ASSESSING DOMESTIC DEBT SUSTAINABILITY OF TURKEY WITH A RISK MANAGEMENT APPROACH

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Abstract

ASSESSING DOMESTIC DEBT SUSTAINABILITY OF TURKEY WITH A RISK MANAGEMENT APPROACH

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This thesis analyzes the debt dynamics of Turkey and assesses the sustainability of fiscal policy. The assessment of fiscal policy follows the methodology of Garcia and Rigobon (2004). This approach focuses on the concept of debt sustainability from a risk management perspective and incorporates the effects of stochastic shocks to the economy in its assessment. The results suggest that a continuation of the present fiscal stances will lead to a fiscal unsustainability in Turkey. Furthermore, the results indicate that the properties of the debt dynamics are closely related to the spreads on both dollar denominated debt and YTL denominated debt. This thesis also provides an application of two traditional methodologies, such as Wilcox's (1989) methodology and Uctum and Wicken's (2000) methodology in order to assess the fiscal sustainability of Turkey.

Keywords: Turkey, Fiscal Sustainability, Monte Carlo Simulation, Risk Management Approach, Vector Auto-Regression.

Öz

TÜRKİYENİN İÇ BORÇLARININ SÜRDÜRÜLEBİLİRLİĞİNİN RİSK YÖNETİMİ YAKLAŞIMI İLE DEĞERLENDİRİLMESİ

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Bu tez, Türkiye'nin borç dinamiklerini ve maliye politikasının sürdürebilirliğini inceler. Mali sürdürebilirlik değerlendirimesi Garcia ve Rigobon'un (2004) metodolojisini takip eder. Bu yöntem, borç sürdürebilirliği kavramına risk yönetimi açısından yaklaşır ve değerlendirme aşamasında ekonomik şokların etkilerini dikkate alır. Sonuçlar, mevcut mali durumun devam etmesi halinde, maliye politikasının sürdürülemez bir duruma geleceğini belirtmektedir. Ayrıca elde edilen borç dinamikleri Dolar cinsinden ve YTL cinsinde getiri eğrileriyle benzerlikler göstermektedirler. Bu tez, ayrıca iç borçların sürdürebilirliğini incelemek amacıyla Wilcox (1989), ve Uctum ve Wickens'e (2000) ait iki geleneksel metodu uygular.

Anahtar Kelimeler: Türkiye, Maliye Politikasının Sürdürülebilirliği, Monte Carlo Simülasyonu, Risk Yönetimi Yaklaşımı, Vektör Otoregresif Regresyon.

To my family

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Chapter 1

Introduction

Public debt sustainability is an important issue in the current policy debate. The potential risks associated with public debt levels have long been a concern of economic policymakers. Starting in the late 1970s in the most of the advanced and emerging economies, debt levels started to rise quickly. Some of these countries have experienced debt crises in mid-1980s. After a decade, the public debt levels, especially, in emerging markets reached again terrifying levels which have major effects on their economic performance so thus even a simple correlation between public debt and growth in emerging markets shows negative relationship since 1990 (IMF,2003b). Moreover, such a high level of their current debt raise the risk of future fiscal crises in emerging markets.[1]

A government can barrow mainly due to the three reasons. First, borrowing provides additional resources that the economy could not generate by itself. This resources may be used to fund spending that contributes to broader economic and social objectives (financing public investment). Moreover, it creates demand for commodities or private investment which accelerates growth of the economy. Finally, debt may be used as a stabilization tool to finance countercylical fiscal policy to stabilize economy and to smooth business cycles.[2]

[1]Notable examples over the past decade have been the financial crises in Argentina 2001, Brazil 1998, Ecuador 1999, Indonesia 1998, Korea 1997, Mexico 1995, Philippines 1998, Russia 1998, Thailand 1997, Turkey 2001, Ukraine 1998, and Uruguay 2002.

[2]The design of the fiscal policy differs between advanced countries and developing countries. Many of the developed countries follow counter-cyclical fiscal policies, that spending goes down (taxes go up) in booms and spending goes up (taxes go down) in recessions. In contrast, in many developing countries fiscal policy has an opposite direction. They follow pro-cyclical physical policies. In particular, government spending as a share of GNP goes up during booms and down in recessions since in bad times many developing countries cannot borrow or can do so only at very high interest rates, therefore cannot run deficits and have to cut spending; in

However, misallocation of the resources and wasteful spending of them on consumption affect the economic development negatively. Especially, a high public debt level has two main negative effects on economic activity.[3] First, it requires high taxes to finance debt and puts upward pressure on real interest rates. This causes, private investment and the certain government expenditures to be crowded out which engenders low level of growth.[4] Second, fiscal policy becomes procyclical rather than countercyclical when the government is forced to reduce its spending or raise revenues (taxes) due to the lack of its ability to finance its deficits. As a consequence of these drawbacks, a debt crisis may occur which forces the government to default or inflate the debt away.[5] Both of those entail large economic and welfare costs.

Although the term *fiscal sustainability* can be defined in various ways, it almost always refers to the fiscal policies of a government. There are two main concepts which are closely related with fiscal sustainability. One concept of sustainability is *solvency* (or fiscal solvency) which requires that a government should be able to service its debt obligations in perpetuity without explicit or implicit default both today and in the future. The other concept of sustainability relates to the government's ability to maintain its *current* policies while remaining solvent. Briefly, the term of fiscal sustainability refers to the future implications of current fiscal policies and, more precisely, to the question of whether the government can continue to pursue its set of budgetary policies without endangering its solvency. If a particular fiscal policy would lead insolvency, then this policy is refereed as

booms they can borrow more easily and choose to do so, increasing public spending (Gavin and Perotti, 1997; Catao and Sutton, 2002; Talvi and Vegh, 2005).

[3]Karağöl (2002) shows that debt service has a significant negative effect on GNP with one year lag in Turkey.

[4]As indicated by Boratav, Yeldan and Köse, (2002), a rising debt burden may cause a decline in expenses on (1) capital accumulation/infrastructure; (2) defense/ security/general services and (3) social public (education,health...). Furthermore, a high level of foreign debt leads reduction in incentives to invest, known as *debt overhang hypothesis* in the literature.

[5]Inflation is an implicit way of default: Burnside, 2004.

unsustainable.

