A Macroeconomic General Equilibrium Model for Turkey: Disinflation, Fiscal Austerity and Labor Markets

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1 Introduction

After a decade of volatile and erratic growth, persistent high rates of inflation, a deteriorated fiscal performance and rapidly increasing debt burden, Turkey initiated an extensive stabilization program to restore its macroeconomic balances in December 1999. Backed and supervised closely by the International Monetary Fund (IMF), the program exclusively relied on a nominally-pegged (anchored) exchange rate system for dis-inflation and targeted a series of austerity measures and structural reforms to restore the fiscal balances.

Despite some progress in 2000, with inflation falling and the public sector recording a sizable primary surplus, unfavorable debt dynamics and financial sector weaknesses combined with the rigidities imposed by the exchange rate peg led to the collapse of the peg and a full-blown financial crisis in February 2001. The crisis was severe, with real GDP falling by 7.4 percent in 2001; inflation in wholesale prices hit

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almost 90 percent, and the Turkish Lira lost about half of its value against the major foreign currencies.[1]

The social costs of the crisis have been high. Per capita GDP contracted by 13 percent between 1998 and 2001. The officially recorded unemployment rate rose from 6.5 percent in 2000 to 8.4 percent in 2001, and to 10.5 percent in 2003. Real wages in manufacturing remained relatively constant through 2000 as nominal wage increases kept pace with inflation, but then declined sharply in 2001 by 11.5 percent (See Table 1).

(Insert Table 1 here)

Credit to the private sector (particularly in the non-tradables sector) fell sharply as the real rates of interest rose to exorbitant levels. In an attempt to combat the deepening banking crisis, the government implemented a rescue operation and issued new debt instruments to re-capitalize the failing banks. It is estimated that the cost of revitalization of the banking sector reached 30 percent of the gross national product.[2] Thus, the ratio of the aggregate public debt stock to GNP rose from 37.7 percent in 1996 to 91.0 percent in 2001.

In response to the crisis and in order to revive the now-stalled reforms, a new *stand-by* agreement was signed with the IMF. The program, which is planned to be operative at least until 2008, incorporates a wide set of issues concerning financial sector, public sector, agriculture and social security, yet relies mainly on three pillars: (1) fiscal austerity that targets pre-determined levels of primary surpluses for the public sector, as a ratio to gross domestic product, (2) contractionary monetary policy (through an independent central bank) that exclusively aims at price stability (with eventually open inflation targeting policy to be enacted starting January 2006), and (3) structural reforms almost in every area of public existence, to improve efficiency

[1]The underlying elements of the disinflation program and the succeeding crises are discussed in detail in Akyüz and Boratav (2002); Alper and Öniş (2002); Ertuğrul and Yeldan (2003) and Yeldan (2002).

[2]See e.g. Ertuğrul and Yeldan (2003), Alper and Öniş (2003).

and *governance* in the Turkish economy.

The European Union's decision to start negotiations on Turkey's full membership by October 2005 has been declared in this setting. The prospect of full membership to the EU, as well as strict adherence to the stabilization program under the guidance of the IMF are regarded as the two strong *institutional anchors* in consolidating the markets' expectations towards the Turkish economy. In fact, the development of the public debt overhang and the consequent need for continuous refinancing of the debt led to a very close link between financial market participants' perceptions of credibility of the government's program, key macroeconomic variables such as interest rates, exchange rates and inflation, and real variables such as employment and growth.

To this end, the program primarily aimed at providing a signal of confidence both to the domestic and international community suggesting that the Turkish fiscal authorities are adhering to the "proper mix of stabilization measures". The program identified the public budget primary surplus (public expenditures net of interest costs) as a ratio to the GNP as the most crucial indicator of this confidence game. According to the program's officially stated rationale, as the non-interest expenditures are reduced and the primary surplus target (of 6.5 percent to the GNP currently) is attained, real rate of interest would fall, converging to its international counterparts. The fall in the real rate of interest would then stimulate private consumption and investment, fueling growth through a virtuous mechanism of crowding-in which can be identified with a non-conventional phrase: *expansionary fiscal contraction*.

