Macroeconomics of Turkey's agricultural reforms: an intertemporal computable general equilibrium analysis[☆]

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Abstract

Turkey recently launched a set of structural reforms to address elimination of producer price subsidies in its agriculture, and replacing them with a targeted direct income transfer program. The paper investigates analytically viable options of the proposed agricultural-cum-fiscal reform and analyzes the formal links between the public sector fiscal balances, accumulation patterns, dynamic resource allocation, and consumer welfare under a medium-long-term horizon. We utilize a dynamic general equilibrium model. The model results suggest that even though there are expected modest welfare gains of consumers' intertemporal efficiency, the repercussions of these policies on the rural economy and aggregate gross domestic product are likely to be deflationary.
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1. Introduction

Turkey recently launched a comprehensive policy reform program towards disinflation of domestic prices under the guidance and proviso of the IMF and the IBRD. The major elements of the program included monetary targets through a quasi-currency board and fiscal austerity via specific targets for non-interest primary expenditures. It also entailed a detailed program of structural reforms addressing elimination of producer price subsidies in agriculture, and replacing them with a moderately targeted direct income transfer program. This shift is expected to create major repercussions both within the domestic economy and also in the fiscal balances of the public sector.

The Turkish macroeconomic environment is known to be very fragile and unsustainable for over a decade. The post-1990 period witnessed rapid deterioration of the fiscal position of the successive Turkish governments, and the public sector borrowing requirement increased to as much as 15% of the GNP in 1999, just before imposition of the disinflation program. The state resorted to a massive operation of domestic debt financing by way of new issues of debt instruments. As a result, the stock of domestic debt grew rapidly to reach 68% of the GNP in 2002. The interest expenditures on domestic debt surmounted to 22% of the GNP by the end of 2001, and continued to exert an important source of macroeconomic disequilibrium within the domestic economy. In spite of the shift in the nature and the scope of the December 1999 and June 2001 stabilization programs, structural reforms in banking, agricultural, energy and telecommunication sectors remain intact.[1,2]

With respect to agriculture, the Turkish state had a long tradition of sectoral support by way of direct price subsidies, and indirect means of subsidized use of agricultural credit, virtual direct un-taxation of rural incomes, and guaranteed state purchases of strategic commodities such as tobacco, sugar beet, and nuts. Recent studies[3] show that the total monetary value of aggregate subsidization reached to 11.3 billions US$ as of 1998, and that about 70% of this cost is borne directly by the domestic consumers. Budgetary transfers to the sector amount to an average of 3.5 billions US$ per annum over the last five years.

It is the purpose of this study to investigate analytically viable options of the proposed agricultural-cum-fiscal reform and adjustment under conditions of a heavy domestic debt burden and persistent foreign trade deficit. We investigate the process of Turkey's recent move towards direct income support in agriculture replacing the long history of price interventions; and analyze the formal links between the

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[1] Turkey's program for transition to a strong economy: Targets, policies, and implementation (in Turkish), May 2001. Undersecretariat of Treasury, Ankara.

[2] Basic structural reform issues in the program for transition to a strong economy (in Turkish), December 12, 2001. Undersecretariat of treasury.

[3] See, e.g., Cakmak, Kasnakoğlu, and Akder (1999), Ozkaya, Oyan, Isin, and Uzmay (2000); OECD (2000).

public sector fiscal balances, accumulation patterns, dynamic resource allocation, and consumer welfare under a long-term horizon. Both the aggregate macro and sectoral micro consequences of agricultural price reforms and public debt management are analyzed within a set of alternative policy environments to smooth out public debt over future generations.

To this end, we utilize an intertemporal, multi-sector, general equilibrium model for the Turkish economy. The model is an extension of the neoclassical growth model, and is based on the infinite-lived Ramsey-consumer framework with maximization of intertemporal preferences subject to the discounted stream of income sources.

The distinguishing features of the model include explicit recognition of the demand and supply interlinkages between agriculture and the rest of the domestic economy within a fully endogenous structure for characterizing price formation; flexible functional forms in describing economic activity; and explicit modeling of fiscal position of the public sector with accumulated past domestic debt so as to characterize the immense fiscal debt rescheduling challenge of the current Turkish economy.

The integrated treatment of intertemporally dynamic adjustments within a multi-sector, multi-factor model offers several attractions for fiscal policy analysis. Traditional (static) CGE analyses of taxation and trade/price liberalization could only account for the static, once-and-for-all effects, and were not able to capture the long run dynamic effects which involve intertemporal behavior such as saving and investment decisions. The incorporation of saving and investment decisions in the CGE models of the static-genre depends on the parametrization of fixed saving rates out of disposable income, and on ad hoc macro closures. These approaches often led to non-robust policy results with arbitrary dependence on modeling specifications (Diao, Roe, & Yeldan, 1998; Srinivasan, 1982). By way of incorporating explicit intertemporal optimizing behavior on the part of rational agents, the current model is able to address many questions of long run effects of tax and subsidization incidence, fiscal debt, foreign exchange constraints on growth, accumulation, and consumer welfare within a theoretically consistent framework.

The plan of the paper is as follows: in the next section we provide a brief overview of the recent developments in the Turkish agricultural economy. We introduce the characteristic features of the model in Section 3, and implement our policy simulations in Section 4. We reserve Section 5 for summary conclusions and policy implications.