Unstable debt dynamics have dreadful connotations for budgetary policy. If the public perceives the unsustainability of fiscal policy, it will give up its holdings of government debt and will entail a change in policy. Otherwise, an explicit or implicit default may occur. Moreover, public debt strategies may become dangerously vulnerable if it faces with unforeseen events such as deteriorating private sector balance that can trigger fiscal, financial and economic crises. Economic shocks can make a public debt strategy vulnerable, which in turn can impact on the overall economy and seriously deteriorate the financial condition of a government. Recent examples in emerging economies have shown that shocks can cause into financial crises, debt management difficulties and budgetary consequences. In this point, the intention of governments should be to preempt this by conducting a change of policy before the holders of debt impose the change on them. Therefore, governments should get accurate answers to the two main questions of fiscal sustainability: At what point does the public debt become insolvent? Which policy actions does a government need to take to ensure that its debt is sustainable? In order to get the accurate answers to these questions, the role of fiscal sustainability analysis becomes important since it provides some indication as to whether a particular policy mix is sustainable or not. Moreover, it discusses alternative fiscal and monetary policy adjustments in order to avoid insolvency in the future. Briefly, the focus of fiscal sustainability analysis is frequently not on default itself rather it is on the consequences of the policy changes needed to avoid eventual default.

In the literature, there are various empirical studies which investigate the sustainability of Turkish debt.[6] These studies follow mainly two traditional approaches: the present value borrowing constraint (PVBC) approach and the accounting approach in order to assess debt sustainability.[7] However, most of them examine

[6]Özatay (1997), Utkulu (1998, 1999), Akçay et al. (2002), Keyder (2002, 2003), San (2002), Özdemir (2004), Salman (2004), Telatar et al. (2004), and Önel and Utkulu (2006).

[7]See Chapter 2.6.

sustainability in an environment where there is no uncertainty. They ignore the effects of stochastic shocks in their assessments. In other words, they do not capture the affects of volatility (uncertainity) in the economy, as well as their incidence on fiscal and financial variables. Moreover, these studies follow an infinite horizon approach, i.e., all of these tests of sustainability are based on the assumption that the process generating deficits and debt will continue into the future. Unfortunately, such a methodology gives a long term picture of fiscal policy but is silent about the details of the adjustment that is required if the fiscal policy is unsustainable.

In this perspective, the main aim of this thesis is to analyze the sustainability of domestic debt in Turkey by emphasizing the role of stochastic factors and following a finite horizon approach. For this purpose, the relationship among the macroeconomic variables, such as interest rate, inflation, growth rate, etc., is examined. Similar to the study of Garcia and Rigabon (2004), a Vector Auto-Regression (VAR) model is estimated to generate the approximate macroeconomic panorama of 1990s for Turkish economy. Then several debt paths are simulated based on the conditional means and variances of the reduced form residuals. Furthermore, the *risk probabilities* are computed as an alternative risk measure of debt sustainability.

The outline of the thesis is as follows: Chapter 2 introduces briefly the concept of fiscal sustainability and discusses the alternative methodologies used in fiscal sustainability analyses. It presents how econometric tests of the present value budget constraint carried out in the literature. Moreover, accounting approach and classical IMF approach are discussed in this chapter. Finally, it concludes with a literature review of the studies that focus on the assessment of Turkish fiscal policy.

Chapter 3 focuses on the structure of the debt dynamics of emerging market economies and makes a comparison between developing countries and advanced countries debt structures. It also analyzes the determinants of the debt structure

of these countries and introduces some potential policies in order to reduce the existing debt levels.

Chapter 4 examines the evolution of public sector debt levels in Turkey for the 1980-2005 period. The stabilization programs which aim to reduce *the public sector borrowing requirement* are also examined in this chapter. Lastly, the structure of the Turkish public debt is analyzed by focusing on maturity and currency composition of the debt.

Chapter 5 discusses three alternative approaches to assess the debt sustainability: Wilcox's (1989) approach, the Uctum and Wickens's approach and Garcia and Rigobon's (2004) approach. It introduces the underlying assumptions of these alternative methodologies and makes a comprehensive comparison among them.

Chapter 6 applies these three alternative approaches in order to assess the sustainability of Turkish domestic debt. In particularly, this chapter focusses on the methodology of Garcia and Rigobon (2004) which captures the uncertainty in its assessment of sustainability by Monte Carlo experiments.

Chapter 7 presents the summary of the thesis and concludes with an addition of possible further researches.

Chapter 2

Fiscal Sustainability

2.1 Introduction

The purpose of this chapter is to introduce the concept of fiscal sustainability theoretically. The first section focuses on the concept of government budget constraint which is the starting point of sustainability analyzes. In the second section, the simple approaches and their assumptions that lie behind the traditional fiscal sustainability analyses are introduced: Present value borrowing constraint (PVBC) framework, sustainability indicators, and reaction functions. In the third section, it is focused on the classical International Monetary Funds's (IMF) methodology to assess fiscal sustainability. In the forth section, the concept of uncertainty and new approaches that take into account uncertainty in their assessments are discussed.This chapter ends with a literature review of the sustainability analyses for the Turkish case.

2.2 The Government Budget Constraint

Most of the traditional fiscal sustainability analyses take as a starting point a representative agent model in which the government satisfy both intertemporal budget constraint and, in every period, a budget constraint.

The government budget constraint is the corner stone of fiscal sustainability analysis. The nominal government budget constraint can be expressed in a mathe-

matical notation as[1]

$$\Delta B_t = B_t - B_{t-1} = I_t - X_t - (M_t - M_{t-1}). \tag{2.2.1}$$

where B_t is the quantity of public debt at the end of period t, I_t is the interest payments, X_t is the primary balance (revenues minus noninterest expenditure), and M_t is the monetary base at the end of period t, all measured in units of local currency.

The analysis must fix on a particular definition of the government or public sector since different measures of the variables in (2.2.1) would apply to different definitions of the public debt. For example, by including seigniorage revenue (the change in the monetary base) to the definition of budget constraint, it has been redefined public sector as a combination of the central bank and the central government. It is quite common to define the public sector as the consolidation of the central government, state, and local governments, state-owned nonfinancial enterprisers and the central bank. Sometimes state banks are also included in the definition of public sector, but more commonly they are not.

Both the debt and interest payments concepts should be net, i.e., debt should be net of any equivalent (comparable) assets. Further, interest payments should be net of receipts.[2] The primary balance should include all flows that affect the debt level, such as privatization revenue or the costs associated with financial sector bailouts. Moreover, for an analysis of fiscal sustainability, it is important to have as broad a coverage as possible of public sector liabilities. In addition to the liabilities of the central government, the liabilities of public sector enterprisers should be included, as well as the contingent liabilities of the government depending on the definition of the public sector (which may include loan guarantees, public

[1]The notations through the this study are based on the ones by Burnside, 2004.

[2]Gross debt which is the total stock of outstanding government financial liabilities, is more commonly used in analyses of debt sustainability. However, it misrepresents the true sustainability position of the government since the government often has financial assets that could be quickly liquidated to repay the debt. (See Chalk and Hemming, 2000)

sector pension liabilities, state insurance schemes, and even the potential costs of bank recapitalization).

