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HOW FISCAL MISMANAGEMENT MAY IMPEDE TRADE REFORM: LESSONS FROM AN INTERTEMPORAL, MULTI-SECTOR GENERAL EQUILIBRIUM MODEL FOR TURKEY

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I. INTRODUCTION

THE decades of the 1980s and 1990s have been a period of transition and adjustment for many developing countries. The transition, in various degrees and stages, entailed elimination of the quantitative barriers to trade, relaxation of foreign exchange controls, liberalization of capital markets, and fiscal reforms that seek to balance revenues with expenditures. However, many countries found some reforms far easier to implement than others, and had difficulty in sequencing the various stages of reform, while other countries tended to stall and not fully complete the reform process. Indeed, a common concern for many "newly industrializing countries" (NICs) and the so-called economies in transition has focused on how to implement fiscal adjustments necessitated by the loss of revenues from trade and capital market reforms.

A typical consequence of ill-coordinated reform is a rise in fiscal deficits that must then be financed by real transfers in one form or another. Policies to finance the deficit from domestic and foreign savings have become more common than seignorage extraction from monetization. Nevertheless, when these policies are implemented prematurely in an environment characterized by fragile and segmented domestic capital markets, they tend to crowd out private sector investment, causing savers, both domestic and foreign, to channel funds to the financing of government deficits rather than capital formation.[1] As the ratio of the public debt to national income rises, numerous uncertainties surface, such as whether the reforms

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[1] See, e.g., Blejer and Cheasty (1989) and the surveys in Caprio, Atiyas, and Hanson (1996).

can be carried to fruition, or whether the distortions caused by deficit financing might deplete the efficiency gains sought by opening goods markets to the world economy. For these and many other reasons, governments must often pay a risk premium above international market rates to clear domestic markets for public debt instruments.[2]

Lessons derived from many of the liberalization episodes of the 1980s and 1990s suggest that the uncoordinated and ad hoc policies to close the "external" and the "fiscal" gaps (Bacha 1990), in most cases, increased the fragility of the newly developing domestic asset markets vis-à-vis the international markets. In the absence of a coherent set of policies to restore the macro fundamentals, the potential volatility of the domestic rate of interest along with the induced swings of capital in/outflows become an important source of macro disequilibria.[3]

In this paper, we develop an intertemporal, multi-sector general equilibrium (GE) model to analyze the nexus of these issues. We focus on the effects of rising fiscal debts and trade liberalization on foreign trade, capital accumulation, and transitional (medium-run) growth in the context of Turkey's post-1990 experience with this problem. The prevalence and nature of the problems that the countries are likely to encounter when trade reforms are not accompanied by broader-based fiscal reforms are briefly discussed in the next section. Then, in the context of this broader problem, the case of Turkey is investigated more closely. This investigation provides the context for the model specified in Section III and the empirical analysis that follows. A special and unique feature of the modeling analysis is the specification of capital markets in a manner that accounts for the level of risk premium apparent in the data. The policy simulations and results are discussed in Section IV. The results suggest that imbalances in the government fiscal accounts cause a contraction of sectoral outputs and real GDP beyond the levels expected from trade liberalization. The simulation results show clearly that the longer the delay in making the necessary adjustments towards sustainable fiscal targets, the larger will be the gap between gains from "coordinated" liberalization and the "ad hoc" liberalization attempts which are accompanied by accumulation of domestic debt. While the

[2] This rise in the domestic rate of interest, in many instances, could also be the result of a discretionary policy towards liberalizing the capital account. Under conditions of an open domestic capital market facing international competition, authorities themselves may choose to use the interest rate as a tool to prevent "currency substitution"—the case where the economic agents may wish to satisfy their demand for monetary services by holding foreign-denominated currency or deposits rather than the domestic assets (Tanzi and Blejer 1982; Girton and Roper 1981; Miles 1978). In addition, high interest rates could as well be taken as part of an investment finance policy to induce the desired level of capital inflows. See, e.g., the UNCTAD, *Trade and Development Report, 1995* (1995) for a broad coverage of these issues and recent country experiences.

[3] See, e.g., the country analyses of Diaz-Alejandro (1985), McKinnon (1982), Tanzi and Blejer (1982), Gibson and Tsakalatos (1994), Fanelli, Rozenwurcel, and Simpson (1998), and Calvo, Goldstein, and Hochreiter (1996).

model is structured to characterize these disequilibria as a property of the transition path, in a real economy these disequilibria may continue indefinitely as the country oscillates from crisis to crisis.

II. DILEMMAS OF TRADE REFORM

A. *The Prevalence of the Problem*

The salient features of the problems encountered due to ill-coordinated trade liberalization can be seen from the data on fiscal balances and external debt indicators of selected low- and middle-income developing countries (Table I).

Note at the outset that despite extensive efforts towards trade liberalization, taxes on foreign trade still provide the bulk of aggregate fiscal revenues in many countries.[4] This is particularly true for the low-income tier, especially sub-Saharan Africa. Countries like Ghana, Lesotho, and Rwanda generate at least a third of their aggregate current revenues from taxes on foreign trade transactions. Many low-income Asian countries, such as Pakistan, India, Nepal, or the Philippines, tend to share this feature as well. Among the lower-middle-income countries, e.g., Bolivia, Cameroon, and Peru, revenues from foreign trade are almost equal to revenues from personal and corporate income. For the upper-middle-income tier, revenues from foreign trade are of lesser importance; nevertheless, cases exist here too where trade tax revenues exceed 10 per cent of the aggregate fiscal revenues.

Overall, these observations reveal the reluctance of many governments to liberalize foreign trade while also broadening the tax base. In fact, another observation pertains to the weak performance of the aggregate current revenues of the governments in the first place. Notwithstanding the important exceptions such as Egypt (38.7 per cent), Bulgaria (35.6 per cent), Tunisia (29.9 per cent), and Portugal (34.3 per cent), many countries covered in Table I reported total fiscal revenues as being less than 20 per cent of their respective national incomes. This highlights the severity of fiscal constraints when pursuing trade reform without broadening the tax base. That fiscal balances are eroding in most of the reported set of countries is also shown in Table I. Fiscal deficits as a ratio of GNP are high, not only in the transition economies such as Bulgaria (12.9 per cent) and Romania (4.7 per cent), but also in many market economies such as Greece (15.6 per cent), Turkey (7.0 per cent), Pakistan (7.4 per cent), and Egypt (4.1 per cent).

The severity of the fiscal constraint together with the current account balance is regarded as one of the major indicators of the external fragility of a country, signaling the associated risk. The fifth column of Table I documents the relevant data.

[4] We observe in the World Bank data set that out of forty-seven low/middle-income developing countries for which data exists for both the income and trade taxation, twenty-four had trade tax revenues exceeding the total revenues from taxes on incomes and capital gains.