2. Overview of the Turkish agriculture

Agricultural production and rural life have a significant share in the Turkish economy and social structure. As of 2000, share of agricultural value added in GDP is 15.5%, and the sector alone employs 45.1% of total labor force. Tables 1 and 2 display basic agricultural indicators of Turkey. In order to give an interna-

Table 1
Output indicators and productivity

	Sectoral contribution to gross value added (% of GDP)		Agricultural productivity agricultural value added per worker 1995 $		Cereal yield (kg/ha)	
	1979–1981	1997–1999	1979–1981	1997–1999	1979–1981	1997–1999
Korea	16.5	5.1	3765	12281	4986	6370
Mexico	9.3	5.2	1482	1749	2164	2676
Poland		4.7		1818	2345	2961
Turkey	26.2	16.4	1860	1858	1869	2155
United States[a]	3.0[b]	2.0[b]			4151	5562

Source: World Bank (2002).

[a] World Bank (2000, Table 12).

[b] 1980 and 1998 only.

tional comparison, we further provide comparable data for Korea, Mexico, and Poland, as examples from upper middle-income country group, and data for the United States and European Union as industrialized country examples in the same tables. As expected, the shares of agricultural production and employment are observed to be very high in Turkey relative to industrialized economies. However, the gap between Turkey and other upper-middle income economies is also considerable. In terms of labor productivity and production per unit of land, Turkish agriculture displays similar performance with that of Mexico and Poland. These observations show that Turkish agricultural sector has typical characteristics of middle-income economies, except for the share of labor force in agriculture. It is no surprise that existence of such a large population in agricultural activities creates strong political pressures on the design of the Turkish agricultural support system.

Another characteristic of the Turkish agricultural sector is that most of the agricultural enterprises are small-sized and are poorly organized.[4] In addition to inefficiency, this characteristic hinders efforts to improve the quality of the cadastral records in the sector, which is necessary step for the implementation of the planned direct income support system.

Until mid-1990s, Turkish agricultural support policies basically rested on direct interventions to input and output prices.[5] To this end, subsidies in input prices, subsidized bank credits, and floor prices are employed as the basic tools to support agricultural activities. In some cases, government would enter the market as the supplier of inputs and buyer of the agricultural products in order to regulate agricultural production.

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[4] Sixty seven percent of the farms are less than 5 ha (State Institute of Statistics, 1994b).

[5] In addition to these "direct" support policies, soil and water conservation, research, education, extension and training are "indirect" support policies in the Turkish agricultural sector (Dogruel, 1993).

Table 2
Population and labor force indicators

	Rural population			Labor force[a]		
	1980 (percentage of total)	2000 (percentage of total)	Average annual percentage of growth	Total	Agriculture	
				2000 (in thousands)	1980 (percentage of total)	2000 (percentage of total)
Korea	43	18	−3.2	24162	34.0	10.1
Mexico	34	26	0.5	40352	26.0	21[b]
Poland	42	34	−0.6	19878	29.9	19.2[c]
Turkey	56	25	−2.0	31307	54.0[a]	45.8[b]
United States	26	23	0.4	144716	3.6	2.6

Source: World Bank (2002).
[a] SIS (2001b).
[b] 1999.
[c] 1998.

Table 3
Aggregate financial data of agricultural supports

	A: Producer support estimate per hectare of agricultural land (US$)		B: Producer support estimate per full-time farmer equivalent (US$ 1000)[a]		C: Total support estimate (TSE) as a share of GDP (%)	
	1986–1988	1997–1999	1986–1988	1997–1999	1986–1988	1997–1999
Korea	5504	8800	8	22	10.07	5.25
Mexico	17	50	n.c	1	1.88	1.48
Poland	209	190	1	1	n.c	2.63
Turkey	93	295	1	2[b]	4.7	8.01
United States	98	106	17	18	1.44	0.97
European Union	707	845	11	17	2.6	1.53
OECD	187	205	11	11	2.32	1.41

Sources: OECD (2000, Table III.8, Table III.7 and Table III.16).
[a] For Turkish data: Cakmak et al. (1999, Table 5.6, p. 60).
[b] 1996–1998 average.

History of the existing agricultural support policies in Turkey dates back to 1932. Until 1947, price support was limited only to cereals. Although the list of the supported crops varies from year to year, during 1963–1980 coverage of price support widened. After 1980, Turkey started to implement various measures to liberate its foreign trade and direct its economy to foreign markets. During this era we also observe a significant change in the price support system. The list of supported crops was reduced and priorities shifted from traditional crops to industrial ones. However, after 1990, the coverage of price support considerably widened once again.[6]

Although the amount of purchases and support prices change from year to year, cereals purchases have varied between 5 and 30% of total cereals production. During 1985–1990, real increase in the price of sugar beet was 100%, cotton 93%, tobacco 74%, paddy 77%, and cereals 50–58%. After 1990, increase in support price was between 5 and 50% (SPO, 2000, p. 26).

Aggregate financial data of agricultural support policies in Turkey is given in Table 3. International comparisons reveal that the Turkish agricultural support is not an extreme case in terms of Producer Support Estimates (PSE) per hectare of agricultural land and PSE per full-time farmer equivalent (sections A and B of Table 3).[7] However, since the shares of agricultural output in GNP and in total

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[6] Details about list of the supported product can be found in SIS (2001a, pp. 244–247, Table 9.30).
[7] Concerning the extent of commodity coverage and existence of monopoly or exclusive rights of state trading enterprises, Ingco and Ng (1998) classify developing countries into four groups: "strong control," "medium status," "weak status," and "not control." Turkey is listed in weak status countries for the first half of the 1990s in this study.

labor force are very high, the cost of the agricultural support borne by the rest of the economy (Total Support Estimates — TSE) exceeds 8% of GDP (section C of Table 3). This is the highest ratio in the country examples given in Table 3.

