THE RURAL ECONOMY UNDER STRUCTURAL ADJUSTMENT AND FINANCIAL LIBERALIZATION

Results of a Macro-Integrated Agricultural-Sector Model for Turkey *

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ABSTRACT

The Macro-Integrated Agricultural-Sector modeling approach is introduced to analyze the economic effects of the post-1980 Turkish structural adjustment reforms on the agricultural economy. The distinguishing feature of the model is its capability in addressing simultaneously the real and financial macro aggregates and the micro-sectoral detail of agriculture in a consistent fashion. The modeling analysis discloses that the Turkish mode of adjustment has typically relied on taxation of agricultural incomes, and suggests that an investment program based on reinvesting the rural surplus within the agricultural economy is a superior option.

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RÉSUMÉ

Un modèle sectoriel agricole intégré à un modèle d'équilibre général est introduit pour analyser les effets des réformes d'ajustement structurel après 1980 sur l'économie agricole. Le trait distinctif du modèle est sa capacité de traiter simultanément les variables réelles et financières et les détails du secteur agricole d'une façon consistante. Les simulations réalisées à l'aide du modèle montrent que le mode d'ajustement turc dépend de la taxation des revenus agricoles, et suggère qu'un programme d'investissement axé sur le réinvestissement des surplus ruraux dans l'économie agricole est une option supérieure.

INTRODUCTION

In January 1980, Turkey embarked on an ambitious structural adjustment program to restore its macro balances. The program aimed to integrate the domestic economy with the world economy through re-orientation of economic incentives towards the traded goods sectors. The theoretical basis of the reform package was the orthodox view that, in an economy in which world prices were undistorted by trade restrictions and capital accumulation was based on the profit motive (which was yet to be privately internalized), one would achieve the optimum allocation of resources.

To restore macro balances, this theoretical perspective rested its policies on the monetarist prescription of domestic credit restraint in order to control excess commodity demand. A price reform was enacted that was complemented by a series of commercial policies to liberalize commodity trade and encourage exports. Subsidies to agriculture and to the state enterprise system were either eliminated or significantly reduced. The foreign exchange regime was liberalized beginning 1984, and successive steps were taken to attain complete liberalization of the financial system by the end of the decade.

Turkish agriculture had to bear the brunt of the adjustment process and was deeply affected from the implemented policy reforms. For decades, the sector has operated under severe government regulation. After the Reform, however, it has found itself in an entirely different environment with competitive pressures of competing imports, market determined prices and reduced subsidies. Surprisingly, although there are numerous accounts of the Turkish adjustment experience in the literature[1], the role of the agricultural economy, a sector employing more than half of the productive labor force, has been overlooked. Furthermore, existing studies either treat agriculture within a detailed sectoral approach, albeit at isolation from the rest of the macro economy at large (Bauer and Kasnakoglu, 1988 and 1990; Cakmak, 1987); or regard agriculture as one of

1. See, e.g., Aricanli and Rodrik (1990); Celasun and Rodrik (1989); Senses and Yamada (1990); Yeldan (1995b); Senses (1994).

many branches of a general equilibrium model (e.g. Celasun, 1986; Yeldan, 1989 and 1995b) leaving much of the desired detail aside for the sector.

Our motivation in this paper is based on the argument that agriculture has strong interlinkages with the rest of the economy (Adelman, 1984; Mellor, 1984; Hirschman, 1981) and that proper recognition of sectorial detail such as farm-level production activities, crop production patterns and plant technology, within the macroeconomic general equilibrium framework should be an integral component of such analysis.

Clearly, agricultural economy does not operate in isolation, independent of the ongoing adjustments occurring in the rest of the system; nor the non-agricultural sectors can be studied without due recognition of the underlying interlinkages with the rural sector. In this paper, we propose a new approach to address these issues through utilization of a new modeling technique, which we will call *Macro-Integrated Agricultural-Sector* (MIAS) modeling. The approach employs an integrated, two-level quantitative analysis: at the first level, a macro general equilibrium model of the domestic economy is used to spell out the real and the financial balances and the structural relationships of the overall economy. At the second level, a detailed sectoral model of the agriculture is utilized to study a series of micro-detailed behavior. We propose that through this two-level integration, one can investigate consistently both the leading role and the adjustment processes experienced by agriculture given its interactions in response to macro policies, and obtain a richer description of the adjustment within the agricultural economy itself.

The MIAS modeling approach has its roots in the folklore of computable general equilibrium modeling (Adelman and Robinson, 1978; Dervis, de Melo and Robinson, 1982; Taylor, 1990); the agricultural sector modelling (Duloy and Norton, 1983; McCarl and Spreen, 1980; Le-Si, Scandizzo and Kasnakoglu, 1983; Bauer and Kasnakoglu, 1990); and the recent computable nonseparable household modeling technique (De Janvry et al., 1992). It derives its strength from its double foci on the national macroeconomic equilibrium as well as on the agricultural microeconomic equilibrium, under conditions of limited multi-period data availability. Especially, for the developing countries where the lack of sufficiently long time series data often precludes the use of econometric modeling techniques, the MIAS modeling approach, based on comparative static policy simulation experiments, offers viable alternatives for policy relevant research.

Based on this agenda, we organize the paper as follows: in the next section, we provide a brief history of Turkish agricultural development and highlight the main problems of the sector. We introduce the MIAS approach in the second section, and utilize it for conducting policy experiments in section three. The fourth section is reserved for concluding remarks.

I. REVIEW OF TURKISH AGRICULTURE

Turkey started an ambitious development program based on five-year plans in 1963. Given the relatively underdeveloped state of the industrial sector, much effort was directed to capital accumulation and urban/industrial investments. The inward looking import substitution policies of 1960s and 1970s were strategically boosted-up by policies that would enhance domestic demand. During this era, the combined policies of high support prices, input subsidies and low interest rates on agricultural credits had the dual effect of increasing the rural demand for industrial commodities, and integrating the agricultural sector with the rest of the economy. By the end of 1970s almost all agricultural products were commercialized and the share of agricultural exports increased.