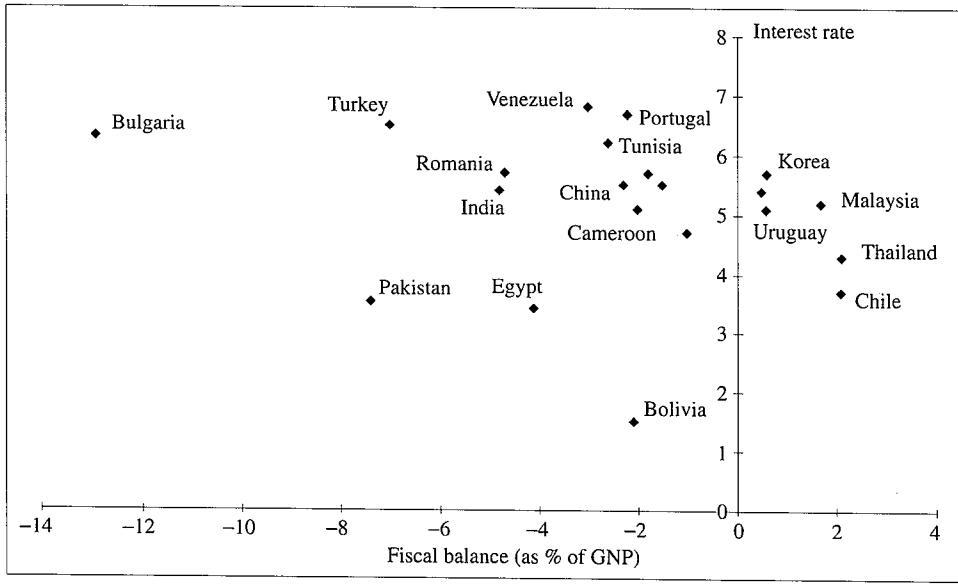
TABLE I

FISCAL BALANCES, TERMS OF EXTERNAL BORROWING IN SELECTED DEVELOPING COUNTRIES, 1993

	As % of Central Gov. Current Revenues		Total Central Gov. Current Revenues (As % of GNP)	Central Gov. Surplus/Deficit (As % of GNP)	Current Account Balance (As % of GNP)	Total Debt Service (As % of Exports)	Interest Payments on External Debt (As % of Exports)
	Taxes on Income and Capital Gains	Taxes on Intl. Trade and Transactions					
Bolivia	6.0	7.1	15.6	–2.1	–12.9	59.4	16.0
Brazil	16.5	1.7	26.6	–1.0	–0.1	24.4	9.2
Bulgaria	12.7	9.1	35.6	–12.9	–5.0	5.6	4.8
Cameroon	19.9	19.6	16.3	–2.0	–7.2	20.3	8.1
Chad	22.6	15.3	9.1	–7.5	–23.3	7.2	5.0
Chile	19.3	9.9	24.4	2.1	–5.5	23.4	9.4
China	36.9	16.9	5.2	–2.3	–2.8	11.1	3.7
Egypt, Arab Rep.	22.0	10.9	38.7	–4.1	0.6	14.9	8.3
Ghana	16.8	26.8	16.9	–2.5	–13.6	22.8	9.0
Greece	29.8	0.1	24.3	–15.6	–7.6		
Guinea	14.6	47.5	14.0	–3.3	–2.1	9.5	4.5
India	18.7	24.9	14.4	–4.8	–0.3	28.0	14.8
Kenya	29.6	10.6	22.5	–3.8	1.3	28.0	11.3
Korea, Rep.	31.4	5.8	18.9	0.6	0.2	9.2	2.9
Lesotho	16.9	51.8	27.1	–0.3	–61.7	5.1	1.9
Malaysia	34.5	13.8	28.7	1.7	–3.3	7.9	2.4
Nepal	9.9	30.8	9.6	–6.3	–7.4	9.0	3.6
Nicaragua	11.3	21.1	29.8	0.5	–47.4	29.1	15.9
Pakistan	13.9	26.3	18.4	–7.4	–8.0	24.7	10.6
Peru	18.3	11.0	10.8	–1.8	–5.4	58.7	23.8
Philippines	29.1	30.1	17.1	–1.5	–6.6	24.9	10.5
Portugal	26.2	0.3	34.3	–2.2	–2.2	19.3	7.8
Romania	35.6	3.6	36.5	–4.7	–4.9	6.2	3.6
Rwanda	15.6	31.1	13.2	–9.1	–26.5	5.0	2.8
Thailand	27.9	18.2	18.3	2.1	–5.6	18.7	5.8
Tunisia	12.6	28.5	29.9	–2.6	–8.0	20.6	7.7
Turkey	35.6	4.3	18.7	–7.0	–4.5	28.3	13.1
Uruguay	6.9	7.1	29.9	0.6	–1.9	27.7	16.5
Venezuela	51.8	10.5	18.0	–3.0	–3.7	22.8	12.5
Zimbabwe	44.4	19.0	31.8	–7.0	–5.9	31.1	10.5

Source: World Bank (1996).

Fig. 1. Fiscal Gap and Average Interest Rate on External Public Debt



Countries that suffer from the fiscal imbalances are observed to be closely associated with worsening current account positions. A culmination of these imbalances is that economies are in an adverse position for attracting foreign funds. Such economies must often offer interest rates in excess of the world market rates in order to attract foreign capital, the differential being largely accounted for by a risk premium. Figure 1 offers an illustration of this, where the cluster of countries with highly negative fiscal balances and high interest costs of external public debt are clearly visible.

The overall picture portrayed in Table I and Figure 1 thus underscores the problem of carrying reform to fruition, as a large number of countries are having difficulties in balancing their fiscal accounts in the course of liberalization imperatives. The post-1990 experience of the Turkish government's attempt to liberalize trade, its failure to broaden the tax base, and then its attempts to form a customs union with the European Union (EU) in the presence of faltering fiscal balances and severe macro disequilibria serve as an outstanding example of this problem.[5]

B. *The Turkish Case*

The rapid deterioration of Turkey's fiscal position during the early 1990s is well

[5] See Mercenier and Yeldan (1997) for an intertemporal general equilibrium analysis of Turkey's recent move to integrate trade under a customs union with the EU. Yeldan (1998) also offers a general equilibrium analysis of the political economy factors behind the prolonged unstability of the Turkish macro environment in the 1990s.

documented (Sak, Özatay, and Özturk 1996; Atiyas 1995; Boratav, Türel, and Yeldan 1996; and Önder et al. 1993). The major breakdown occurred in the flow of factor revenues generated by the state economic enterprise system, and by the rapid rise in transfer payments. The aggregate disposable income of the public sector fell by 30 per cent in real terms between 1988 and 1995 and the public savings-investment gap widened almost fourfold. The rise in transfers was largely caused by political pressures associated with the elections of 1989 and 1990. As a ratio of GNP, transfers rose from 6.1 per cent in 1991 to 12.0 per cent in 1994. Likewise the savings generation capacity of the public sector eroded severely and turned negative after 1992.

In the presence of these difficulties, Turkey pursued efforts to form a customs union with the EU in 1995. The government agreed to harmonize its tariff regime which resulted in further revenue losses from trade taxes. The loss of these revenues placed additional strains on the fiscal balances. Harrison, Rutherford, and Tarr's (1996) estimate that value-added taxes must be increased by 16.2 per cent in order to compensate for this loss of revenue. Köse and Yeldan (1995) incorporated oligopolistic markup pricing in a static CGE of twenty-six sectors and found that the necessary indirect tax adjustment reached 36 per cent. The loss of tariff revenues occurred at a time when fiscal authorities realized that continued seignorage extraction through monetization was no longer feasible, meaning that the Treasury had almost fully exploited the Laffer curve (Yeldan1997; Selcuk 1996). These developments led to a sharp increase in the public sector borrowing requirement (PSBR) which rose to 11.7 per cent of the GNP in 1993, and then leveled off to about 7 per cent thereafter. Since external sources of public sector finance were extremely limited,[6] the state was forced to resort to massive domestic debt financing by issuing new debt instruments (bonds), part of which were needed to service the existing debt.

These instruments dominated the financial markets almost exclusively. In 1995 the share of new issues of public securities in total securities issued stood at 90 per cent; and the share of public assets in the secondary market reached 95 per cent (Balkan and Yeldan 1996). For bond markets to clear at rising volumes, higher real rates of interest had to be paid. Rising rates presumably reflected not only the rising opportunity cost of savings but also a risk premium. These factors combined led to excessively high interest rates, crowding out private investment.

Under these conditions the stock of domestic debt grew rapidly, reaching 20 per cent of GNP by the end of 1995. A critical feature of debt accumulation was its extreme short-term maturity. By 1992 the state was already trapped in a "Ponzi-

[6] Net foreign borrowing of the government during 1989–97 was almost negative, and in those years when the public sector experienced "net inflows," their amount barely reached 1 per cent of the GNP (Yeldan 1998).

style" financing of its debt, with net new government borrowings reaching 92 per cent of outstanding domestic debt. By 1995 this ratio accelerated to 132 per cent. Thus "management" of the domestic debt and the increase in the fiscal gap emerged as issues of paramount importance for Turkish policymakers in the second half of the1990s.

The following pages analyze these issues within the context of laboratory experiments of an intertemporal GE model that is specified in the next section.

III. THE MODEL

With some modification, the model utilized in this section is an extended neoclassical intertemporal GE model of a government whose purpose is to collect taxes, administer expenditures, and issue debt instruments. The model draws upon the recent contributions on intertemporal GE modeling by Wilcoxen (1988), Ho (1989), Goulder and Summers (1989), Mercenier and de Souza (1994), and Diao and Somwaru (forthcoming). 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 1994), and other sources; and these represent the macro equilibrium of the Turkish economy in 1990. 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 supply,[7] labor is mobile across sectors (but not mobile internationally). 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.

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:

$$\text{Max}\, U_1 = \sum_{t=1}^{\infty} \left(\frac{1}{1+\rho}\right)^t \frac{\left(\prod_i c_{i,t}^{a_i}\right)^{1-\theta} - 1}{1-\theta}, \tag{1}$$

subject to the intertemporal wealth constraint:

$$\sum_{t=1}^{\infty} R_t \left(\sum_i p_{i,t} c_{i,t}\right) = TW_1, \tag{2}$$

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

where ρ is the positive rate of time preference; θ is inverse of the intertemporal elasticity of substitution; $c_{i,t}$ is household demand for each of the six goods; $0 < a_i < 1$, and $\sum a_i = 1$; $p_{i,t}$ is the price for good i, TW_1 is the initial private wealth, and R_t is a discount factor defined as:

$$R_t = \prod_{s=1}^{t} \frac{1}{(1 + r_s)}, \tag{3}$$

and r_s is the interest rate. The household budget constraint can also be defined in terms of current income and expenditure flows, i.e., in each period the household earns incomes from wages (wL), firm's profits (div), government transfers (TI), and interests on government and foreign bonds ($BPG + BF$), such that:

$$SAV_t + \sum_i p_{i,t} c_{i,t} = (1 - ty_t)\,[w_t L_t + div_t + TI_t + r_t(BPG_{t-1} + BF_{t-1})], \tag{4}$$

