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Inflation Stabilization in Turkey

An Application of the RMSM-X Model

Luc Everaert

Adding estimated behavioral equations to the standard RMSM-X model allows it to simulate the short-run consequences of inflation stabilization.

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This paper — a product of the Country Operations Division, Country Department I, Europe and Central Asia Region — is part of a larger effort in the Region to enhance its macroeconomic monitoring capabilities. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Barbara Mondestin, room H5-105, extension 36071 (51 pages). January 1992.

The model Everaert persents is an extension of the simple RMSM-X model developed to improve the Country Operations Division's macroeconomic monitoring and modeling capabilities. Adding econometrically estimated behavioral equations and the use of lagged relationships makes the model fit for short-run simulations while maintaining an essentially recursive structure and thus keeping computational costs at a minimum.

First, Everaert reviews the theoretical framework of an inflation stabilization program. In the absence of price rigidities, a reduction in inflation simply implies finding a replacement for revenue lost from a decline in the inflation rate. In reality, backward-looking nominal contracts and credibility problems induce short-run costs, making a fall in the economic growth rate an inevitable part of inflation stabilization. The theoretical framework yields the specification of a few key behavioral equations to be implemented in the model.

Next, Everaert shows in detail how this theoretical framework is implemented in the RMSM-X model by specifying demand and supply sides of all markets. An econometrically estimated short-run price equation plays a key role.

Everaert's simulation results show that even if a credible program is implemented, at least two years of negative per capita growth are needed to bring inflation down from its current levels to below 10 percent a year. The accompanying fiscal effort is great: the equivalent of a 40 percent increase in direct tax revenues if no other expenditure or revenue measures are taken. Scenarios that do not incorporate strong fiscal action do not succeed in permanently lowering inflation and lead to lower per capita GDP at the end of the decade than does the scenario of fiscal stabilization. Inflation in the Turkish context is costly because it reduces not only the level of productive investment but also its efficiency.

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Inflation Stabilization in Turkey: An Application of the RMSM-X Model

by

Luc Everaert*

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The World Bank has recently upgraded its Revised Minimum Standard Model, from an set of projection rules for the balance of payments and the national accounts, to a RMSM-X (eXtended), which attempts to model the interaction of the different sectors of an economy in a consistent manner. This macro-model is mainly used for medium-term projections required to guide the Bank's operational decisions. The model focuses on the budget constraints of the different sectors, especially on the fiscal accounts and the foreign sector (the balance of payments) as they are key determinants of the macroeconomic balances. The RMSM-X model contains few estimated relations since for most countries good time series data is unavailable and frequent shifts in policy-regimes make most estimated parameters unstable.

The purpose of this paper is to show how, by making creative use of lagged economic relationships and adaptive price setting mechanisms (ie. backward looking contracts), the RMSM-X model can be used for short-term policy simulations. In particular, attention is paid to the short-run output costs of inflation stabilization as a result of price rigidities. The recursive solution of the model, leading to quantity closures of different markets does lower the confidence one can have in the point forecasts of the simulation. By testing the sensitivity of the simulations to the chosen path of the key intermediate variable (in this case the domestic real interest rate), and by checking whether the solution enters in the confidence interval of existing econometrically estimated equations, not incorporated in the model, this confidence can be greatly enhanced.

This paper first reviews the main features of the basic RMSM-X model and then applies the model to the problem of inflation stabilization in the Turkish context. The second section of the paper establishes the theoretical framework for the analysis of the problem of disinflation. The third section shows how the RMSM-X model can be adapted for short-run policy simulations by incorporating some additional estimated behavioral equations. The fourth section the paper reviews briefly the relevant recent economic developments in Turkey and then presents a scenario of adequate fiscal adjustment that leads to a sustainable reduction of inflation. This scenario is compared with a policy of monetary contraction without fiscal support. In both scenarios attention is paid to price rigidities which lead to short-run adjustment costs in terms of output lost. A final section summarizes the main findings.

1. THE STRUCTURE OF THE MODEL

The RMSM-X model starts conceptually from a flow-of-funds matrix which contains the budget constraints of all the specified sectors in the economy. In this way, no matter how the variables entering the budget constraints are projected, consistency is assured. In order to

introduce meaningful economic behavior in the model, markets need to be added to the budget constraints and demand and supply behavior needs to be specified. Since only a limited set of variables can be solved for endogenously, the specification of this set determines the nature of the closure of the model.

1.1. THE BUDGET CONSTRAINTS

The model assures consistency in the projections by requiring that the budget constraints for the economic sectors are satisfied at all times. Six different sectors are identified in the Turkey model: (i) the non-financial State Economic Enterprises, (ii) the rest of the non-financial public sector, which is called "budget", (iii) the private non-financial sector, (iv) the central bank, (v) the domestic banking system, and (vi) the foreign sector. The symbols used in the budget constraints throughout the paper are explained in Table 1.1.[1/] Figure 1.1 presents the budget constraints of the six sectors in flow-of-funds format, omitting the time subscript for current end-of-period stocks and for flows occurring during the current period to save notation.[2/] Each budget constraint consists of two statements of the type:

CURRENT INCOME - CURRENT EXPENDITURE = SAVING

SAVING = NET ACCUMULATION OF WEALTH

The top half of Figure 1.1 presents the current account of all sectors in matrix format while the bottom half shows the capital account. All budget constraints are defined in nominal terms and include sufficient detail in order to distinguish the most relevant categories of income, expenditure and changes in assets for each of the sectors. In both matrices, rows represent incoming and columns outgoings. The specification of the various entries in the matrices is

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[1/] Throughout the paper we will use the following conventions:

$\delta X = X - X_{-1}$; $\quad \hat{X} = \delta X / X_{-1}$

A superscript asterisk indicates a foreign currency denominated variable.

[2/] For a more detailed description of the budget constraints and the flow-of-funds concept see Everaert et. al. (1990).

TABLE 1.1: DEFINITIONS OF VARIABLES IN BUDGET CONSTRAINTS

Variables with an asterisk are defined in US$. The rest of the variables are expressed in local currency at current prices except for those variables marked with (#) which are defined in constant terms.

B	Bonds
C	Consumption (#)
CR	Credit from the Central Bank
CU	Currency in circulation
DD	Demand deposits
E	Average exchange rate
F^*	Net foreign-currency denominated borrowing
FG^*	External debt
FX^*	Foreign currency deposits with domestic sectors
FI	Factor income
I	Investment (#)
i^*	Nominal foreign interest rate
i_D	Nominal interest rate on deposits
i_C	Nominal interest rate on credits
i_R	Nominal rate of rediscount
IM	Imports (#)
KT	Capital transfers
NW	Net worth
OFI	Other factor income
P&L	Distributed profits
PR^*	Profit remittances abroad
R^*	Foreign reserves
RR	Legal reserves
S	Savings
SUB	Subsidies
T	Net current transfers
T^*	Net transfers from abroad
TD	Direct taxes
TI	Indirect taxes
VA	Value added
WR^*	Workers, remittances from abroad
X	Exports (#)

Sector-specific variables and intersectoral flows are represented by the following suffixes at the end of each variable:

b	Budgetary government
c	Central Bank
d	Banking system
o	Other non-financial public sector (SEEs)
g	Consolidated non-financial public sector
p	Private sector
m	Consolidated monetary sector
f	Foreign sector
t	Total

FIGURE 1.1: SOURCES AND USES OF FUNDS MATRIX

CURRENT ACCOUNT

	Government Budget	Other Public	Private Sector	Central Bank	Banking System	Balance of Payments	Production Account	Total Sources
Government Budget		TD_o	TD_p	$P\&L_c$		$E \cdot Tf^*_b$	TI $-SUB$ OFI_b	
Other Public	Tb_o						Fi_o	
Private Sector	T_{bp} $i_C \cdot B_{bp}$				$i_D \cdot DD$ $P\&L_d$	$E \cdot Tf^*_p$ $E \cdot MR^*_p$	VA_p	
Central Bank	$i_R \cdot CR_b$	$i_R \cdot CR_o$			$i_R \cdot CR_d$	$i^* \cdot (R^*_c - F^*_c)$		
Banking System	$i_C \cdot B_{bd}$	$i_C \cdot B_{od}$	$i_C \cdot B_{pd}$					
Balance of Payments	$E \cdot i^* \cdot F^*_b$	$E \cdot i^* \cdot F^*_o$	$E \cdot i^* \cdot F^*_{dp}$ $E \cdot PR^*$	$E \cdot i^* \cdot F^*_c$	$E \cdot i^* \cdot F^*_d$		IM_t $-X_t$	
Consumption and Savings Account	C_b S_b	S_o	C_p S_p	δNW_c	δNW_d	S_f		
Total Uses								

CAPITAL ACCOUNT

	Government Budget	Other Public	Private Sector	Central Bank	Banking System	Balance of Payments	Savings Account	Total Sources
Government Budget			δB_{bp}	δCR_b	δB_{bd}	$E \cdot \delta F^*_b$	S_b	
Other Public	KT_{bo}		δB_{op}	δCR_o	δB_{od}	$E \cdot \delta F^*_o$	S_o	
Private Sector	KT_{bp}	KT_{op}			δB_{pd} KT_{dp}	$E \cdot \delta F^*_p$ $E \cdot \delta DFI^*$	S_p	
Central Bank			δCU_p		δRR δCU_d	$E \cdot \delta F^*_c$	δNW_c	
Banking System	KT_{bd}		δDD	δCR_d		$E \cdot \delta F^*_d$	δNW_d	
Balance of Payments				$E \cdot \delta R^*_c$			S_f	
Investment Account	I_b	I_o	I_p					
Total Uses								

presented in section 3. Although it is by no means necessary for the purposes of this paper to maintain such a large amount of detail in the budget constraints, the RMSM-X model is designed as a multi-purpose model to be used for a multitude of tasks which potentially require such detail.

1.2. THE MARKETS

The flow of funds is a useful accounting framework that helps to organize the data in a consistent manner. For policy analysis, the consistency framework is linked to a model that contains the behavioral and technical relationships among variables. These relationships involve five markets: one goods market and four asset markets. The specification of the components of supply and demand in each of the markets is presented in section 3. Here, only the market clearing conditions are stated.

For simplicity, the domestic economy is assumed to produce only one composite good that can be used for domestic consumption and investment, or sold abroad. Equilibrium in the goods market requires:

$$(1.1) \qquad Y + IM = C_p + C_b + I_p + I_b + I_o + X$$

where C, I, Y, X and IM denote consumption, investment, output, exports and imports of goods and services, respectively. All variables are measured in real terms.

The model considers the different components of money (currency and demand deposits) as perfect substitutes. Therefore, the equilibrium condition in the money market is simply:

$$(1.2) \qquad M^s = M^d$$

There is only one type of foreign-currency-denominated asset which can be held by all sectors. Hence, the equilibrium condition in the foreign credit market is:

$$(1.3) \qquad F^{*d}_b + F^{*d}_o + F^{d*}_p + F^{d*}_d + (F^*_c - R^*_c)^d = F^{s*}_t$$

The sum of the net demands for foreign credit of each of the national sectors must equal the total supply of foreign credit.

The domestic bond, issued by the budget, other public and/or private sectors, is held by the private and/or banking sectors. This market could be further disaggregated into credit provided by the financial system and domestic public debt sold to the private sector. While this distinction may appear appropriate, it will only be relevant for practical purposes if the assets are assumed to be imperfect substitutes from the viewpoint of at least one economic sector and if meaningful behavioral assumptions can motivate the imperfect substitutability. Furthermore, for each asset distinct supply and/or demand schedules would have to be specified. For simplicity only one domestic bond is considered and the equilibrium condition in the domestic bond market is given by:

$$(1.4) \qquad B_b^s + B_o^s = B_p^d + B_d^d$$

The net supply of the domestic bond by the budget and other public sector, must equal the net demand by the private and banking sectors.

The equation that must be satisfied in order to assure equilibrium in the central bank's credit market is:

$$(1.5) \qquad CR_t^s = CR_b^d + CR_o^d + CR_d^d$$

Overall credit extended by the central bank is distributed among the budget, the other public sector and the banking system.

1.3. MODEL CLOSURE AND SOLUTION PROCEDURE

If none of the savings variables in the budget constraints is exogenously determined, the model contains eleven equations: six budget constraints and five market clearing conditions. From Walras' law only ten of these equations are independent. If all markets clear and five of the six sector's budget constraints are satisfied then the budget constraint of the remaining sector is also satisfied. If, on the other hand, all sectors are on their budget constraint and four markets clear, then the remaining market always clears. Consequently, the system can be solved for ten endogenous variables with the additional mathematical constraint that each of the

eleven equations must at least contain one endogenous variable.[3/] By specifying additional behavioral functions, it could be solved for many more intermediate variables but these are not truly endogenous. Given the amount of detail specified in the budget constraints, especially of the public sector, it is necessary to add a relatively large set of exogenous projection rules for such variables as transfers between different sectors, taxes, subsidies and factor income for the Government. However, since these variables are only of limited importance for the analysis of the problem of inflation stabilization, these projection rules are kept constant across simulations (see also section 3).

Typically, macroeconomic models add to the basic structure of the model described above a complete set of estimated behavioral equations for the supply and demand sides of all markets. These behavioral equations are functions of prices and quantities and allow the simultaneous solution of the model. The construction of such a model requires reliable data, stable estimated parameters and is quite resource intensive. Even in the case of Turkey, data is still limited and frequent changes in policy regimes over the past decade make it almost impossible to find stable parameters. Therefore, the solution of the RMSM-X model is essentially recursive and contains only a few local simultaneities that can be solved analytically (for example the trade block and the goods market). Hence, solving the model does not require optimization software and takes only a few minutes. A recursive solution procedure does imply, however, that markets are closed with quantities and, hence, are either supply or demand determined. As a result, it becomes necessary to check the solution of the model "ex-post" and iterate it further if the solution is not economically plausible.