In the 1980s (except in 1982 and 1988) the growth rate of the agricultural gross domestic income was less than the corresponding growth rate of the overall economy, resulting in a declining share of agriculture in gross domestic income from 22.6% in 1980 to 15.1% in 1993 (Table 1). Following the historical trend in the development process of most of the developing countries,

TABLE 1
SELECTED INDICATORS OF THE AGRICULTURAL SECTOR
1980–1993

Years	Share of agriculture in GDP[1] (%)	Growth rate of agricultural GDP[1] (%)	Growth rate of GDP[1] (%)	Share of agricultural fixed investment in total[2] (%)	Share of agricultural credits in agricultural GDP[3] (%)	Terms of trade[a] (1976 = 100)[4]
1980	22.6	1.9	-2.0	6.67	18.38	67.3
1981	22.0	-1.6	5.4	8.88	16.69	65.4
1982	20.8	4.4	4.2	9.24	11.85	56.7
1983	19.6	-0.8	5.3	9.55	13.55	59.7
1984	19.6	1.4	7.4	9.38	11.63	66.1
1985	18.8	0.1	4.4	7.10	12.22	63.7
1986	18.5	5.4	7.8	6.45	17.01	62.1
1987	18.0	1.1	9.0	7.62	16.97	59.0
1988	17.5	7.9	2.2	7.14	11.71	49.8
1989	16.7	-7.4	-0.5	6.77	13.24	57.8
1990	18.1	7.1	9.6	6.58	10.27	70.7
1991	16.9	-1.2	0.9	6.93	11.73	66.2
1992	15.9	3.7	5.5	5.00	8.75	66.5
1993	15.1	-1.9	5.3	5.17	7.97	71.6

Note:
a. Index of agricultural prices/index of manufacturing prices.
Sources:
1. SIS (1994)
2. SPO (1995)
3. SIS (1989), SIS (1995)
4. Boratav et al. (1996)

TABLE 2
PERCENTAGE OF SUBSIDIES TO THE AGRICULTURAL SECTOR

Category of Subsidy	1986	1987	1988	1989	1990	1991	1992	1993
Input Subsidies	31	30	23	23	25	14	17	18
Duty Losses	2	2	6	12	4	34	3	10
Concessional Loans	68	68	71	65	71	53	80	72
to Farmers and ASCUs	60	58	61	59	65	47	76	66
by the CB to TMO	8	10	10	6	6	6	4	6
Total (1987 billion TL)	1594	1940	2185	2416	1495	2246	1967	1850
Share of total subsidy in agricultural value-added	12	15	15	18	11	16	14	13

Source: Calculated from OECD (1994) using GNP implicit deflator of SPO.

the share of agricultural labor in total labor force has declined from 55% in 1980 to 43% in 1993 (SPO, 1995). This was mainly due to the relatively high productivity growth in the non-agricultural sectors.

Another factor which compounded the slow growth rate of the agricultural GDP was the declining importance of agricultural fixed investment in total fixed investment (Table 1). The growth rate of fixed investment fluctuated throughout the era. Moreover, contraction of agricultural credits exacerbated the unfavorable environment for capital accumulation in the agricultural economy.

Indices of terms of trade can be cited as an important indicator of the extent of the extraction of economic surplus and transfer of resources from agriculture (Yeldan, 1995a; Mutlu, 1990). As can be seen in Table 1, the terms of trade reveal a dramatic regression from 1976 to 1984, followed by strong recovery starting from 1990. With the implementation of the structural adjustment program in 1980, cutbacks in the support prices, biased export incentives directed almost exclusively to manufacturing, and the reduction of the purchasing power of urban workers caused a substantial fall in the relative net price of the agricultural sector (Celasun and Rodrik, 1989). The differences between pricing behavior of agriculture and industry provide an additional explanation of the terms of trade movements. Numerous studies (Sahinkaya, 1993; Yeldan, 1994; Boratav, et al., 1996) argue that, the pricing behavior of industrial sector is mostly characterized by average cost plus mark-ups in oligopolistic markets, whereas agricultural prices are determined in perfectly competitive markets. This dual structure had perverse effects on domestic agriculture and constituted the main mechanism in extracting surplus from the rural economy.

The level of government involvement in the agricultural sector declined in the 1980s (Table 2). The relative importance of the premia and input subsidies,

almost 90% of which is fertilizer subsidy, has diminished throughout the period. The most important component was observed to be the interest concessions through concessional loans to farmers and Agricultural Sales and Credit Cooperatives (ASCU) by the Agricultural Bank. The concessional loans by the Central Bank (CB) are only devoted to the Turkish Grain Board (TMO) and were on a decreasing trend as a result of the pressure on the Central Bank to control the process of monetary expansion. Another subsidy item has been the transfers to the state agencies to compensate for the losses that were incurred due to their support purchases.

In the 1980s, the agricultural economy has further witnessed a secular rise in interest costs of credit, along with an economy-wide repression of loanable funds. In this period, the Treasury has gradually changed its financial policy away from monetization through the Central Bank advances towards domestic finance via issues of new debt instruments. With the rapid rise in the public sector borrowing requirements and the increase in the claims of the Treasury in the credit markets, the real cost of credit rose sharply and squeezed rural incomes. We will study the main mechanism of this policy maneuver thoroughly in the first scenario below. We begin by introducing the elements of the MIAS model in the following section.