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

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 $I_{i,t}$ and labor employment to maximize the present value of all future profits, taking into account the expected future prices for sectoral outputs, the wage rate, the capital accumulation constraint, and the capital adjustment cost function, $a_{i,t} = \phi(I_{i,t}^2/K_{i,t})$. Specifically, the firm chooses the sequences $(I_{i,t}, L_{i,t})$,

$$\text{Max } V_i = \sum_{t=1}^{\infty} R_t div_{i,t} \equiv \sum_{t=1}^{\infty} R_t \{PVA_{i,t}[f_i(K_{i,t}, L_{i,t}) - a_{i,t}] - w_t L_t - PI_{i,t} I_{i,t}\}, \tag{5}$$

subject to

$$K_{i,t+1} = (1 - \delta_i) K_{i,t} + I_{i,t}, \tag{6}$$

where V_i is the current market value of firm; PVA_i is the price of value added (net producer price); δ_i is the sectoral depreciation rate; and R_t was introduced in equation (3) above. Because of the recognition of adjustment costs on capital, marginal products of capital differ across sectors, resulting in unequal although optimal rates of investments. New capital equipment, 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. However, PI_i only represents the unit cost of the forgone outputs used to produce the new capital equipment, while the marginal value of capital (the well-known Tobin's q) has to take into account the adjustment costs, i.e.,

$$q_i = PI_i + PVA_i \frac{\partial a_i}{\partial I_i}.$$

3. *The government as the fiscal authority*

The government has four interrelated functions in the model: collecting taxes, distributing transfers payments, purchasing goods and services, and administering 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. The government's basic spending includes transfer payments to households, public consumption expenditures (inclusive of wage costs of public employees), and interest costs on outstanding public debt. A government budget deficit may arise from the excess of aggregate expenditures over tax income.[8] The fiscal deficit is financed exclusively through new issues of government bonds. Thus, government bonds issued at period t is defined as:

$$BPG_t - BPG_{t-1} = GDEF_t, \tag{7}$$

and

$$GDEF_t = r_t BPG_{t-1} + r_t BFG_{t-1} + \sum_i p_{i,t} GD_{i,t} TI_t - (yt_t HY_t + \sum_i it_{i,t} PX_{i,t} X_{i,t} + \sum_i tm_{i,t} PWM_{i,t} M_{i,t}), \tag{8}$$

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, $it_{i,t}$ is indirect tax rate for sector i, $PX_{i,t}$ is output price of good i, $X_{i,t}$ is output of good i; $tm_{i,t}$ is the tariff rate; $PWM_{i,t}$ is the world price for imported good i; and $M_{i,t}$ and $GD_{i,t}$ denote the volume of imports and government consumption of commodity i, respectively.

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, caused by a shock to either the government's sources of revenue or to its expenditure items,

[8] It has to be noted that even though this formulation of the fiscal position of the government is fairly "general," there are differences of opinion on the "precise" calculation of the public sector's budget constraint. In their extensive survey on the "measurement of fiscal deficits" across countries, for instance, Blejer and Cheasty (1991, p. 1644) state that "from one country to the next, the considerations that need recognition in budgetary analysis . . . may vary widely. Hence, the search for the single perfect deficit measure may be futile." In this study, we rely on the World Bank's (1988, p. 56) assessment of the deficit generating components, where "expenditure includes wages of public employees, spending on goods and fixed capital formulation, interest on debt, transfers and subsidies. Revenue includes taxes, user charges, interest on public assets transfers, operating surpluses of public companies and the sales of public assets."

is financed exclusively by new issues of public debt instruments which are purchased by domestic households, *BPG*.

To avoid the difficulties that would result from modeling the government as an intertemporal optimizing agent,[9] 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 according to fixed expenditure shares.

4. *The foreign sector*

Following traditional CGE terminology, the model incorporates the Armingtonian composite good system for the determination of imports, and the constant elasticity of transformation (CET) specification for exports. In this structure, domestically produced and foreign goods are regarded as imperfect substitutes in aggregate demand, given an elasticity of substitution/transformation. The economy is "small," hence the world prices are regarded as exogenously given. However, the "composite" prices do change endogenously as domestic prices adjust to attain equilibrium in the commodity markets. The output of public services consists entirely of civil servant wages, and hence, is regarded as a (non-traded) home good with the government being its sole buyer.

In each period-equilibrium, the difference between 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 as $FBOR_t$, and interest income received from accumulated foreign assets $r_t BF_{t-1}$. Thus accumulation of the private foreign assets evolve as follows:

$$BF_t - BF_{t-1} = r_t BF_{t-1} + FBOR_t. \tag{9}$$

Regarding the foreign sector, a concept of particular interest is the "exchange rate system." Since the model is based on the Walrasian general equilibrium system in which monetary phenomena and many financial assets are not explicitly recognized, it cannot capture directly the effects of currency depreciation on the domestic commodity and asset markets. In the absence of a full-fledged theory on financial-real economy linkages, we therefore abstain from introducing an explicit variable for converting nominal values of currencies between the domestic and foreign markets.

One can, however, make use of various concepts of the "real exchange rate" that have been developed in the context of applied general equilibrium analysis. One such concept is an extension of the real exchange rate definition utilized in pure

[9] See Mercenier and de Souza (1994).

international trade theory as the ratio of the basket of tradables to that of the non-traded home goods. In the context of the (Armingtonian) composite good specification adopted in the current model, however, goods are not regarded as "pure tradables and non-tradables," but instead are ranked on a continuum index of tradability, given their (Armingtonian) substitution elasticities. Accordingly the exchange rate faced by the "consumers" is given by the value of the imported goods to the value of the domestic goods:

$$ER_t^C = \frac{\sum_i [PWM_{i,t}(1 + tm_{i,t})\,\Omega_i]}{\sum_i PD_{i,t}\Omega_i},$$

where ER_t^C is the (real) exchange rate faced by the consumers, $PD_{i,t}$ is the price of the domestically produced good, and Ω_i is the weight of the commodity in the consumer's basket.[10]

A related concept of the real exchange rate can also be obtained from the open-economy macroeconomics literature where it is defined as the relative cost of the common reference basket of goods among two regions, where the baskets' costs in the two regions are compared after conversion to the common numeraire. For two regions A and B, with price levels $PINDEX_{A,t}$ and $PINDEX_{B,t}$, we say that region A experiences a real appreciation (region B a real depreciation) when the ratio of the respective price indices, $PINDEX_{A,t}/PINDEX_{B,t}$, rise.[11] Our system of equations are amenable to both of the conceptualizations of the real exchange rate introduced.

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) demand for labor equals its supply; and (iii) government spending equals government revenues plus new issues of public debt instruments. The inter-temporal equilibria are further constrained by the following steady-state conditions:

$$r_{SS} V_{SS} = div_{SS}, \tag{10}$$

$$I_{i,SS} = \delta_i K_{i,SS}, \tag{11}$$

$$0 = r_{SS} BF_{SS} + FBOR_{SS}, \tag{12}$$

$$GDEF_{SS} = 0. \tag{13}$$

Equation (10) implies that at the steady state, the value of the firm, V_{SS}, becomes constant and hence the profits, div_{SS}, are simply equal to the interest earnings from the same amount of riskless assets. Equation (11) implies that in each sector i,

[10] See de Melo and Robinson (1989) for a discussion regarding the analytics of the treatment of the foreign sector in applied general equilibrium models.

[11] See, e.g., Obstfeld and Rogoff (1996, Chap. 4).

investments just cover the depreciation of sectoral capital; hence the stock of capital remains constant. Equation (12) states that foreign asset holding is constant. Equation (13) is the solvency (transversality) condition on government debt[12] which requires that government debt remains constant at the steady state. This implies that the government has to have a surplus in its primary budget which equals its interest payments on its domestic and foreign debt.

IV. ANALYSIS OF ALTERNATIVE POLICY REGIMES

A. *Description of the Simulation Experiments and Their Motivation*

Theory suggests that, in the absence of market imperfections and/or external effects, trade liberalization increases efficiency of the economy due to reallocation of resources among the production sectors. However, liberalization attempts also have income redistribution consequences, especially between the public and private sectors, as government revenues from trade protection fall. This requires that liberalization episodes concur with a stable macroeconomic environment, especially in fiscal balances of the public sectors. In many instances, however, trade liberalization and fiscal reform are loosely coordinated, and the expected benefits from reform fail to materialize. 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 uncertainty 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 savings and investment decisions of the residents.

Given this background, we attempt to study analytically the resource allocation processes of trade liberalization together with the ongoing pressures of delayed/uncoordinated fiscal reform with the aid of three simulation experiments. First, we envisage an environment in which both the trade and the fiscal policies are perfectly coordinated. We eliminate all existing tariffs on imports, and to compensate for the losses of fiscal revenues, we endogenously adjust the income tax rate. Thus the fiscal budget balance of the government is maintained for all time periods, and the trade reform has neutral consequences for the public-sector expenditure patterns. We treat this case as the optimal bench-mark and identify as EXP-1.

Under EXP-2 and EXP-3 we consider a case where reform causes losses of tax

[12] Since interest payments are recorded as part of the current period public expenditures, this steady-state condition does not involve interest costs.

TABLE II

SUMMARY OF SIMULATION EXPERIMENTS: FISCAL POLICY ALTERNATIVES FOR THE GOVERNMENT

Trade policy shock: Eliminate all tariffs on imports.