The equivalent real government budget constraint as a ratio of real gross domestic product, (GDP), can be derived from the nominal government budget constraint. Let P_t and y_t represent the GDP deflator and real GDP, and define:

$$\begin{aligned} \overline{b}_t &= B_t/(P_t y_t) \\ \overline{i}_t &= I_t/(P_t y_t) \\ \overline{x}_t &= X_t/(P_t y_t) \\ \overline{\sigma}_t &= (M_t - M_{t-1})/(P_t y_t) \end{aligned}$$

Dividing both sides of equation (2.2.1) by $P_t y_t$ yields;

$$\overline{b}_t - \frac{P_{t-1}y_{t-1}}{P_t y_t}\overline{b}_{t-1} = \overline{i}_t - \overline{x}_t - \overline{\sigma}_t \tag{2.2.2}$$

After defining the inflation rate $\pi_t = P_t/P_{t-1} - 1$, growth rate of real GDP, $g_t = y_t/y_{t-1} - 1$ and denoting the growth rate of nominal GDP, $z_t = (1+\pi_t)(1+g_t) - 1$, we reach the general case for the real government budget constraint (rGBC) where the variables are expressed as fractions of GDP;

$$\overline{b}_t - \overline{b}_{t-1} = \overline{i}_t - \overline{x}_t - \overline{\sigma}_t - \frac{z_t}{1+z_t}\overline{b}_{t-1} \tag{2.2.3}$$

or

$$\overline{b}_t - \overline{b}_{t-1} = \overline{i}_t - \overline{x}_t - \overline{\sigma}_t - \frac{\pi_t}{1+\pi}\overline{b}_{t-1} - \overline{\sigma}_t - \frac{g_t}{1+z_t}\overline{b}_{t-1} \tag{2.2.4}$$

These equations indicate that the change in the debt to GDP ratio is the sum of the five components. These are: (1) interest payments (2) the primary balance (3) seigniorage (4) the inflation effect (5) the growth effect.

From now on, for simplicity, assume that time is discrete, all debt has a maturity of one period, that debt is real, in the sense that its face value is indexed to the price level, and pays a constant real rate of interest r. Now, (2.2.1) can be

rewritten in real terms as;[3]

$$b_t = (1+r)b_{t-1} - x_t - \sigma_t \tag{2.2.6}$$

where $b_t = B_t/P_t$ is the end-of-period t stock of real debt, $x_t = X_t/P_t$ is the real primary surplus and $\sigma_t = (M_t - M_{t-1})/P_t$ is the real value of seigniorage revenue. Rearranging Equation (2.2.7) yields;

$$b_{t-1} = (1+r)^{-1}b_t + (1+r)^{-1}(x_t + \sigma_t) \tag{2.2.7}$$

Updating this equation to period t gives;

$$b_t = (1+r)^{-1}b_{t+1} + (1+r)^{-1}(x_{t+1} + \sigma_{t+1}) \tag{2.2.8}$$

This can be substituted into the right-hand side of (2.2.7):

$$b_{t-1} = (1+r)^{-2}b_{t+1} + (1+r)^{-1}(x_t + \sigma_t) + (1+r)^{-2}(x_{t+1} + \sigma_{t+1}) \tag{2.2.9}$$

The same procedure could be used to substitute for b_{t+1} and then for b_{t+2}, etc., in a recursive fashion. Hence, after several iterations we would obtain *the intertemporal budget constraint*

$$b_t = (1+r)^{-(j+1)}b_{t+j} + \sum_{i=0}^{j}(1+r)^{-(i+1)}(x_{t+i} + \sigma_{t+i}) \tag{2.2.10}$$

This equation provides a link between the amounts of debt that the government has at two different times: $t-1$ and $t+j$. The amount of debt that the government has on date $t+j$ is a function of the debt that the government initially had at date $t-1$, as well as the primary surpluses it ran, and a seigniorage it raised in this period.

[3]The interest payments I_t include the indexion adjustment for both the interest and the principal on the loan;

$$I_t = [(P_t/P_{t-1})(1+r) - 1]B_{t-1} \tag{2.2.5}$$

From this equation, solvency requires that the present value of the future primary surpluses and seigniorage revenues must exceed the present value of future primary deficits by a sufficient amount to cover the difference between the initial debt stock and the present value of the terminal debt stock. However, this equation also states that a government will attempt to run a Ponzi Game -a government rolls over its debt in full every period by borrowing to cover both principal and interest payments- which is not feasible with a finite number of agents (O'Connell and Zeldes, 1988) and this would imply that some individuals would have to be holding government bonds at some infinite point in the future.[4] As a result, this individual would have lower consumption level in at least one period, and therefore lower welfare, compared to a situation where individual chooses not to hold the debt at all. The option of holding debt, which will be continuously rolled over, is strictly dominated by that of holding no debt at all. As a result , a government, attempting to run a Ponzi Game will find that no rational individual is willing to hold its liabilities. Therefore, it cannot roll over its debt in full in every period.

A no-Ponzi Game restriction is typically regarded as a synonym with sustainability , which implies that the transversality condition,

$$\lim_{j \longrightarrow \infty} (1+r)^{-(j+1)} b_{t+j} \leq 0, \tag{2.2.11}$$

has to hold. In fact, this condition will hold as an equality since private agents cannot end up being indebted to the government. As a consequence sustainable fiscal policy has to respect the present value budget constraint, PVBC (also called as lifetime budget constraint)

$$b_t = \sum_{i=0}^{\infty} (1+r)^{-(i+1)} (x_{t+i} + \sigma_{t+i}) \tag{2.2.12}$$

This states that the present discounted value of future primary fiscal surpluses are at least equal to the value of the existing stock of public debt. In other words, namely a government finances its initial debt by its future surpluses and seignior-

[4]The No-Ponzi Game condition corresponds to the transversality condition of the lender's intertemporal maximization problem in a representative agent model.

age revenues.

2.3 Assessing Fiscal Sustainability: Traditional Methods

2.3.1 The Present Value Budget Constraint (PVBC)

Two approaches to analyzing the sustainability of fiscal policy have been used in the PVBC framework. The first one consists of testing the stationarity of the debt and/or deficit (Hamilton and Flavin, 1986; Wilcox, 1989). Other studies look for a cointegration relationship linking the primary deficit, the stock of outstanding debt and interest payments (Trehan and Walsh, 1988; Kremers, 1989; Hakkio and Rush,1991).

The sustainability tests in the literature of PVBC try to verify whether No-Ponzi Game condition holds or not. If the PVBC holds for historical data, then the null hypothesis

$$\lim_{j \longrightarrow \infty} (1+r)^{-(j+1)} b_{t+j} = 0, \tag{2.3.13}$$

will not be rejected in statistical tests.

The classical test is that of Hamilton and Flavin (1986). In their innovative paper, Hamilton et al. test for price bubbles to the PVBC for the postwar period of United States. Their goal is to detect any sign of unsustainable fiscal policy implementation.