II. THE MACRO-INTEGRATED AGRICULTURAL-SECTOR MODEL

The MIAS modeling approach of the present study utilizes a general equilibrium methodology in its macro frame which zooms into a highly disaggregated agricultural sector model using static optimization techniques. The macro setting of the model is decomposed into two interdependent real and financial components which are linked through various channels of flows of funds, commercial bank intermediation processes, central bank monetary policy instruments, and private portfolio choices. The sector model, on the other hand, is a direct augmentation of the classic economic surplus models. Its maximand consists of the aggregate economic surplus plus net export revenue. The optimal solution entails equating aggregate supply and demand, and prices to marginal costs for all commodities. The sector model recognizes three distinct geographical regions to explore interregional comparative advantage for policy impact analysis. Crop and livestock production activities are endogenously integrated through explicit recognition of input demand of the livestock subsector from the crop production processes.

The overall MIAS model is built around four production sectors (agriculture, industry, commerce, and public services); four private households (rural, urban labor, industrial, and commercial capitalist); and a government. The agricultural sector comprises 22 distinct annual crops, nine perennial crops, and six livestock activities. With three production regions and multi-faceted techniques of production for most crops, the total number of agricultural activities distinguished in the model sum to 123. Finally, the "rest of the world" is

TABLE 3
POLICY INSTRUMENTS OF THE MIAS MODELING APPROACH

Macro-model Specific Variables	Integration Variables	Agricultural Sector Specific Variables
• Credit (deposit) interest rate	• Exchange Rates	• Techniques of Production
• Government bond interest rate	• Commercial policy instruments	• Regional Input availability
• Monetization rate	• Agricultural terms of trade	• Price and income elasticities for agricultural products
• Public savings, investment rates	• Agricultural tax rates	• Input prices
• Income tax rates		
• Sectoral shares of public investment		

aggregated as one single entity engaging into foreign relations with the domestic economy.

The MIAS modeling approach is primarily designed to study the policy-related "what if" scenarios in a comparative static setting. To achieve maximum flexibility in policy design, the model encompasses a wide variety of instruments of the government's fiscal and monetary operations at various levels of decomposition. Table 3 displays a general, but not exhaustive, list of certain policy novelties of the macro-integrated sector modeling approach.

The integration mechanism between the macro-general equilibrium phase and the within-sector component is achieved directly through the set of "integration variables" as identified in the middle column of Table 3. The exchange rate variable is a conversion factor in translating foreign prices into domestic currency units and is endogenously solved in the macro-general equilibrium phase to close the balance of payments accounts. This in turn is used parametrically in the agricultural sector model in optimizing the sector's behavior towards export versus domestic sales. Likewise, the effects of various commercial policy instruments and resulting terms of trade movements are solved endogenously in the macro model to be implemented parametrically in the agricultural sector model. With this transmission mechanism, the general equilibrium model directs the agricultural sector, and achieves consistency of the micro level, within-sector balances of agriculture with the rest of the economy.

One important caveat of our approach here is that, the integration process is unidirectional; i.e., that implementation of policy affects the overall macro equilibrium first, which is then "zoomed" into the disaggregated agricultural activities. That is, macro equilibrium is prior to agricultural sector equilibrium. Though potential inconsistencies across the macro and micro specific equilibria

may remain to be unresolved with this design, we nevertheless observed that our policy conclusions remain robust to ordering of the model-specific solutions.

The overall model is brought into equilibrium through a Walrasian tatonnement adjustment mechanism based on the endogenous iteration of market prices, the interest rate and the foreign exchange rate to clear the commodity markets, the credit market and the balance of payments. In the labor markets, wage rates are assumed to be nominally fixed, and are cleared through quantity adjustments of employment. In industry, the market price is hypothesized to be set by oligopolistic producers by downward rigid mark-ups over variable costs. This specification highlights the oligopolistic, non-competitive pricing rules thought to be prevalent in various branches of manufacturing industry. Further evidence is suggested by Boratav et al. (1996) who argue that oligopolistic mark-ups display upward flexibility at times of accelerating material input costs, but tend to be constant during periods of low/falling material costs. Based on Boratav et al.'s findings, the model adopts – in the terminology of Gibson et al. (1986) – Kaleckian mechanism of constant mark-ups under periods of price deflation; yet, during inflation, it is characterized by the Marx-Sraffian wage-profit trade-off with flexible mark-ups, adjusted upwards by the rate of inflation. Consequently, industrial output supply is determined by aggregate final demand, given the mark-up based market price. The domestic money market is brought into equilibrium through perturbations of the interest rate and the overall price level, generating inflationary pressures in the domestic economy. Changes in the supply of domestic currency result from government's policy of fiscal deficit finance, either through bond issuing at the rate γ, or monetization (at the rate $1-\gamma$). Thus, currency supply obeys:

$$\Delta M_t^S = (1-\gamma)GRDEF - \rho TDEP + \Delta FRES \cdot ER \qquad (1)$$

where the first term on the right hand side is the monetized portion of the deficit; the second item is the reserves of the banking system, while the last gives the foreign reserve accumulation of the central bank in domestic currency units. Aggregate demand for currency is in the tradition of the "quantity theory," with velocity being considered as a function of the real interest rate, R, and the inflation rate, π:

$$M_t^D = \left[\frac{1}{V_y + V_R(R+\pi)}\right] \cdot GDP \qquad (2)$$

with GDP denoting the nominal gross domestic product.

A portion of the fiscal deficit is covered through new bond issues at the rate γ:

$$\Delta GDI = \gamma\, GRDEF \qquad (3)$$

As stated in the previous section, successive Turkish governments during the latter half of the 1980s, devised both market and administrative (non-market) mechanisms to transfer resources from the private sector to hold the fiscal

debt. Given the historically observed trend, we assume that the new issues of government debt instruments (*GDI*) are held exclusively by the commercial banking sector. This process, however, crowds out private investment demand as it squeezes the loanable funds market:

$$(1-\rho-\lambda)TDEP - \Delta GBND = \Sigma_i\, DKP_i \tag{4}$$

In (4) $TDEP = f(R_+)$ is total deposits at the banking system; λ is the liquidity requirement ratio; and *DKP* is sectoral private investment demand which is funded through bank intermediation. Private investment demand is in the tradition of Tobin's q-formulation, with *DKP* increasing with respect to the real profit rate (*RP*), and decreasing with respect to the real interest rate:

$$DKP_i = \overline{DK}_i \left[\frac{1+RP_i}{1+R}\right]^{\varepsilon_i} \tag{5}$$

given the elasticity ε_i and the shift variable, *DK*.