Figure 1.2 illustrates the recursive closure that was adopted for the purpose of this paper. Given a time path for the budget constraints of the non-financial public sector (fiscal policy) and a time path for the rate of base money growth (monetary policy) the model will be solved for the target variables: inflation, growth and the level of foreign reserves. The arrows in the figure show how the model is solved and the variables indicated on the arrows are the "closing" variables of the markets or budget constraints they are associated with. Starting with monetary policy on the supply side of the money market, the demand side is solved for the rate of capacity utilization (for details see section 3). This variable determines the supply side of the goods

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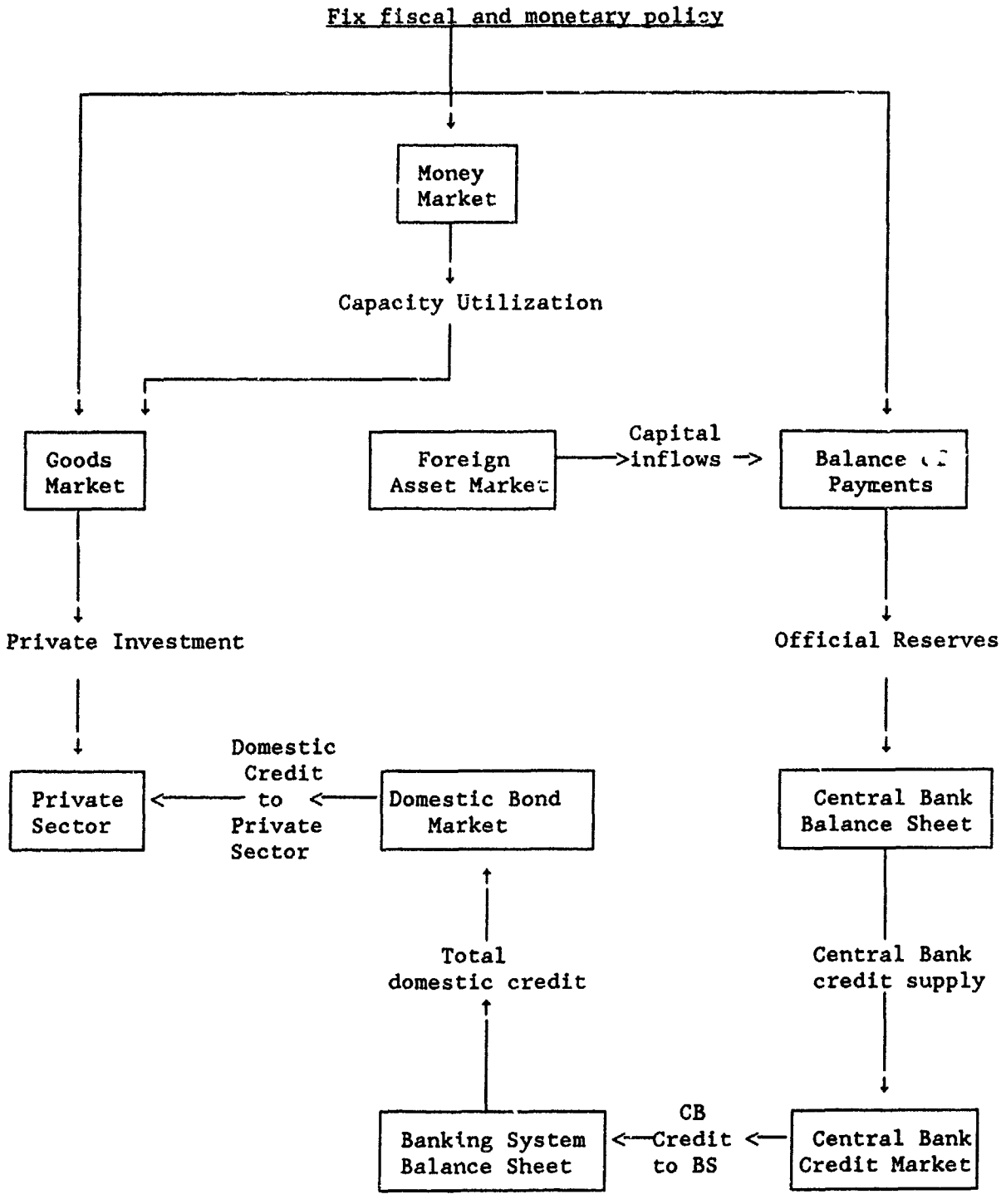
[3/] If one or more equations would not contain at least one selected endogenous variable, these equations would not be part of the system (but in fact, identities) and the dimension of the system as well as the number of variables that can be solved for would be reduced.

FIGURE 1.2: STRUCTURE OF THE MODEL



market and private investment closes the market on the demand side. The other parts of the model are solved in a similar manner. Of course, nothing guarantees that private investment behaves in an economically meaningful manner when solved for in the way described above. Variables such as the interest rate, the rate of capacity utilization and inflation in general have awell-defined impact on private investment at least in terms of direction. The solution of the model must be verified ex-post for its compatibility with the paths of the other variables.

2. INFLATION STABILIZATION: THEORETICAL FRAMEWORK

2.1. INFLATION AND FISCAL DEFICITS IN A MUNDELL-FLEMING MODEL

Introducing a short-run Phillips curve and the Government's budget constraint in the conventional Mundell-Fleming model provides us with an appropriate tool to analyze inflation stabilization. Since Turkey completely opened its capital account in August 1989, perfect capital mobility is assumed.[4/]

The level of aggregate demand (Y) is the sum of domestic demand or absorption (E) and net foreign demand or the trade balance (TB):

$$Y = E + TB \tag{2.1}$$

Aggregate supply is defined as capacity utilization (cu) times potential output (Y^F),

$$Y = cu \cdot Y^F \tag{2.2}$$

Net foreign demand is a negative function of the real exchange rate (q) and a positive function of the level of domestic income (Y):

$$TB = TB(q,Y) \tag{2.3}$$

The level of domestic expenditure depends negatively on the real interest rate (r) and positively on the level of income (Y):

[4/] These variants of the Mundell-Fleming model have been discussed extensively in the economic literature; for an overview, see for example Stevenson et. al. (1988).

$$E=E(r,Y,\Theta+r\cdot d+r^{*}\cdot d^{*}-(\pi+\hat{Y})\cdot h)$$

Explicit consideration of the Government's budget constraint [5/] adds a third determinant to domestic expenditure: the inflation-adjusted or operational deficit ($\Theta+r\cdot d+r^{*}\cdot d^{*}$) where Θ denotes the primary deficit and d the debt GDP ratio, minus the revenue that the public sector obtains from money creation $(\pi+\hat{Y})\cdot h$. The latter consists of the erosion of money holdings due to inflation, the well-known inflation tax $(\pi\cdot h)$, where h represents the real money base as a share of GDP, and of the revenue that accrues to the provider of money in a growing economy $(\hat{Y}\cdot h)$. The following assumptions underlie the formulation of equation (2.4): (i) the multipliers of government expenditure and taxes are the same in absolute value, (ii) the possible distributive effects of a shift from a "normal" tax to the inflation tax, or vice versa, would not have any impact on the level of expenditure and (iii) private agents do not anticipate the burden of future taxes (Ricardian equivalence), perceive government bonds as net wealth and, hence, a bond-financed increase in the public sector deficit would result in an increase in the level of domestic expenditure.

The supply side is represented by a standard Phillips curve:

$$(2.5) \qquad \pi = \pi^{e} + \alpha\cdot(cu-cu^{N}) \qquad \alpha>1$$

where π^{e} and cu^{N} refer to expected inflation and "normal" capacity utilization, respectively. Equation (2.5) equates actual inflation to the expected inflation rate unless demand pressure forces inflation above its expected level. Well known motivations for a short-run Phillips Curve are wage contracts (Fischer 1977ab, Taylor (1980), price contracts (Buiter 1980) or imperfect information (Lucas 1973).

There are three assets in the theoretical model: base money, a domestic bond and a foreign bond. The latter two are assumed to be perfect substitutes so that the interest parity condition (expressed in real terms) holds:

[5/] Including the monetary authorities.

$$r = r^* + (q^e - q)/q \tag{2.6}$$

where q^e is the expected real exchange rate. The equilibrium condition in the money market is:

$$H/p = k(r+\pi^e)\cdot Y \tag{2.7}$$

where H is the base money and p the price level. Equation (2.7) assumes a simple transactions demand for base money.

Finally, the budget constraint of the public sector including the monetary authorities shows the linkage between fiscal deficits and money creation (see Sargent and Wallace 1981, Buiter 1983, van Wijnbergen 1989 and Anand and van Wijnbergen 1983).[6/] At any point in time, a given primary deficit including possible quasi-fiscal deficits arising from the central bank's involvement in fiscal activities, must be financed either by interest bearing liabilities (public domestic and external debt) or by non-interest bearing liabilities (base money). Expressed as share of GDP this budget constraint can be written as follows:

$$\Theta + i\cdot d + e\cdot i^*\cdot d^* = (\delta H + \delta D + e\cdot\delta D^*)/p\cdot Y \tag{2.8}$$

where i and e are the nominal interest rate and exchange rate, respectively; and D is the nominal stock of public sector debt. Consequently, open market operations of the central bank change the composition of outstanding public liabilities between interest-bearing and non-interest-bearing. In this sense, the monetary authorities control the amount of base money issued and, therefore, the revenue from the inflation tax or seignorage. The inflation tax is a current tax that affects the holders of base money proportionally. However, this tax can be evaded by lowering the holdings of base money and, hence, inflation tax revenue will start to decline at some inflation rate.[7/] Nevertheless, over the relevant range for the analysis the revenue from money creation will decline as inflation falls. This is one of the key aspects of a disinflationary program, indicating the need to find alternative sources of financing or to reduce the fiscal deficit.

[6/] For a complete exposition of fiscal policy in our IS-LM framework see Artis (1979).

[7/] Econometric estimates put this inflation rate in the Turkish context at about 125% per year. At that rate, revenue from inflation tax is maximized.

2.2. DISINFLATION IN THE MEDIUM-RUN [8/]

In a medium-run equilibrium expectations must be fulfilled, and, hence, the following relations must hold at all times:

$$(2.9) \qquad \pi^e = \pi$$

$$(2.10) \qquad q^e = q$$

Using (2.9) and (2.10) and making the appropriate substitutions, the analytical framework presented in the previous section reduces to:

$$(2.11) \qquad cu^N \cdot Y^F = E(r, cu^N \cdot Y^F, \Theta + r \cdot d + r^* \cdot d^* - (\pi + \hat{Y}) \cdot h) + TB(q, cu^N \cdot Y^F)$$

$$(2.12) \qquad H/p = k(r+\pi) \cdot cu^N \cdot Y^F$$

$$(2.13) \qquad r = r^*$$

Equations (2.11) and (2.12) describes the equilibrium in the goods and money markets respectively. Equation (2.13) is the medium-run version of the interest parity condition. The system (2.11)-(2.13) can be solved for q, π and r.

In the case of Turkey, the inflation rate has remained at a high level equilibrium for the last three years because of the public sector's inability to finance its expenditures through conventional taxes. Consequently, the Government had to resort to money creation to obtain the needed revenue through the inflation tax. Inflation stabilization requires essentially finding a substitute for the inflation tax. The revenue from the inflation component of money creation can be replaced either by raising taxes, cutting expenditure, or by increasing domestic and/or foreign borrowing (δd and/or δd^*).

First, take the case of an <u>increase in direct taxes</u> to replace the revenue lost from a decline in monetary growth and inflation. Given the assumptions made above, the level of demand and, hence, the goods market equilibrium is unaffected according to equation (2.11) as the rise in demand due to the decline in $\pi \cdot h$ is offset by a fall in Θ, the fiscal deficit. However,

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[8/] For more elaborate models of disinflation with forward looking agents see for example Drazen and Helpman (1987) and Obstfeld (1985).

the lower inflation reduces the opportunity cost of holding money and increases the demand for base money for a given real interest rate. In the new equilibrium, the real interest rate and exchange rate remain unaltered. The only effect of disinflation is to increase the demand for real balances which will be satisfied by a temporary reduction of the rate of inflation below the rate of money growth while after this transitory period the rate of inflation, nominal depreciation and money growth will all be the same again.

This result would be slightly altered if domestic bonds and foreign bonds are not perfect substitutes or if the increase in money balances reduces the demand for bonds so much that world interest rates are affected. Although the second condition is unlikely to hold in the case of Turkey, the first one is almost certainly valid. Hence, the increased holdings of money would reduce the demand for the domestic bond and increase the interest rate at a given supply. The real exchange rate will have to depreciate somewhat to maintain goods market equilibrium. The main result is that a package of monetary restraint and supportive fiscal policy would be necessary and sufficient to reduce permanently inflation in the absence of price rigidities. Furthermore, if the reduction in the inflation rate brings about the expected increase in the volume and efficiency of investment, one would expect that the medium-run growth rate of output would increase.

Consider the case in which the Government replaces the revenue lost from the decline in inflation by increased borrowing. The additional Government bonds issued are at least partially perceived as net wealth by the private sector. Consequently, as can be seen from equation (2.11) the level of aggregate demand increases which, in the Turkish context of an open capital account, would raise the expected real exchange rate as well as the actual one and bring in extra resources through short-term capital flows. However, at this new equilibrium both fiscal and current account deficits could well reach unsustainable levels as debt dynamics would become unstable (see Text Box 2.1). In the end, the Government will have to resort to money creation again, moving the economy back to a high inflation path (Sargent and Wallace 1981).

2.3. SHORT-RUN PRICE INERTIA AND THE COSTS OF DISINFLATION

In the short-run, inflation may be temporarily unresponsive to changes in money growth. If private agents' inflationary expectations do not react immediately to the reduction in money growth and/or nominal contracts cannot be adjusted instantaneously, inflation will temporarily

Text Box 2.1: Sustainability of the Fiscal Deficit

Define the public debt to GDP ratio as:

$$b = \frac{B}{P \cdot Y}$$

and differentiate to obtain:

$$\delta b = \frac{\delta B}{P \cdot y} - (\pi + \hat{Y}) \cdot b$$

The Government budget constraint can be written as (all in percent of GDP):

$$\delta b = e + i \cdot b - (\pi + \hat{Y}) \cdot b - (\pi + \hat{Y}) \cdot h$$

with $\delta b = 0$ as a minimum condition for a sustainable level of public debt. The steady state level of debt that satisfies this condition is:[1/]

$$b = \frac{e - (\pi + \hat{Y}) \cdot h}{\hat{Y} - r}$$

with 50% inflation, growth at 5%, r = 4% and e = 5.2% of GDP as in 1990:

$$b = \frac{.052 - (.50 + .05) \cdot .086}{.05 - .04} = 47\% \text{ of GDP}$$

with 10% inflation and all other assumptions the same while taking into account some remonetization (reflected in the increase in h):

$$b = \frac{.052 - (.10 + .05) \cdot .12}{.05 - .04} = 340\% \text{ of GDP}$$

a solution which is clearly unsustainable.