At a glance on Table 1, the Turkish economy shows a considerably high rates of growth during the post-crisis period. Inflation was sailing on a platform of 50 percent yearly average more than two decades; it ha snow come down to single digit levels. Concurrently, the public net debt stock, which stood around 91 percent of GNP in 2001 has come down to 64 percent of GNP at the end of 2004.

Turkey has faced these (seemingly strong) reductions in debt burden via drastic cuts in non-interest fiscal expenditures. Public investments have severely contracted

in sharp contrast with the high growth rates of the economy and public wages have been sternly cut down, in order to maintain the primary surplus values of 6.8 percent in 2001, 4.3 percent in 2002, 5.3 percent in 2003 and finally 6.2 percent in 2004.

Still, further investigation of the table reveals a number of vulnerability signs for the Turkish economy as we believe. Despite courageous growth rates in real GDP, the pace of employment creation remained stagnant. The unemployment rate has remained above 10 percent following 2001-the crisis year. Likewise, the table also traces the ever-worsening balance of payments (BOP) statistics, as reflected on the exchange rate appreciation and trade deficits. The appreciation of the nominal exchange rate has been needed to secure inflows of foreign capital, on which the whole growth performance of the economy depends. In 2003, the finance account of the BOP displayed a surplus of $5.9 billion. In contrast, the same account displayed a surplus of $1.2 billion in 2002. In 2004, if the unrecorded foreign exchange funds of $3.1 billion, which are displayed under the "net errors and omissions" column in the financial accounts is taken into account, we reach to a total sum of $11.6 billion of liquid inflows into the Turkish economic system. Considering that the same pace continues in 2005, it is not surprising that the current account deficit has reached to $11.1 billion in the first 5 months of 2005, compared to a value of $15.4 billion for the whole 2004. As the rapid growth of the current account deficits continue, the vulnerability of the Turkish economy keeps increasing, threatening objectives on both debt roll-over and favorable growth rates.

The abundance of foreign currency revealing itself on both increasing reserves and appreciating exchange rate in Table 1, clearly associates itself with still elevated real interest rates and expectations of high financial arbitrage. Such abundance encourages imports and in turn leads to enlarged deficits in foreign trade balances, while at the same time, reducing the TL-based external debt burden of the government.

Motivated by this current "success" story of the past four years, it has been argued by various observers that Turkey needs to continue running sizable primary surpluses over the medium to long term to lower its public debt burden, meet its

(dis)inflation targets and convince markets that the debt is sustainable, for the risk premium embedded in interest rates on domestic debt to fall. Mostly based on this impetus, many researchers and financial rating agencies conducted a series of programming exercises to monitor the Turkish fiscal sustainability and its debt burden in the short-to-medium run.[3] However, such exercises are often restricted to a partial adjustment framework, and do not go beyond an accounting check between the real rate of growth of the GNP, the interest rate, and the debt to GNP ratio. In fact, what is perhaps most notably lacking in these exercises is a general equilibrium framework where all macroeconomic variables are resolved in a consistent (Walrasian) system of flow equations describing production, expenditures on consumption and investment both by the private and the public sectors, savings and asset accumulation, the foreign economic relations, and the fiscal balances together with debt dynamics.

By itself, this endeavour is not new; over the years, a number of CGE models have been developed for Turkey. These include Lewis (1992), Yeldan (1997, 1998), Diao, Roe, and Yeldan (1998), Karadağ and Westaway (1999), De Santis (2000), Voyvoda and Yeldan (2005), Agénor et al (2004) and Elekdağ (2003). Those of Lewis (1992), Yeldan (1998), Elekdağ (2003) and Agénor et al (2004) include a financial sector, whereas the others are "real" models focusing on tax and trade policy issues. With the exception of Agénor et al (2004), in all of these models, the treatment of the labor market is fairly rudimentary and some important channels through which the real and financial sectors interact are absent. Indeed, as far as we are aware, some of these channels have been either ignored or improperly addressed in the previous literature; our framework should therefore be of independent interest to researchers focusing on other countries