The interest rate acts as the equilibrating variable to satisfy (4). In this process the model captures the effects of financial squeeze emanating from the policy of bond financing of the fiscal deficits through the credit market. As government's bond financing ratio, γ, increases, the interest rate is bid up, as a portion of the private financial funds is capitalized by bond financing of the deficit. This process leads to crowding out of the private investment via (5), and deflation of the price level by reducing the liabilities of the central bank, and leading to contraction of the domestic currency supply via (1)[2].

As the overall price level is solved in the macro component, the prices of the agricultural products are determined endogenously by demand and supply conditions in the sector including foreign trade. Producers and consumers are price-takers within the agricultural product markets, hence perfectly competitive behavioral assumptions apply.

In the agricultural sector component, the model seeks to maximize the area between the demand and supply curves with a quadratic objective function in revenue and cost. The objective function represents the sum of consumers' and producers' surpluses, and net export revenue:

$$\begin{aligned} OBJEC = {} & \sum_o [\alpha_o * TOTCONS_o - 0.5 * \beta_o * TOTCONS_o^2] \\ & + \sum_o \exp_o * EXPORT_o - \sum_o imp_o * IMPORT_o \\ & - \sum_c \sum_r COST_{c,r} - 0.5 * \sum_o \sum_r pmp_{r,o} * REGPROD_{r,o}^2 \end{aligned} \tag{6}$$

2. See experiment E1 in section III.

All of the variables (denoted by capital letters) are obtained from the production and national commodity balances. First part of (6) represents the total area under the demand curves of each product. The demand curves can be repositioned depending on population and income growth, and form one of the major links between the macro model and the sector model. Second part of the objective function is the net export revenue for the agricultural products. The first term in the third part of the objective function is obtained by the cost equation:

$$\sum_i ccost_{c,r,i} * CROP_{r,i} + \sum_j lcost_{c,r,j} * LSTOCK_{r,j} = COST_{c,r} \qquad (7)$$

It shows the total cost of all crop and livestock activities for each cost items (c) and regions (r). The cost items include labor, machinery, and various chemical input costs. Fertilizer is an important cost component, its price to the producer depending both on the exchange rate and the subsidy level. The non-linear term in the third part of the objective function is obtained using the positive mathematical programming (PMP) method to overcome the problem of over-specialization in the model[3]. The parameter *pmp* in (6) is obtained from the calibration stage of the model assuming that the production pattern observed in the base year is optimal. The calibration results are then used to estimate the cost terms which can not be captured by the fixed proportion production activities in the sector model.

The core of the agricultural sector component consists of production activities and resource constraints. Land, labor and machine hours, and fertilizer comprise the major input categories. Land constraints (equation 8) for each region (r) and type of land (s) form another link between the two models since most of the government investment activities in agriculture consist of infrastructural investment.

$$\sum_i cp_{r,s,i} * CROP_{r,i} + \sum_j lp_{r,s,j} * LSTOCK_{r,j} \leq resav_{r,s} \qquad (8)$$

Part of the increase in public investment in agriculture is translated into an increase in the availability of irrigated land. Input and output coefficients for crop production are specified for each unit of land. The commodity production activities also constitute factor demand activities. Some factor supply functions are perfectly elastic (such as fertilizers), while some others are perfectly inelastic (e.g., types of land in equation 8). In the former category factor prices are exogenous, whereas in the latter they are determined by the solution of the model.

Livestock production is an integrated part of the model. The input structure of the livestock activities are more detailed and more flexible than the previous models built for Turkish agriculture (e.g. Le-Si et al., 1983; Cakmak, 1992).

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3. For a detailed discussion of the PMP method which was used to calibrate and validate the sector model see Kasnakoglu and Howitt (1987), and Howitt (1995).

The feed supply is disaggregated into different categories. The model ensures that the minimum feed composition requirements are fulfilled. For animal husbandry, the explicit production cost is labor. Other required inputs are cereals and crop by-products. Pasture land is also required for grazing.

Production technology for the non-industrial sectors of the macro-economy follows CES specification with limited substitution possibilities among physical capital and labor. Stocks of physical capital are regarded fixed, leading to standard convexity hypotheses with consequent upward sloping supply schedules. Following the classic computable general equilibrium tradition, a further CES function is formulated between the imported and the domestically produced good. Sectoral exports at the macro level are determined via the constant elasticity of transformation approach. Private consumption demands follow fixed sectoral shares with the underlying assumption that the preferences are of the Cobb-Douglas type. Aggregate public consumption and public investment are nominally fixed, leading to financial squeeze as discussed above. The overall model is calibrated to 1987, a year in which the domestic economy is considered to be in equilibrium. The state of the macro economy in 1987 can be read through the first columns of the tables in Section III below. We now turn to policy simulation analyses of the model.

III. THE MIAS ANALYSIS OF THE MACROECONOMY AND AGRICULTURE

On general grounds, it can be stated that agriculture is affected from the macro policy design through three distinct channels: *first*, is the relative price effect. As discussed above, with the removal (or reduction) of the input subsidy component of the government's support policy, the sector has suddenly found itself in a competitive environment. Yet, the agricultural economy was surrounded by sectors which have been operating under oligopolistic pricing and non-competitive behavior, such as the industry and finance. Thus, price reforms under structural adjustment practically meant taxation through adverse domestic terms of trade for the sector. *Second*, is the demand effect. As incentives were re-directed to the traded sectors in general, but towards the manufactured exports in particular, domestic absorption capacity contracted and there occurred a structural shift in the composition of aggregate demand unfavorable to agriculture. *Third*, there were the financial sector effects. With the contraction of the domestic credit market and the secular rise of credit costs, agricultural producers incurred heavy losses, and agriculture had to transfer additional income to commerce and the financial sectors through the credit market.