The first test, which is performed by Hamilton and Flavin, is based on Diba and Grossman (1984) and Hamilton and Whitemans (1985) critique of Flood and Garbers (1980) test for bubbles in prices. This test points out that the hypothesis that the government is subject to a present-value borrowing constraint implies

that;

$$b_t = E_t \sum_{i=1}^{\infty} (1+r)^{-i} z_{t+i} + a(1+r)^t + \eta_t. \tag{2.3.14}$$

where E_t is the expectations operator conditional on information available at time t, η_t is an error term, $z_t = x_t + \sigma_t$ represents fundamentals determining price, $b_t = B_t/P_t$ is the price of debt and the term $a(1+r)^t$ would look like a bubble. Their first test involves two steps;

1. Assume that η_t is stationary and test for a unit root in z_t. If one rejects the presence of a unit root in z_t, then one can assume that $E_t \sum_{i=1}^{\infty} (1+r)^{-i} z_{t+i}$ is also stationary, and one may proceed to the second step.

2. Test for a unit root in b_t. If one cannot reject the presence of a unit root, then no-Ponzi game restriction is rejected in favor of price bubble. Otherwise no-Ponzi game restriction is not rejected.

From this test they conclude that the sustainability requires the stationarity of the stock of government debt B_t.

The second test proposed by Hamilton and Flavin is based on a regression. Specifically, they take the equation

$$b_t = \beta_0 + \sum_{i=1}^{k_b} \gamma_i b_{t-i} + \sum_{i=0}^{k_z} \kappa_i z_{t-i} + a(1+r)^t + \epsilon_t. \tag{2.3.15}$$

where ϵ_t is a white noise error term. A test for fiscal sustainability, in this case, is simply a test of whether $a = 0$ or not. They conclude that the bubble term turns out not to be significant and the hypothesis that postwar U.S. fiscal policy should be regarded as sustainable cannot be rejected.

However, it should be noted that the requirement of stationarity in B_t is a sufficient but not necessary condition for sustainability since fiscal policy could be sustainable even if debt is nonstationary.

Wilcox (1989) extends Hamilton and Flavin' s method by allowing a non-constant real interest rate in the analysis. In their methodology, PVBC holds if the discounted debt series is stationary around mean zero. Since his approach allows the conversion of a sequence of public debt to a base year for which the discount factor is normalized to unity, it might be considered as an explanation and solution for long-run trends in public debt by linking them to interest rate movements.

Trehan and Walsh (1988) argue that under the constant real interest rate, a necessary and sufficient condition for sustainability is that debt and primary balances are cointegrated. This can be seen by rewriting government budget equation as

$$\Delta B_t = B_{t+1} - B_t = rB_t + D_t \tag{2.3.16}$$

where B_t is the beginning period stock of government debt (i.e., bonds outstanding), r_t is the interest rate applyied between periods t and t+1, and D_t is the primary fiscal deficit. Now, if B_t is I(1) process then $B_{t+1} - B_t$ is stationary by definition which implies that $rB_t + D_t$, the overall balance, is stationary and that if the interest rate is constant, B_t and D_t are cointegrated with a cointegrating vector (1,r). Briefly, if cointegration tests suggest that debt and primary fiscal surpluses move together, then fiscal policy is sustainable. Moreover, under the assumption of time-varying real interest rates, Trehan and Walsh (1991) show an alternative condition for the PVBC to hold which requires the stationarity of $r_tB_t + D_t$.

Hakkio and Rush (1991) test whether the B_t and D_t are cointegrated under the assumption that real interest rate is stationary. Roberds (1991) shows that transversality condition implies cross-equation restrictions on the stochastic processes generating debt and deficits in a bivariate VAR framework, and finds strong evidence that such restrictions are rejected for the US, again suggesting unsustainable fiscal policy.

Quintos (1995) introduces *strong* and *weak* conditions for fiscal sustainability by extending the studies of Hakkio and Rush (1991). Alternatively, they test the

stationarity of $\Delta B_t = G_t - T_t + r_t B_{t-1}$ rather than to test the stationarity of $r_t B_t + D_t$. They use the following regression model

$$\Delta B_t = (1-\beta)(G_t + r_t B_{t-1}) - \alpha + \varepsilon_t \tag{2.3.17}$$

where ε_t is the error term. The deficit would be defined as "strong sustainable" if ΔB_t is stationary and the cointegration between government revenues (T) and expenditures (G) holds with cointegrating vector (1,-1). He shows that no Ponzi game restriction is also satisfied where ΔB_t is integrated of a finite order d regardless the value of β for in (0,1) interval. For β smaller than 1, the debt can be interpreted still sustainable, however this situation is inconsistent with the government's ability to market its debt in the long run since the government has the tendency to spend more than its revenue. This situation is defined as *weak sustainability*.

Empirical literature testing the PVBC, has the obvious advantage of not requiring the steady-state assumption, nor do they involve choosing arbitrary deterministic paths for $\overline{x}_t$, $\overline{\sigma}_t$, g_t and r_t . But these tests have a major drawback, apart from the obvious standard criticisms of unit root tests. First, it should be noted that representative agent models divorce the fortunes of the real economy from the activities of government. Thus sustainability judgments based on the PVBC are made without reference to any economic variables except the debt, projected primary surpluses and deficits, taxation, government expenditure and the interest rate on government debt. Second, they are based on historical data and are, therefore, fundamentally backward looking. While they may be useful to identify violations of fiscal sustainability in historical data, they say little about whether future surpluses will be sufficient to service the current stock of debt and finally, all of these tests are based on the assumption that the processes generating deficits and debt will continue into the future without allowing a policy change. This is mainly due to the infinite horizon approach which draws a long-term picture of fiscal policy but says little about the details of the adjustment that is required if it is unsustainable. This suggests the need to analyze sustainability allowing for expected changes in fiscal policy with a finite horizon approach. Therefore, in

the PVBC framework, it is not surprising to face some cases where fiscal policies obviously unsustainable can satisfy the PVBC while some other fiscal policies obviously sustainable but can not satisfy PVBC.

2.3.2 Debt Stabilizing Primary Balance

The most basic approach for fiscal sustainability analysis is to view fiscal policy as sustainable if it delivers a ratio of public debt to GDP that is stable. This approach requires the steady-state assumption of debt to GDP ratio as a criteria of fiscal sustainability and involves choosing arbitrary deterministic paths for $\overline{x}_t$, $\overline{\sigma}_t$, g_t and r_t, and calculating primary budget balance that would achieve that ratio, known as *debt stabilizing primary balance*. In literature, it is known as *accounting approach*. The difference between the actual primary balance and *the debt stabilizing primary balance* indicates the degree of fiscal adjustment that is needed to achieve a constant debt-to-GDP ratio. This method is based on long-run and perfect foresight considerations that transform the government's budget constraint into an equation that maps the long-run primary fiscal balance as a share of GDP into a "sustainable" debt-to-GDP ratio that remains constant over time. For this purpose sustainability indicators are used.

