration in exports. The average growth rate per year of 2.5% during the period 1980-85, which overlaps with the liberalization era, is taken as the basis for potential increase in exports. According to the projection results, total exports will decline slightly. With a 2.5% per year growth in population, it is not possible to increase the export of agricultural commodities if the yield growth follows the historical pattern.

TARP can also be used to identify social profitability in exports by tabulating the exchange cost or domestic resource cost for export commodities from the simulation results. A Bruno-style (Bruno M., 1967) estimate of TL cost of an additional dollar of exports may be calculated from the dual values of trade bounds. The shadow price on export bounds signifies the amount of producers' excess profits per incremental unit exported. The difference between the exogenous export price and producers' excess profits gives the marginal cost of domestic production or marginal return of selling the commodity on the domestic market. Production costs derived from the model are a composite of input costs which are exogenously priced, and input costs which are endogenously valued by the model. The latter are composed of marginal valuation of fixed resources and implicit costs embodied in the PQP terms. The exchange cost is calculated as the ratio of marginal product costs in TL to the export price in dollars, and hence it measures the level of production costs in TL required to earn a dollar in exports.

Several conclusions may drawn about the competitiveness of Turkish agriculture in the international markets *(Table 2.8)*. Firstly, the comparison of the exchange costs with the prevailing exchange rate in the base year (US$ 1=TL 669.4) shows that, overall, Turkish agriculture is quite competitive in the world market at the margin. Significant potential gains in exports may be realized by increasing marketing efforts, assuming that Turkey is a small country. Secondly, the ranking of major export crops remains stable during the projection period. Thirdly, the calculation of exchange costs gives some clues to improving gain from trade by changing the composition of agricultural exports. For instance, the exchange costs for olives, melons, and barley show high potential for exchange earnings. However, cotton and lentil exports, which have high shares in total export revenue, are not profitable at the margin. Further increase in the export of these crops is only possible through an export subsidy.

III – Conclusion

The results of this study can be summarized in two main parts, parallel to the applications of the models. Comparative static experiments, such as fertilizer pricing policy, increase in irrigation investment in the southeastern region, and the exploration of medium-term growth prospects of Turkish agriculture, formed the first type of experiments. CGE analysis of the macroeconomy under alternative policy scenarios with respect to agriculture was the second type.

Comparative static experiments showed the importance of incorporating cross-supply effects with respect to both crops and regions. Phasing out the fertilizer subsidy had different effects with respect to both crops and regions. The high value cash crops and the regions with a relatively high endowment of irrigated land were the least affected by the elimination of the fertilizer subsidy. The overall negative effect on production was modest. The increase of irrigated land in the southeastern region caused increased production of some crops not only in this region, but in other regions as well. The results of medium-term growth prospects revealed an important development resulting from 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 indicates that the government has been 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 been unable to adjust to the new market environment with less government intervention in both input and output markets.

On the other hand, our results with CGE model experiments indicate that conflicting claims of various social classes on national output, and conflicting rates of intersectoral accumulation warranted by com-

peting producer groups, are important sources of macrodisequilibrium in the domestic economy. The Turkish mode of adjustment in the early 1980s relied heavily on worsening income distribution and on agricultural taxes. 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 private commercial capital ventures.

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

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