Since we focus in this paper mostly on the transfers from the central budget to the agricultural sector, it is necessary to decompose total transfers from the rest of the economy. The total amount of TSE is $ 11.5 billions in 1998 (Cakmak, Kasnakoğlu, & Akder, 1999). The amount of TSE paid by taxpayer reaches to $2.4 billions. That is, 20.9% of TSE is borne by the taxpayers. Therefore, we can conclude that the share of the direct transfer from the central budget to the agricultural sector in GNP is about 1.5%. This is the rate of subsidization that we take as historically given under the experiments in Section 4.

Beyond the price instrument, support is provided through payments based on input use in the actual agricultural policy system.[8] Subsidies to farmers for *material inputs* in the crop production have rebates (discount) on fertilizers and pesticides; insemination services; seed production and distribution; and reduction on charges for maintaining and operating irrigation infrastructure. In livestock production, feed subsidies are recognized as material input subsidies.

Another component of the support system is the supply control system. Under the supply control scheme, the government controls cultivated area for quality maintenance, and to address problems of excess capacity in tobacco, hazelnut, and tea. Sugar beet output is indirectly controlled by the Turkish Sugar Factories Inc. through contracts. Direct payments, on the other hand, have no importance in the Turkish agricultural support policy. Financial subsidies are the crucial instruments in implementing the agricultural support policies. Ziraat Bank is also charged to finance Turkish farmers through subsidized agricultural loans.[9] Furthermore, most farmers are already exempt from income tax. However, for the period of 1960–1984, Turkey is classified as "representative taxer," in between "extreme taxer" and "mild taxer" countries, in terms of total tax burden on the agricultural sector through indirect taxes and industrial protection (Schiff & Valdés, 1992).[10]

The core of the agricultural reform package introduced in 1999 is to replace price supports with direct income supports (DIS). This system is designed to be moderately targeted during the beginning of its implementation, and it is planned that, over time, the payments will be targeted toward the poor. Payments are made on a per hectare basis up to 20 ha per beneficiary. As an initial step, implementation of a pilot program in 2000 covered nearly 10,000 farmers in the selected counties

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[8] The details of Turkish support policy in Kasnakoğlu and Cakmak (2000, pp. 93–94), OECD (1994, pp. 18–20 and 2000, pp. 113–116), and SPO (2000, pp. 26–35).

[9] Since its foundation in the year 1888, Ziraat Bank has been specialized in financing the agricultural sector (Tekeli & Ilkin, 1997, p. 73). See Dogruel and Dogruel (1986) and Dogruel (1993) for further assessment on the history of Turkish agricultural-support policies.

[10] For the mechanisms of the indirect taxes on the agricultural sector through macroeconomic policies in developing countries see Binswanger and Deininger (1997).

of four provinces. Major difficulties in pilot implementation concentrated on insufficient cadastral and farmer records and on traditional/local tenant–landowner relationships (particularly sharecropping).

Policies such as reorganization of the Agricultural Sales Cooperatives Unions (ASCUs), elimination of the state's commitment to buy certain agricultural produces (support price reform), privatization of State Economic Enterprises, and credit and input subsidy reform are other components of the package to support direct income support system. Initially, the primary objective of the agricultural reform efforts during the 1990s was to eliminate the distortions resulting from either the direct interventions of the government in the agricultural sector or inefficiencies of the ASCUs.[11] Consequently, it was anticipated that the cost of the existing agricultural support system on the budget will decrease, and the Turkish support system will approach to the regulations and the limitations of the international community, such as the World Trade Organization and the European Union.[12]

As quasi-state agencies, ASCUs and their partner Agricultural Sales Cooperatives (ASCs) played crucial roles in implementing the agricultural support policies. Therefore, programs for restructuring ASCUs and privatization of state assets should be seen as integral components of the reforms of the agricultural support system.[13] These reforms go parallel with the elimination of the government's direct and indirect price interventions in the sector. In line with the Government's fiscal program, price subsidies in grain, sugar beet, tobacco, and tea will be reduced in real terms, and will be terminated as the direct income support system is fully implemented. Similar trends also can be observed for the subsidies in inputs and agricultural loans.

We now turn to the discussion on technical specifics of our analytical model.

3. The model

With some modification, the model utilized in this section is an extended neoclassical intertemporal general equilibrium model with a government whose purpose is to collect taxes, administer agricultural subsidies, and issue debt instruments. The model draws upon the recent contributions on intertemporal GE modeling by Goulder and Summers (1989), Mercenier and de Souza (1994), Go

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[11] See Yükseler (1999) for a lucid summary of the changes in the Turkish agricultural supports during 1990s.

[12] The objective of the Agricultural Agreement of WTO is to reform trade in the sector and to make policies more market oriented. Negotiation proposal of the EU also stresses similar target: "to move away from price support towards more transparent and less trade-distorting policies" (WTO Committee on Agriculture, G/AG/NG/W/90 14 December 2000).

[13] See the World Bank (2001) and "Agricultural sector reform" (in Turkish) (September 19, 2001. Undersecretariat of treasury, Ankara. http://www.treasury.gov.tr/tarim_web.pdf), for the details of the realized and the planned attempt of the agricultural reforms program outlined here.

(1994), and Diao et al. (1998). Data used to calibrate the model parameters and to conduct our simulation experiments are drawn from Köse and Yeldan (1996), the recent Input–Output Table of Turkey (SIS, 1994a), and other sources to represent the macro equilibrium of the Turkish economy in the 1990s.