Sustainability indicators are usually not backed by a formal definition of sustainability. As argued by Chalk and Hemming (2000), sustainability indicators show how far fiscal policy departs from sustainability.[5] Those indicators of sustainability have considerable intuitive appeal.

Buiter (1985) derives a sustainability indicator based on the concept that sustainability implies that the ratio of the public sector net worth to output w_t should be maintained at its current level. Under this assumption, he expresses the constant wealth primary deficit as a ratio to output, $\overline{d} = \overline{D}/Y_t$, as follows

$$\overline{d} = (r_t - n_t)w_t \tag{2.3.18}$$

[5]For further discussions see Horne, 1991.

where $w_t = W_t/Y_t$ is the ratio of net worth to output, r_t is the interest rate and n_t is the growth rate . The sustainability indicator suggested by Buiter is

$$\overline{d} - d_t = (r_t - n_t)w_t - d_t \tag{2.3.19}$$

where $d_t = D_t/Y_t$ is the current primary deficit ratio to output. This indicator shows the difference between the constant wealth primary deficit and the current primary deficit. A negative value suggests that the current primary deficit is too large to stabilize the net worth ratio and the fiscal policy should thus be regarded as unsustainable. For example, as a reaction, the policymaker may change its policy to get an increase in the interest rate levels in order to stabilize the ratio. However, the indicator, that Buiter suggests, has an important drawback. In reality, it is difficult to obtain perfect information on the true size of government net worth.

Blanchard (1990) modifies this indicator in the light of difficulties in measurement public sector net worth by looking at the change in policies required to maintain the current debt to GDP ratio. Blanchard (1990) develops two indicators of sustainability. The first one, which is called as *primary gap indicator*, is based on the permanent primary deficit, $\overline{d}$, necessary to stabilize the debt ratio, calculated by using following equivalence;

$$\overline{d} = (n_t - r_t)b_t \tag{2.3.20}$$

where $b_t = B_t/Y_t$ is the ratio of debt to output. Then the primary gap indicator is;

$$\overline{d} - d_t = (n_t - r_t)b_t - d_t. \tag{2.3.21}$$

A negative value for primary debt indicator suggests that the current primary deficit is too large to stabilize the debt ratio and that fiscal policy is thus unsustainable necessitating a change in fiscal policy.

The second indicator proposed by Blanchard is the *tax gap indicator*, which is based on the permanent tax to output ratio, $\overline{t}$, necessary to stabilize the debt

ratio. The tax gap indicator is calculated as follows;

$$\overline{t} = g_t - (n_t - r_t)b_t \tag{2.3.22}$$

where g_t is the ratio of government non-interest spending of output. The tax gap indicator is

$$t_t - \overline{t} = t_t + (n_t - r_t)b_t - g_t \tag{2.3.23}$$

which is the difference between the constant debt tax ratio and the current tax ratio. A negative value for this indicator suggests that current taxes are too low to stabilize the debt ratio given current spending policies.

Briefly, the primary gap indicator points to the reduction in the primary deficit which is required for sustainability of the debt, while the tax gap indicates the increase in the tax ratio required for sustainability of the debt given current spending policies. A medium-term tax gap indicator is also suggested by Blanchard (1990). The medium-term tax gap indicator is the difference between the current tax ratio and that of tax ratio which is necessary to stabilize the debt ratio over the next N years (assuming constant interest and growth rates). The debt-stabilizing tax ratio is given by

$$\overline{t} = (1/N)\sum_{i=0}^{N}(g_{t+i} - (n_{t+i} - r_{t+i})b_{t+i}) \tag{2.3.24}$$

$$= (1/N)\sum_{i=0}^{N}(g_{t+i} - (n_t - r_t)b_t) \tag{2.3.25}$$

and the medium-tax gap indicator is

$$t_t - \overline{t} = t_t + (n_t - r_t)b_t - (1/N)\sum_{i=0}^{N} g_{t+i} \tag{2.3.26}$$

This indicator is forward looking and requires a projection of future spending. It measures how much the tax ratio needs to rise over the next N years to stabilize the debt ratio given current and expected future spending policies. These indi-

cators are useful in that they are quite simple.

However, the major drawback of these indicators is that they are based on arbitrary definitions of sustainability, namely a constant ratio of either net worth or debt to output. They have limited scope of the sustainability assessments comparing with PVBC which does not require that the debt ratio needs to be bounded. There is one important point to remark. If fiscal policies are sustainable according to one of the indicators, and if the growth rate is less than the interest rate, then PVBC will also be satisfied (Chalk and Hemming, 2000). It is a one saving grace in this regard.

2.3.3 Reaction Functions

This approach looks at the relationship between fiscal policy instruments and long-run debt sustainability. However, not so many types of fiscal reaction functions are constructed in studies of fiscal policy. Generally, in these models, the primary fiscal balance is considered as the key operating target of the fiscal authorities. A positive response of primary balance to the public debt is generally considered as a signal of long-run solvency. Bohn (1998) develops a model based on Barro's (1979) tax-smoothing model. He estimates the following equation:

$$p_t = \alpha + \Sigma_{j=1}^{J} \beta_j X_{j,t} + \rho b_{t-1} + \varepsilon_t \tag{2.3.27}$$

where p_t is the primary balance of the country at time t; α_i is an intercept ; b_{t-1} is the debt level at the end of previous period; ε_t is an error term: and $X_{j,t}$ is a vector of macroeconomic variables explaining changes in the primary balance unrelated to the long-run solvency requirement. He states that a positive response of primary surpluses to the debt-GDP ratio (if $\rho > 0$) implies that debt-GDP ratio should be mean reverting, despite the fact that a unit root is virtually impossible to reject in standard univariate time series tests.

In the model developed by IMF (2003b), the primary fiscal balance is assumed to

respond to public debt, and temporary factors such as business cycles, inflation, commodity prices and debt restructuring/default.[6]

Overborrowing ratio is an another method used by IMF to see if a government is overborrowing in the sense of whether its debt stock exceeds the present discounted value of its expected future primary surpluses. The analysis assumes a linear cross-section regression model of the form

$$y = \alpha + X\beta + \varepsilon, \tag{2.3.28}$$

where y is a vector of the overborrowing ratio measured as the ratio of actual public debt to the benckmark level of debt and X is a matrix of economic and institutional characteristics. A ratio greater than 1 suggests that the government is overborrowing.