[3]In one such study, Agénor (2001) reports that with an output growth rate of 5 percent, a real interest rate of 12 percent, and an inflation rate of 5 percent, a primary surplus of 3.5 percent of GNP would be needed to stabilize the Turkish debt-to-GNP ratio at 60 percent. More recently, Keyder (2003) carried out a similar exercise and, using detailed fiscal data, concluded that Turkey's debt would come out to be sustainable on the condition that the real interest rate be reduced to 15 percent or less. Noting that at the time of her writing (March, 2003), the weighted-average real interest rate was around 25 percent, Keyder recommended strict continuation of the austerity policies programmed. In addition, various financial institutions and rating agencies carried out similar exercises almost on a monthly basis in their close monitoring of the Turkish fiscal stance. In those exercises, various combinations of low and high rates of growth and real interest rates are contrasted to a "plausible" benchmark scenario, and the resultant debt-to-GNP ratio is reported. See also IMF (2000), and World Bank (2000).

with large market-financed debt overhangs.

The model captures a number of features that we believe are essential to analyze the impact of disinflation and fiscal reforms on labor market adjustment and public debt sustainability. First, it provides a proper account of linkages between the financial and the real sectors. Next, the labor market is disintegrated into its formal and informal components. Furthermore, there is a comparatively detailed financial system and credit market. We pay particular attention to the central bank's current inflation (targeting) policy with the effects on fiscal environment, production and labor markets and give emphasis to the financial sector issues such as high degree of exchange rate flexibility, external risk premium in the banking sector, dollarization of loans and bank deposits, the link between market interest rates and official policy rates, and interactions between credibility, default risk on government debt, and inflation expectations.

The remainder of the paper is organized as follows. Section II describes the model. Section III considers various policy experiments and discusses the response of production, wages and unemployment, as well as the behavior of various financial and fiscal variables. ..... (Explanation of the experiments here....) Finally in the last section, we summarize the main results of the paper and offer some concluding remarks and paths to future research.

2 Structure of the Model

This section reviews various building blocks of the model. We consider in turn the production side, the labor market, income formation, saving and investment, the financial sector and asset allocation decisions, and the links between default risk, credibility, and inflation expectations.

2.1 Production

The model is fairly aggregate over its microeconomic structure but accommodates a relatively detailed treatment of the labor market, and of real-financial sector linkages.

There are four production sectors as agriculture, industry, private services and public services. There is a financial sector with a full-fledged banking segment, a central bank, enterprises, government and household portfolio instruments. The model distinguishes between informal and formal production within the private sector.

Gross output supply in each sector is represented by a Leontief function constrained over the value added and intermediate inputs. the intermediate input demand in each sector is determined by fixed coefficients:

$$INT_i = \sum_j a_{ji} X_i^S \qquad i = AGRI, INDS, PRSV, GSRV \tag{1}$$

A two-level production technology for the value-added is assumed. Specifically, the formal labor, LF, private capital, KP, and public capital, KG, combine through a constant elasticity of substitution (CES) production function to form a composite factor which then combines with informal labor, IL to produce the value added:[4]

$$V_i = \overline{A}_{V_i} \left[\beta_{V_i} J_i^{-\rho_{V_i}} + (1 - \beta_{V_i}) LI_i^{-\rho_{V_i}} \right]^{-\frac{1}{\rho_{V_i}}} \tag{2}$$

2.2 Labor Market

In order to represent the main features of the labor market structure in Turkey, the "labor" in the model is disaggregated into its formal and informal components. As the evidence in Turkey suggests, the employment protection laws may have increased the insecurity faced by workers, as employers avoid paying altogether and hire short-term workers illegally, and may have shifted activity to the informal sector, with some adverse effects on tax revenues.[5] In the meantime, collective agreements between the government and the major trade unions -almost all civil servants and employees of state-owned enterprises are unionized- serve as a model for unions in the formal private sector. Based on these observations, we envisage that formal labor may be employed

[4]Note that in the specification of the production technology, we need a special treatment for the public services sector, i.e. for $i = GSRV, a_{ji} = 0$.