We aggregate production activities into six production sectors (agriculture, consumer manufacturing, producer manufacturing, intermediates, private services, and public services), employing labor and capital to produce the respective single outputs. With fixed endowment,[14] labor is mobile across sectors (but not mobile internationally). The private household chooses its allocation of labor supply to work or to leisure based on optimization, given market prices and wage remunerations. Capital, on the other hand, is sector-specific, and is accumulated over time. Technological change is assumed not to be influenced by the policies considered in the paper, and hence is ignored.

3.1. The household and consumption/savings

The representative household owns labor and all private financial wealth, and allocates income to consumption and savings to maximize an intertemporal utility function over an infinite horizon:

$$u(c) = \frac{c^{1-\theta} - 1}{1 - \theta}, \quad \text{for } \theta > 0, \theta \le 1 \tag{1}$$

subject to the intertemporal wealth constraint. The household budget constraint, as defined in terms of current income and expenditure flows is composed of incomes from wages, wL^S, firms' profits, div, government transfers, TI, and interests on government and foreign bonds, BPG + BF, such that:

$$\text{SAV}_t + w_t\text{LEIS}_t + \sum_t p_{it}c_{it} = (1 - \text{ty}_t)[w_t L_t^s + \text{div}_t + \text{TI}_t \\ + r_t(\text{BPG}_{t-1} + \text{BF}_{t-1})] \tag{2}$$

where SAV is household savings which will be invested on the purchases of government and foreign bonds or firm equities; and ty_t is the income tax rate.

3.2. Firms and investment

The representative firm in each sector carries both production and investment decisions so as to maximize the value of the firm. The intertemporal decision problem of the firm can be stated as follows: in each sector-i, the firm chooses the levels of investment, I_{it}, and labor employment to maximize the present value of all future profits, taking into account the expected future prices for sectoral outputs, the

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[14] This specification has no real effects on the model since, alternatively, we could normalize all variables in per capita terms.

wage rate, the capital accumulation constraint, and adjustment costs on investment allocation, $a_{it} = \phi(I_{it}^2/K_{it})$. Specifically, the firm chooses the sequences $\{I_{it}, L_{it}\}$,

$$\text{Max } V_i = \sum_{t=1}^{\infty} R_t \text{div}_{it} \equiv \sum_{t=1}^{\infty} R_t[P_{it}(f_i(K_{it}, L_{it}) - a_{it}) - w_t L_{it} - \text{PI}_{it} I_{it}] \quad (3)$$

subject to the capital accumulation constraint. Here V_i denotes the current market value of firm; and R_t is given by

$$R_t = \prod_{s=1}^{t} \frac{1}{(1 + r_s)} \quad (4)$$

with r_s denoting the interest rate. Because of the recognition of adjustment costs on capital, marginal products of capital differ across sectors, resulting in unequal, although optimal rates of investments. The new capital equipment, I_i, is produced by forgone outputs of the six sectors with a Cobb–Douglas function, and hence, PI_i, can be written as a function of the final good prices, P_{it}.

3.3. The government as the fiscal authority

The government has four interrelated functions in the model: collect taxes, distribute transfers payments, purchase goods and services, and administer domestic public debt.

The model distinguishes three types of tax structure. *Direct income taxes* are set at a given ratio of private income; *indirect taxes* are levied on the gross output value in each sector; and *trade taxes* are implemented *ad valorem* on imports. Government's basic spending includes the transfer payments to households, public consumption expenditures (inclusive of wage costs of public employees), and interest costs on outstanding public debt. Government budget deficit may arise from the excess of aggregate expenditures over the tax income. The fiscal deficit is financed exclusively through new issues of government bonds. Thus, government bonds issued at period t is defined as:

$$\text{BPG}_t - \text{BPG}_{t-1} = \text{GDEF}_t \quad (5)$$

and

$$\text{GDEF}_t = r_t^D \text{BPG}_{t-1} + r_t^D \text{BFG}_{t-1} + \sum_i P_{it} \text{GD}_{it} + \text{TI}_t$$

$$- \left[\text{ty}_t \text{HY}_t + \sum_t \text{tx}_{it} \text{PX}_{it} X_{it}^S \sum_i \text{tm}_{it} \text{PWM}_{it} M_{it} \right] \quad (6)$$

where GDEF_t is the government's budget deficit at time t; BFG_t is the stock of foreign debt of the public sector; HY_t is household gross income, tx_{it} is indirect tax rate for sector i, PX_{it} is output price of good i, X_{it} is output of good i; tm_{it} is

the tariff rate; PWM_{it} is world price for imported good i; and M_{it} denotes imports of good i. GD_{it} is the government consumption of commodity-i.

Presuming restricted foreign borrowing opportunities, the public sector's foreign debt, BFG, is assumed to remain constant at the level given by the initial data throughout the simulated policy experiments. A rise in the fiscal deficit is financed exclusively by new issues of public debt instruments which are purchased by the domestic households, BPG.

To avoid the difficulties that would result from modeling the government as an intertemporal optimizing agent (see Mercenier & de Souza, 1994), we assume that the transfer payments are proportional to aggregate government revenues, while the total public consumption of goods (excluding for public services) is set as a constant share of the gross domestic product. Similarly, sectoral purchases are distributed given fixed expenditure shares.

3.4. The foreign sector

The model incorporates the Armingtonian composite good system where domestically produced and foreign goods are regarded as imperfect substitutes in aggregate demand, given an elasticity of substitution. The economy is *small*, hence the world prices are regarded as given constants.