1/ If the real interest rate is larger than the real growth rate then it can be shown that the Government budget constraint is an unstable first difference equation in public debt for a given monetary policy.

remain high while money growth has already been reduced.[9/] This inertia is introduced in the model by substituting the following short-run equations for equations (2.9) and (2.10):

(2.9') $\pi^e = f(\pi_{-1}, \hat{e}, \ldots)$

(2.10') $q^e = g(\bar{q}, \ldots)$

Expected inflation and the expected real exchange rate are no longer always equal to their realized value, but deviate from it in the short run. Inflationary expectations could be a function

9/ For an overview of the role of inflationary rigidities in disinflation attempts in Latin America see in Kiguel and Liviatan (1988). Dornbusch (1985) gives a more general treatment of the problem.

of past inflation, exchange rate movements and other variables as indicated in equation (2.9'). The expected real exchange rate could be a function of a long-term equilibrium rate and other variables such as fiscal and monetary policy. With this short-run formulation, the system (2.11)-(2.13) is modified to:

$$(2.11') \qquad cu \cdot Y^F = E(r, cu \cdot Y^F, \Theta + r \cdot d + r^* \cdot d^* - (\pi + \hat{Y}) \cdot h) + TB(q, cu \cdot Y^F)$$

$$(2.12') \qquad H/p = k(r + f(\pi_{-1}, \hat{e}, \ldots)) \cdot cu \cdot Y^F$$

$$(2.13') \qquad r = r^* + (g(\bar{q}, \ldots) - q)/q$$

$$(2.14) \qquad \pi = f(\pi_{-1}, \hat{e}, \ldots) + \alpha \cdot (cu - cu^N)$$

This system can be solved for capacity utilization (cu), the real interest rate (r), the real exchange rate (q) and inflation (π). In the short-run, departures from full-employment are possible when actual inflation is different from expected inflation. Given the inertia of inflation, a reduction in the growth rate of money would result in a fall in the real money supply as inflation adjusts less than proportionally. This leads to an increase in the real interest rate, a real appreciation and a reduction in capacity utilization. After a lag, when expectations are modified and contracts expire, inflation would fall, reversing the initial reduction in the real money supply. Note that this result follows irrespective of whether the Government supports the monetary contraction with a fiscal contraction or not. However, if the problem of inflationary momentum is an issue of credibility [10/], the absence of fiscal action is likely to worsen the short-run losses incurred during disinflation. In addition, the nature of debt and wage contracts in Turkey may provide another source of adjustment cost.

3. IMPLEMENTATION IN THE RMSM-X MODEL [11/]

In order to simulate the RMSM-X model and to implement the above described theoretical framework it is necessary to specify the demand and supply side of all markets and incorporate some projection rules for variables in the budget constraints of the six sectors that do not appear in the market clearing conditions. Two key considerations influence this implementation: (i) the

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[10/] For an extensive treatment of the credibility issue, see Sargent 1986.

[11/] Those readers not interested in the technical aspects of the implementation can skip this section without loss of continuity.

importance of short-run rigidities leading to adjustment costs, and (ii) the recursive nature of the solution.

3.1 THE GOODS MARKET

The economy is assumed to be operating under a fixed coefficients production function and capital is the constraining factor. Therefore, potential output Y^F is linked to past investment as follows:

$$(3.1) \qquad Y^F = \beta \cdot I_{t-1} + Y_{t-1}^F$$

where β is the inverse of the ICOR, which is assumed to be exogenous. Since I_t represents total investment in the economy, it is assumed to have the same efficiency across sectors. Total investment is defined as:

$$(3.2) \qquad I_t = \sum_{j=1}^{h} I_j \qquad\qquad j = b,o,p.$$

Actual output in the economy does not necessarily equal potential output as the rate of capacity utilization (cu) may differ from unity:

$$(3.3) \qquad Y = Y^F \cdot cu$$

How cu is determined is explained below.

Given the choice of closure of the model, the time path of public components of demand is determined exogenously:

$$(3.4) \qquad C_b = \bar{C}_b$$
$$(3.5) \qquad I_o = \bar{I}_o$$
$$(3.6) \qquad I_b = \bar{I}_b$$

Private consumption is a function of disposable income adjusted for the inflation tax and the nominal component of domestic interest payments:

$$(3.7)\quad C_p = c \cdot Y_d$$

$$(3.8)\quad Y_d = [VA_p + T_{bp} + E \cdot (T^*_{fp} + WR^* - PR^*) + r_c \cdot B_{p-1} + r_{DD} \cdot DD_{-1} + r_{DT} \cdot DT_{-1} + P\&L_d - TD_p - E \cdot r^* \cdot F^*_p] / p_C$$

Exports are specified as a function of the real exchange rate q, and the level of foreign income:

$$(3.9)\quad X = (1 + \epsilon_x \cdot \hat{q} + \eta_{Y^*} \cdot \hat{Y}^*) \cdot X_{-1}$$

where the elasticities are taken from the equation estimated by Arslan and van Wijnbergen (1990):

$$(3.10)\quad \log X = \underset{(1.8)}{-0.01} + \underset{(2.48)}{1.15} \log q + \underset{(0.64)}{0.26} \log q_{-1} + \underset{(2.45)}{1.5} \log Y^*$$

$$R^2 = 0.43,\ TSLS,\ SMPL = 69\text{-}87$$

and the constant and lagged real exchange rate were dropped as they are insignificantly different from zero. The growth rate of foreign output is taken from the Bank's standard projections. The determination of the real exchange rate will be discussed below. Imports consist of five different components:

$$(3.11)\quad IM = IM^C + IM^I + IM^{OIL} + IM^V + IM^G$$

All components, except IM^G, non-monetary gold imports, are linked to their corresponding aggregate demand components and to the real exchange rate:

$$(3.12)\quad IM^C = (1 + \epsilon_C \cdot \hat{q} + \eta_C \cdot \hat{C}) \cdot IM^C_{-1}$$

$$(3.13)\quad IM^I = (1 + \epsilon_I \cdot \hat{q} + \eta_I \cdot \hat{I}) \cdot IM^I_{-1}$$

$$(3.14)\quad IM^{OIL} = (1 + \epsilon_{OIL} \cdot \hat{q} + \eta_{OIL} \cdot \hat{Y} + \epsilon^P_{OIL} \cdot \hat{P}^*_{OIL}) \cdot IM^{OIL}_{-1}$$

$$(3.15)\quad IM^V = (1 + \epsilon_V \cdot \hat{q} + \eta_V \cdot \hat{Y}) \cdot IM^V_{-1}$$

Import demand for consumption, IM^C, investment IM^I, and intermediate inputs, IM^V, are estimated econometrically while imposing all $\eta_i = 1$. The results are (t-statistics in parenthesis):

$$(3.12)'\quad \log \frac{IM^C}{C_t} = \underset{(-2.69)}{-2.43} - \underset{(-6.94)}{2.63} \log q$$

R^2 = .55, S.E. = 0.68, D.W. = 1.26, SMPL 81-88, OLS

(3.13)' $\log \frac{IM^I}{I_t} = -1.55 - 2.16 \log q$
$\quad (-15.5)\ (-3.26)$

R^2 = .64, S.E. = 0.18, D.W. = 1.09, SMPL 81-88, OLS

(3.15)' $\log \frac{IM^V}{Y} = -2.19 - 0.53 \log q$
$\quad (-40.3)\ (-1.46)$

R^2 = .26, S.E. = 0.097, D.W. = 1.44, SMPL 81-88, OLS

Import demand for crude oil, IM^{OIL}, was not econometrically estimated and the price elasticities with respect to the real exchange rate and its own relative price, P^*_{OIL} were set to zero for the simulations implying that there is no substitutability away from the use of oil during the projection period. It is projected as a function of domestic production with a constant elasticity. Imports of monetary gold are projected exogenously:

(3.16) $IM^G = \overline{IM^G}$

Given the specification of these equations, the trade block is simultaneous with the demand side of the goods market, since contemporaneous demand components determine the import demands. The remaining variable in the goods markets is private investment, I_p, which is determined endogenously to clear the market.

The preceding discussion of the goods market concerns only real variables, but the model also calculates various prices and nominal variables. These follow simple rules:

(3.17) $p = (p_c \cdot p_{E-1})^{1/2}$

(3.18) $p_I = (1-\alpha_M) \cdot p + \alpha_M \cdot p_{IMI}$

(3.19) $p_{IMC} = E \cdot p^*_{IMI}$

(3.20) $p_{IMV} = E \cdot p^*_{IMC}$

(3.21) $p_{OIL} = E \cdot p^*_{IMV}$

(3.22) $p_{IM} = E \cdot p^*_{OIL}$

(3.23) $p_X = E \cdot p^*$

Equation (3.17) defines the period average GDP deflator (p) as the geometric average of end-of-period GDP deflators (p_E). The deflator for investment goods (p_I) is a weighted average of the domestic (p) and foreign (p_{IM}) cost of investment goods, with α_M the weight of imports in total investment. Equations (3.19) to (3.22) define the set of import deflators as the product of the corresponding foreign prices and the average nominal exchange rate (E). Once these prices are obtained, it is straightforward to calculate the nominal variables corresponding to the real component of the goods market. The goods market equilibrium condition or national accounts in nominal terms can be written as:

$$(3.24) \qquad p \cdot Y + p_{IM} \cdot M = p_X \cdot X + p_C Ct + p_I \cdot It$$

This equation is used to determine $p_C \cdot Ct$ and, given real consumption, the consumer price index can be derived as follows:

$$(3.25) \qquad p_C = \frac{p \cdot Y + p_{IM} \cdot M - p_x \cdot X - p_I \cdot I_t}{C_t}$$

This ensures mathematical consistency among prices, real and nominal variables.[12/]

3.2. THE MONEY MARKET

Total supply of money (M1) is given by:

$$(3.26) \qquad M^s = \tau \cdot H$$

with H representing base money:

$$(3.27) \qquad H = CU_p + CU_d + RR$$

which consists of currency in hands of the public (CU_p), vault cash (CU_d) and required reserves (RR). The money multiplier, τ, is defined as:

[12/] It does not, however, ensure economic consistency which would require as many prices and material balances as there are goods.

(3.28) $\tau = (cc+1)/(cc+re)$

with re the reserve/deposit ratio and, cc the currency/deposit ratio. These ratio's are specified exogenously.

Demand for money is specified as follows:

(3.29) $$\frac{M^d}{P_E} = K\,(\pi^e,\ iTD,\ \hat{e}) \cdot cu \cdot Y^F$$

Transactions are proxied by actual output ($cu \cdot Y^F$) and the inverse of velocity K (...) is a function of price expectations, nominal interest rates and the rate of depreciation of the exchange rate. This equation is econometrically estimated as:

(3.29)' $$\frac{M^d}{P_E} = [\ 6.846 - \underset{(3.14)}{3.119}(1+\pi^e) - \underset{(-3.27)}{2.913}(1+i_{TD}) - \underset{(-2.99)}{0.454}(1+\hat{e}) - \underset{(-1.09)}{0.109}\ X854\ ] \cdot cu \cdot Y^F$$

$$\underset{(-2.68)}{}$$

$R^2 = 0.77$, S.E. $= 0.045$, D.W. $= 2.54$, TSLS AR(1), 84.1-89.4

where X854 is a dummy for a statistical outlier in the series on interest rates in the fourth quarter of 1985 only.

Since the focus of the analysis is on price rigidities, a short-run price equation was estimated in order to project P_E:

(3.30) $$\frac{P_E - P_{E-1}}{P_{E-1}} = \underset{(6.18)}{0.669}\pi_{-1} + \underset{(2.51)}{0.367}\hat{e}^{\pi}_{-1} + \underset{(2.02)}{0.233}\hat{M} - \underset{(-2.37)}{0.278}\ (\overline{cu} - cu_{-1}) + \underset{(3.86)}{0.135}\ X842$$

$R^2 = 0.41$, S.E. $= 0.034$, D.W. $= 2.43$, TSLS, 82.1-89.4

where $\hat{e}^{\pi}$ is the proportion of the exchange rate depreciation orthogonal on the inflation rate:

(3.31) $$\hat{e} = \underset{(11.27)}{0.887}\pi$$

This reduces the coefficient on the lagged inflation rate in equation (3.30) to 0.3436. Consequently, the sum of the coefficients on the nominal variables in equation (3.30) adds to 0.944, insignificantly different from unity as needed for the model to satisfy steady state conditions.

Equation (3.30) is observationally equivalent to a system of equations of the type:

$$(3.32) \qquad \pi = f(\pi^e, \hat{M}, \overline{cu} - cu_{-1})$$

$$(3.33) \qquad \pi^e = f(\pi_{-1}, \hat{e}_{-1})$$

on which a particular process of inflationary expectations is imposed. Empirical analysis in Vieira da Cunha et al (1990) indicates the dominant importance of lagged inflation and exchange rate behavior for the formation of inflationary expectations. Hence, in order to maintain consistency between the estimated price equation (3.30) and the expected inflation rate used in the money demand equation (3.29), expectations are calculated according to (3.33). Using the estimated parameters, this yields:

$$(3.34) \qquad \pi^e = 0.4582\ \pi_{-1} + 0.5165\ \hat{e}_{-1}$$

This equation approximately satisfies the steady state conditions.

Three remaining variables are undetermined in this system of equations. By imposing the international real interest rate arbitrage condition the actual real exchange rate can be determined and the rate of nominal exchange depreciation can be solved for as foreign prices are exogenous and domestic inflation is determined in the price equation. This condition can be written as:

$$(3.35) \qquad r = r^* + \frac{q - q^E}{q_{-1}}$$

where r is the real domestic bond rate, of which the time path is specified exogenously, r^* is the foreign real bond rate taken from the Bank's projections of international variables and q^E is the expected real exchange rate. This rate is a function of the fiscal deficit, θ, and the current account, CA, both observed with a lag:

(3.36) $q^E = h(\theta_{-1}, CA_{-1})$

Since an appreciation is defined as a decline of q^E, it is assumed that $h_{\theta_{-1}} < 0$ and $h_{CA_{-1}} > 0$, with the parameters calibrated to match the most recent historical observation, i.e., 1990.

The usual relation between nominal and real interest rates and inflation determines the nominal interest rate used in the money demand function:

(3.37) $(1 + i_{TD}) = (1 + \pi)\cdot(1 + r)$

This completes the specification of all the variables entering the demand side of the money market except for the rate of capacity utilization. Hence, the money market clearing condition is solved for this rate by equating demand and supply as specified in equations (3.26) and (3.29). Since the rate of capacity utilization enters the goods market equilibrium as well, monetary policy influences actual output and leads to a short-run Phillips curve in the model. The dynamics of the model for a given shock are largely determined by equation (3.30) as a fall in the rate of capacity utilization leads to a reduction in price expectations, raises real supply of money which, in turn, raises the rate of capacity utilization in the next period. In the medium-term, when the rate of capacity utilization attains its natural level, all nominal variables will grow at the same rate.