Existing studies on the Turkish agricultural economy thus far have generally focused on either of the first two channels identified above[4]. The third

4. See, e.g., Mutlu (1990) and Kazgan (1992) on the first effect; Celasun and Rodrik (1989) on the second effect.

mechanism, however, is often neglected. In what follows, we attempt to examine all three aspects of the adjustment that the sector has undergone in response to the structural adjustment policy reforms. In particular, we address three distinct, but interrelated issues: (i) the effects and the policy dilemmas confronted as a result of the government's choice of the deficit financing strategy to control domestic credit expansion; (ii) the effects of the reductions in producer subsidies in agricultural incomes; and (iii) the pressing need for revitalization of an agricultural investment program together with an analysis of a viable policy alternative to support capital accumulation in agriculture. The policy experiments are implemented via time-independent, static perturbations of the policy instruments under three simulation exercises.

A. Deflation Through Monetary Contraction (Experiment E1)

Liberalization of the financial markets in 1980s involved a series of reforms towards financial "deepening" and strengthening of the national currency via monetary contraction. As for fiscal operations, this practically meant a switch to domestic sources of fiscal deficit financing through issues of government debt instruments (GDIs) in contrast to monetary finance from the central bank sources. In Experiment E1, we analyze the macro-aggregate and the micro-sectoral effects of this policy maneuver by increasing the bond financing rate (γ) to 0.95 – its historically observed average for 1988–1992.

The net effects of the experiment reveal the classic adjustment mechanisms of monetary contraction. With the reduction of the pace of monetary finance, supply of domestic currency shrinks (equation 1); and consequently, domestic price level deflates. In the meantime, the GDI rate of interest increases in the bond market to sustain the increased supply of GDIs. In the commercial banking system, as funds are directed towards acquisition of government bonds, supply of loanable credit is curtailed and the credit interest rate increases.

The effects of price deflation on relative prices are not neutral due to imperfections in the factor and the commodity markets. Since urban wages are exogenously fixed in nominal terms, real wage costs increase under a period of price deflation. However, as the industrial final price is protected by way of downward-rigid mark-ups, increased wage and rental costs are passed on to the final consumers. Implementation of oligopolistic mark-ups in this manner, de facto fixes the relative price of industry against the rest of the economy, and restricts the process of adjustment of the price system. Thus, the fall in the aggregate price level in the face of protected urban prices causes a downward adjustment in the relative price of agriculture. Terms of trade deteriorate for the rural economy. These results are documented in Tables 4 and 5.

The impact of the change in financial variables on the real sectors permits a related experiment with the sector model. The deflationary impact of the monetary contraction is passed onto the agricultural sector. Agricultural sector specific results of the experiment are presented in Tables 6 and 7.

TABLE 4.
MACRO EQUILIBRIUM OF THE DOMESTIC ECONOMY

	Base Run (1987 Billion TL)	E1[a]	E2[b]	E3[c]
		(Base Run = 100)		
GDP	58200.6	99.54	100.74	100.99
Consumption				
Private	39033.1	98.72	100.54	100.85
Public	5306.5	101.79	101.48	101.77
Savings				
Private	9138.9	100.41	100.91	100.82
Public	4812.7	112.23	101.31	101.60
Fixed Investments				
Private	7025.2	99.73	100.04	100.23
Public	7766.4	101.79	101.48	101.77
Aggregate Investment by Destination				
Agriculture	1117.0	99.18	101.00	116.20
Industry	4615.5	100.66	101.49	100.17
Commerce	1759.0	100.90	99.75	100.80
Public Services	6558.0	100.46	102.46	99.78
Exports[d]				
Agriculture	792.4	100.58	99.33	103.72
Industry	8174.5	100.26	100.29	99.95
Imports[d]				
Agriculture	829.4	84.18	94.31	103.64
Industry	13457.4	101.15	100.47	99.94
Government Budget				
Fiscal Revenues	17033.3	101.71	101.31	101.59
Fiscal Expenditures	19987.0	101.74	101.38	101.66
Domestic Borrowing	2113.7	102.22	102.46	102.77
Bond Issues	1690.9	121.4	102.47	102.77
Monetization	422.7	25.55	102.48	102.77

a. Deflation through monetary contraction.
b. Reduce agricultural subsidies.
c. Reduce agricultural subsidies and increase agricultural investments.
d. Million US $.

Price levels in all agricultural commodity markets decline as a result of the contraction in the domestic economy. This situation causes an increase in net exports parallel to the results of the macro model. Given the low elasticity for most of the food crops, the impact is relatively less on food crops, but more intense on livestock production.

Agricultural producers bear the burden of the policy change as indicated by the decline of the producers' surplus by almost 4% together with the decline in the value of land. Volumes of agricultural production and consumption fall on average, by 0.8% and 1.1%, respectively. Overall, wheat and pulse producers experience favorable relative price effects in contrast to the rest of the

TABLE 5
PRICES, WAGES AND PROFITS (1987 BILLION TL)

	Base Run	E1[a]	E2[a]	E3[a]
Price Level	100.0	98.5	98.8	98.5
Real Interest Rate (%)	5.3	6.1	4.3	4.6
Real Bond Interest Rate (%)	5.1	11.9	5.8	5.7
Exchange Rate (TL/$)	857.0	851.0	858.0	844.2
Agricultural Terms of Trade	100.0	94.9	102.2	97.8
Indirect Taxes on Agriculture	39.2	34.2	185.9	181.9
Real Wages[b]				
Rural Labor	0.632	0.642	0.639	0.642
Urban Labor	1.639	1.664	1.659	1.664
Real Profits (%)				
Agriculture	21.3	16.9	19.0	21.1
Industry	18.1	18.3	18.1	18.2
Commerce	12.7	14.0	10.0	14.3
Public Services	14.2	13.2	20.1	11.9
Average Total Costs				
Agriculture	0.715	0.695	0.721	0.697
Industry	0.745	0.747	0.732	0.752
Commerce	0.492	0.503	0.485	0.501
Public Services	0.374	0.376	0.393	0.372

a. See notes in Table 4 for the experiments.
b. Million TL, in 1987 prices.