In each period-equilibrium, the difference between the household savings, SAV_t, and the government's borrowing requirement, GDEF_t, gives the amount of new foreign bonds held by households. The time path of private foreign assets has two components: trade surplus (deficit if negative) denoted FBOR_t, and interest income received from the accumulated foreign assets, $r_t \mathrm{BF}_{t-1}$. Thus, accumulation of the private foreign assets evolve as follows:

$$\mathrm{BF}_t - \mathrm{BF}_{t-1} = r_t \mathrm{BF}_{t-1} + \mathrm{FBOR}_t \tag{7}$$

3.5. Equilibrium

Intra-temporal equilibrium requires that at each time period (i) domestic demand plus export demand for the output of each sector equal its supply; (ii) producers' demand for labor plus household's leisure demand equal total labor supply; and (iii) government spending equals government revenues plus new issues of public debt instruments. The intertemporal equilibria are further constrained by the following steady state conditions:

At the steady state (i) the value of the firm, V_{SS}, becomes constant and hence the profits; $\mathrm{div}_{i,SS}$, is simply equal to the interest earnings from a same amount of riskless assets; (ii) in each sector-i, investments must just cover the depreciation of sectoral capital; hence the stock of capital remains constant; and (iii) foreign asset holding has to be constant. Finally in the steady state, government debt has to be constant, implying that the government eventually ought to have a surplus on its primary budget (which equals its interest payments on its domestic and foreign debt).

This last condition, technically known as the *transversality condition*, rules out the possibility of *Ponzi* games, i.e., financing over an initial fiscal deficit via a repeated series of net borrowing into the infinite future. The transversality condition warrants that the initial deficit is ought to be serviced in the long run through fiscal surpluses. During the simulations that follow, we have implemented this technicality by allowing for an endogenous adjustment of the income tax rate starting period 20. Thus, we allow for the government to accumulate its debt for an initial 20 periods, and then require it to start servicing the debt. It is clear that the timing of this decision is completely arbitrary, and the modeler has no specific rule so as when to implement the transversality constraint other than the historical realities of the modeled economy. In our simulations we found the timing of this constraint bears very little relevance for the time horizon at work — 15 periods for our analysis, and postponing this adjustment further has little impact, if any, on the initial evolution path of the macro variables of interest.

Thus, during the course of simulation experiments, in the absence of simultaneous compensating schemes for generating revenue sources, an initial fiscal gap naturally emerges. The government then resorts to domestic borrowing, and issues debt instruments to finance its deficits. However, this added reliance on the domestic financial funds leads to a rise in uncertainty and increases fragility of the asset markets. This makes the domestic and foreign savers increasingly reluctant to be indifferent between investing in government debt instruments and other instruments offered in the domestic and the international markets at the ongoing interest rate. To depict this phenomenon, we posit a simple function that maps the ratio of the fiscal deficit to GDP into a risk premium. More formally, let π_t denote the risk premium over the international lending/borrowing rate; we set π_t as

$$\pi_t = \varphi \frac{\text{GDEF}_t}{\text{GDP}_t} \tag{8}$$

where φ is a shift parameter. Thus, the domestic interest rate, r_t^{D}, diverges from its foreign counterpart by π_t, i.e., $r_t^{D} = (1 + \pi_t) r_t^{F}$. Under these conditions, with the rise of the risk premium, the fragility of the domestic asset market is worsened, and the domestic interest rate increases over its foreign counterpart, r^{F}.

4. Analysis of alternative policy regimes

4.1. Description of the experiments and their motivation

In this section, we turn to an analysis of agricultural support options of the fiscal authority from the point of view of consumer welfare and resource allocation processes. For this objective, we start from the 1990 equilibrium in our initial data set, and fix the historical average of the subsidy rate in Turkish agriculture to a sum of 1.5% of the gross domestic product (see discussion above in Section 2 for the breakdown of the agricultural support regime during the 1990s).

This subsidy is paid exclusively from the central budget. We treat this equilibrium as our *base run* against which the agricultural support alternatives are simulated and tested.

The historically observed rise in the fiscal deficit under the *base run* is met entirely by issuing domestic debt instruments which are to be held exclusively by the domestic private sector. Persistent fiscal deficits necessitate extraction of financial funds from the capital markets which could otherwise be utilized in new capital formation. On the other hand, the ongoing rise of the borrowing requirement of the public sector generates additional pressures on the newly developing indigenous asset markets and tends to increase fragility in the economy. With the increased risk and the accompanying fragility of the domestic financial markets, transactors often face higher interest costs than those that prevail in the international markets. Thus, a risk premium emerges between the domestic and the international interest rates, a consequence of which is the distortion of the saving and investment decisions of the residents (see Eq. (8) above).

Given this background, we implement two sets of objectives: "fiscal austerity" and "policy efficiency." Under experiment Exp-1, *first*, we study the pure fiscal effects of the elimination of price supports and envisage an environment where all price subsidies from the central government budget are eliminated. We treat this as an interim scenario to capture the welfare and the output supply responses of the domestic economy in return to the elimination of indirect subsidies in the Turkish agriculture. Under Exp-2, this interim step is concluded with a switch to DIS. Here we utilize the laboratory characteristics of the model and generate a pool of direct income support for the agricultural producer which is equivalent in magnitude to the level of support attained indirectly via price subsidization. Thus, Exp-2 narrates an environment where price distortions are eliminated, and yet, the *same level* of total income support is attained by way of lump sum payments from the government budget. Clearly both the microeconomic impact and the welfare consequences of this policy initiative will depend on the existing level of price distortions. Yet the fiscal consequences on the government's budget constraint will necessarily remain. In a setting which underlines the current fragile fiscal position of the Turkish state, the size of the fiscal impact, as captured by our risk generation function in Eq. (8) is important.