[5]Taymaz and Özler (2003) estimated that the informal sector accounts for more than 30 percent of output and 40 percent of employment in the manufacturing sector. Similar estimates are cited in Işkur (2003).

in privately dominated sectors, agriculture, industry and private services. In fact, Telli (2005?) provides estimates of the extent of informalization of labor and the corresponding wage rates in these sectors. The public sector employs only formal labor.

2.3 Income Generation

For the household, the basic sources of income are returns to labor input, the wages and returns to capital, distributed profits. The enterprise profits amounts to what is left over after paying both types of wages and profits to the government:

$$RP_i = PVA_i V_i^S - (1 + pyrltax)\overline{W}_F L_{F,i}^D - W_I L_{I,i}^D - RG_i \tag{3}$$

Profits from commercial bank activities, on the other hand are defined as the difference between the revenues from loans to firms (for investment financing in domestic currency) and households, income from holdings of government debt and interest payments on their borrowings from the central bank and interest payments on both household deposits and foreign loans:

$$\begin{aligned} PROF^B \quad = \quad & intLD[DomDebt_{-1}^E + DomDebt{-}1^H] + intB\,GDI_{-1}^B \\ & -intR\,DomDebt_{-1}^B - intD\,DD_{-1}^H - intDF\,\varepsilon FDDom_{-1}^H \\ & -intFW\,\varepsilon ForDebt_{-1}^B - intFW\,\varepsilon PFI^{ROW} \end{aligned} \tag{4}$$

In Equation 4, $intLD$ represents the domestic bank lending rate and is defined as a premium over the marginal cost of funds in the banking sector. $intB$ is the return on government bonds; $intR$ is the cost of funds provided by the central bank to the domestic banking sector, $intD$ is the interest on domestic-currency denominated deposits whereas $intDf$ denotes the interest on foreign-currency denominated deposits. $intFW$ on the other hand, is the country-risk premium inclusive foreign interest rate.

Therefore household total income composes of returns to productive labor, YHW_{net}, retained earnings from private production activities, net of funds allocated

to investment, $(1 - shpinv)YE_{net}$, retained earnings from commercial bank activities, $PROF^B$, interest receipts on holdings of financial assets, $intDDD^H$, $intDFFDDom^H$, $intFW^{RF}PFI^H$ and $intBGDI^H$, and government transfers including the transfers from the social security institutions, $GtrHH$, $SSItrHH$:

$$\begin{aligned} totYHH &= YHW_{net} + (1 - shpinv)YE_{net} + GtrHH + SSItrHH \\ &\quad + \varepsilon\, ROWtrHH + PROF^B + intD\, DD^H_{-1} + intDF\varepsilon\, FDDom^H_{-1} \\ &\quad + intFW^{RF}PFI^{HH} + intB\, GDI^H_{-1} \end{aligned} \tag{5}$$

Households save a fraction $0 < s^P < 1$ of their disposable income. The saving rate is considered to be a positive function of the expected real interest rate in domestic currency denominated deposits:

$$s^P = s^P_0 \left(\frac{1 + intD}{1 + E[Inf]} \right)^{\sigma^h_{SAV}} \tag{6}$$

with $E[Inf]$, the expected inflation rate and with s^P_0, the scaling parameter. The portion of income that is not saved is allocated to consumption and that total flow of savings of the household is channeled to the accumulation of household financial wealth, which also counts for the valuation effects on the stock of foreign-currency denominated deposits.[6]

2.4 Investment Behavior

As "fiscal prudence" is one of the most emphasized parts of the program as sketched in Introduction, government investment no longer treated to be policy variable of choice under the circumstances of the current Turkish economy. Therefore, in most of the policy settings, government investment is in a sense the "residual" variable, determined in consistency with the fiscal policy dominated by the primary surplus targets. Otherwise, it is taken as exogenous.

[6]Note that accounting for the valuation effects on the stock of foreign-currency denominated deposits is associated with the changes in the nominal exchange rate, which turns out to be one of the crucial variables in the model.