3.3. THE FOREIGN CREDIT MARKET

Since it is assumed that Turkey would not be facing an external credit constraint, the demands for foreign credit of all domestic sectors need to be specified. The public sector's foreign borrowing, here expressed in terms of its stock, is given exogenously:

(3.38) $F_b^* = \overline{F_b^*}$

(3.39) $F_o^* = \overline{F_o^*}$

(3.40) $F_c^* = \overline{F_c^*}$

Similarly, foreign exchange deposits of the public sector held at the central bank are predetermined:

(3.41) $FX_{bc} = \overline{FX}_{bc}$

(3.42) $FX_{oc} = \overline{FX_{oc}}$

Foreign borrowing by the domestic banking system and the private sector are inversely related to the real money supply with a parameter calculated on the most recent historical observation (1989):

(3.43) $F_d^* = f_d(M/PE)$ $\qquad f'_d < 0$

(3.44) $F_p^* = f_p(M/PE)$ $\qquad f'_p < 0$

Foreign exchange deposits held by the private sector in the domestic banking system are a function of demand deposits of the private sector:

(3.45) $FX_{pd} = \alpha_{pd} \cdot DD/EE$

Finally, the domestic banking system must deposit some of its foreign exchange at the central bank in the form of required reserves:

(3.46) $FX_{dc} = rr_{FX} \cdot FX_{pd}$

where rr_{FX} is the reserve coefficient determined by the central bank.

On the supply side, it is assumed that Turkey can borrow in the international market at the going interest rate:

(3.47) $i_n^* = \overline{i_n^*}$

i_n^* is the foreign interest rate for "new" borrowing by Turkey. All sectors are assumed to be facing the same interest rate. Given this rate for new borrowing, it is straightforward to calculate the weighted average interest rate that Turkey is facing:

(3.48) $i^* = i_o^* \cdot F_o^* / F_t^* + i_n^* \cdot (F_t^* - F_o^*)/F_t^*$

where i_o^* and F_o are the interest rate and dollar amount of already existing credit and F_t^* is the total demand for credit obtained by summing equations (3.38) - (3.40) and (3.43) - (3.44).

To complete the set of foreign currency denominated variables, the foreign exchange reserves of the domestic banking system and the central bank still need to be specified. Domestic banks hold free reserves as a share of private sector foreign exchange deposits:

$$(3.49) \qquad RES_d = rf_{FX} \cdot FX_{pd}$$

Consequently, as all variables entering the balance of payments have been determined, central bank reserves are the residual.

3.4. CENTRAL BANK CREDIT

The central bank sets its rate of growth of base money as a policy variable and obtains whatever reserves the balance of payments outcome determines. Consequently, total supply of central bank credit is determined as follows:

$$(3.50) \qquad CR_t^s = H - E_E \cdot (RES_c - F_c^* - FX_{dc} - FX_{bc} - FX_{oc}) + NOL_c$$

where NOL_c is net other liabilities.

Demand for central bank credit from the non-financial public sector is given exogenously:

$$(3.51) \qquad CR_b^d = \overline{CR}_b$$

$$(3.52) \qquad CR_o^d = \overline{CR}_o$$

Consequently, the demand for central bank rediscounts from the domestic banking system is determined residually in this market:

$$(3.53) \qquad CR_d^d = CR_t^s - CR_b^d - CR_o^d$$

3.5. THE DOMESTIC BOND MARKET

The domestic bond is a composite asset, incorporating all remaining assets in the economy. As a result of the fact that the private sector is at the same time borrower (credits) and lender (time deposits) to the domestic banking system, these offsetting transactions were

netted out in order to obtain the net demands and supplies for domestic bond.

Supply of bonds from non-financial public entities is given by the budget constraints of the respective sectors as they result from policy decisions:

$$(3.54) \qquad B_b^s = \bar{B}_b$$

$$(3.55) \qquad B_o^s = \bar{B}_o$$

Given the predetermination of the money supply, demand for deposits from the private sector and rediscounts obtained from the central bank, the budget constraint of the domestic banking system dictates the demand of bonds in the market:

$$(3.56) \qquad B_d^d = DD_p + CR_d + E_E \cdot (F_d + FX_{pd} - FX_{dc} - RES_c) + NOL_d - CU_d - Dd_c$$

where NOL_d are net other liabilities, CU_d is vault cash and Dd_c is required reserve deposits at the central bank. The market is closed by solving for the private sector's availability of net domestic credit:

$$(3.57) \qquad B_p = B_d^d - B_b^s - B_o^s$$

3.6. PROJECTING OTHER VARIABLES

A comparison of the market clearing conditions and the budget constraints indicates that the latter contain more variables than are included in demand and supply functions of the various markets. Given the choice of closure, it is clear that the budget constraints of the non-financial public sectors are predetermined by policy choice, within the limit of the adding-up constraints. The variables in those budget constraints are projected as follows:

$$(3.58) \qquad FI_o = fi \cdot p \cdot Y$$

$$(3.59) \qquad OFI_b = ofi \cdot p \cdot Y$$

$$(3.60) \qquad TI = t_y \cdot p \cdot Y + t_{IM} \cdot P_{IM} \cdot IM$$

$$(3.61) \qquad TD_p = t_p \cdot VA_p$$

$$(3.62) \qquad TD_o = t_o \cdot FL_o$$

$$(3.63) \qquad SUB = t_s \cdot p \cdot Y$$

$$(3.64) \quad T_{bo} = (1 + \pi) \cdot T_{bo-1}$$

$$(3.65) \quad T_{bp} = (1 + \pi) \cdot T_{bp-1}$$

$$(3.66) \quad KT_{bo} = (1 + \pi) \cdot KT_{bo-1}$$

$$(3.67) \quad KT_{bd} = (\hat{} + \pi) \cdot KT_{bd-1}$$

$$(3.68) \quad KT_{bp} = (1 + \pi) \cdot KT_{bp-1}$$

$$(3.69) \quad KT_{op} = (1 + \pi) \cdot KT_{op-1}$$

$$(3.70) \quad T^{*}_{fb} = (1 + \pi^{*}) \cdot T^{*}_{fb-1}$$

$$(3.71) \quad P\&L_{c} = \overline{P\&L_{c}}$$

Factor income of the budget (OFI_b) and the SEEs (FI_o) is projected as a share of nominal GDP, with parameters fi, ofi, that are adjusted to reflect the time path of policies. Similarly, indirect taxes (TI) and direct taxes from the private sector (TD_p) and SEEs (TD_o) as well as subsidies (SUB) are linked with parameters to their respective tax bases. Transfers, T_{bo}, T_{bp}, KT_{bo}, KT_{bd}, KT_{op}, T^{*}_{fb} are projected in constant real terms and distributed profits by the central bank are projected exogenously. Value added of the private sector is defined as:

$$(3.72) \quad VA_{p} = p \cdot Y - FI_{o} - OFI_{b} - TI + SUB$$

Various transactions between the foreign sector and the domestic private sector are projected as follows:

$$(3.73) \quad T^{*}_{fp} = (1 + \pi^{*}) T^{*}_{fp-1}$$

$$(3.74) \quad WR^{*} = \overline{WR^{*}}$$

$$(3.75) \quad DFI^{*} = \overline{DFI^{*}}$$

with WR^{*} = workers' remittances, T^{*}_{fp} = other transfers and DFI^{*} = direct foreign investment. Finally, the domestic banking system distributes its profit to the private sector:

$$(3.76) \quad P\&L_{c} = \overline{P\&L_{c}}$$

4. INFLATION STABILIZATION: POLICY SCENARIOS

4.1. RECENT ECONOMIC DEVELOPMENTS IN TURKEY

Key economic indicators for the past five years show the rather high degree of instability

of the Turkish economy (see Table 4.1). Economic growth, although high on average, fluctuated between 1.1% and 8.8% while inflation remained relatively high. The fiscal deficit appears to be the main cause of the instability, and its financing can explain the peculiar relationship between inflation and growth. The fiscal expansion in 1987 managed to maintain high capacity utilization and economic growth and was largely financed by foreign borrowing of the central bank and, hence, did not immediately lead to higher inflation. Nevertheless, the high deficit was unsustainable and the contraction in 1988 lead to a recession in the industrial sector at the end of the year and a significant decline in growth in the period 1988-89.[13/] Inflation accelerated sharply in 1988 and remained high thereafter, however, mainly because of unsterilized purchases of foreign reserves by the central bank which had become concerned with its deteriorating net foreign exchange position as the result of past foreign borrowing on behalf of the Treasury. The continuing structural transformation of the banking system and increasing sophistication of the financial intermediaries also lead to a structural fall in the demand for base money, requiring a higher inflation rate for a given amount of seignorage.

Before 1990, monetary policy was essentially accommodating and base money was used to finance any residual gap of the fiscal deficit. In 1990, the monetary authorities announced and implemented a contractionary monetary program, reducing the rate of reserve money growth from 80% in 1989 to below 50% in 1990. At the same time, mainly for political reasons, the fiscal authorities could not prevent a further widening of the deficit. This mix of expansionary fiscal and contractionary monetary policy led to upward pressure on domestic interest rates and a sharp squeeze on domestic credit available to the private sector. However, in August 1989 the capital account had been opened completely and the policy mix attracted a large volume of short-term capital inflows. As can be seen from Table 4.1, notwithstanding the sharp deterioration of the current account, the central bank had to purchase more than $1.2 billion in foreign exchange in a largely unsuccessful attempt to slow the real appreciation of the Turkish lira. Nevertheless the impact on inflation was quite modest as the year-on-year rate of consumer price inflation remained above 60% while the wholesale price index dropped to a rate of increase of about 55%. The Middle East crisis had only a modest impact on inflation as the central bank did not accommodate the increase in international oil prices and an ambiguous impact on the fiscal position as higher expenditure was offset by increased revenue from petroleum excise taxes. Moreover, Turkey's role in the crisis was compensated by large foreign assistance.

[13/] It should also be noted that adverse weather conditions led to a significant drop in agricultural output in 1989 (11%).

Table 4.1: Turkey - Key Macroeconomic Indicators

	1986	1987	1988	1989	1990
GDP Growth	8.3	7.4	3.9	1.1	8.2
GDP deflator	31.7	38.2	66.5	64.2	56.4
CPI inflation	34.6	38.9	75.4	69.6	66.3
WPI inflation	29.6	32.1	68.3	69.6	54.7
Fiscal Deficit 1/	6.0	9.6	6.9	8.0	10.1
Current Account 2/	-1465.0	-806.0	1596.0	966.0	-2611.0
Official Reserve Change 2/	545.0	649.0	421.0	2510.0	1255.0
Real Exchange Rate 3/	100.0	98.5	97.6	105.3	123.7

Source: SPO, Central Bank

1/ Percent of GDP, including net lending
2/ US$ Million, period flow
3/ Up is appreciation

The Turkish central bank announced its contractionary monetary program in early 1990 in an attempt to force the fiscal regime towards more debt-financing by lowering the amount of monetization of public interest-bearing debt. On the other hand, the fiscal authorities announced plans for taxes and expenditure that would be feasible, if at all, only in a regime where some deficits continue to be monetized. Such a combination of monetary and fiscal policy were incompatible; if the monetary authority would refuse forever to monetize any government debt then the arithmetic of the budget constraint would compel the fiscal authorities to back down and swing the budget into balance; if the fiscal authority were to stick to its guns, the same arithmetic would compel the monetary authorities to monetize large parts of the deficit. In the Turkish case, this policy conflict appears to be resolved in favor of the fiscal authorities, at least temporarily. During the first quarter of 1991, the central bank has been forced to triple its credit to the Treasury and consequently has refused to announce a monetary program for this year. This

does not bode well for future inflation as private agents will certainly incorporate this change in policy regime and revise their inflationary expectations upward.

Even if the central bank had been able to limit monetary expansion as it did in 1990, fiscal deficits of the current magnitude in Turkey are simply not financeable. Due to the Government's emphasis on domestic borrowing, total domestic public debt, excluding debt held by the central bank, rose more than 4 percentage points of GNP in 1990. This implies a sizeable shift in the portfolio of domestic investors toward public paper, but there are limits to such a policy, since public debt, just like private debt, must ultimately be backed by the net present value of future income streams. In order for such a policy to be credible it must not only be feasible, but private economic agents must also believe that it is feasible. However, during the same year (1990) as the monetary authorities were implementing a pre-announced program to reduce the growth rate of base money, the fiscal deficit rose to unprecedented levels. This is hardly the appropriate signal upon which private economic agents will accept a promise to run future surpluses without raising eyebrows. Furthermore, the 1991 Annual Program contains little, if anything, that would lead to a medium-term structural improvement of the fiscal deficit, and past experience in Turkey has revealed the willingness of the public sector to resort to inflationary financing of the fiscal deficit. Consequently, since the second half of 1990, interest rates on Treasury Bills have risen continuously while inflation remained fairly stable. In March 1991 interest rates rose rapidly to about 85% for 3-month Treasury bills while inflation expectations were still around 65%. A real interest rate of this level is certainly in excess of potential real growth of the economy and leads to unsustainable debt accumulation for a given monetary policy. Hence, the shift in monetary policy observed in the beginning of 1991 was not unexpected. The simulations presented below show this trade-off betwe n deficit reduction and inflation. However, in order to make the case for inflation reduction one needs to address the issue whether inflation is costly for society or not. After all, inflation is just a tax on a particular type of assets and if it does not imply any real costs there is no a priori reason why governments should not use this type of tax.

4.2. COSTS OF INFLATION

In the absence of a complete adjustment of the economy to high inflation, mainly through indexing, persistent high inflation tends to be associated with pervasive distributive effects and is likely to adversely affect medium-run growth. There are no good examples in which an

economy has successfully adjusted to inflation through indexing mechanisms. Indexation is often incomplete, asynchronized, backward-looking or tied to indicators which affect the contracting parties in different ways. As a result, relative prices are not only distorted but inflation also tends to raise uncertainty about future real variables. The Turkish reality contains many examples of inflation induced distortions.