Given these two broad objectives, one can further envisage an environment where direct income transfers are reduced in relative terms. Here, rather than supporting farmers at the current level, we reduce the available income support to half of what is attained via price subsidization. This scenario combines the two objectives of pure fiscal austerity (Exp-1) and the welfare analysis of direct income support regime (Exp-2). So Exp-3 should be regarded as a weighted average of these two stylized objectives concerned. This manoeuvre reduces the income support available to the Turkish agriculture, yet generates fiscal savings for the Treasury. The dilemma of the policy implementation remains: provision of an adequate level of income support to the rural economy versus reduction of aggregate public expenditures to attain fiscal balances.

Table 4
Change in consumer welfare (%)

Period	Exp-1	Exp-2	Exp-3
10	0.125	−0.077	0.025
20	0.041	−0.169	−0.063
Long run equation	0.068	−0.237	−0.152

4.2. Policy analysis

We document the welfare consequences and output responses of our simulation results in Tables 4 and 5, and portray the adjustment paths of selected variables in Figs. 1–5. All solution results are reported as ratios to the base-run equilibrium.

Under scenario Exp-1, the government eliminates all existing price subsidies to agriculture from the central budget. In this policy environment, the intertemporal nature of our model allows us to capture both the static gains from resource real-location, and the dynamic gains from increases in capital investment. We compute the social welfare gains by constructing an *equivalent variation index* which is a function of the current and future aggregate "full" consumption, where future consumption is discounted by the rate of time preference. We calculate an initial gain of 0.12% in consumer welfare by the end of the tenth year of implementation. This welfare gain is the end result of the gains in the intertemporal efficiency due to elimination of price distortions, and is further related to the path of aggregate consumption. By period 20 such gains amount 0.04% and are observed to stabilize at 0.09% under long run equilibrium.

We find that output consequences of the experiment are deflationary (see Fig. 1). The fall in GDP is due to both the decline in agricultural output supplied, and also due to the fall in investment expenditures. The initial rise in aggregate consumption lowers aggregate savings available for fixed investments. With the fall in saving funds for investment, aggregate demand for national output is hampered. Thus, the elimination of price subsidies in agriculture is expected to reduce aggregate GDP, in spite of the fact that its intertemporal effects on consumer welfare are positive. This dilemma between consumer welfare and producers' output response will likely to dominate the current policy debates on the Turkish agricultural price reforms.

Table 5
Real agricultural output (deviations from base = 1.0)

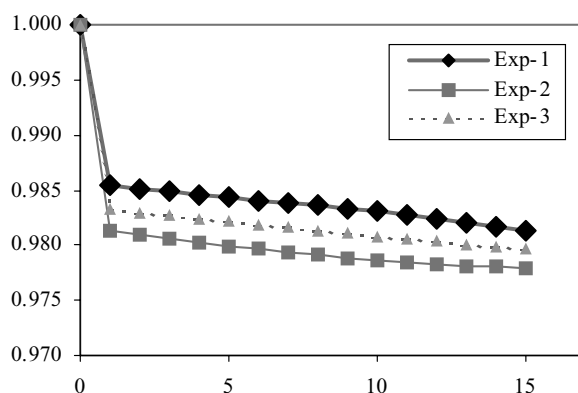| Periods	Exp-1	Exp-2	Exp-3
1	0.972	0.973	0.973
5	0.961	0.961	0.961
10	0.952	0.951	0.952
15	0.947	0.945	0.946

Fig. 1. Gross domestic product (base = 1.0).

We mentioned that investment expenditures are expected to fall in the national economy (Fig. 2). This is due to the sudden rise in aggregate consumption, intertemporally substituting current consumption against the future. This allows consumers to enjoy gains from the elimination of producer subsidies by raising their commodity consumption along the whole post-reform adjustment path. Yet, the increase in commodity consumption results in an expanding trade deficit and necessitates higher foreign capital inflows.

Fig. 3 portrays the (optimal) path of foreign trade deficit under the experiment. Foreign deficit expands by almost 10 percentage points upon impact and is expected to narrow down by period 14.

We observed that real output in agriculture fell by 2.8% upon impact. By the end of fifteenth period real output in agriculture was 5.3% below its comparable
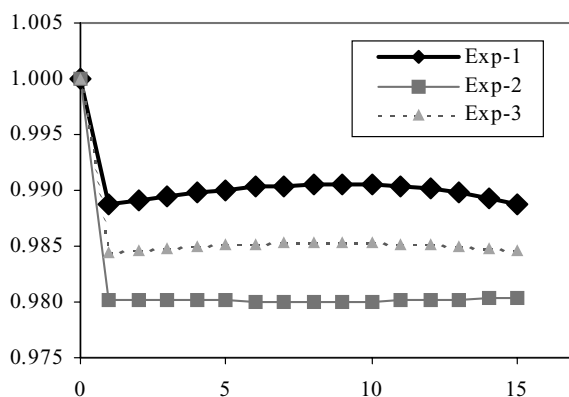

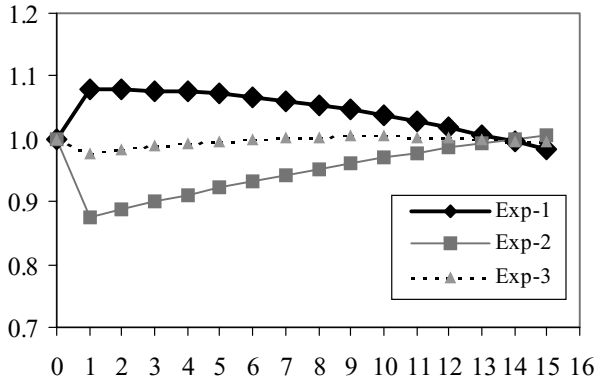Fig. 2. Aggregate investment (base = 1.0).