2.4 IMF's Approach

The classical IMF's approach to assess the fiscal sustainability, which is a broader version of accounting approach, takes the following government budget constraint as a starting point.

$$B_t = (1 + R_t)B_{t-1} - X_t \tag{2.4.29}$$

where B_t is the stock of public debt at the end of period t, X_t is the primary balance (The IMF's basic approach do not take into account the seigniorage explicitly). If the stocks and flows will be written as fractions of nominal GDP we get

$$\overline{b}_t = \frac{(1 + R_{t-1})}{(1 + \pi_t)(1 + \gamma_t)}\overline{b}_{t-1} - \overline{x}_t \tag{2.4.30}$$

where $\overline{b}_t = B_t/(P_t y_t)$, $\overline{x}_t = X_t/(P_t y_t)$ (P_t represents the GDP deflator and y_t represents the real GDP) and $\pi_t = P_t/P_{t-1}$ is the inflation rate and $\gamma_t = y_t/y_{t-1}$

[6] A more recent study by Mello, 2005 measures the fiscal performance of Brazil by estimating fiscal reaction functions for the consolidated public sector and different levels of government, and tests for the sustainability of the public debt dynamics.

is the real growth rate. Based on this equation, the IMF's approach can be summarized in three steps:[7]

- Based on the historical macro-data of the economy, a projection with a five-year horizon is made using the equation denoted above. This is regarded as the benchmark scenario;
- From this projection, debt dynamics is generated and then sustainability is assessed. More generally, an increasing debt ratio is usually regarded as a cause for concern;
- If the debt dynamics is indicated as unsustainable, an alternative scenario is prepared, making necessary corrections on fiscal policy variables which will typically define a stable path over the medium-term. Attention is usually on the adjustment of the primary balance required to meet the debt target and the fiscal measures that can generate the adjustment.

The IMF also claims that it pays considerable attention to the external debt sustainability as well, with a methodology followed that is analogous to the fiscal sustainability approach. However, in theory, there is no clear linkage between the external sustainability and the fiscal sustainability.

2.5 Sustainability and Uncertainity

Bohn (1991, 1995) notice that the policies which are sustainable in a certain world may no longer be so under uncertainty. The methods discussed so far examine sustainability in an environment where there is no uncertainty. Besides the limitations in coverage (definition of budget deficit), they do not adequately address the downside risk of adverse future economic and financial outcomes. Recently, several methods for bringing uncertainty into the analysis have been proposed in recent years.

[7] See Chalk and Hemming (2000).

Barnhill and Kopits (2003) extend the Value-at-Risk (VaR) methodology to the analysis of public sector balance sheet. They model the government's net worth as an explicit stochastic process to capture the uncertainties due to fiscal risks. The VaR analysis is used to estimate the effect of these fiscal risks on the government's net worth, and their co-movements in order to assess the probability of net worth becoming negative, which is interpreted as a probability of default. Also other versions of VaR methodology are suggested. Adrogue (2005) suggests a VaR approach to model the debt-to-GDP ratio and computes the probability distribution of the ratio of public debt to GDP at some future year. IMF (2003b) suggest that the VaR can be used to estimate an overall probability distribution of the government's net worth. Da Costa et al. (2004) use the VaR approach of Barnhill and Kopits (2003) in their case study of Brazil.

Xu and Ghezzi (2003) design a model which aims to price the government debt and then to calculate fair yields. In their study, flows in the government budget are modelled as stochastic processes to estimate the default probabilities. Then these probabilities are used for calculating fair yield spreads. As a part of their methodology, forecasts of the timing of fiscal crises and the default probabilities at different horizons are estimated.

Mendoza and Oviedo (2004) develop a theoretical model, which brings uncertainty into the analysis, to calculate the government borrowing limits in order to guarantee the sustainability.

International Monetary Fund's modern approach which is based on the forward simulation of the budget constraint takes into account the importance of short-term and long-term fluctuations.[8] Then, these projections are analyzed for fiscal sustainability. Generally, this methodology focuses on sensitivity (or stress) tests with respect to arbitrary changes in selected variables based on Monte Carlo simulations. Mora (2004) applies the IMFs formal statistical approach by fitting vector auto regressions (VARs) to historical Colombian and Costa Rican time

[8]The IMFs approach to assess the fiscal sustainability is described in details in two reports (IMF; 2002, 2003a).

series on the interest rate, the inflation rate, the real growth rate, and the primary balance. Then estimated VAR's are used to simulate the debt-to-GDP ratio.

Garcia and Rigobon (2004) propose a VAR model to estimate the correlation pattern of the macro variables and use it to implement Monte Carlo simulations. These projections are then used to compute *risk probabilities* for different thresholds which are deemed as risky.

Polito and Wickens (2005) prelude an index as a short-term sustainability indicator based on VAR framework, in which sense differing from the traditional sustainability indicators. Moreover, they propose a methodology to examine the effect on fiscal sustainability of a change in fiscal policy within a VAR framework.

Carriero et al. (2005) develop a fiscal sustainability indicator which is backed by a formal definition of sustainability in the Bayesian-VAR framework.

Gapen et al. (2005) propose a new approach based on the liability side of the balance sheet. They obtain estimates for sovereign asset value and its volatility by using contingent claims balance sheet and derive a set of credit-risk indicators that serve as a sign of sovereign risk.

A more recent study by Hostland and Karam (2005) applies stochastic simulations methods to assess debt sustainability in emerging market economies and provide probability measures for projections of external and public debt burden over the medium term.

2.6 The Sustainability Analyses for Turkey

In the literature, there are a number of empirical studies which investigate the sustainability of Turkish debt. Most of these studies follow IMF's approach in their analyses within a panel data framework. Basically, this works assess the

situation of Turkish debt by comparing it with the situation of other economies. However, following such a way, most of the time, does not give so much remarkable information about the underlying elements of high public debt of Turkey and it is also significant that Turkey is an outlier in most of these studies, both of which indicates the necessity of a special care in assessing Turkish fiscal policy. Moreover, various rating agencies, such as JP Morgan, perform similar studies to rate the sustainability of both the domestic and external debt of Turkey. In addition, the World Bank and the Undersecreteriat of Treasury of Turkey carry out similar exercises. However, most of them can not go beyond an accounting exercise. In the rest of this section, some of the studies will be introduced.

Bahmani-Oskooee and Domac (1995) apply the intertemporal approach to the Turkey's growing external deficit. They are able to find evidence of external deficit sustainability, only when the structural break in 1973 is incorporated into cointegrating equations.

Özatay (1997), following the Wilcox (1989) study, tests whether the present-value constraint is violated for the Turkish economy by using monthly data from the 1985:5 to 1993:12 period. The study concludes that the domestic debt strategy was not sustainable through the end of 1993.

Utkulu (1998), following the methodology used in Hakkio and Rush (1991), analyzes the long run tendency of the Turkish exports and imports over 1950-1996 period by using annual data, however finds evidence of no-cointegration between exports and imports implying that the Turkish external deficits are not sustainable. Further, in an another paper, Utkulu (1999) analyzes the sustainability of Turkish external debts for the period of 1970-1998 following the methodology of Trehan and Walsh (1991), but finds no evidence in favor of solvency.