Inflation can affect medium-term growth adversely through its negative impact on the marginal productivity of capital and the share of output devoted to investment. The effect of the shift of portfolios out of fixed investment as the inflation rate increases is somewhat controversial, as it is against the traditional Tobin-Mundell effect.[14/] Theoretical support for a negative relation between inflation and capital formulation can be found in McKinnon (1973) and Stockman (1981). Their arguments are based on the concept of money as a store of value and on the existence of a cash-in-advance constraint, respectively.[15/] Casual econometric analysis for Turkey shows the negative impact of inflation on the share of private investment (I^P) in output (t - statistics in parenthesis, sample 1973-88):

$$(4.1)\quad \log \frac{I^P}{GDP} = \underset{(-28.1)}{-1.872} - \underset{(-2.99)}{0.295\ RECB} - \underset{(-2.66)}{0.306\ \pi}$$

$$R^2 = 0.42,\quad S.E. = 0.106,\quad D.W. = 1.30$$

Although the econometric fit of the equation could be improved, the significant negative sign on the inflation rate supports this conjecture. The real effective cost of borrowing (RECB) also has the expected significantly negative sign.

Theory also suggests that the marginal efficiency of capital is adversely affected by the rate of inflation independent of its impact on the volume of investment, mainly due to difficulties

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[14/] This effect anticipates more private fixed investment as investors shift out of real money balances and into other assets when inflation increases (Tobin 1980).

[15/] McKinnon argues that if real money balances are needed to purchase capital goods and investment is lumpy and mainly self-financed, savings in the form of money will ease the purchase of capital goods. Low real return on money balances (i.e. high inflation) will reduce the role of money as a store of value. Stockman shows that if money is used to purchase investment goods, the existence of a cash-in-advance constraint will lower the steady-state value of the capital stock.

in observing and adjusting relative prices in a high inflation environment. This is borne out by an econometric specification of potential output growth (t-statistics in parenthesis, sample 1973-88, annual data):

$$(4.2) \qquad \hat{y}^F = -0.117 + 0.543 \underset{(-1.75)}{} \frac{I^t}{GDP} \underset{(3.05)}{} - 0.052 \underset{(-2.33)}{} \pi + 1.47 \underset{(2.95)}{} \hat{L} + 0.0001 \underset{(1.31)}{} \frac{X}{GDP}$$

$$R^2 = 0.66, \qquad D.W. = 2.37, \qquad S.E. = 0.0156$$

As expected, a larger share of investment in GDP as well as in an increase in the labor force ($\hat{L}^F$) have a significantly positive effect on potential growth. However, the inflation rate has a separate significantly negative impact on growth indicative of a backward-sloped, long-run Phillips curve. Kormendi and Meguire (1985) in a large cross-country study, found a similar significantly negative sign of inflation in a regression on growth. [18/]

Although the adverse impact of inflation on income distribution is more difficult to establish empirically and while the decline in the share of wage and salary payments in value added over the last decade in Turkey can certainly not exclusively be blamed on rising inflation, there are good theoretical reasons to expect redistributions of income with high and volatile inflation. Since inflation is a tax on holdings of money balances, it affects disproportionately the less sophisticated groups of society which are liquidity constrained or do not dispose of mechanisms to avoid the inflation tax. Bracket creep of the income tax system further raises the relative burden of taxation on the lower income groups while withholding taxes on wage and salary income produce the same result compared to the treatment of income from profits and rents which is typically taxed with a much longer lag. The relative worsening of the position of wage and salary earners cannot be continued indefinitely and demands for restoration of real wages as well as increased indexation have taken strong hold in the recent past in Turkey. These developments have also undermined support from large popular groups for the Government's policies and may prove an additional obstacle in a disinflationary program.

In addition, public debt is not indexed and interest rates are based on past rates, implying that there is more than one way in which the fiscal authorities would benefit from a resurgence of inflation as it would erode the real value of outstanding debt. Private bondholders would be

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[18/]The export to GDP ratio was included in the regression to capture possible technological externalities from trade and turns out to have the proper sign but insufficient significance.

taxed as the ex-post nominal interest rate would be higher than the one at which private bondholders had initially contracted these bonds, and the ex-post real rate of return would be lower than the anticipated one. This is just one more example of how inflation increases uncertainty in the Turkish economy.

4.3. FISCAL ADJUSTMENT FOR SUSTAINABLE DISINFLATION

The conceptual analysis of section 2 shows that a permanent reduction in inflation will come about only by a coordinated fiscal and monetary contraction. The fiscal contraction is needed because of the loss of seignorage resulting from the slowdown in monetary growth. As was indicated in Text Box 2.1, the current fiscal situation does not permit a reduction of inflation in the medium-term, and even the current inflation rate of about 50% is not sufficient to prevent a further increase of public debt as a share of GDP. In addition, the existence of backward-looking nominal contracts will impose a temporary loss of output due to low capacity utilization, as the result of the fall in the real money supply. In addition, if the program is not perceived as credible, inflationary expectations will not decline and the real costs in terms of output foregone will be substantially higher and could last longer.

The scenario of fiscal and monetary coordination is based on the assumption that the announced program is perceived to be credible, so that the short-term price rigidities are essentially due to nominal contracts. The rate of base money growth is set to decline by 20% per year for the next six years and is announced in advance.[17/] Since the central bank has the intention to lower reserve requirements this allows larger monetary aggregates (M1, M2) to grow somewhat faster than base money. The accompanying fiscal policy rule is defined in such a way that the stock of net public debt does not increase over time. Although this is admittedly a somewhat arbitrary rule that need not be adhered to at all times, it is not too restrictive. As long as population grows less than GDP, for example, this rule implies a build-up in per capita public debt. Moreover, in the very long run, the Government should aim for a zero stock of public debt in order to meet its solvency condition as described above. On the other hand, this fiscal policy rule, applied in each year, could lead to a procyclical policy, since it allows the public sector to

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[17/] The rate of decline in money growth should be determined by minimizing the cost in terms of output lost. However, such a problem cannot be solved within the framework of a RMSM-X model. The rate was selected by iterating the model and verifying the level of output at the end of the simulation period. Slower rates of decline do not yield as high an output, while higher rates cause stronger initial recessions and lead to the same result.

borrow more and, hence, to run larger deficits if the growth rate of the economy is higher. It turns out that this property of the fiscal policy rule has only modest implications for the simulations because real growth rates are steady after the initial adjustment period. Hence, the issue of whether the real growth in per capita public debt implied by the fiscal rule is feasible at real interest rates below the real growth rate of the economy is of a concern.

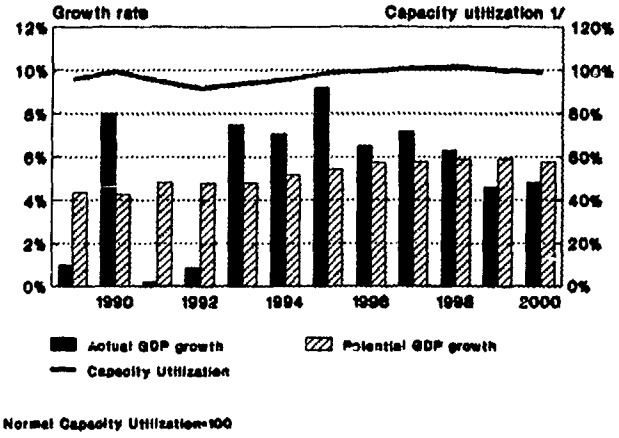
In the model simulations fiscal policy is varied through changes in the direct tax rate on private sector income only. This is for expositionary simplicity since the analytical model does not address the distributional consequences or second order effects from different ways to cut the fiscal deficit (except that the model could show the effects of reduced government investment). From the fiscal policy rule it is known how the stock of debt should behave over time, and, hence by modifying the level of direct taxes the desired fiscal deficit is obtained. The direct tax rate that satisfies the fiscal policy rule should not be taken as an estimate of the average direct tax rate that Turkey should attain. During the disinflationary program the tax base is likely to change endogenously, for example, as the Tanzi-Oliveira effect is reversed, the real revenue from the withholding tax on deposit interest payments declines and the real revenue from corporate income tax rises as the deductibility of nominal interest payments on corporate borrowing erodes the taxable income base less. These endogenous changes will automatically be reflected in the ratio of direct taxes on private income which should therefore not be interpreted as a tax rate.

In the absence of a fully simultaneous model, it is necessary to choose a time path for at least one price (or quantity) in order to start the simulations. In this application, the domestic real interest rate was chosen as the starting variable. As the fiscal adjustment program is assumed to be strong enough and the program is perceived to be credible, there is little reason to believe that real interest rates would be very high. Due to existing nominal rigidities, however, it could temporarily be higher than international rates. Hence, it was assumed in the simulation that the domestic real bond rate would rise from 2% in 1990 to about 5.5% in 1991 (first year of simulations) or about 2 percentage points above international rates.

The result of this simulation is presented in Table 4.2. Data for 1989 are based on historical observations transformed in a flow- of-funds matrix to match the economic concepts of the model and could therefore deviate from original sources. Data for 1990 correspond, to the extent possible, with the preliminary estimates, especially of the fiscal accounts, made available during the preparation of the annual program for 1991. For 1990, the effects of the

Middle East crisis are taken into account; it is assumed that this crisis would be resolved in the beginning of 1991 which does not affect the simulations except for the starting point.

Figure 4.2: Output Costs of Stabilization



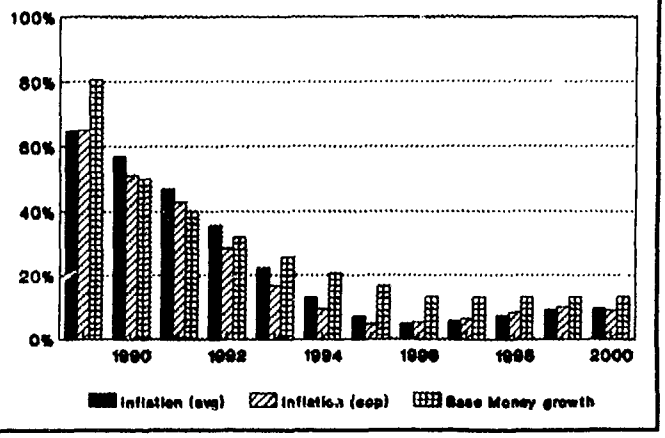
Although the coordinated disinflationary program permanently brings down inflation over time, the contraction of the growth rate of reserve money from 50% in 1990 to 40% in 1991 does not reduce inflation proportionately in the same year (see Figure 4.1). Inflation during 1991 declines to 43% while period average inflation still remains at 47%. The fact that the inflation rate remains higher than the rate of money growth results from prices being determined by pastinflation, the past rate of nominal exchange depreciation and the level of capacity utilization and only to a limited extent by thecontemporaneous rate of money growth. Consequently, the real supply of money and hence, of domestic credit, falls by about 6% in 1991. This is assumed to increase real interest rates by about 3.5 percentage points from the very low level of 2% in 1990 to 5.5% in 1991, somewhat above international rates. The upward pressure on domestic interest rates attracts foreign capital and the real exchange rate further appreciates by about 3.5% from 1990 to 1991. Higher real interest rates also increase domestic nominal interest rates which leads to a reduction in demand for money and velocity rises from 10.6 in 1990 to 10.8 in 1991. However, the reduction in money demand as a result of higher interest rates is not sufficient to equilibrate the money market by itself, and output must adjust for the market to clear. Hence, there is a fall in capacity utilization by about 4% from .99 in 1990 to .95 in 1991. Real GDP growth declines sharply from the historical high of 8% in 1990 to almost zero in 1991. This primarily reflects the cost of adjustment due to the absence of perfectly flexible prices. It is only to a very

Table 4.2 Tax Scenario: Key Indicators

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
POLICY MIX												
Base Money Growth	0.81	0.50	0.40	0.32	0.26	0.20	0.16	0.13	0.13	0.13	0.13	0.13
Direct Tax Rate	0.125	0.135	0.166	0.172	0.166	0.173	0.172	0.184	0.181	0.184	0.189	0.189
NATIONAL ACCOUNTS												
Potential growth	0.043	0.043	0.048	0.048	0.048	0.051	0.054	0.057	0.058	0.059	0.059	0.058
Actual GDP Growth	0.010	0.080	0.002	0.009	0.075	0.071	0.092	0.065	0.071	0.063	0.046	0.048
Capacity Utilization	0.960	0.994	0.951	0.915	0.938	0.955	0.990	0.997	1.010	1.014	1.001	0.992
Normal Capacity Utilization	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Absorption Growth	0.053	0.138	0.014	0.006	0.070	0.072	0.095	0.056	0.064	0.054	0.040	0.049
Composition of GDP:												
Resource Balance	-0.005	-0.042	-0.038	-0.032	-0.033	-0.036	-0.042	-0.039	-0.038	-0.035	-0.032	-0.033
Consumption	0.777	0.809	0.808	0.804	0.803	0.803	0.806	0.804	0.803	0.801	0.799	0.799
Private	0.662	0.668	0.670	0.666	0.664	0.664	0.667	0.664	0.662	0.659	0.657	0.658
Public	0.116	0.141	0.138	0.138	0.139	0.139	0.139	0.140	0.141	0.141	0.142	0.142
Investment	0.227	0.233	0.230	0.228	0.230	0.233	0.236	0.235	0.235	0.235	0.233	0.233
Private	0.127	0.125	0.129	0.127	0.129	0.131	0.134	0.132	0.132	0.130	0.128	0.128
Public	0.101	0.108	0.101	0.101	0.102	0.102	0.102	0.103	0.104	0.104	0.105	0.105
Per Capita Consumption growth	0.057	0.044	0.000	-0.016	0.044	0.047	0.070	0.033	0.041	0.031	0.019	0.027
MONEY AND PRICES												
Real Average Exchange Rate	0.950	0.849	0.817	0.811	0.829	0.836	0.848	0.871	0.893	0.918	0.933	0.936
Expected Real Exchange Rate	0.852	0.850	0.843	0.854	0.855	0.851	0.865	0.885	0.905	0.930	0.930	0.930
Real Domestic Bond Rate	-0.053	0.020	0.055	0.050	0.040	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Income-Velocity	10.123	10.612	10.678	10.288	10.084	9.614	9.251	8.973	8.846	8.813	8.862	8.845
Inflation (e.o.p.)	0.650	0.510	0.428	0.284	0.167	0.094	0.046	0.051	0.063	0.083	0.101	0.090
Inflation (p.a.)	0.648	0.570	0.468	0.354	0.224	0.130	0.070	0.049	0.057	0.073	0.092	0.095
PUBLIC SECTOR												
(share of GDP)												
Nominal PSBR:	0.070	0.098	0.082	0.072	0.073	0.064	0.058	0.044	0.046	0.047	0.047	0.049
Inflation-Adjusted PSBR:												
Consolidated Public Deficit	0.050	0.074	0.038	0.033	0.046	0.044	0.046	0.034	0.036	0.033	0.029	0.030
Budget Deficit	0.011	0.024	0.002	0.000	0.011	0.007	0.009	-0.001	0.001	-0.002	-0.006	-0.005
SEEs Deficit	0.017	0.033	0.028	0.029	0.033	0.036	0.039	0.037	0.037	0.037	0.037	0.039
Central Bank	0.022	0.017	0.008	0.005	0.002	0.000	-0.001	-0.002	-0.002	-0.002	-0.003	-0.003
Financing:												
Money Creation	0.043	0.029	0.023	0.019	0.015	0.013	0.011	0.009	0.009	0.009	0.009	0.008
Net Domestic Borrowing	0.040	0.069	0.012	0.014	0.033	0.030	0.028	0.015	0.017	0.016	0.013	0.015
Net Foreign Borrowing	-0.033	-0.024	0.003	0.000	-0.002	0.001	0.008	0.010	0.010	0.009	0.007	0.007
Public Debt (net)	0.432	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380
Total Domestic (net)	0.073	0.137	0.149	0.162	0.183	0.202	0.212	0.215	0.217	0.221	0.224	0.229
Non-Financial	0.094	0.139	0.162	0.178	0.195	0.212	0.229	0.239	0.247	0.255	0.260	0.265
Total External (net)	0.350	0.243	0.231	0.218	0.197	0.179	0.168	0.166	0.162	0.160	0.156	0.150
EXTERNAL SECTOR:												
Resource Balance/GDP	-0.005	-0.042	-0.038	-0.032	-0.033	-0.036	-0.042	-0.039	-0.038	-0.035	-0.032	-0.033
CAB/GDP	0.012	-0.023	-0.019	-0.013	-0.015	-0.019	-0.026	-0.025	-0.025	-0.023	-0.020	-0.022
Total External Debt/GDP	0.523	0.423	0.412	0.400	0.380	0.360	0.339	0.329	0.318	0.310	0.303	0.295
Total Net External Debt/GDP	0.405	0.319	0.311	0.300	0.281	0.265	0.256	0.256	0.254	0.252	0.250	0.245
Private External Debt/GDP	0.087	0.105	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Total Interest/Exports	0.145	0.123	0.128	0.121	0.123	0.122	0.128	0.131	0.132	0.130	0.132	0.134
Stock of Reserves (US$ mio)	6178.9	7955.3	8280.9	8855.9	9914.6	10718.9	10366.8	9667.7	9037.6	8671.3	8693.8	8687.3