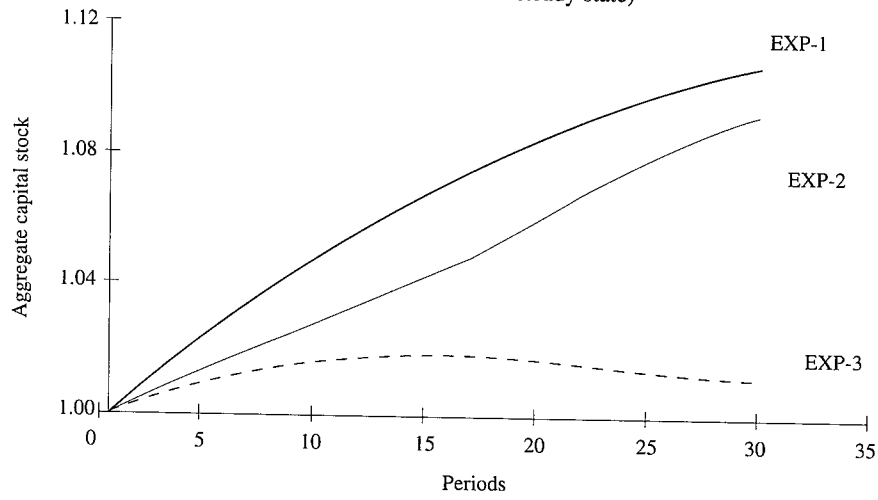
EXP-1	EXP-2	EXP-3
Simultaneously adjust the income tax rates such that the government current budget constraint holds.	1. Raise public service wages and delay government income adjustment for 20 periods. 2. After period 20, income tax rate adjusts endogenously to impose government's solvency constraint on its debt.	1. Raise public service wages and delay government income adjustment for 40 periods. 2. After period 40, income tax rate adjusts endogenously to impose government's solvency constraint on its debt.

revenues, but the government is reluctant to curtail its expenditures or to introduce offsetting sources of non-distorting revenue instruments. In addition, pressures from public sectors force the government to raise public employees' wage payments. Thus the government's budget gap is further widened. In practice, policies can seldom be perfectly coordinated due to miscommunications among various layers of the bureaucracy, pressures from domestic interest groups which are hurt by the reform, and the like. Thus the purpose of EXP-2 and EXP-3 is to capture such delays in accommodating the necessary policy coordinations and to trace out their consequences on the overall economy.

Under the EXP-2 policy environment, we first portray a stance of "inaction," and delay implementation of the necessary revenue enhancing measures for "twenty periods." Thereafter the income tax rate is endogenously adjusted so as to impose intertemporal budget (solvency) constraint of the government.[13] Under EXP-3, on the other hand, we worsen the fiscal stance of the government and portray a situation of "no adjustment" at all. In this setting, the income tax adjustment is delayed until period 40 which, for all practical purposes, amounts to a complete paralysis of the government's ability to carry out any viable fiscal reform. Thus with these two experiments we highlight many of the basic attributes of the Turkish reality of

[13] It has to be noted that our focus is mainly on the evolution of the transition path, rather than the time period when the economy has sufficiently approached the fully intertemporal equilibrium—the steady state. One has to note that the eventual attainment of a government budget balance is part of the technical constraints of intertemporal equilibrium. This implies that from the technical point of view the government eventually has to raise taxes and/or adjust expenditures to meet the steady-state equilibrium constraint on fiscal balances. The model per se cannot give us a guideline about the specific timing of the imposition of this endogenous adjustment, and one has to impose this constraint at an arbitrary point. We thus rely on the laboratory characteristics of the model to impose this constraint and endogenize the income tax rate such that the fiscal balances are met with no deficit under the steady state. Since our exclusive purpose here is to capture the effects of delayed fiscal reform, our discussion will focus on the time periods before the tax rate has been endogenized to impose this constraint.

Fig. 2. Aggregate Capital Stock
(Ratios to the base-run steady state)



the 1990s, i.e., deferral of the necessary adjustments through a tax reform, heavy reliance on the domestic asset markets for financing the fiscal gap, intensified use of the politically motivated high-income transfers initiated to the private sector, and diversion of the domestic rate of interest away from the return on international assets. We summarize the salient features of each experiment in Table II.

B. *Policy Analysis*

We document our simulation results in Tables III and IV, and portray the adjustment paths of selected variables in Figures 2–5. All results are reported as ratios to the base-run steady state.

Under scenario EXP-1, the government simultaneously adjusts the income tax rate when the tariffs are eliminated such that its budget balance is continuously maintained. This tax adjustment neutralizes the macro economic consequences of tariff liberalization, and does not involve any distortionary effect due to the celebrated Ricardian equivalence.[14]

In this best policy environment, the intertemporal nature of our model allows us to capture both the static gains from resource reallocation, and the dynamic gains from increases in capital investment. We observe that investment is stimulated and capital is accumulated along the transitional path (see Figure 2). This allows con-

[14] The Ricardian equivalence proposition has been popularized by Barro (1974, 1979) and has been extensively debated in the empirical literature on fiscal debt management (see, e.g., Eisner 1989; Gramlich 1989; Barro 1989; Velthoven, Verbon, and van Winden 1993). An extensive critical evaluation of the Ricardian equivalence can be found in Buiter (1989), Bernheim (1989), and Bernheim and Bagwell (1988).

TABLE III

DYNAMIC RESULTS OF ALTERNATIVE POLICY REGIMES (Ratios to Base-Run Study State)

	EXP-1			EXP-2			EXP-3		
	Period 1	Period 10	Period 30	Period 1	Period 10	Period 30	Period 1	Period 10	Period 30
Aggregate investment	1.079	1.081	1.133	1.045	1.066	1.128	1.033	1.027	1.011
Aggregate capital stock	1.006*	1.047	1.108	1.003*	1.027	1.093	1.002*	1.015	1.011
Government revenues	0.987	1.000	1.021	0.736	0.752	1.685	0.733	0.756	0.846
Government expenditures	0.987	1.000	1.021	1.002	1.163	1.686	0.996	1.149	1.871
Government domestic borrowing	n.a.	n.a.	n.a.	16.104	24.811	0.098	15.855	23.703	61.877
Ratio of gov. domestic debt to GDP	n.a.	n.a.	n.a.	0.046*	0.508	1.356	0.046*	0.502	2.689
Ratio of interest payments on domestic debt to gov. revenues	n.a.	n.a.	n.a.	0.017*	0.189	0.217	0.017*	0.182	0.970
Trade deficit	1.456	1.197	0.756	0.788	0.951	1.118	0.181	0.260	1.463
Private foreign borrowing	1.349	1.151	0.813	0.838	0.979	1.091	0.372	0.448	1.397
Domestic interest rate	1.000*	1.000	1.000	1.049*	1.071	1.000	1.049*	1.069	1.178
Wage rate	0.987	1.002	1.025	0.976	0.987	1.019	0.968	0.972	0.973
Sectoral outputs:									
Agriculture	0.975	0.976	0.988	0.975	0.971	0.986	0.973	0.966	0.971
Consumer manufacturing	0.988	1.022	1.085	0.999	1.018	1.061	1.009	1.038	1.006
Producer manufacturing	0.951	0.900	0.873	0.958	0.890	0.854	0.963	0.891	0.788
Intermediates	0.968	0.946	0.945	0.975	0.938	0.928	0.978	0.942	0.873
Commercial services	1.022	1.076	1.128	1.018	1.061	1.123	1.016	1.046	1.070

Notes: 1. * indicates period 2.
2. n.a. = not applicable.

TABLE IV

DYNAMIC EFFECTS OF ALTERNATIVE POLICY REGIMES ON CONSUMER WELFARE
(% Deviations from the Base-Run)

	EXP-1	EXP-2	EXP-3
Real gross domestic product:			
Period 10	2.203	1.556	1.206
Period 20	4.219	2.948	1.677
Period 30	5.518	4.760	1.532
Change in consumer welfare index:[a]			
First 10 periods	0.164	–0.616	–1.977
First 20 periods	0.457	–0.313	–2.554
First 30 periods	0.708	0.139	–2.311

[a] Percentage change in equivalent variation index.

sumers to enjoy gains from liberalization by raising their final consumption along the whole transitional path. At the same time, the increases in consumption and investment result in an expanding trade deficit and hence stimulates foreign capital inflows. As the economy specializes in producing goods over which it has a comparative advantage, its exports start to grow faster than its imports after the eighteenth period, and thereafter the trade deficits start to fall. For example, the consumer manufacturing and the service sectors are observed to be the major net export sectors in Turkey. Thus, under the EXP-1 scenario, liberalization of trade leads to increased investments towards these two sectors in comparison to those which were under higher tariff protection initially. Thus outputs and hence exports of the consumer manufacturing goods and services grow rapidly after the returns to investment are capitalized. These observations imply that the initial increases in trade deficits do not necessarily deteriorate the economy's balance of payments in the long run if the increase in aggregate investment succeeds in raising production and exports of the sectors in which the economy has a comparative advantage.