The private capital investment is assumed to depend on a number of factors: The first is the growth rate of real GDP, which captures the regular accelerator effect. This effect is positive. The next one is the negative effect of the expected real cost of borrowing from the domestic banks. Specifically, private investment demand is represented by:

$$\frac{PK\,PINV}{NomGDP} = \left(1 + \frac{\Delta\, RealGDP_{-1}}{\Delta\, RealGDP_{-2}}\right)^{\sigma_{ACC}} \left(\frac{1 + intLD}{1 + E[Inf]}\right)^{-\sigma_{INTL}} \tag{7}$$

where $NomGDP$ and $RealGDP$ stand for nominal and real GDP, respectively.

2.5 Financial Market, Asset Allocation and Risk Premia

Household's financial wealth is typically allocated to five different categories of assets: domestic money, H^d, domestic-currency denominated bank deposits held at home, DD^H, foreign-currency denominated deposits held domestically, $FDDom^H$[7], holdings of government bonds, GDI^H, and portfolio investments abroad, PFI^H[8].

Given the liabilities of the household, $DomDebt^H$, financial wealth of the household is defined as:

$$WT^H = H^d + \varepsilon FDDom^H + DD^H + GDI^H + PFI^H - DomDebt^H \tag{8}$$

where the accumulation of financial wealth should behave according to:

$$WT^H = WT^H_{-1} + PSAV + \Delta\varepsilon FDDom^H_{-1} \tag{9}$$

with $PSAV$ denoting private saving and with the term $\Delta\varepsilon FDDom^H_{-1}$, accounting for the re-valuation effects of the accumulated foreign-currency denominated stock of assets.

[7]By allowing households to hold foreign-currency denominated deposits in the domestic banking system, we try to represent the high level of dollarized liabilities in the Turkish financial system (See Table 1).

[8]Both residents' portfolio investments abroad, PFI^H and non-residents' portfolio investments at home, PFI^{ROW} are incorporated in the model in order to capture any real-economy effects of these "speculative" means, which we believe are important in understanding the growth pattern of the Turkish economy in the last decade.

The household demand function for currency is positively related to consumption and negatively related to expected inflation and interest on domestic-currency denominated deposits, $intD$. It also depends negatively on the interest on foreign-currency denominated deposits, $intDF$, adjusted for the expected rate of depreciation, $(1 + \Delta\varepsilon^{exp})$:

$$H^d = \frac{H^0 PRIVCON^{\theta^H_{CON}} E[Inf]^{-\theta^H_{INF}} (1 + intD)^{-\theta^H_{DD}}}{\{(1 + \Delta\varepsilon^{exp})(1 + intDF)\}^{\theta^H_{DF}}} \tag{10}$$

Household allocation on domestic vs. foreign-currency deposits is a function of the interest rate on domestic-currency denominated deposits as a ratio to the rate of return on foreign-currency denominated deposits held at home:

$$\frac{DD^H}{\varepsilon FDDom^H} = \left\{ \frac{(1 + intD)}{(1 + \Delta\varepsilon^{exp})(1 + intDF)} \right\}^{\theta^H_{DD}} \tag{11}$$

If the accumulated portfolio investments of households abroad is taken to be a fixed fraction of total household financial wealth, then it becomes possible to express the demand for government bonds by households as a ratio to the interest-bearing wealth, as follows:

$$\frac{GDI^H}{(WT^H - (H^d + PFI^H))} = \frac{(1 + E[intB])^{\theta^H_{GDI}} (1 + intD)^{-\theta^H_{DD}}}{[(1 + \Delta\varepsilon^{exp})(1 + intDF)]^{\theta^H_{FD}}} \tag{12}$$

Apart from the portion of retained earnings of the enterprises allocated to investment, $YENetInv$, forms borrow both domestically and abroad to finance their investment plans:

$$PK\,PINV = YENetInv + \Delta\, DomDebt^E + \varepsilon\, \Delta\, ForDebt^E - \Delta GDI^E \tag{13}$$

Equation 13 necessitates a decision on the allocation on the part of the firms, between funds to private investment and funds to government bonds, which, on one hand, depends on the average profit rate expected from production activity, and on the

other, expected returns on government debt instruments. Such a specification should correspond to a version of a financial crowding-out effect as referred in the literature.