In addition to Utkulu (1998), Önel (2003) examines the Turkish external debt following the methodology of Hakkio and Rush (1991) for 1987-2002 period and concluded that Turkeys current external debt is below the expected present value

of the future net primary surpluses, indicating that Turkey is likely to be a solvent country in terms of its external debt.

In a more recent study, Önel and Utkulu (2006) test the solvency condition of Turkish external debt using the methodology of Hakkio and Rush (1991). Indeed, this study determines the possible structural shifts endogenously and includes them into the testing procedure of solvency using different methods. This study conclude with or without considering any structural break, that the Turkish external debt is weakly sustainable.

Akcay et.al (2002) investigate the debt sustainability of Turkey for 1970-2000 period in the PVBC framework and report that Turkish debt to GNP discloses an unsustainable fiscal outlook.

Keyder (2002) follows the World Bank's approach (2000) to estimate the primary surplus to GNP ratio for the sustainability of the debt. After analyzing the different scenarios conditioning various GDP growth rates, the study indicates that Turkey's debt will be in a sustainable path if the average real interest rate declines to 15 per cent or less. Again using a modified version of World Bank approach, Keyder (2003) estimates the primary surplus requirement for debt sustainability in Turkey by taking into account the operational deficit, seigniorage factor and exchange rate factor. Under different scenarios, she finds that the primary surplus requirement is below 6.5 percent target level and concludes that under the current economic outlook there is no debt sustainability problem.

San (2002) investigates fiscal sustainability for Turkey in his master thesis. Firstly, the study applies Blanchard's (1990) primary gap indicator to Turkey and concludes that a 6.5 percent primary surplus together with an additional 1 percent gap by foreign support will stabilize the public debt. Secondly, the sustainability of securitized real domestic debt stock by using monthly data from 1986:1 to 2001:2 within a PVBC framework is tested in the thesis. The study concludes that the unsustainable characteristic of fiscal policy is due to the capital account

liberalization in 1989.

Voyvoda and Yeldan (2003) study the problem of debt sustainability of Turkey by using a overlapping generations model (OLG) and conclude that the path of public debt as a ratio to GNP displays significant degree of inertia even under an assumption that a primary surplus of 6.5 per cent as a ratio to GNP is maintained invariably, at all times.

Günaydin (2003) follows the Quintos (1995) methodology in order to determine whether the fiscal policies in Turkey satisfies the PVBC in the *strong* or *weak* sense and also he investigates the cointegration relationship between public expenditures and revenues. Günaydin concludes that the debt stock of Turkey is "weakly sustainable" since the government has the tendency to spend more than its revenues and this constitutes an inconsistency with the government's ability to market its debt in the long run.

Salman (2004) proposes an alternative method, namely Intertemporal Gap, GAP, to the static budget deficit measure for constructing fiscal policy regarding projections for revenues and expenditures. The study points out that the Turkey will face with an adverse effect on the sustainability of public debt due to the increasing social security payments.

Telatar et al (2004) extend Bohn's (1998) model for the Turkish case. They analyze the relationship between primary surpluses and total government liabilities over the period of 1980-2001 in order to test whether the fiscal authority takes corrective actions or not. They conclude that the relationship might be unstable due to the changes in intensions of the governments towards sustainability of fiscal policy.

Özdemir (2004), following the Hamilton and Flavin' study (1986), shows that the unit root behavior in debt/GDP ratio in Turkey can not be rejected and concludes that fiscal policies are not consistent with a sustainable debt/GDP ratio.

2.7 Conclusion

Most of the traditional fiscal sustainability analyses take as a starting point a representative agent model in which the government satisfy both intertemporal budget constraint and, in every period, a budget constraint. Thus, solvency requires that the present value of the future primary surpluses must equal to the present value of future primary deficits. Two approaches have been used in the PVBC framework. The first consists of testing the stationary of the debt and the other one looks for cointegration relationship linking the primary deficit, the stock of outstanding debt and interest payments. However, PVBC methodology is based on historical data and therefore fundamentally backward looking. Indeed, this methodology follows the infinite horizon approach which is silent about the details of the adjustment that is required if the policy is unsustainable.

In traditional analyses, sustainability indicators, which are forward looking, are commonly used as an alternative to PVBC approach. However, the major drawback of these indicators is that they are based on arbitrary definitions of sustainability, namely a constant ratio of either net worth or debt to output. Furthermore, in the traditional analyses, reaction functions are constructed. A positive response of primary balance to the public debt is generally considered as a signal of solvency. The classical IMF's approach is a broader version of accounting approach. It constructs a baseline scenario. Using this baseline scenario, debt dynamic are generated by projections and then sustainability is assessed.

New methodologies which address the downside risk (uncertainity) of adverse future economic and financial outcomes are introduced in recent years. The common characteristic of all these approaches is the explicit incorporation of uncertainity about the behavior of the variables determining the evaluation of the government's debt, and the formulation of specific indicators that capture the effect of volatility in the economy, as well as their incidence on fiscal and financial

variables. These methodologies use specific procedures to estimate the expected value of the relevant variables. The studies, particularly those using the probability of default, provide useful analytical tools for policymakers to foresee the wideness of the period available to undertake corrective fiscal policies.

Chapter 3

Debt in Emerging Markets

3.1 Introduction

In emerging market economies, high public debt levels have often had more immediate consequences on economic performances when compared with developed countries. Moreover, the deterioration in the fiscal accounts in these countries requires higher yields and lower maturities in order to maintain capital flows and finance the deficits. As a result, the financial cost of servicing the debt is exacerbated deeply.

The purpose of this chapter is to analyze the debt dynamics of emerging markets. Indeed, a comparison between the debt dynamics of emerging market economies and developed economies is carried out. In the first section, the structure of the debt stock of emerging markets are introduced. Further, the determinants of the debt structure in emerging market economies are discussed and the original sin hypothesis is introduced. In the second section, the focus will be on some potential policies to reduce the existing debt stocks in emerging markets.

3.2 Public Debt in Emerging Markets

Before the 1980s, the main component of public debt of countries was the external debt. Official loans and long-term commercial bank loans used to be the main forms of external borrowing in 1970s and early 1980s. In the 1980's, the world experienced several debt crises in which highly indebted Latin American and other

developing countries were unable to repay the debt.[1] In August 1982, Mexico declared its inability to service its international debt and suspended its payments. The similar problem quickly spreaded to the rest of the world. To counter this, macroeconomic tightening and structural adjustments such as liberalization and privatization were administered often through the conditionality of the IMF and the World Bank in these countries.[2] A stock conversion of loans into bonds took place through the Brady deals. As a conclusion of the liberalization procedures, governments met a new borrowing opportunity, namely domestic borrowing.