The model solutions reveal that the steady-state capital stock increases by 14.5 per cent and aggregate consumption by 2.2 per cent in comparison to the pre-reform equilibrium. The expansion of aggregate capital stock enables the real gross domestic product to increase uniformly throughout the adjustment period. Valued in base-year prices, we find that the real gross domestic product is increased by 2.2 per cent in period 10 and by 5.5 per cent in period 30 as the economy approaches its long-run equilibrium (Table IV).

We compute the social welfare gains by constructing an "equivalent variation" index which is a function of the current and future aggregate consumption, where future consumption is discounted by the discount rate of time preference. The welfare gains are summarized and contrasted with the alternative policy scenarios in Table IV. The welfare gains from trade liberalization amount to 0.16 per cent dur-

ing the first ten periods, and reaches 0.71 per cent by the end of period 30. Together with the expansion of the real gross domestic product, these gains are mainly the result of tariff liberalization under conditions of perfect policy coordination with reliance on direct income taxes as best policy instruments.

It is clear that achieving a balance in the fiscal budget by a simultaneous tax adjustment may not be politically feasible, given the tax administration capacity of the country. Thus, we next invoke a stance of stagnation, and delay the process of tax adjustment under scenarios EXP-2 and EXP-3. Furthermore, we envisage here that pressures form the public-sector employees are intensified, and that the government complies with the increased wage demands of the public employees by raising their wage remunerations by 100 per cent.[15]

Within the EXP-2 and EXP-3 environments, in the absence of compensating measures for generating revenue sources, a fiscal gap emerges. The government resorts to domestic borrowing and issues debt instruments to finance its deficits. However, this added reliance on domestic financial funds leads to a rise in uncertainty and increases the fragility of the asset markets. This raises the awareness of domestic and foreign savers between investing in government debt instruments and other instruments offered on the domestic and international markets at the going 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

$$\pi_t = \varphi \frac{GDEF_t}{GDP_t}, \tag{14}$$

where φ is a shift parameter. Thus, the domestic interest rate, r_t^D, diverges from its foreign counterpart by π_t, i.e., $r_t^D = (1 + \pi_t) r_t^F$.

We employ the simulation results of EXP-1 as the best bench mark against which the distortionary policy environments of EXP-2 and EXP-3 are to be contrasted. With the rise of the risk premium, the fragility of the domestic asset market is worsened, and the domestic interest rate increases by 4.9 to 7.1 per cent under EXP-2, and by 4.9 to 17.8 per cent under EXP-3 (Figure 3).

The ratio of fiscal debt to GDP accumulates rapidly as the borrowing conditions from the domestic market become more and more expensive. To pay for the high interest costs, the government has to increase its borrowing ever more. Thus the fiscal debt accumulates at an increased speed and, for example, by period 10 its ratio to GDP reaches 50 per cent (Figure 4). Interest payments emerge as a major expenditure item. For the case of EXP-3, interest costs are observed claiming almost 50

[15] These, in fact, very much articulate the recent political-economy impasse that has befallen the Turkish government by failing to implement a coherent tax reform together with increased liabilities of transfers to the private sector, as we highlighted in Section II. The analytics of this path are discussed further below.

Fig. 3. Ratio of the Domestic Interest Rate to the Foreign Interest Rate

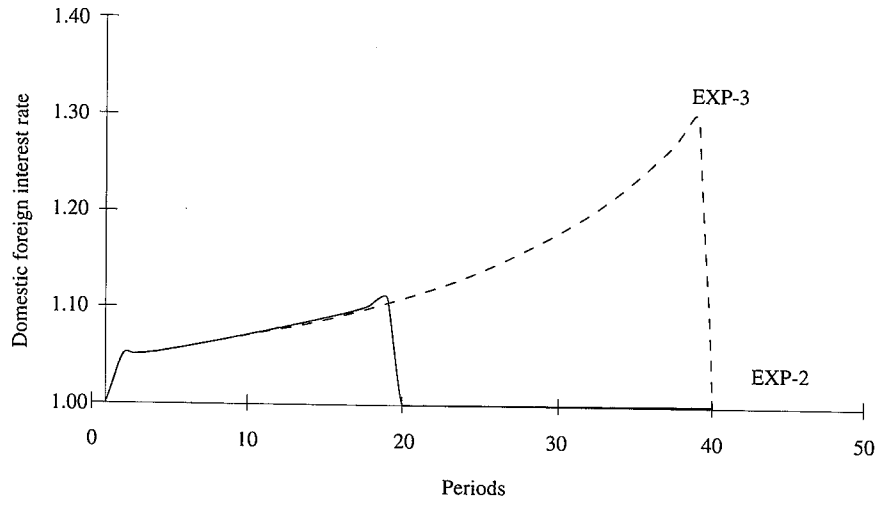
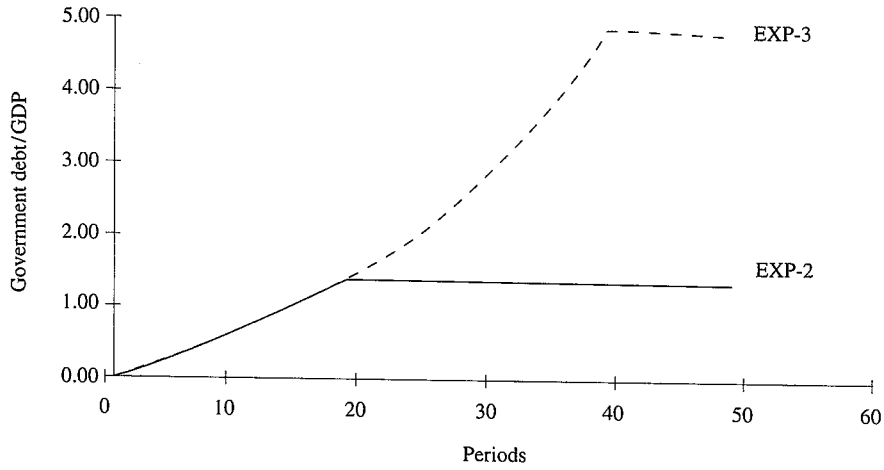


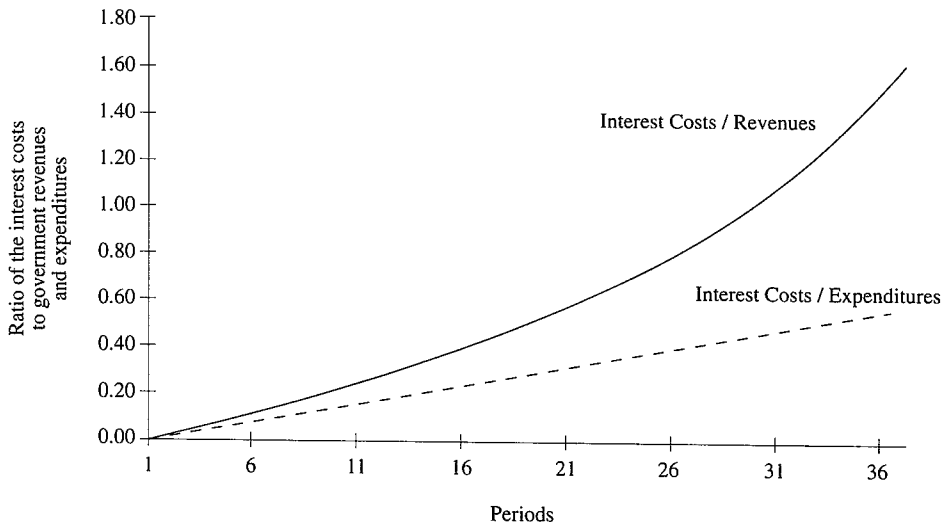
Fig. 4. Ratio of Government Debt to GDP



per cent of aggregate public revenues by period 20, necessitating the government to switch to a "short-termist" strategy of Ponzi-style financing based on the rolling of debt over time, i.e., the government has to issue new bonds to pay interest on the outstanding debt which clearly would not be sustainable either politically or economically (see Figure 5).

The rise of the domestic rate of interest increases costs and reduces expected returns on investment. Hence aggregate investment falls in comparison with the EXP-1 scenario. Consequently, the aggregate capital stock of the EXP-3 environ-

Fig. 5. Ratios of the Interest Costs on Public Debt to Government Revenues and Expenditures under EXP-3



ment converges to its steady-state level from below (Figure 2), and the real gross domestic product falls short of its EXP-1 value (Table IV).

Deceleration of investment demand and the hesitant accumulation of physical capital stocks, together with the postponement of consumption, result in a stagnant environment in EXP-2 and EXP-3. These factors combined lead to a fall in the welfare index from its pre-liberalization level, inhibiting part of the potential welfare gains of trade liberalization (Table IV). The adjustment path under the EXP-3 scenario portrays an even more stringent environment, and the delay in fiscal reform coupled with the expansionary expenditure policy is observed to lead to a contractionary environment where almost all welfare gains of liberalization are negated.