TABLE 6
AGRICULTURAL SECTOR SPECIFIC RESULTS

	Base Run (m.$)	E1[a]	E2[a] (Base Run=100)	E3[a]
Total Surplus	29,922	97.63	98.35	98.99
Consumers' Surplus	24,371	97.92	99.81	100.36
Producers' Surplus	5,551	96.34	91.91	92.96
Total Production				
Volume	15,773	99.20	99.07	100.55
Value	-	97.88	99.35	99.75
Crop Production				
Volume	12,174	98.92	98.85	100.66
Value	-	97.43	99.20	99.70
Food Crops				
Volume	4,293	99.76	96.86	100.99
Value	-	99.02	97.33	99.24
Price Levels				
Agricultural Products	-	98.79	100.66	99.50
Crop Products	-	99.39	100.83	99.30
Land Value Index				
Dry	-	93.19	16.45	16.53
Irrigated	-	97.70	81.00	81.01

a. see notes in Table 4 for the experiments.

TABLE 7
THE IMPACT OF THE EXPERIMENTS ON AGRICULTURAL PRODUCTS

	Volume of production[b]				Volume of consumption[b]			
	Base run (m.$)	E1[a]	E2[a] (% change)	E3[a]	Base run (m.$)	E1[a]	E2[a] (% change)	E3[a]
Cereals	3108	-0.18	-3.28	0.71	2281	0.21	-0.10	0.63
Wheat	2058	0.05	-5.01	0.40	1636	0.26	-0.18	0.55
Others	1051	-0.63	0.21	1.35	644	0.07	0.12	0.84
Pulses	590	0.27	-2.37	2.82	315	-1.43	0.33	0.76
Industrial Crops	1460	-0.32	-0.75	2.45	1082	-1.30	-0.28	0.17
Oil Seeds	458	-1.31	0.12	1.08	457	-1.31	0.12	1.08
Tuber Crops	685	-0.33	-1.95	0.61	661	-0.79	-0.18	0.03
Vegetables	2217	-1.14	-0.04	0.08	2042	-1.24	-0.04	0.08
Fruits and Nuts	4196	-1.06	-0.14	0.03	3058	-1.27	-0.16	0.03
Livestock	3059	-1.33	0.01	0.08	3211	-1.61	0.01	0.08
Total	15773	-0.80	-0.93	0.55	13558	-1.08	-0.08	0.19

a. See notes in Table 4 for the experiments.
b. Valued at the base year prices

agricultural economy and expand production; whereas livestock producers face the most severe adverse price effects and cut production by 1.3%.

The results of experiment E1 highlight many attributes of the adjustment experience of the real commodity sectors to financial reforms of the 1980s: deterioration of agricultural incomes, and a heavy transfer of resources to the urban sectors, especially to industry and the financial sectors (Mutlu, 1990; Yeldan, 1994); rapid increases in the share of profits in the industrial sector and increased interest expenditures in industrial value added (Ozmucur, 1991); and hesitant recovery of private fixed investment (Senses, 1994).

B. REDUCTION OF AGRICULTURAL SUBSIDIES (EXPERIMENT E2)

Reduction (and at certain instances complete elimination) of subsidies granted to the agricultural economy has been an integral part of the Turkish structural adjustment reforms since their initiation. The rationale of this policy was the argument that the removal of price subsidies would create a conducive environment for competitively functioning commodity markets, and fiscal pressures on the government budget would be lessened. However, this policy coincided with a general re-direction of commercial incentives towards manufactured exports, and a secular rise in the prices of industrial inputs used in agriculture concurrent with increased costs of domestic credit. Thus, the rural economy was double-squeezed. In this experiment, we will attempt to depict the macro/micro sequence of these adjustments by implementing a parametric increase of (net) indirect taxes on agricultural production by four-folds.

We first report on the macro effects of this policy in column E2 of Tables 4 and 5. As observed, increased (indirect) taxation of agriculture enables alleviation

of fiscal pressures on the government's budget and leads to deflation of the price level via contraction of the domestic currency supply. With falling interest expenses, industrial output increases and the overall gross domestic product expands in real terms. Furthermore, aggregate private consumption increases, while agricultural output supply and the rural incomes fall. Thus, macro results of the E2 environment clearly depict the "urban bias" of the rural pricing strategy of Turkish adjustment reforms.

The sector model accommodates this experiment by directly reducing the subsidies to the agricultural sector. The overall results of the reduction of the fertilizer subsidy are presented in the E2 columns of Tables 6 and 7. As expected, the producers bear the negative impact of the new policy. Welfare index of the producers declines by 8.1%, with only 1.65% decline in the welfare of the consumers. The volume of production is not affected significantly, but the effect on basic food production is relatively high. Shadow price of land shows the size of the rent accruing to the producer at the margin. The farmers are seriously hit by the decline in the land value index. The weighted land value index shows that dry-land rent will decrease by more than 80%. The slight change in the prices of agricultural commodities is principally due to a rather serious deviation of exports towards domestic consumption.

The results of the experiment for commodity groups are presented in Table 7. The basic staple, wheat, is the most affected commodity from the elimination of fertilizer subsidy, whereas the impact on the total volume of production and consumption are negligible. The decrease in net exports is mainly due to the decline in exports of wheat and pulses.