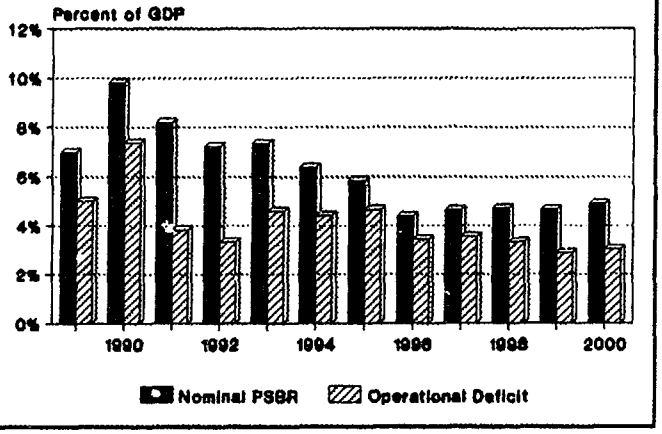
small extent due to the fiscal contraction that accompanies the reduction in the growth rate of money supply in order to make it sustainable in the medium run (see Figure 4.2).

Figure 4.1: Inflation under Fiscal Stabilization.



The fiscal contraction is larger than what would be required merely to offset the revenue lost from the current slowdown of money creation. As seen in Table 4.2, the financing lost from the reduction in money creation is only 0.6% of GDP while the reduction in the budget deficit is 2.2% of GDP.[18/] This reduction is obtained by increasing the direct tax rate on the private sector's income from 13.5 to 16.6 percent.[19/] A sharper fiscal reduction is needed because the 1990 deficit is incompatible with both maintaining inflation around 50% per year and keeping the ratio of public debt to GDP constant. Note that, while the total nominal PSBR falls from 9.8 to 8.2% of GDP between 1990 and 1991, the inflation adjusted deficit falls from 7.4 to 3.8% of GDP (see Figure 4.3). It is the inflation-adjusted deficit that accurately reflects the required fiscal effort and not the nominal PSBR since the size of the

Figure 4.3: Fiscal Adjustment



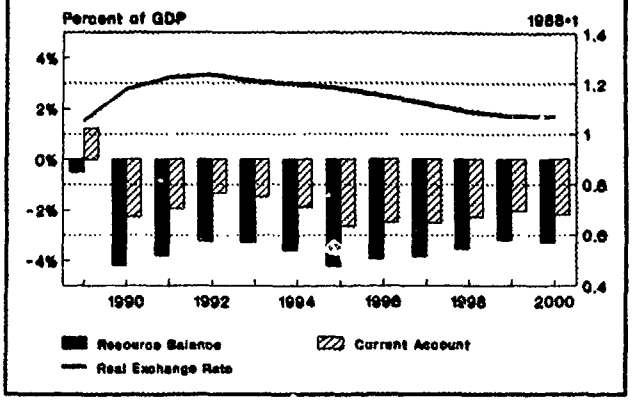
[18/] The deficit of the SEEs declines because of the anticipated reduction in stockbuilding in 1991 as expressed in the government's program. The central bank's deficit declines because of an improvement in its net foreign exchange position as a result of the increase in foreign exchange reserves and an increase in the real rediscount rate.

[19/] The increase in the tax rate does not lead to a one-for-one percentage-point reduction in the deficit because of the use of different denominators. The tax rate is expressed as a ratio of factor income of the private sector which is less than GDP, while the deficit is expressed as a share of GDP.

latter is influenced by the composition of public debt between domestic and external.[20/]

As mentioned above, the reduction in the real money supply and domestic credit available to the private sector leads to capital inflows and an exchange rate appreciation. As economic growth slows down considerably, however, exports rise as a share of GDP while imports remain constant, leading to an improvement of the resource balance as a share of GDP. This spills over in an improvement of the current account as a share of GDP from a deficit of 2.3% in 1990 to a deficit of 1.9% in 1991 or US$2.2 billion (see Figure 4.4). Together with further external borrowing of the private sector, this allows the central bank to increase foreign exchange reserves by about US$300 million.

Figure 4.4: External Accounts



Consistent with the observations on nominal contracts in Turkey, price rigidities are assumed to disappear within one year and there is no problem with the credibility of the program because the private sector would have observed an actual decline in prices backed by a fiscal adjustment. Hence, in 1992, end-of-period inflation is lower than the growth rate of reserve money and real money balances rise. Inflation does not decline enough, however, to make real balances rise enough to match the increase in real demand for money, as a result of the reduction in expected inflation. Therefore, real interest rates stay high and capacity utilization needs to fall further to equilibrate the money market. If the growth rate of money had not been reduced further or if private agents had guessed the change in money growth correctly and adjusted real money demand accordingly, no further reduction in capacity utilization would have been necessary. Lower inflation would have allowed the private sector to replenish its real money balances to desirable levels. In 1992, the further reduction in money growth is still met by nominal rigidities that prevent inflation from falling enough to equilibrate the money market. Hence, a second year of declining capacity utilization follows. This time it does not lead to a further fall in the actual growth rate since

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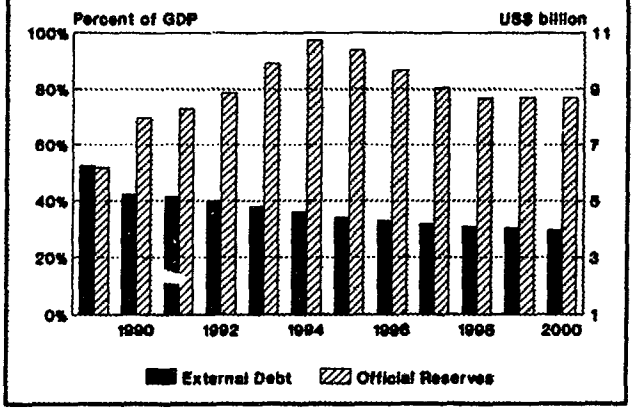
[20/] Under high inflation and with non-indexed debt, a shift to more domestic financing, as occurred in 1990, will widen the gap between the nominal PSBR and the inflation-adjusted deficit and will increase the PSBR for any given inflation-adjusted deficit. This is because the inflation component of nominal interest payments is equivalent to an early retirement of principal and leads to large current interest payments when inflation is high.

potential output continues to increase as well. There is still a moderate real appreciation of the average real exchange rate (less than one percent), but the expected real exchange rate already depreciates. The further fiscal reduction that supports the monetary contraction by 0.5% of GDP for the inflation adjusted deficit, matches almost exactly the loss in revenue from the money creation (0.4% of GDP). The overall nominal PSBR declines further by 1% of GDP. Direct taxes as a share of private sector income need to be increased further from 16.6% in 1991 to 17.2% in 1992. The second consecutive year of low growth again raises the share of exports in GDP while maintaining imports constant as a share of GDP and leads to improvements of the resource balance, the current account, and the international reserve position of the central bank. Total net external debt of the economy (including central bank reserves) declines slightly as a share of GDP to about 30%.

Figure 4.5: Debt and Reserves

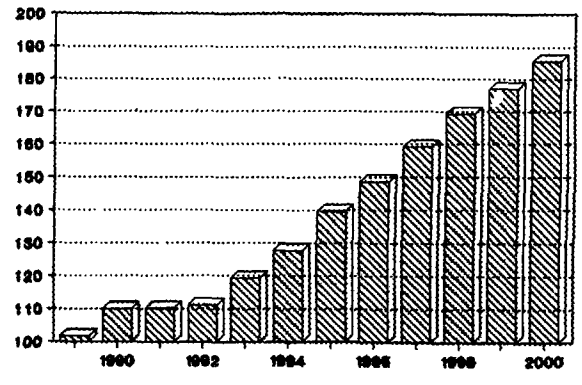


After the two consecutive years of low growth and a decline of capacity utilization the economy recovers from the temporary losses induced by the price rigidities and inflation starts to adjust more rapidly than the decline in the rate of money growth leading to an expansion of the real supply of money. This enables the rate of capacity utilization to recover and domestic interest rates to fall. At the same time the exchange rate starts to depreciate. Economic growth recovers strongly and reaches 7.5% in 1993. Consequently, as economic growth improves the fiscal position there is no need to increase taxes to offset a further decline in the revenue from money creation. In fact, taxes can even be lowered and the inflation adjusted deficit can increase somewhat, without leading to a larger share of public debt in GDP. The worsening of the external accounts due to higher growth is partially offset by the modest exchange rate depreciation and the current account deficit increases from1.3 to 1.5% of GDP. As Turkey's creditworthiness is unaffected or even improved, however, increased foreign borrowing leads to further reserve accumulation by the central bank while the total net external debt GDP ratio declines to 28% (see Figure 4.5).

During most of the remainder of the decade capacity utilization rates continue to improve leading to economic growth rates in excess of normal medium-term growth and rapid increases

in real output (Figure 4.6). From 1993 to 1998, the economy grows at an average annual rate of 7.3%. Thereafter, the economy slows down somewhat but will settle in the medium term at growth rates close to 6% per year. From 1995 onwards, inflation stays below 10% per annum, yielding a revenue from money creation just below 1% of GDP. In order to maintain inflation at this level, the nominal PSBR including the central bank must fall below 5% of GDP while the inflation adjusted PSBR must not be higher than 3% of GDP. The direct tax parameter, representing the fiscal policy stance, has increased to almost 19% of value added of the private sector. This implies an increase in direct tax revenue by 40% in real terms if the government were to rely solely on this instrument to reduce the fiscal deficit. In the medium-term the scenario of fiscal adjustment does not cause any problems on the external accounts. Although initially the current account worsens to about 2.5% of GDP as economic growth is sustained at high levels, the stock of external debt as a share of GDP does not increase. Towards the end of the simulation period, the current account deficit stabilizes at about 2.2% of GDP and the resource balance around 3.3% of GDP. International reserves of the central bank stabilize at about US$8.7 billion.

Figure 4.6: Real GDP



Qualifications

Higher real interest rates. Given the recursive nature of the model, the time path of the real domestic interest rate, an intermediate variable imposed on the simulations but usually solved for simultaneously, is of crucial importance for the simulations. With adequate fiscal retrenchment as assumed in the scenario presented above, the domestic interest rate increases only because of the monetary contraction. It is difficult to assess the response of the interest rate to such a contraction and even if estimated demand equations had been used, it is not certain that elasticities obtained in a period of accommodating monetary policy with relatively high inflation would continue to hold under a contractionary policy.

In order to test the sensitivity of the model to the real interest rate, the same scenario,

hereafter designated as "reference scenario", is simulated with an interest rate response three times as strong. This implies for 1991 that the ex-ante real interest rate would increase to 9.5 % (See figure 4.7) and return more slowly to the medium-term level of 3.5%.[21/] Since higher real interest rates imply that domestic demand is stronger for a given reduction in real money supply, output is expected to be higher initially. The simulation results indeed show an initially higher growth rate of 2.7 percent in 1991 while the bulk of the adjustment costs are taken in 1992 when output falls 1.5% (see Figure 4.8).