It is illuminating to note that, even though the initial design of the model is not suitable for forecasting analysis, one can draw striking parallels between the historically realized development path of the Turkish economy and the results of our simulation experiments in many of the macro aggregates concerned, especially in the fiscal indicators. We noted above in Section II-B that currently the ratio of the Turkish government's fiscal debt to GNP stands at about 20 per cent, and the interest costs already account for about 40 per cent of the total budgetary expenditures. In contrast, the ratio of fiscal debt to GNP was only 2 per cent as recently as 1990. As documented vehemently in many recent analyses of the Turkish economy,[16] the rapid deterioration of the fiscal balances clearly signals an unsustainable pattern;

[16] See, e.g., Yeldan (1998), Boratav, Türel, and Yeldan (1996), Özatay (1996), Sak, Özatay, and Öztürk (1996), and Atiyas (1995).

the current situation of the Turkish fiscal authorities is already one of a Ponzi model of debt rolling with annual net new borrowings by the public sector exceeding its existing stock of domestic debt. The short termism embedded in the maturities of the public-sector assets is a significant cause for concern over the continued crisis of confidence 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 trade liberalization are exhausted. The ongoing attempts at trade reform in an environment characterized by coordination failures and unsustainable fiscal targets are clearly futile, with realized outcomes falling short of expectations for achieving a more efficient allocation of resources and of a rise in social welfare. Our results further underscore that the longer the delay in the necessary adjustments towards sound fiscal reform, the higher the gap between such expectations and their realizations.

V. CONCLUSIONS

Before summarizing our main findings, we feel that some caveats are in order regarding the limitations of our modeling approach. First, we want to make clear that there can be no distinctive conclusions about the characterization of the future path of the Turkish economy based on "calendar" dates from our model. The policy experiments performed are basically "comparative" in nature and are meaningful only in relation to each other, rather than revealing forecasts of the future.

Second, we abstained from an explicit portrayal of the government's savings and investment behavior; and hence, the spillover effects of public consumption and investment on the private sector were not captured. In the absence of empirical evidence on the nature and causes of such spillovers (especially in the context of a developing country), we tried to avoid forming arbitrary algebraic characterizations as much as possible, and abstained from modeling the public sector as an optimizing agent.

Third, one has to note that the adjustment path as characterized by the simulation exercises reflects a smooth "equilibrium" time horizon in the absence of rigidities and/or structural bottlenecks. Thus the speed of transitional adjustments in the model economy should not be taken as a measure of the global stability properties of the real economy, but rather as a direct outcome of the laboratory characteristics of a set of macroeconomic simulations. For these reasons, our results should at best be regarded as crude approximations of the long-run equilibrium effects of public debt management and of foreign trade policies on current account, output, capital accumulation, and consumer welfare.

The model results reveal that postponement of adjustment to growing public debt and fiscal imbalances is detrimental in that it merely warrants a deeper and wider use of the relevant tax instruments in due course. The simulation results suggest that with prolonged reliance on debt instruments, governments may aggravate the fragility of the domestic asset markets, and lead to a distortion of the intertemporal decisions such as consumption/savings and investment. The results indicate substantial losses of potential output and a significant loss of consumer welfare contrary to expectations of increased efficiency of resource use due to best economic environment of trade reform.

In the face of delaying the necessary fiscal reforms, our experiments reveal rapidly expanding ratios of the stock of domestic debt to GDP, and interest costs account for almost a third of the aggregate fiscal revenues under conditions of long-run equilibrium. With relative contraction of the gross domestic product, the burden of the fiscal debt is more severe, and the path of private investment is significantly impeded.

Social welfare gains were computed as changes in the equivalent variations. The best policy environment, with perfect policy coordination between trade and fiscal reforms, leads to positive gains in this measure. The distorting environment of delayed/uncoordinated fiscal reforms, however, significantly reduces such potential gains. Our results show that the more delayed the necessary adjustments towards sustainable fiscal targets, the severer the gap between the realizations of the gains from liberalization market and the theoretical expectations.

Under the analyzed patterns of fiscal adjustment and tariff liberalization, there could be sizable increases in trade deficits of the Turkish economy as, initially, imports grow faster than exports and investment increases. This would naturally call for the feasibility of access to foreign funds to finance the import-export gap. A key concern here is the fragility of the current external position of Turkey, given the international standards. As shown by the experiments undertaken to capture the conditions of worsening fiscal balances and increased servicing costs of external public debt, the economy would be restricted to a slower growth path with a significant rise in domestic resource costs to attain equilibrium in the commodity markets and to accommodate the fiscal demands of the state.

Finally, we believe that the modeling approach presented in this study provides a viable example for an integrated treatment of the trade and fiscal reform policies within a multi-sector, multi-factor intertemporal general equilibrium model. It is now a well-recognized feature of modern macroeconomic thought that the analytics of fiscal debt management and trade reform require an intertemporal framework where the full solvency constraints of both the public and the private sectors are taken into account. By way of incorporating explicit intertemporal optimizing behavior on the part of private agents, and an explicit recognition of the intertemporal budget constraint of the government simultaneously within an open-econo-

my framework, we were able to address numerically many questions of how the incidences of import tariffication and income taxation affect rates of growth, capital accumulation, and consumer welfare in a manner of theoretical consistency.

REFERENCES

Atiyas, Izak. 1995. "Uneven Governance and Fiscal Failure: The Adjustment Experience of Turkey." In *Governance, Leadership, and Communication: Building Constitutiences for Economic Reform*, ed. L. Frischtak and Izak Atiyas. Washington, D.C.: World Bank.

Bacha, Edmar L. 1990. "A Three-Gap Model of Foreign Transfers and the GDP Growth Rate in Developing Countries." *Journal of Development Economics* 32, no. 3: 279–96.

Balkan, Erol, and A. Erinç Yeldan. 1996. "Financial Liberalization in Developing Countries: The Turkish Experience." In *Financial Reform in Developing Countries*, ed. Rohinton Medhora and Jose M. Fanelli. Basingstoke: Macmillan.

Barro, Robert J. 1974. "Are Government Bonds Net Wealth?" *Journal of Political Economy* 82, no. 6: 1095–117.

———. 1979. "On the Determination of the Public Debt." *Journal of Political Economy* 87, no. 5, part 1: 940–79.

———. 1989. "The Ricardian Approach to Budget Deficits." *Journal of Economic Perspectives* 3, no. 2: 37–54.

Bernheim, B. Douglas. 1989. "A Neoclassical Perspective on Budget Deficits." *Journal of Economic Perspectives* 3, no. 2: 55–72.

Bernheim, B. Douglas, and K. Bagwell. 1988. "Is Everything Neutral?" *Journal of Political Economy* 96, no. 2: 308–38.

Blejer, Mario I., and Adrienne Cheasty. 1989. "Fiscal Policy and Mobilization of Savings for Growth." In *Fiscal Policy, Stabilization and Growth in Developing Countries*, ed. Mario I. Blejer and Ke-young Chu. Washington, D.C.: International Monetary Fund.

———. 1991. "The Measurement of Fiscal Deficits: Analytical and Methodological Issues." *Journal of Economic Literature* 29, no. 4: 1644–78.

Boratav, Korkut; Oktar Türel; and A. Erinç Yeldan. 1996. "Dilemmas of Structural Adjustment and Environmental Policies under Instability: Post-1980 Turkey." *World Development* 24, no. 2: 373–93.

Buiter, Willem H. 1989. *Macroeconomic Theory and Stabilization Policy*. Ann Arbor, Mich.: University of Michigan Press.

Calvo, Guillermo A.; Morris Goldstein; and Eduard Hochreiter, eds. 1996. *Private Capital Flows to Emerging Markets after the Mexican Crisis*. Washington, D.C.: Institute for International Economics.

Caprio, Gerard; Izak Atiyas; and James A. Hanson. 1996. *Financial Reform: Theory and Experience*. Paperback ed. Cambridge: Cambridge University Press.

De Melo, Jaime, and Sherman Robinson. 1989. "Product Differentiation and the Treatment of Foreign Trade in CGE Models of Small Economies." *Journal of International Economics* 27, no. 1: 47–67.

Diao, Xinshen, and Agapi Somwaru. Forthcoming. "An Inquiry on General Equilibrium Effects of MERCOSUR: An Intertemporal World Model." *Journal of Policy Modeling*.

Diao, Xinshen; Terry L. Roe; and A. Erinç Yeldan. 1998. "A Simple Dynamic Applied General Equilibrium Model of a Small Open Economy: Transitional Dynamics and Trade Policy." *Journal of Economic Development* 23, no. 1: 77–101.

Diaz-Alejandro, Carlos. 1985. "Good-Bye Financial Repression, Hello Financial Crash." *Journal of Development Economics* 19, no. 1/2: 1–24.

Eisner, Robert. 1989. "Budget Deficits: Rhetoric and Reality." *Journal of Economic Perspectives* 3, no. 2: 73–93.

Fanelli, Jose Maria; Guillermo Rozenwurcel; and L. Simpson. 1998. "Financial Liberalization in Developing Countries: The Argentine Experience in the Nineties." In *Financial Reform in Developing Countries*, ed. Rohinton Medhora and Jose M. Fanelli. Basingstoke: Macmillan.

Gibson, H., and E. Tsakalatos. 1994. "The Scope and Limits of Financial Liberalisation in Developing Countries: A Survey." *Journal of Development Studies* 30, no. 3: 578–628.