$$\frac{PK\,PINV}{\Delta GDI^E} = \mu^E_{GDI}\left[\frac{(1+E[IntB])}{(1+avgRPR_{-1})}\right]^{-\sigma^E_{GDI}} \tag{14}$$

Equation 13 also calls for defining the composition of demand for loans, which may be assumed to depend on the lending rates on each category of loans, domestic and foreign:

$$\frac{\varepsilon\, ForBor^E}{DomBor^E} = \phi^E_{DomBor}\left[\frac{(1+intLD)}{(1+intLF)(1+\Delta\varepsilon^{exp})}\right]^{\theta^E_{DomBor}} \tag{15}$$

with $intLF$, the interest paid on foreign debt.$intLF$ is equated to the country-risk premium inclusive foreign interest rate, $intFW$.

To take into account the functioning of the commercial banking system as closely as possible, we assume that commercial banks in the model provide loans, both to households, $DomDebt^H$ and to firms, $DomDebt^E$; hold government bonds, GDI^E, and hold required reserves of the central bank, $ResReq$ on the asset side of their balance sheet. The domestic and foreign-currency denominated deposits, DD^H and $FDDom^H$, borrowings from the central bank, $DomDebt^B$, borrowing from abroad, $ForDebt^B$ and portfolio investments from abroad, PFI^{ROW} constitute the asset side of the banks' balance sheet:

$$\begin{aligned} &DomDebt^H + Domdebt^E + GDI^E + ResReq - NW^B \\ &\quad = DD^H + \varepsilon FDDom^H + \varepsilon ForDebt^B + DomDebt^B + PFI^{ROW} \end{aligned} \tag{16}$$

Among these financial instruments, the demand of commercial banks for government bonds as a ratio to net worth, for instance, is assumed to be positively related to the expected return on these bonds, $E[intB]$, and negatively related to the opportunity cost, which is the doemstic lending rate, $intLD$:

$$\frac{GDI^B}{NW^B} = \phi^B_{GDI}\left(\frac{1+E[intB]}{1+intLD}\right)^{\theta^B_{GDI}} \qquad \phi^B_{GDI} > 0 \tag{17}$$

The demand for foreign loans by commercial banks, then again, depends on the cost of borrowing from domestic households or central bank, in addition to the (premium-inclusive) cost of borrowing from abroad. The demand function then, can be specified as a function of the official interest rate, $intR$, and the foreign interest rate, $intFW$, adjusted for expected rate of depreciation:[9]

$$\frac{\varepsilon ForDebt^H}{NW^B} = \phi^B_{FD}\left(\frac{1+intR}{(1+intFW)(1+\Delta\varepsilon^{exp})}\right)^{\theta^B_{FD}} \qquad \phi^B_{FD} > 0 \tag{18}$$

Banks set both deposit and lending interest rates. The deposit rate on domestic-currency denominated deposits, $intD$, is set equal to the borrowing rate from the central bank, $intR$:

$$(1+intD) = (1+intR) \tag{19}$$

The deposit rate on foreign-currency deposits at home, on the other hand, is set on the basis of the (premium inclusive) marginal cost of borrowing on world capital markets:

$$(1+intDF) = (1+intFW) \tag{20}$$

In turn, the risk-premium inclusive foreign interest rate depends on the (risk-free) world interest rate, $intFW^{RF}$, and an external risk premium:

$$(1+intFW) = (1+intFW^{RF})(1+riskpr) \tag{21}$$

in which the risk premium is assumed to be a function of total foreign debt to exports ratio:

$$riskpr = contag + \frac{\kappa}{2}\left(\frac{\sum ForDebt}{\sum E_i}\right)^2 \tag{22}$$

[9]The equation implies that if domestic and foreign borrowing are perfect substitutes, then the central bank's refinancing rate cannot deviate from the premium-inclusive, and expectations-adjusted, world interest rate, that is $(1+intR) = (1+intFW)(1+\Delta\varepsilon^{exp})$.

In Equation 22, *contag* captures the characteristic changes in the "sentiments" in world capital markets.