Figure 4.7: Comparison of Ex-Ante Real Interest Rates

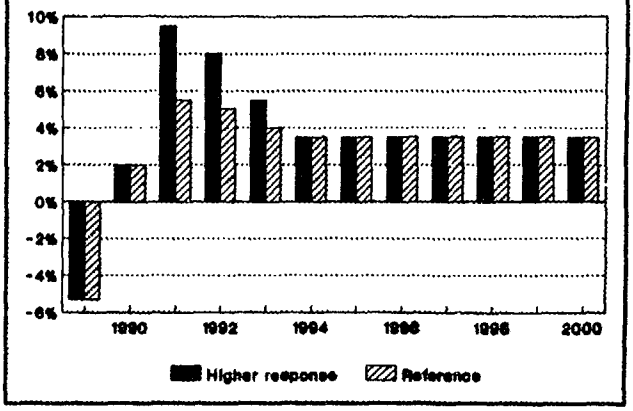


Figure 4.8: Comparison of GDP Growth

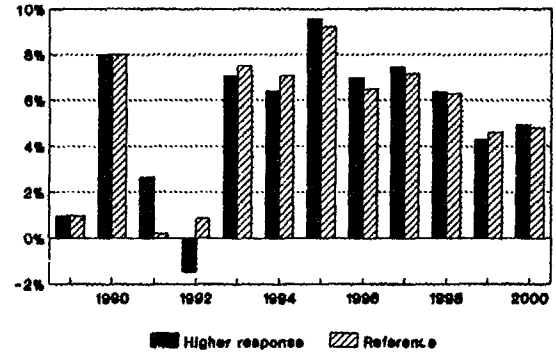
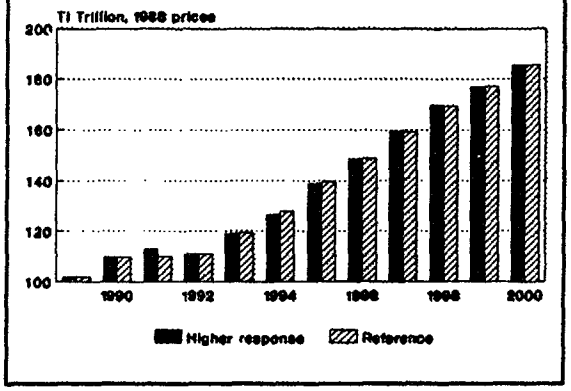


Figure 4.9 Comparison of Real GDP



Thereafter, output recovers quickly and subsequent growth rates lead the economy to reach the same level of output as in the reference simulation by the end of the period (see Figure 4.9). The time path of inflation is essentially unmodified as it is mainly determined by the price equation (see Figure 4.10). Overall, the difference with the reference scenario is rather small, implying comparable behavior of the economy for a wide range of interest rate responses.

[21/] Ex-post real interest rates will be different because the difference between expected and actual inflation. Typically, in disinflationary programs ex-post real rates exceed ex-ante rates significantly. In the reference scenario, ex-post real rates are higher than 10% in the period 1994-95 while ex-ante rates are below 5%.

No contemporaneous effects of money on prices. Although the econometrically estimated price equation is statistically highly significant, the presence of the current growth rate of base money is translated immediately into a change in the inflation rate at no output cost. Admittedly, the weight of this variable is only 23% so that the effect of price rigidities still dominates. In order to test the robustness of the results the coontempo-oraneous money supply was set equal to zero. Consequently, current inflation becomes a function of past inflation, the parameter on change in the nominal exchange rate and the deviation of capacity utilization from its normal level. This modification leads to a stronger initial recession in 1991 but allows the economy to recover quickly thereafter (see Figure 4.11). The path of inflation is essentially the same reflecting the dominance of all other variables in the price equation (see Figure 4.12). Since the initial fall in capacity utilization is somewhat stronger, inflation falls faster in the period 1993-95, as private agents are more willing to adjust their prices. By the end of the projection period there are no significant differences between the simulations and the level of real output is almost identical (Figure 4.13). Given these results, the exlusion of contemporaneous money growth shifts the recession towards the beginning of the period as agents need more time to adjust their expectations but leaves all other conclusions unaltered.

Figure 4.10: Comparison of Inflation

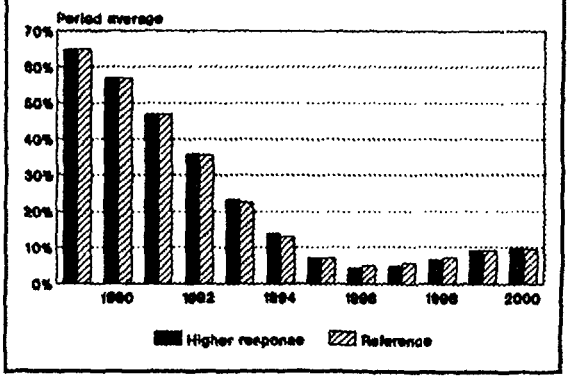


Figure 4.11: Comparison of GDP Growth

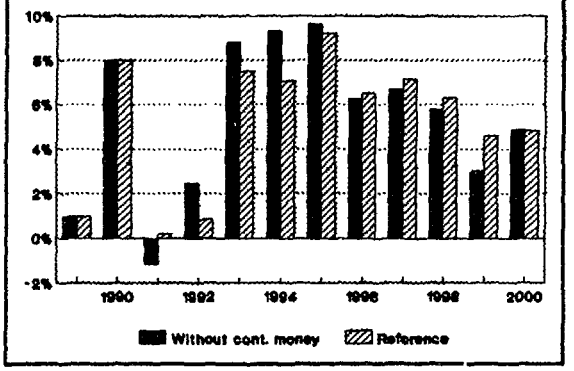
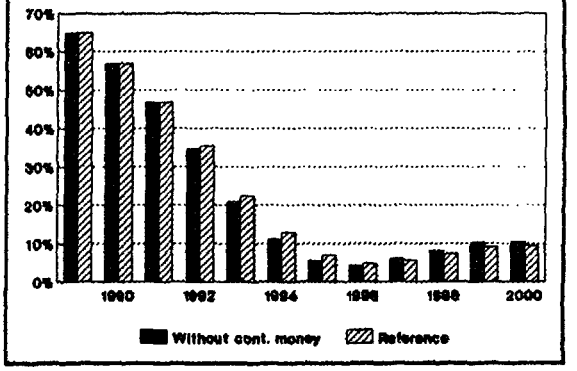


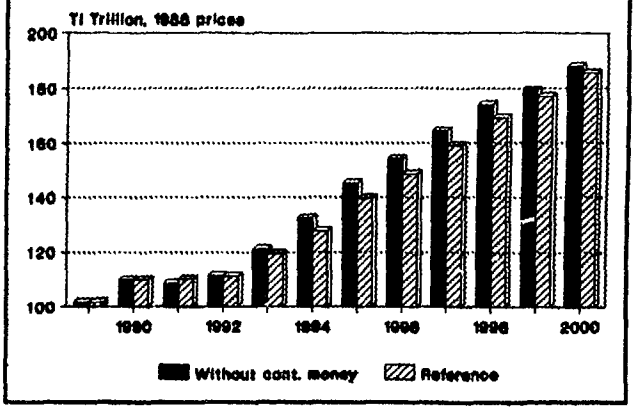
Figure 4.12: Comparison of Inflation



Slower monetary contraction. As the adjustment costs in the reference scenario are substantial one might consider a slower monetary contraction. A reduction in the growth rate

of base money by 10% per year instead of 20% per year not surprisingly lengthens the adjustment process while alleviating its impact in the earlier years. Growth declines from 8% in 1990 to 2.9% both in 1991 and 1992 instead of 0.2% and 0.9%, respectively. However, inflation never declines below 12% throughout the entire simulation period (see Figure 4.14).

Figure 4.13: Comparison of Real GDP



As a consequence of the continuing decline in money growth the economy does not recover as much as in the previous scenario. The average growth rate for the period 1993-2000 is only 5.1% compared to 6.6% in the scenario with the faster adjustment. Hence, although initial hardship is less severe with faster money growth, total output in the economy is 7.5% smaller by the end of the simulation period (see Figure 4.15). Most other indicators are not significantly affected by the slower reduction of mon etary growth. The time profile of the reduction in the fiscal deficit is tilted into the future since initially more revenue from money creation is obtained. However, by the end of the simulation period the direct tax rate as a share of private factor income is the same across both alternatives. The welfare implications of the alternative scenarios depend crucially on the relative weights of inflation and output and on the private discount factor in Turkey's welfare function.

Figure 4.14: Comparison of Inflation

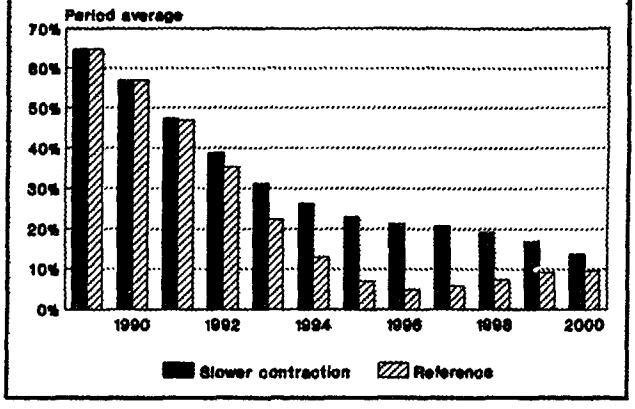
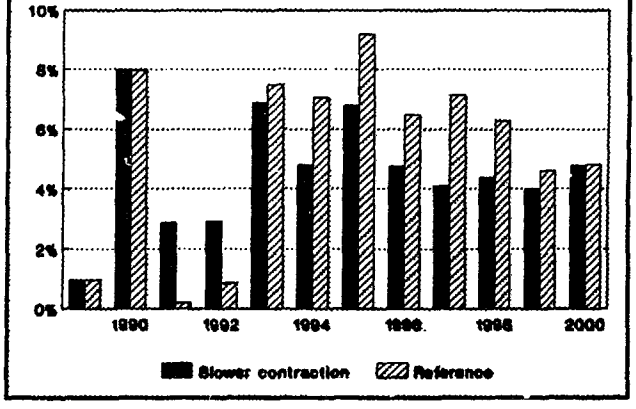


Figure 4.15: Comparison of Real GDP Growth



If the weight on output is large or if the discount factor is high, the alternative of a slower

reduction in money growth maybe welfare improving. Nevertheless, at any discount factor smaller than infinity the faster reduction of money growth would be preferable from 1995 onwards because per capita output is higher, and probably even before that if inflation has a positive weight since it is substantially higher than in the reference scenario from 1993 onwards. From the political perspective, given the 1992 elections, the slower monetary contraction may improve re-election chances for the Government. This proposition is, however, doubtful as in any case growth rates will have been drastically decreased while little progress will have been made on the inflation front. If inflation is a more important issue, the scenario with the faster slowdown in money creation is clearly preferable.

Although the scenario of fiscal stabilization is economically feasible, based on the econometric estimates, the required fiscal adjustment is substantial and the temporary output costs are significant. The scenario implies two years of harsh adjustment, during one of which consumption per capita actually declines. The adjustment comes at a difficult moment for the present Government in the light of the 1992 elections. Hence, possible slippage in the area of economic management is to be expected primarily from the fiscal side. An alternative scenario could arise from the unwillingness of the government to adjust the fiscal deficit based on the perception that it would lead to a fall in growth while at the same time the monetary authorities continue to reduce the rate of growth of money supply. It may become clear during the implementation of such a policy package, however, that the monetary contraction has severe negative output effects because of the credit squeeze that it provokes. A relaxation of monetary policy inspired by the desire to maximize output growth in the short-run would be a second alternative.

4.4. MONETARY CONTRACTION WITHOUT FISCAL ADJUSTMENT

While coordination between fiscal and monetary policy is crucial for the permanent success of a disinflationary program, the Turkish central bank has independently reduced the rate of monetary expansion in 1990. By provoking a credit squeeze and a rise in domestic interest rates it hoped to coerce the non-financial public sector to reduce the fiscal deficit. In the mean time, the public sector received less revenue from money creation, and, therefore, had to borrow more. A monetary contraction not sustained by a fiscal contraction is akin to a fiscal expansion. Private economic agents are no longer taxed as much on their current money holdings. Nevertheless, due to the price rigidities, the monetary contraction still has short-run

adjustment costs.

For the sake of exposition, it is assumed in this scenario that private agents perceive it as sustainable and that both foreign creditors as well as domestic economic agents are willing to absorb an increasingly larger amount of public bonds. This assumption would only be realistic if it is believed that the Government will make the correct fiscal adjustment in the future. In this hypothetical situation economic agents do not have adverse inflationary expectations and do not charge a risk premium on Government bonds. Consequently, domestic real interest rates are high but are not increasing as the ratio of public debt to GDP rises. As it turns out, this scenario becomes quickly unsustainable, which indicates that this policy cannot be followed more than a couple of years. The same rate of reduction in money growth as in the fiscal stabilization scenario, i.e., a decline by 20% per year, is implemented while fiscal policy is kept the same as in 1990 throughout the simulation period, except for a reduction in public stockbuilding which was extra-ordinarily high in 1990. As a result of the assumption about the credibility of this scenario, inflation follows a very similar time path as in the scenario of fiscal stabilization. However, the model generates whatever public debt will be given by the constant fiscal stance. The transition path of the economy is still marked by price rigidities that lead to short-run adjustment costs (see Table 4.3). The relative fiscal expansion does not offset much of this rigidity, and output growth declines to 0.6% and 0.9% in 1991-92, as opposed to 0.2% and 1% in the fiscal stabilization scenario. Domestic real interest rates are significantly higher and the real exchange rate appreciates more than in the previous scenario (see Figure 4.16). Consequently, both fiscal and external accounts deteriorate significantly. Even with falling