Girton, L., and D. Roper. 1981. "Theory and Implications of Currency Substitution." *Journal of Money, Credit and Banking* 13, no. 1: 12–30.

Go, Delfin S. 1994. "External Shocks, Adjustment Policies, and Investment in a Developing Economy: Illustrations from a Forward-Looking CGE Model of the Philippines." *Journal of Development Economics* 44, no. 2: 229–61.

Goulder, Lawrence H., and Lawrence H. Summers. 1989. "Tax Policy, Asset Prices, and Growth: A General Equilibrium Analysis." *Journal of Public Economics* 38, no. 3: 265–96.

Gramlich, Edward M. 1989. "Budget Deficits and National Saving: Are Politicians Exogenous?" *Journal of Economic Perspectives* 3, no. 2: 23–35.

Harrison, Gale; Thomas Rutherford; and David Tarr. 1996. "Economic Implications for Turkey of a Customs Union with the European Union." World Bank, International Economics Department, Policy Research Working Paper, no. 1599. Washington, D.C.: World Bank.

Ho, M. Sung. 1989. "The Effects of External Linkages on US Economic Growth: A Dynamic General Equilibrium Analysis." Ph.D. diss., Harvard University.

Köse, Ahmet, and A. Erinç Yeldan. 1995. "Gümrük birliği sürecinde Türkiye ekonomisinin gelişme perspektifleri" [Development perspectives of the Turkish economy under the customs union]. Proceedings of the 1995 Congress of the Industry, Chamber of Mechanical Engineers, Ankara, December.

———. 1996. "Çok sektörlü genel denge modellerinin veri tabanı uzerine notlar: Türkiye 1990 sosyal hesaplar matrisi" [Notes on the databases of multi-sector general equilibrium models: Turkey social accounting matrix, 1990]. *METU Studies in Development* 23, no. 1: 59–83.

McKinnon, Ronald. 1982. "The Order of Economic Liberalization: Lessons from Chile and Argentina." In *Economic Policy in a World of Change*, ed. Karl Brunner and Allan H. Meltzer. Carnegie-Rochester Conference Series on Public Policy, vol. 17. Amsterdam: North-Holland.

Mercenier, Jean, and M. da C. S. de Souza. 1994. "Structural Adjustment and Growth in a Highly Indebted Market Economy: Brazil." In *Applied General Equilibrium and Economic Development: Present Achievement and Future Trend*, ed. Jean Mercenier and T. N. Srinivasan. Ann Arbor, Mich.: University of Michigan Press.

Mercenier, Jean, and A. Erinç Yeldan. 1997. "On Turkey's Trade Policy: Is a Customs Union with Europe Enough?" *European Economic Review* 41, no. 4: 871–80.

Miles, A. Marc. 1978. "Currency Substitution, Flexible Exchange Rates, and Monetary Independence." *American Economic Review* 68, no. 3: 428–36.

Obstfeld, Maurice, and Kenneth Rogoff. 1996. *Foundations of International Macroeconomics*. Cambridge, Mass.: MIT Press.

Önder, Izzettin; Oktar Türel; Nazim Ekinci; and Cem Somel. 1993. *Türkiye'de kamu maliyesi, finansal yapı ve politikalar* [Public finance, financial structures, and policies in Turkey]. Istanbul: Tarih Vakfi Yurt Yay.

Özatay, Fatih. 1996. "The Lessons from the 1994 Crisis in Turkey: Public Debt (Mis) Management and Confidence Crisis." *Yapı Kredi Economic Review* 7, no. 1: 21–37.

Sak, Güven; Fatih Özatay; and Emin Öztürk. 1996. *1980 sonrasında kaynakların kamu ve özel sektor arasında paylaşımı* [Distribution of assets between the pubic and private sectors after 1980]. No. 96–1/189. Istanbul: Businessmen and Industrialists Association of Turkey.

Selcuk, Faruk. 1996. "Seignorage and Dollarization in a High-Inflation Economy: Evidence from Turkey." Bilkent University, Department of Economics Discussion Paper, no 96–7. Ankara.

State Institute of Statistics (SIS). 1994. *The 1990 Input-Output Structure of Turkey*. Ankara: SIS Publications.

Tanzi, Vito, and Mario I. Blejer. 1982. "Inflation, Interest Rate Policy, and Currency Substitution in Developing Economies: A Discussion of Some Major Issues." *World Development* 10, no. 9: 781–89.

United Nations Conference on Trade and Development (UNCTAD). 1995. *Trade and Development Report, 1995*. Geneva.

Velthoven, B.; Harrie A. A. Verbon; and Frans A. A. M. van Winden. 1993. "The Political Economy of Government Debt: A Survey." In *The Political Economy of Government Debt*, ed. Harrie Verbon and Frans A. A. M. van Winden. Amsterdam: North-Holland.

Wilcoxen, Peter J. 1988. "The Effects of Environmental Regulation and Energy Prices on U.S. Economic Performance." Ph.D. diss., Harvard University.

World Bank. Various years. *World Development Report*. New York: Oxford University Press.

Yeldan, A. Erinç. 1997. "Financial Liberalization and Fiscal Repression in Turkey: Policy Analysis in a CGE Model with Financial Markets." *Journal of Policy Modeling* 19, no. 1: 79–117.

———. 1998. "On Structural Sources of the 1994 Turkish Crisis." *International Review of Applied Economics* 12, no. 3: 397–414.

APPENDIX A

EQUATIONS AND VARIABLES OF THE INTERTEMPORAL MODEL

A.1. *List of Equations*

The time-discrete intertemporal utility

(The elasticity of intertemporal substitution is chosen as one.)

$$U_1 = \sum_{t=1}^{\infty} \left(\frac{1}{1+\rho} \right)^t \sum_i (a_i \ln c_{i,t}).$$

Intertemporal value of firms

$$V_{i,1} = \sum_{t=1}^{\infty} \frac{1}{\prod_{s=1}^{t} (1 + r_s^D)^t} \{PVA_{i,t}[f_i(K_{i,t}, L_{i,t}) - adjcost_{i,t}] - w_t L_t - PI_{i,t} I_{i,t}\}.$$

$$adjcost_j = \phi_j \frac{I_j^2}{K_j}.$$

Within Period Equations (time subscript is omitted)

(1) Armington composite functions

$$PC_i = \frac{1}{\Lambda_i}\{\beta_i^{\sigma m_i}[PWM_i(1 + tm_i)]^{1-\sigma m_i} + (1-\beta_i)^{\sigma m_i} PD_i^{1-\sigma m_i}\}^{\frac{1}{1-\sigma m_i}}.$$

$$\frac{M_i}{C_i} = \Lambda_i^{1+\sigma m_i}\left[\beta_i \frac{PC_i}{PWM_i(1 + tm_i)}\right]^{\sigma m_i}.$$

$$\frac{D_i}{C_i} = \Lambda_i^{1+\sigma m_i}\left[(1-\beta_i)\frac{PC_i}{PD_i}\right]^{\sigma m_i}.$$

(2) CET functions

$$PX_i = \frac{1}{\Gamma_i}[\eta_i^{-\sigma e_i}(PWE_i)^{1+\sigma e_i} + (1-\eta_i)^{-\sigma e_i} PD_i^{1+\sigma e_i}]^{\frac{1}{1+\sigma e_i}}.$$

$$\frac{E_i}{X_i} = \Gamma_i^{-(1+\sigma e_i)}\left[\eta_i \frac{PX_i}{PWE_i}\right]^{-\sigma e_i}.$$

$$\frac{D_i}{X_i} = \Gamma_i^{-(1+\sigma e_i)}\left[(1-\eta_i)\frac{PX_i}{PD_i}\right]^{-\sigma e_i}.$$

(3) Value added and output prices

$$PVA_i = \frac{1}{A_i \alpha_i^{\alpha_i}(1-\alpha_i)^{1-\alpha_i}} Wk_i^{\alpha_i} Wl^{1-\alpha_i}.$$