The decline in the use of fertilizer is relatively small in comparison to the increase in its price. Yet, the increase in the cost of fertilizer and in its share in total factor cost indicate that farmers might face difficulties in the procurement of operating capital.

The 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 end result is a rather small decline in both production and fertilizer use.

Regional responses to the increase in fertilizer price are different. The least affected region is the Aegean-Mediterranean Coastal Region. The crop substitution effect is the deciding factor in the relatively small loss in the regional volume of production.

The results of E2 indicates that the consumers are not effected due to the diversion of the commodities from exports to domestic consumption. Yet, the producers are adversely affected as shown by the decline in producers' surplus and a significant decline in the size of rent accruing to the producer of agricultural commodities.

C. Reduction of Agricultural Subsidies with Increased Public Investments in Agriculture (Experiment E3)

The previous experiment suggested that although there have been efficiency gains in return to the Turkish agricultural price reforms, these nevertheless were implemented under a non-competitive and biased macro environment; and consequently, produced highly skewed distribution results unfavorable to agriculture. Starting from this observation, as an alternative public investment program we suggest re-investment of the public funds that are extracted from agriculture back to the sector. That is, we purport to analyze the consequences of a new agricultural support policy which is now based on a dynamic investment expansion scheme, rather than static income support through price controls.

This alternative is simulated under experiment E3. Here, agricultural (indirect) taxes are increased at the same scale as in E2, and the accumulated funds are pooled separately to augment the level of public investments in agriculture. We hypothesize that the gestation lag of these new investments would be one year.

The macro results of the MIAS clearly suggest favorable results both for the domestic economy at large, and for the agricultural sector in particular. Within agriculture both employment and rural incomes (wages and profits) increase. Interestingly, increased agricultural investments lead to expansion of not only the agricultural output, but also that of industry as well. Through the domestic network of intersectoral resource pulls the increased rural incomes create an expanded mass-market for the final and intermediate products produced by the domestic industry, a route which was extensively analyzed in Adelman (1984) and Yeldan (1989). Furthermore, the E3 policy environment succeeds in reduction of the domestic price level and the credit interest rate. Thus, anti-inflationary results are obtained not through classic monetary contraction (with stagnationist consequences), but through a heterodox policy of investment and output expansion.

Almost all of the public investments are realized as expansion of irrigated land. The micro sectoral consequences of E3 suggest favorable output effects in return to the simultaneous increase in agricultural investments together with the decline in the subsidy rate. Part of the loss in the producers' surplus, due to the removal of fertilizer subsidy, is compensated by the increase in investments. The increase in the production of food crops is more than the other products. Net trade of the agricultural products improves compared to the base run. It seems that the pressure on the producers caused by the removal of the fertilizer subsidy would be minimal if this policy is supported by the increase in agricultural investments.

CONCLUSION

In this paper we introduced a new modeling technique under the rubric of macro-integrated agricultural-sector (MIAS) approach to study both the macro-aggregate and the micro-sectoral effects of the recent Turkish adjustment reforms on the agricultural economy. Previous studies in the literature have either regarded agriculture as one homogenous entity among many other macro sectors, thus with a blurry rural focus; or treated agriculture in isolation ignoring the intersectoral and the financial linkages. Thus the major motivation of the MIAS approach is the argument that through a two-level quantitative analysis, one can investigate the adjustment process experienced by agriculture within the domestic economy given its interactions in response to macro policies, and obtain a more detailed description of the adjustment within the agricultural economy itself.

Our simulation results underscored that the Turkish mode of adjustment in the early 1980s relied heavily on worsening income distribution and on rural taxation. The surge in manufacturing exports and economic growth could have been financed by transferring real income away from the rural economy towards the urban industrial and financial ventures. In addition, anti-inflationary policies of monetary contraction and bond issues by the government exert upward pressure on credit costs and lead to contraction of private investments and of real output.

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-adjustment experience and the quantitative analyses of our model 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 agriculture.

In this vein, we outline an "agricultural-led" investment program which is based on reinvesting rural surplus back to the agricultural economy through "neutral" fiscal incentives. The strategy derives its strength from its focus on the domestic production network of sectoral interlinkages and the expansion of the domestic market through increased investment demand for the industry.

Clearly, the research program initiated here should be regarded as an initial step towards the development of a new modeling paradigm, and as such, it suffers from many constraints. An important drawback is the uni-directionality of the transmission mechanism which directs the integration variables from the macro-general equilibrium to the within-sector modeling stage. The presumption is that the general equilibrium endogeneity of the overall model has to

encompass the partial equilibrium structure of the sector model, and a full-fledged integration ought to incorporate two-way feedback mechanisms. Nevertheless, we share the opinion that, the modeling discipline imposed by the endogenous specification of many of the relevant parameters utilized in the otherwise partial equilibrium structure of the agricultural sector analysis constitutes a major step in enabling such modeling attempts with more realistic interactions with the rest of the economy.

At a more general level, our modeling exercise supports the notion that the sector-specific attributes of the agricultural economy can be successfully extended to the macro economy in a consistent fashion, to cover both the fiscal and the monetary operations of the government. Especially, for many modeling attempts where lack of long series data preclude application of econometric techniques, the integrated general equilibrium methodology may serve as a viable option in conducting policy relevant research.

REFERENCES

ADELMAN, I., "Beyond Export Led Growth," *World Development*, 1984, p. 937-949.

ADELMAN, I. and S. ROBINSON, *Income Distribution Policies in Developing Countries*, California, Stanford University Press, 1978.

ARICANLI, T. and D. RODRIK, *The Political Economy of Turkey: Debt, Adjustment and Sustainability*, London, MacMillan, 1990.