Figure 4.16 Monetary contraction

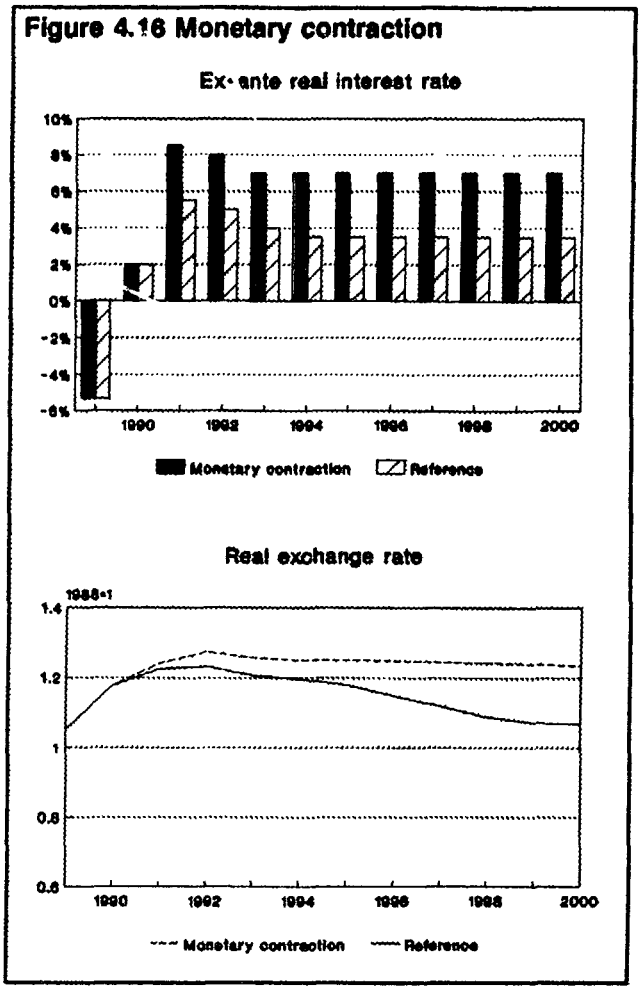


Table 4.3 Borrowing Scenario: Key Indicators

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
POLICY MIX												
Base Money Growth	0.81	0.50	0.40	0.32	0.26	0.20	0.16	0.13	0.13	0.13	0.13	0.13
Direct Tax Rate	0.125	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135
NATIONAL ACCOUNTS												
Potential growth	0.043	0.043	0.048	0.048	0.049	0.053	0.055	0.058	0.059	0.061	0.062	0.061
Actual GDP Growth	0.010	0.080	0.006	0.010	0.084	0.069	0.080	0.073	0.079	0.066	0.049	0.050
Capacity Utilization	0.960	0.994	0.954	0.919	0.950	0.964	0.986	1.001	1.019	1.024	1.012	1.001
Normal Capacity Utilization	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Absorption Growth	0.053	0.138	0.026	0.019	0.084	0.072	0.089	0.079	0.085	0.069	0.050	0.050
Composition of GDP:												
Resource Balance	-0.005	-0.041	-0.042	-0.043	-0.047	-0.050	-0.058	-0.064	-0.070	-0.074	-0.075	-0.075
Consumption	0.777	0.809	0.812	0.813	0.815	0.817	0.821	0.824	0.827	0.829	0.830	0.830
Private	0.662	0.668	0.674	0.676	0.678	0.680	0.684	0.687	0.690	0.692	0.693	0.693
Public	0.116	0.141	0.138	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137
Investment	0.227	0.233	0.231	0.230	0.232	0.233	0.237	0.240	0.243	0.245	0.245	0.246
Private	0.127	0.125	0.130	0.131	0.132	0.133	0.137	0.139	0.142	0.145	0.144	0.145
Public	0.101	0.108	0.101	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.101	0.101
Per Capita Consumption growth	0.057	0.044	0.013	-0.001	0.061	0.048	0.065	0.056	0.061	0.046	0.030	0.028
MONEY AND PRICES												
Real Average Exchange Rate	0.950	0.849	0.805	0.785	0.796	0.800	0.800	0.801	0.803	0.805	0.807	0.810
Expected Real Exchange Rate	0.852	0.850	0.843	0.844	0.844	0.840	0.837	0.835	0.835	0.835	0.835	0.835
Real Domestic Bond Rate	-0.053	0.020	0.085	0.080	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
Income-Velocity	10.123	10.612	10.718	10.263	10.086	9.652	9.283	9.016	8.849	8.767	8.774	8.861
Inflation (e.o.p.)	0.650	0.510	0.428	0.275	0.160	0.100	0.057	0.044	0.051	0.074	0.092	0.091
Inflation (p.a.)	0.648	0.570	0.468	0.349	0.216	0.129	0.078	0.051	0.048	0.063	0.083	0.091
PUBLIC SECTOR												
(share of GDP)												
Nominal PSBR:	0.070	0.098	0.111	0.115	0.117	0.119	0.116	0.112	0.113	0.118	0.126	0.136
Inflation Adjusted PSBR:												
Consolidated Public Deficit	0.050	0.073	0.068	0.070	0.082	0.092	0.096	0.097	0.098	0.097	0.097	0.105
Budget Deficit	0.011	0.025	0.030	0.035	0.044	0.052	0.055	0.056	0.055	0.054	0.052	0.055
SEEs Deficit	0.017	0.033	0.029	0.030	0.035	0.040	0.042	0.042	0.043	0.043	0.043	0.046
Central Bank	0.022	0.016	0.008	0.005	0.002	0.001	-0.001	-0.001	0.000	0.000	0.002	0.004
Financing:												
Money Creation	0.043	0.029	0.023	0.019	0.015	0.013	0.011	0.009	0.009	0.009	0.009	0.009
Net Domestic Borrowing	0.040	0.069	0.039	0.041	0.054	0.061	0.058	0.052	0.043	0.034	0.027	0.029
Net Foreign Borrowing	-0.033	-0.024	0.006	0.010	0.013	0.018	0.027	0.036	0.046	0.054	0.061	0.067
Public Debt (net)	0.432	0.380	0.405	0.437	0.464	0.506	0.546	0.589	0.626	0.666	0.713	0.763
Total Domestic (net)	0.073	0.137	0.175	0.215	0.252	0.297	0.333	0.362	0.379	0.390	0.399	0.410
Non-Financial	0.094	0.139	0.190	0.240	0.286	0.343	0.399	0.454	0.503	0.552	0.603	0.657
Total External (net)	0.358	0.243	0.230	0.223	0.212	0.209	0.213	0.226	0.247	0.276	0.313	0.353
EXTERNAL SECTOR:												
Resource Balance/GDP	-0.005	-0.041	-0.042	-0.043	-0.047	-0.050	-0.058	-0.064	-0.070	-0.074	-0.075	-0.075
CAB/GDP	0.012	-0.022	-0.024	-0.025	-0.030	-0.036	-0.046	-0.054	-0.063	-0.070	-0.076	-0.081
Total External Debt/GDP	0.523	0.423	0.407	0.390	0.366	0.347	0.326	0.309	0.294	0.282	0.273	0.266
Total Net External Debt/GDP	0.405	0.318	0.311	0.305	0.298	0.297	0.303	0.318	0.340	0.371	0.410	0.450
Private External Debt/GDP	0.087	0.105	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Total Interest/Exports	0.145	0.123	0.128	0.123	0.125	0.126	0.131	0.135	0.138	0.138	0.143	0.145
Stock of Reserves (US$ mio)	6178.9	7984.3	7940.7	7302.0	6341.3	4495.4	933.7	-4837.7	-13332.0	-24841.4	-39282.7	56764.2

inflation, the nominal PSBR increases from 9.8% in 1990 to 11.1% in 1991 and edges up further to more than 13% by 2000 (see Figure 4.17). Mainly as a result of the increasing stock of public debt, the inflation-adjusted deficit also increases to more than 10% of GDP, a deterioration of more than 7 percentage points of GDP, compared to the reference scenario (see Figure 4.18). This is also reflected in a rapidly rising stock of public debt as a share of GDP. Total net public debt rises from 38% to 40.5% of GDP between 1990 and 1991 and continues to increase by about 4 percentage points of GDP per year to reach more than 76% by the end of the simulation period (see Figure 4.19). As long as the weighted average real interest rate on public debt exceeds the real growth rate of the economy and the primary deficit minus the revenue from money creation is positive, this ratio will continue to increase.

Figure 4.17: Nominal PSBR

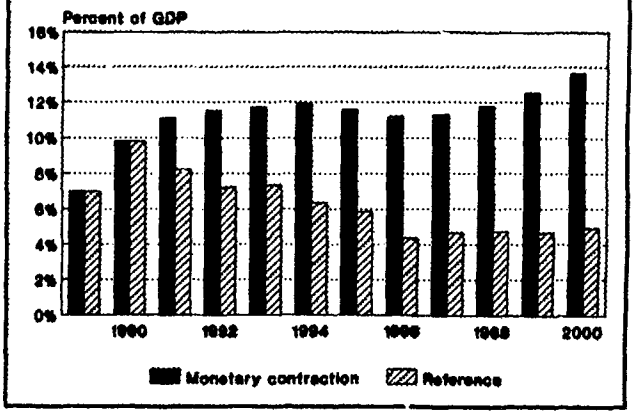


Figure 4.18: Operational Deficit

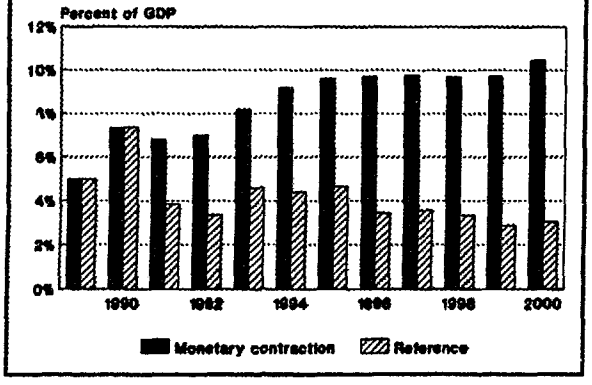
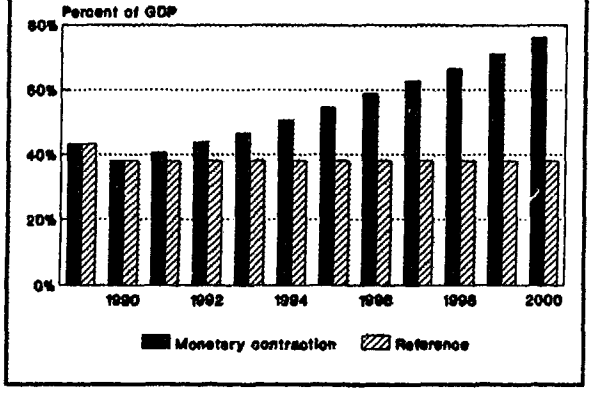


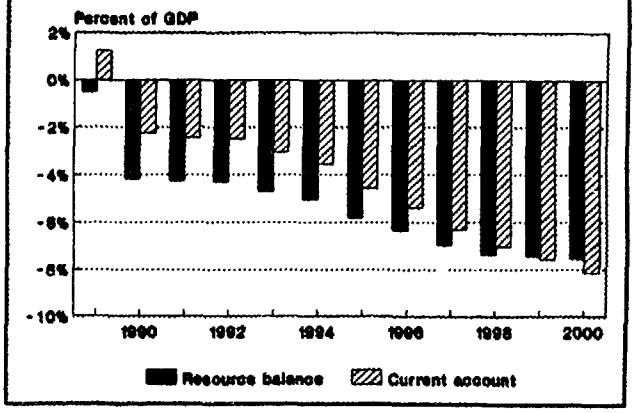
Figure 4.19: Net Public Debt



The evolution of the external accounts mirrors the domestic effects of the monetary contraction without fiscal adjustment. The real appreciation initially worsens the resource balance only moderately, since growth falls. Starting in 1993, however, the real exchange rate stabilizes and growth resumes, worsening the resource balance significantly (see Figure 4.20). The resource gap stabilizes at around 7.5% of GNP, and the current account deficit reaches similar levels. Contrary to the fiscal stabilization scenario, the current account deficit is not lower than

the resource balance, because of interest payments due on an increasing stock of external debts. At the current level of international reserves, the current account deficits can only be sustained for a short period. From 1996 onwards the stock of reserves of the central bank turns negative and the central bank's foreign borrowing increases rapidly (see Table 4.3)[22/].

Figure 4.20: External Accounts



Although the simulations are technically feasible, the ever-increasing stock of net domestic and foreign public debt increases the likelihood that the real interest rate will exceed the real growth rate of the economy. Hence, the recently initiated attempt to disinflate by monetary policy alone has put the economy on an unfeasible medium-term path. As long as private agents believe that the Government will run future surpluses the economy can remain on this path. Given Turkey's history of using the inflation tax to finance mushrooming fiscal deficits, however, the private sector will most likely anticipate the return of the inflation tax. At some point, a further monetary contraction will no longer be perceived as sustainable and private agents will revise their inflationary expectations upward, resulting in a much stronger credit contraction for any given monetary policy. Alternatively, they may demand a risk premium on Government bonds. Initially, the exchange rate might still appreciate as further external borrowing is attempted, but given the likely loss of output due to this contraction, any foreign borrowing raises external debt/GDP ratios and the loss of credibility will spill over to international credit markets leading to a foreign credit constraint. Some of these expected developments materialized in the first quarter of 1991; private agents expect inflation to be higher by 10-15% in 1991, short-term ex-ante real interest rates on Treasury bills have risen above the growth rate of the economy and the real exchange rate has started to depreciate.

The simulation of a scenario with a shift in expectations or a worsening of credibility cannot be done without modifying the underlying behavioral equations of the model. This poses the crucial problem of the timing of the shift in the behavior of the private sector. This issue

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[22/] A negative stock of reserves simply implies that the Central Bank can borrow sufficiently to sell the foreign exchange in the domestic market in order to finance the current account deficit.

cannot be addressed within the analytical framework developed above, in part because the dynamics of such developments are better expressed in terms of months or weeks rather than years. Nevertheless, embarking on a path as described in Table 4.3 increases the probability of a dramatic shift in the private sector's behavior which will almost certainly lead to larger costs than those involved in the fiscal stabilization scenario. Knowing this, the Government may choose to forego the short-run costs and avoid the unsustainable debt dynamics by continuing to rely on the inflation tax instead of making a reduction of inflation one of its primary objectives. Unfortunately, this is what appears to be happening in the first quarter of 1991 as the central bank has abandoned its restrictive monetary program and tripled its advances to the Treasury.

5. CONCLUDING REMARKS

This paper has shown how the standard RMSM-X model can be transformed into a model useful to analyze short-term behavior of the economy. The incorporation of an estimated price-equation and the solution of the money market for capacity utilization yields a short-run Phillips curve. Deviations of capacity utilization from its normal level will lead to price adjustments in the following period, giving the model a stable behavior over time. If actual and expected inflation are equal, the model will exhibit full employment and remain in that steady state. Admittedly, the recursive nature of the model imposes a somewhat peculiar use of lagged variables and the closure of markets through quantities. To the extent that the lagged responses can be motivated by theory or econometric estimation this does not pose a problem. The quantity closure of markets requires some ex-post checking of the behavior of the variables that close the markets and necessitates a sensitivity analysis of the solution to the specified time path of the key intermediate variable, in this case, the real domestic interest rate.

Turning to the problem of inflation stabilization in Turkey, the scenarios make clear that a sizeable up-front fiscal adjustment is necessary to embark on a credible disinflation program. They also reveal that the 1990 situation of contractionary monetary policy and fiscal expansion cannot continue and that, in the absence of fiscal adjustment, a return to the use of the inflation tax is unavoidable. In any case, with or without fiscal adjustment, a monetary contraction will have sizeable costs in terms of lost output. During the initial years of the stabilization program, output growth is likely to slow to almost zero. However, once this cost is incurred, per capita income will recover quickly and medium-term growth rates of around 5% per year are feasible. Delaying the adjustment will most likely increase its costs and raises the risk of accelerating

inflation due to the likely shift in private agents' expectations as the credibility of economic policies declines.

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