$$PVA_i = (1 - it_i)PX_i - \sum_j PC_j IO_{i,j}.$$

(4) Factor market equilibrium

$$\alpha_i PVA_i X_i = Wk_i \cdot K_i.$$

$$\sum_i (1-\alpha_i) PVA_i X_i = Wl \cdot L.$$

(5) Private demand system

$$CD_i = \frac{a_i(Y - SAV)}{PC_i}.$$

$$INTD_i = \sum_j IO_{i,j} X_j.$$

$$INVD_i = \frac{\theta_{i,j} PI_j I_j}{PC_i}.$$

(6) Household income

$$Y = (1 - ty)(Wl \cdot L + r^F BF + r^D BPG + TI + \sum_i div_i).$$

$$div_i = Wk_i K_i - PVA_i \phi_i \frac{I_i^2}{K_i} - PI_i I_i.$$

(7) Commodity market equilibrium

$$C_i = CD_i + GD_i + \sum_j INVD_{j,i} + INTD_i.$$

(8) Government fiscal balances

$$GREV = ty \cdot HY + \sum_i tm_i PWM_i M_i + \sum_i it_i PX_i X_i.$$

$$GEXP = TI + \sum_i PC_i GD_i + r^D BPG + r^F BFG.$$

$$GBOR = GEXP - GREV.$$

$$PC_i GD_i = \gamma_i GDP, \qquad i \neq PSRV \ (public\ services).$$

$$GD_{PSRV} = Wl \cdot L_{PSRV}.$$

(9) Domestic interest rate

$$\pi = \varphi \frac{GBOR}{GDP}.$$

$$r^D = (1 + \pi) r^F.$$

(10) Trade balance

$$FBAL = \sum_i (PWE_i E_i - PWM_i M_i).$$

$$FBAL = FBOR + GFPAY.$$

Dynamic Difference Equations

(11) Euler equation for consumption

$$\frac{Y_{t+1} - SAV_{t+1}}{Y_t - SAV_t} = \frac{1 + r_{t+1}^D}{1 + \rho}.$$

(12) Non-arbitrage condition for investment

$$q_i = PI_{i,t} + 2 \frac{adjcost_{i,t}}{I_{i,t}}.$$

$$(1 + r_t^D) q_{i,t-1} = Wk_{i,t} + adjcost_{i,t} + (1 - \delta_i) q_{i,t}.$$

(13) Sectoral capital accumulation

$$K_{i,t+1} = (1 - \delta_i)K_{i,t} + I_{i,t}.$$

(14) Private foreign asset formation (debt if negative)

$$BF_{t+1} = (1 + r_t^F)BF_t + FBOR_t.$$

(15) Government debt

$$BPG_{t+1} = BPG_t + GBOR_t.$$
$$BFG_{t+1} - BFG_t = 0, \qquad \text{for all } t.$$
$$GFPAY_t = -R_t^D BFG_{t-1}.$$

(16) Terminal conditions (steady-state constraints)

$$\delta_i K_{i,SS} = I_{i,SS}.$$
$$V_{i,SS} = \frac{div_{i,SS}}{r_{SS}^D}.$$
$$r_{SS}^F BF_{SS} + FBOR_{SS} = 0.$$
$$GBOR_{SS} = 0.$$
$$r_{SS}^F = r_{SS}^D = \rho.$$

(17) Welfare criterion (equivalent variation index)

$$\sum_{t=1}^{T} \left(\frac{1}{1+\rho}\right)^t \ln\left[\prod_{i,t}(\hat{c}_{i,t}^{a_i})(1+\psi)\right] = \sum_{t=1}^{T} \left(\frac{1}{1+\rho}\right)^t \ln\left(\prod_{i,t} c_{i,t}^{a_i}\right),$$

where, $\hat{c}_{i,t}$ is base-year consumption for good i. Thus, (17) states that the welfare gain resulting from the policy shocks is equivalent from the perspective of the representative consumer to increasing the reference consumption profile by ψ per cent.

A.2. *Glossary*

Parameters

Λ_i : shift parameter in Armington function for good i.
Γ_i : shift parameter in CET function for i.
A_i : shift parameter in value-added function for i.
A_k : shift parameter in capital-good production function.
a_i : share parameter in private consumption demand function for i.
α_i : share parameter in value-added function for i.
β_i : share parameter in Armington function for own good i.
η_i : share parameter in CET function for own good i.
$\theta_{i,j}$: share parameter in capital good production function for input i, sector j.
σm_i : elasticity of substitution in Armington function for i.
σe_i : elasticity of substitution in CET function for i.
$IO_{i,j}$: input-output coefficient for i used in j.

ρ : rate of consumer time preference.
δ_i : capital depreciation rate.
ϕ_i : capital installation adjustment cost parameter.
γ_i : sectoral government consumption share.
φ : risk function parameter.

Exogenous variables
L_t : labor supply.
$tm_{i,t}$: tariff rate for *i*.
$it_{i,t}$: indirect tax rate for *i*.
ty_t : income tax rate.
$PWM_{i,t}$: world import price for good *i*.
$PWE_{i,t}$: world export price for good *i*.
r_t^F : world interest rate.

Endogenous variables
$PD_{i,t}$: own good price for *i*.
$PX_{i,t}$: producer price for *i*.
$PC_{i,t}$: composite good price for *i*.
$PVA_{i,t}$: price of value added for *i*.
$PI_{i,t}$: unit price of investment quantity in sector *i*.
$q_{i,t}$: shadow price of capital in sector *i*.
$div_{i,t}$: dividends of sector *i*.
Wl_t : wage rate.
$Wk_{i,t}$: marginal product of capital in sector *i*.
$X_{i,t}$: output of good *i*.
$C_{i,t}$: total absorption of composite good *i*.
$D_{i,t}$: own good *i*.
$M_{i,t}$: import good *i*.
$E_{i,t}$: export good *i*.
TC_t : aggregate private consumption.
$CD_{i,t}$: private consumption demand for composite good *i*.
$INVD_{i,j,t}$: investment demand for composite good *i*, from sector *j*.
$INTD_{i,t}$: intermediate demand for composite good *i*.
Y_t : household income.
SAV_t : household savings.
$K_{i,t}$: capital stock in sector *i*.
$I_{i,t}$: investment quantity in sector *i*.
$FBOR_t$: new purchases of foreign assets held by the private sector.
$FBAL_t$: trade surplus (deficit if negative).
BF_t : private foreign assets.

$GREV_t$: government revenues.
$GEXP_t$: government expenditures.
$GBOR_t$: government domestic borrowing.
$GFPAY_t$: interest payments on external public debt.
BPG_t : government domestic debt.
$GD_{i,t}$: sectoral public consumption.
π_t : risk premium.
r_t^D : domestic interest rate.
TI_t : transfers (set at a given ratio of *GREV*).
$adjcost_{i,t}$: capital adjustment cost in sector *i*.
$V_{i,t}$: value of the firm.

APPENDIX B

DATA AND THE CALIBRATION STRATEGY

The data where calibration and the base-run are initiated are drawn primarily from the 1990 input-output data (SIS 1994) and an accompanying social accounting matrix (Köse and Yeldan 1996). Calibration of the model involves specifying values for certain parameters based on outside estimates, and deriving the remaining ones from restrictions posed by the equilibrium conditions. As in a static CGE model where calibration begins with the assumption that data obtained for the domestic economy reflect period-equilibrium, we assume the Turkish economy in the model to be evolving along a balanced growth path.[a]

The calibration method used here is similar to that in Diao and Somwaru (forthcoming). For data consistency, we try to choose as fewer as possible outside determined parameters/variables. We first set the elasticity of intertemporal substitution to unity, and, hence, the household time discount rate, ρ, is equalized with the world interest rate, r, for which a value of 0.04 is chosen. The Köse and Yeldan (1996) SAM database further provides both the values of each sector's stock of capital and the flows of capital. Thus, given the data on the value of total investment, including adjustment costs, it is straightforward to calculate the initial level of dividend payments (div = value of capital flows – value of total investment). The aggregate steady-state value of the firms, V, and the marginal product of capital (Tobin's q), are then obtained from the relations, $V = div/r$; and $q = V/K$. The values of the capital depreciation rate, δ_i, and the coefficient of the capital adjustment function, ϕ_i,

[a] The steady-state assumption, though questionable for most developing economies, is systematically adopted in applied intertemporal general equilibrium models due to its extreme convenience for calibration. For example, see Goulder and Summers (1989), Go (1994), and Mercenier and Yeldan (1997).

have to be determined in a consistent fashion, given the conditions of steady-state equilibrium. We can choose either ϕ, or δ first; and then calculate the other parameter from the steady-state conditions presented above. If ϕ is chosen first, then δ can be calculated from the following equation derived from the steady-state conditions:

$$\delta = \frac{q}{2P\phi} - \left[\frac{rq - Wk}{P\phi} + \left(\frac{q}{2P\phi}\right)^2\right]^{1/2}.$$

The quantity of aggregate investment, I, can be determined via $I = \delta K$. The capital adjustment costs and the price of investment, PI, then can easily be obtained.

Data on sectoral trade elasticities have to be set outside the SAM accounts. Both the (Armingtonian) composite good substitution and the export-domestic good transformation elasticities are adopted from Yeldan (1998) and Diao, Roe, and Yeldan (1998). Diao, Roe, and Yeldan further report sensitivity tests on how these elasticity magnitudes affect the nature of the intertemporal dynamics, and argue that the main characteristics of the out-of-steady-state transitional dynamic paths remain robust to a wide range of the numerical values chosen for such parameters.

In a dynamic general equilibrium model, the analyst is typically interested in the adjustments generated in the "finite" time periods in response to parametric changes of selected exogenous variables, rather than the long-term intertemporal equilibria of the economy at which all transitions to the steady state have been completed. Hence, imposition of a terminal condition becomes pertinent for a discrete time dynamic model given the presence of an out-of-steady-state transitional path for the endogenous variables. Since the so-called terminal conditions are, in fact, conditions for the steady state (see equations 10 to 13), an ideal terminal period should be chosen when a steady state is asymptotically approached. In administering the dynamic experiments, we adhered to two criteria to select the "convergence" of a steady state: the first is the time horizon when 99.99 per cent of the transitional life of the main variables is realized; and the second is the time period when all endogenous variables cease to change by less than 0.000001. The model is solved in a PC using the GAMS software.