Fig. 3. Foreign deficit (base = 1.0).

path in the base run. Table 5 narrates the real output supplied in agriculture as a result of the elimination of price subsidies.

Now we proceed to complement this scenario with implementation of the direct income support to farmers. To do this we first calculate the income equivalent of the dismantled system of price subsidies to the farmers. We had reported above in Section 2 that the current subsidy scheme amounts to an income transfer of 1.5% of the gross domestic product in Turkey at the existing rates. The proposed scenario in Exp-2 eliminates indirect price subsidies but instead replaces it with a scheme of direct income payments fixed at the 1.5% level of period 1 GDP. These transfers are paid lump sum to the private household and are financed directly from the central budget.

Exp-2 narrates the paths of the macro aggregates as shown in Figs. 1–3. Aggregate consumption now falls below its base-run path and we found the contraction
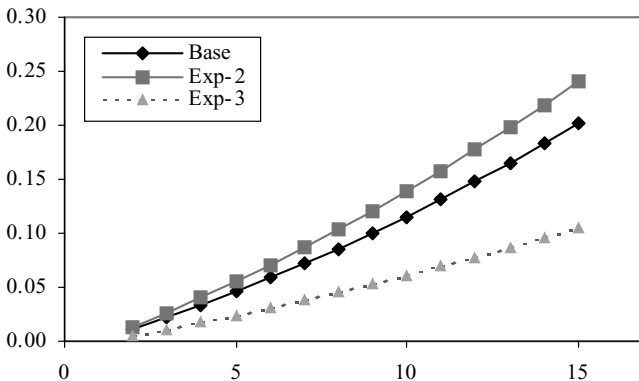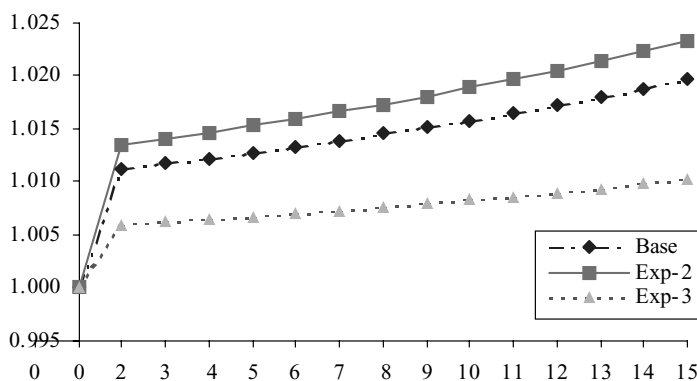

Fig. 4. Public debt to GDP ratio.

Fig. 5. Interest rate (base = 1.00).

in GDP to be severer. Consumer welfare is calculated to fall by 0.08% by period 10 after the implementation of the Exp-2 policy environment. In a longer time horizon, the fall in private consumption efficiency amounts 0.24%.

Why is it possible that under a regime of income transfers to the private households we witness a fall in aggregate consumer welfare as well as contraction of the macro aggregates? The answer lies with the consequences of fiscal deficits over the domestic economy. Income transfers from the central budget indicate a rise of aggregate public expenditures. Hence, whereas in the Exp-1 policy environment subsidies were eliminated and public savings were generated, now the fiscal expenditures are observed to change form, yet expected to be maintained. The contraction of the GDP, on the other hand, results in a rise of the ratio of government's budget deficits to the GDP and augments the fiscal debt servicing problem. The rise in the ratio of domestic debt relative to GDP signals the deepening of financial fragility in the domestic economy. This, as to be recalled, is captured by the fragility generation mechanism recognized in Eq. (8) above. This distinguishing feature of the model narrates a mechanism where increased financial fragility raises the country risk premium in the financial markets and causes an increase of the domestic interest rate. All these imply a contractionary environment for fixed investment demand together with consequent loss of gross output supplied. Fig. 4 portrays the path of domestic debt while the path of equilibrium interest rate is depicted in Fig. 5.

Under Exp-2, the ratio of fiscal debt to GDP accumulates rapidly as the borrowing conditions from the domestic market become more expensive. Interest payments emerge as a major expenditure item. Under this scenario, interest rate is calculated to rise by 2% in real terms upon impact and by almost 3% by the end of period 15 (Fig. 5). Rise of the domestic rate of interest increases costs and reduces expected returns to investment. Hence aggregate investment falls in comparison with the Exp-1 scenario. (Fig. 2 above).

Deceleration of the investment demand and the hesitant accumulation of the physical capital stocks result in a stagnationary environment in Exp-2. These factors combined lead to a fall of the welfare index from its pre-liberalization level, inhibiting part of the potential welfare gains of price reforms in agriculture (Table 4).

The rather dismal character of our findings under Exp-2 invited us to reformulate our income supporting scheme. In scenario Exp-2, the income transfers were set at a level of 1.5% of the period 1 level of aggregate GDP. The fiscal pressures of this level of income transfers were observed to exert significant pressure on the domestic debt profile of the government. Hence as an alternative, we now change the level of the income transfers and cut their size by half. This maneuvre clearly indicates a real income loss to the farmers, yet it is likely to generate public savings to the fiscal authority.