BAUER, S. and H. KASNAKOGLU, "Non-linear Programming Models for Sector and Policy Analysis: Experiences with the Turkish Agricultural Sector Model," *Economic Modelling*, July, 1990, p. 275-290.

____, Turkish Agricultural Sector Model, Report presented to Ministry of Agriculture, Forestry and Village Affairs, Ankara, 1988.

BORATAV, K., O. TUREL and E. YELDAN, "Dilemmas of Structural Adjustment and Environmental Policies Under Instability: Post-1980 Turkey," *World Development*, 24, 2, 1996, p. 373-393.

CAKMAK, E. H., A Regional Model of Turkish Agriculture: Structure, Validation and Applications, Unpublished Ph.D. Dissertation submitted to Stanford University, California, 1987.

____, "Medium-Term Growth Prospects for Turkish Agriculture: A Sector Model Approach," *The Developing Economies*, 30, 2, June, 1992, p. 132-153.

CELASUN, M., "A General Equilibrium Model of the Turkish Economy: SIMLOG1," *METU Studies in Development*, 13, 1-2, 1986, p. 29-94.

CELASUN, M. and D. RODRIK., "Debt, Adjustment and Growth: Turkey," in J. Sachs and M. Collins, eds., *Developing Country Debt and Economic Performance, Country Studies*, Book IV, Chicago and London, The University of the Chicago Press, 1989.

DE JANVRY, A., E. SADOULET, M. FAFCHAMPS and M. RAKI, "Structural Adjustment and the Peasantry in Morocco: A Computable Household Model", *European Review of Agricultural Economics*, 1992, p. 428-453.

DERVIS, K., J. DE MELO and S. ROBINSON, *General Equilibrium Models for Development Policy*, London, Cambridge University Press, 1982.

DULOY J. H. and R. D. NORTON, "CHAC: A Programming Model for Mexican Agriculture," in R. D. NORTON and M. L. SOLIS, eds., *The Book of CHAC Programming Studies for Mexican Agriculture*, Baltimore, John Hopkins, 1983.

GIBSON, B., N. LUSTIG and L. TAYLOR, "Terms of Trade and Class Conflict in a Computable General Equilibrium Model," *Journal of Development Studies*, 23, 1, 1986, p. 40-59.

HIRSCHMAN, A. O., "A Generalized Linkage Approach to Development with Special Reference to Staples," in *Essays in Trespassing*, Cambridge, Cambridge University Press, 1991, p. 59-97.

HOWITT, R. E., "Positive Mathematical Programming," *American Journal of Agricultural economics*, 77, May 1995, p. 329-342.

KASNAKOGLU H. and R. E. HOWITT, "A Positive Approach to Validation and Calibration in Agricultural Sector Models," in B. MARTOS, L.F. PAN and M. ZIERMAN, eds., *Proceeding of the 5th IFAC/IFORS Conference on Control of National Economies*, Oxford, Pergamon Press, 1987, p. 273-279.

KAZGAN, G., "Current Trends and Prospects in Turkish Agriculture," *METU Studies in Development*, 19, 3, 1992, p. 337-360.

LE-SI, V., P. L. SCANDIZZO and H. KASNAKOGLU, "Turkey: Agricultural Sector Model," The World Bank AGREP Working Paper No 67, March, 1983.

MCCARL, B. A. and F. H. SPREEN, "Price Endogenous Mathematical Programming as a Tool for Sector Analysis," *American Journal of Agricultural Economics*, 62, 1980, p. 87-102.

MELLOR, J., "Agricultural Development and the Intersectoral Transfer of Resources," in EICHER and STAATZ, eds., *Agricultural Development in the Third World*, Baltimore, Johns Hopkins Press, 1984, Ch. 9.

MUTLU, S., "Price Scissors in Turkish Agriculture," *METU Studies in Development*, 17, 1-2, 1990, p. 163-212.

OECD, *National Policies and Agricultural Trade, Country Study: Turkey*, Paris, OECD, 1994.

OZMUCUR, S., "Prices and Income Distribution," Bosphorus University Research Papers, NO ISS/Ec 91-17, 1991.

SAHINKAYA, S., "Imalat Sanayiinde Sektörel Isgücü Verimliligi, Reel Ücretler ve Markup Oranları," *Toplum ve Ekonomi*, 4, April, 1993.

SENSES, F., *Recent Industrialization Experience of Turkey in A Global Context*, Greenwood Press, 1994.

SENSES, F. and T. YAMADA, "Stabilization and Structural Adjustment Program in Turkey," Institute of Development Research Program Series, No 85, Tokyo, 1990.

SIS , State Institute of Statistics, *Turkish Economy: Economic and Statistical Evaluation*, Ankara, May 1991-December 1994 various issues.

SIS, *Turkey, Statistical Yearbook*, Ankara, 1995.

SIS, *Turkey, Statistical Yearbook*, Ankara, 1989.

SPO , State Planning Organization, *Turkey, Basic Economic Indicators*, Ankara, February 1995 and various past issues.

TAYLOR, L., *Socially Relevant Policy Analysis*, Cambridge and London, MIT Press, 1990.

YELDAN, A. E., "Surplus Creation and Extraction under Structural Adjustment: Turkey, 1980-92," *Review of Radical Political Economics*, 27, 2, 1995a, p. 38-72.

____, "Political Economy Perspectives on the 1994 Turkish Economic Crisis: A CGE Modelling Analysis," Economic Development Center, University of Minnesota, Bulletin No. 95-3, 1995b.

____, "The Economic Structure of Power under Turkish Structural Adjustment: Prices, Growth and Accumulation," in F. Senses, ed., *Recent Industrialization Experience of Turkey in A Global Context*, Greenwood Press, 1994.

____, "Structural Adjustment and Trade in Turkey: Investigating the Alternatives 'Beyond Export-led Growth'," *Journal of Policy Modeling*, 11, 2, 1989, p. 273-296.