Domestic risk premium, *dompr*, is one factor that affects the bank lending rate over loans to households and firms. It is assumed to depend positively on the ratio of assets to liabilities of private firms. Therefore, the risk premium charged by the banks reflects the "perceived" risk of default on their loans to domestic firms in the model. The bank lending rate, $intLD$ in the last analysis is defined as a weighted average of the cost of borrowing from the central bank and the cost of borrowing from foreign capital markets. It also takes into account the (implicit) cost of holding required reserves:

$$1 + intLD = \frac{\left\{(1 + intR)^{\kappa^B_{DL}}[(1 + intFW)(1 + \Delta\varepsilon^{exp})]^{1-\kappa^B_{DL}}\right\}(1 + dompr)}{1 - resreq} \quad (23)$$

2.6 Public Sector

Balance sheet of the central bank consists of, on the asset side, loans to commercial banks, $DomDebt^B$, foreign reserves (treated exogenously), FF, and government bonds held, GDI^{CB}. On the liabilities side, it has monetary base, consisting of domestic supply of money and required reserves:

$$DomDebt^B + \varepsilon FF - NW^{CB} = H^S + ResReq \quad (24)$$

The monetary base, then evolves according to:

$$MB = MB_{-1} + DomBor^B + \varepsilon\Delta FF + \Delta GDI^{CB} - PROF^{CB} \quad (25)$$

$PROF^{CB}$, above represents the net profits of the central bank and is given as sum of interest receipts on loans to commercial banks, and interest receipts on its holdings of foreign assets and of the government debt.

In order to rigorously characterize the main instruments of the current austerity program, government's fiscal policy is basically centered around the primary balance:

$$PRIMBAL = GREV - GOVCON - GINV - GtrHH - GtrEE - GtrSSI \quad (26)$$

where $GREV$ denotes government revenues from taxes and net factor income, $GOVCON$ indicates public expenditures on consumption of goods and services, $GINV$ symbolizes government investment and the last three terms stand for different types of transfer payments undertaken by the government.

The primary surplus policy of public revenues over public expenditures, together with the interest costs on the outstanding public debt stock defines the public sector borrowing requirement, $PSBR$:

$$\begin{aligned} PSBR &= -[GREV - GOVCON - intFW_G \varepsilon ForDebt^G - intBDomdebt^G \\ &\quad -GtrHH - GtrEE - GtrSSI] \end{aligned} \tag{27}$$

which, than is financed by either an increase in foreign loans or by issuing bonds:

$$PSBR = \varepsilon \Delta ForDebt^G + \Delta DomDebt^G \tag{28}$$

therefore, making it able for us to trace the path of public domestic and foreign debt stocks.

However, one of the crucial variables in the model, as reflected in the current conditions of the Turkish economy is the interest rate on government bonds. The expected rate of return on this instrument is defined as:

$$E[intB] = (1 - PR^{default})intB \tag{29}$$

where $PR^{default}$ denotes the probability of default on the current stock of public debt as perceived by the "markets". This variable is supposed to depend on, among various alternative measures, the current debt stock to tax revenues ratio.

The probability of default, $PR^{default}$, also has an effect on inflation expectations in such a way that the less the probability of default that is perceived, the higher the chances for the "declared" inflation target to materialize:

$$E[Inf] = (1 - PR^{default})Inf^{trgt} + PR^{default}Inf_{-1} \tag{30}$$

Note that, under such a setting, the demand for government bonds is affected by the probability of default. Private investors assign a non-zero probability of default in the current period. The *expected* rate of return will reflect the probability and will demand compensation in the form of higher nominal interest rates on government bonds. On the other hand, the larger the stock of debt, the higher the probability of default, and the higher the interest rate.

For a given probability of default, a continued increase in the supply of bonds will require an increase in interest rates to evoke investors' demand. Next, an increase in the stock of debt will lead to a rise in the probability of default, which will also rise the prevailing interest rate on government bonds. Such a mechanism in the model tries to capture the structure of government trying to provide a *signal of confidence* to the markets under the current measures of the program.

References