Our results are contrasted in the figures above under the acronym Exp-3. The elimination of price subsidies indicates modest gains in consumer welfare, yet the contraction in agricultural output and the negative consequences of falling investment demand remain to be tackled. The pressures of domestic debt and the associated fragility in the asset markets remain, despite the fact that their severity is reduced. Thus, notwithstanding the possible fiscal savings in return to the reduction in income supports for the rural economy, the social consequences of the sudden fall in such income support will continue to endanger the social equilibrium of the society. Such issues, clearly of extreme importance in devising socially relevant policy programs, are beyond the scope of our paper. Yet, the policy dilemma as manifested in our technical results are very clear.

5. Concluding comments and policy discussion

Some caveats are in order on the limitations of the study before we go on with the summary of our main findings. First, it has to be clear that, with this type of a methodology, no distinctive conclusions can be inferred about the characterization of the future path of the economy based on "calendar" dates. The policy experiments performed are basically of *comparative* nature and are meaningful only in relation to each other, rather than revealing forecasts of the future.

Secondly, one has to note that the adjustment path as characterized by the simulation exercises reflect *equilibrium* relationships on a *smooth* time horizon, mainly in the absence of rigidities and/or structural bottlenecks. Thus, the speed of transitional adjustment of many variables to their respective equilibrium paths should not be taken as a measure of the global stability properties of the modeled economy, but rather as a direct outcome of the laboratory characteristics of a macroeconomic model with continuous, well-behaved functional forms.

The model results reveal that output consequences of the warranted shift of agricultural support policies from price subsidies to direct income transfers are likely to be deflationary. The expected contraction of the aggregate GDP is due to

both the decline in agricultural output, and also to the fall in capital investment expenditures.

Under the new agricultural income support regime, our results further reveal an increased ratio of the stock of debt to GDP, with interest costs rising and further curtailing capital investments. With relative contraction of the gross domestic product, the burden of the fiscal debt is more severe, and the path of private consumption is significantly impeded. Consequently, the initial (modest) gains of consumers' intertemporal welfare turn negative over a longer time frame.

Welfare gains were computed as changes in equivalent variations. Overall elimination of the existing price subsidies with no compensating income support measures report positive gains in this indicator, mainly as a result of the (partial) elimination of the existing price distortions. Yet, invigoration of the scheme of direct income support to farmers has a significant impact on this metric. The income transfers from the central budget culminate the problem of fiscal deficits and signal deepening of the financial fragility of the public sector in the asset market. Within the context of our model, this increase of financial fragility raises the country risk premium and causes an increase of the domestic rate of interest. The real output effects of all these prove to be deflationary in the domestic economy.

A major flaw, in our view, on the discussions of agricultural policy making in Turkey is to treat the rural economy in isolation, and to evaluate the budgetary costs of agricultural support policies independent of the fiscal constraints and debt obligations. However, our modeling results clearly underscore the main dilemma of the current Turkish agricultural-*cum*-fiscal policy: given the high servicing costs on fiscal debt, the state has very limited (and often conflicting) options to address its objectives of agricultural income support and fiscal austerity. A second dilemma concerns the expected deflationary consequences of the reforms over the price support scheme. With the elimination of the direct and indirect price supports to the farmers, agricultural output supply is expected to be negatively affected in the short-to-medium run, and in the absence of compensating welfare programs, such a policy shift will likely have significant social repercussions on both the rural and the urban economy. Given that the sector currently employs as much as 45% of the labor force, the social welfare implications for the rural economy is likely to dominate the policy setting in the interim.

In closing, we note that similar results were also obtained by Cakmak and Kasnakoglu (2002) by employing a partial equilibrium methodology: They have calculated that harmonization of the Turkish agriculture with the Common Agricultural Policy (CAP) of EU decreases output in most of the agricultural products. Herok and Lotze (2000), on the other hand, concluded that agricultural output and domestic welfare in the Central and East European Countries will rise after EU integration, but liberalization of CAP will decrease agricultural output in these countries after EU membership. Our simulation exercises are designed to capture two objectives of the Turkish agricultural reform: (i) to reduce the cost of the existing agricultural support system on the budget, and (ii) to converge the Turkish support system to the regulations and the limitations set forth by the WTO. Con-

sidering that the existing CAP of EU is less restrictive than the limitations of WTO on agricultural supports, possible liberalization of CAP towards WTO standards will not impose further restriction on the new Turkish agricultural support system in terms of level of support and choice of instrument. However, the existence of a large rural population in Turkey is likely to remain as the main constraint on the fiscal discipline in implementing any agricultural support system.

Under these conditions, the short termism embedded in the maturities of the public sector assets is a significant cause of concern for the continued confidence crisis and the increased fragility (riskiness) of the domestic financial system. These elements, no doubt, lie at the heart of the reason for the presence of significantly high real rates of interest in the Turkish domestic asset markets, and are directly responsible for the invigoration of a series of adjustments which, in the technical language of our modeling analysis, lead to distortions of the investment path of the economy where expected gains of agricultural price reforms are exhausted. The ongoing attempts of price reform in an environment characterized by coordination failures and unsustainable fiscal targets are clearly no easy task, with realized outcomes falling short of expectations of achieving a more efficient allocation of resources and of a rise in social welfare. Our results further underscore that the more delayed the necessary adjustments towards a sound fiscal reform, the higher would be the gap between such expectations and their realizations. On the other hand, this undesirable environment can be partly reversed by use of EU funds for regional development as Turkey succeeds in her efforts for full membership.

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