The structure of public debt in emerging markets differs in several respects from public debt in advanced countries. First, developing countries find it relatively difficult to issue long term debt in their own countries, compared with advanced countries. Therefore, short-term debt constitutes the main part of their debt stock. Moreover, the emerging market economies could not borrow in their own domestic currency in international markets. So, they borrow in foreign currencies and as a consequence, with relatively large shares of foreign currency debt, any depreciation in their domestic currencies abruptly renders a country insolvent. In contrast, developed market countries issue debt dominated in their own currency on international markets. This is mainly due to the size of their economies and the use of their currencies as a vehicle for international trade. Third, reliance on externally issued debt has been far greater in emerging market economies than advanced countries. Finally, average debt levels were traditionally equivalent to a lower share of GDP in emerging markets than they were in advanced countries but the gap has been closed in recent years.

The external borrowing has been based on loans and bond issues since mid-1980s, not only on loans. Generally, the structure of the external debt of emerging markets is similar to that of advanced countries in terms of maturity, currency composition and prevalence of indexed debt. The only difference is that the developed

[1]The Latin American debt crisis refers to a period in the early 1980s (and for some countries starting in the 1970s), often known as the *lost decade*, where countries in the region reached a point where their foreign debt exceeded their earning power and they were not able to repay it.

[2]See Ohno's lecture notes (2006).

countries can borrow in their own domestic currency in international markets whereas the emerging market economies can not issue any kind of debt in their own currency in international markets. Actually, this is the main reason of the similarity in external debt structures, since there are only a few currencies in international markets which are traded. On the other hand, the structure of the domestic debt is very different across countries. The difference is observed not only between developed countries and emerging market economies but also among the whole countries. Each country has its own domestic debt structure based on the underlying economic characteristics of the country. Briefly, the external debt structure is homogenous whereas domestic debt structure is heterogeneous across the countries.

Following the debt crises in 1980s, public debt in emerging markets started to decline. These improvements continued until mid- 1990s. The 1990s witnessed a boom in short-term lending by international banks to developing countries.[3] Another crucial financial trend in the 1990s was a substantial increase in the share of private sector borrowing -especially by banks- in total borrowing. Despite the Brady debt restructuring initiative and large scale privatization programs in many countries, the debt levels of the emerging market economies have been deteriorating. Actually, policy changes such as financial deregulation and capital account liberalization in developing countries, combined with distortions in international capital-adequacy regulations, favored short-term debt. The rapid rise in short-term borrowing reflected speculative asset booms in some emerging market countries. Starting from the mid-1990s, the world experienced again several debt crises: (i) 1994-95 Mexican crisis, (ii) 1997 Asian crisis, (iii) 1998 Russian crisis, (iv) 1999 and 2002 Brazilian Crises (v) 2001 Turkish crisis, and (vi) 2001 Argentine crisis (vii) 2002 Uruguay crisis, etc. These crises occurred sequentially differing from the crises of 1980s which happened at the same time. Mid-1990s crises were often caused by short-term commercial bank debt and/or securities market investments. For example, the Asian crisis of 1997-98 was mainly caused by short-term commercial loans.

[3]The growth of short-term borrowing in the 1990s naturally accompanied with higher incomes, faster growth, and greater openness to trade in developing countries.

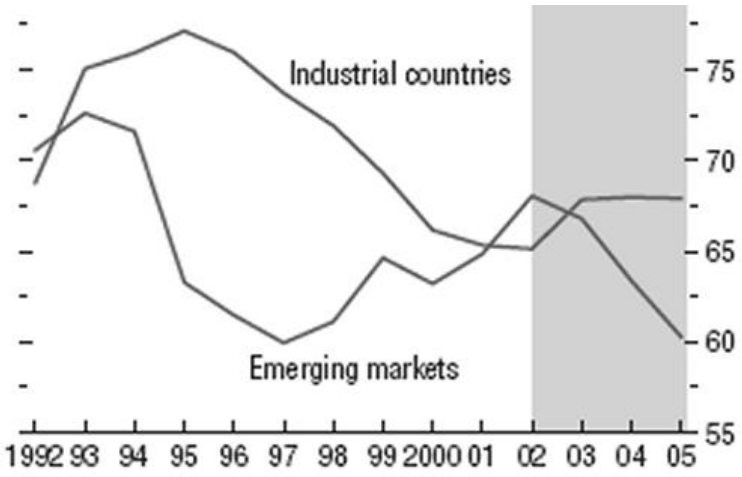


Figure 3.1: Public Debt (as a percent of GDP)

Especially, after the mid-1990s crises, an increase was observed in average public debt ratios of emerging market economies and reached at 70 percent of GDP in 2003 such that, for the first time, it was higher than the average ratio of industrial countries (Figure (3.1), Source: IMF 2003). The rise has been accounted for by interest rate and exchange rate movements, the recognition of off-balance sheet and contingent liabilities and weakened primary fiscal balances (IMF, 2003b).[4] The increase in the debt levels was extreme particularly in Latin America and Asia due to impact of the financial crises which occurred in the late 1990s. In contrast, in the transition countries in Europe, the levels declined. In the Middle East and Africa, debt levels remained unchanged. For example, in Argentina, public debt has risen from 30 percent of GDP in the early 1990s to 150 percent of GDP at the end-2002 and in Bulgaria, debt levels has declined from 160 percent of GDP in the early 1990s to less than 60 percent of GDP in 2002. By the end of the 2005, public debt ratios in emerging markets have fallen to an average of about 60 percent of GDP. In this period, high level of growth rates and exchange rate appreciations in emerging markets has acted to reduce the public debt ratio.

[4]In a number of countries, the costs of recapitalizing baking systems have been financed by borrowing through both international markets and domestic markets.

In contrast, public debt ratio in developed countries reached to an average of about 68 percent of GDP.

3.2.1 External Debt

The structure of the external debt is much homogeneous across countries. Bond financing and the loans are the main forms of external borrowing in international markets. However, bond financing has became more common after the capital account liberalizations in developing countries and its relative importance has grown especially for a decade. The main difference between the developing countries and advanced countries is that most countries, especially emerging market economies, do not borrow abroad in their own currency. Most sovereign debt issued internationally by both emerging market countries and advanced countries is in foreign currency, particularly in US dollars. Moreover, most internationally issued public debt carries a fixed interest rate for both advanced countries and emerging markets. Currently, floating-rate bonds make up less than 5 percent of the J.P. Morgan 's Emerging Markets Bond Index Global (EMBIG).[5] Although the 1990s witnessed a boom in short-term lending by international banks to developing countries that lasted until Asia's financial crisis erupted in 1997, most external sovereign debt of emerging market countries based on bonds at medium term (5-10 year) or longer term maturities currently. However, the average maturity of emerging market external debt is now lower than for advanced countries and there are also significant differences in the maturity structure of the external debt among emerging markets. Finally, the share of external public debt in total public debt has declined since mid-1980s. This is mainly due to the increasing popularity of domestic borrowing.

[5]See Rajan, 2004.

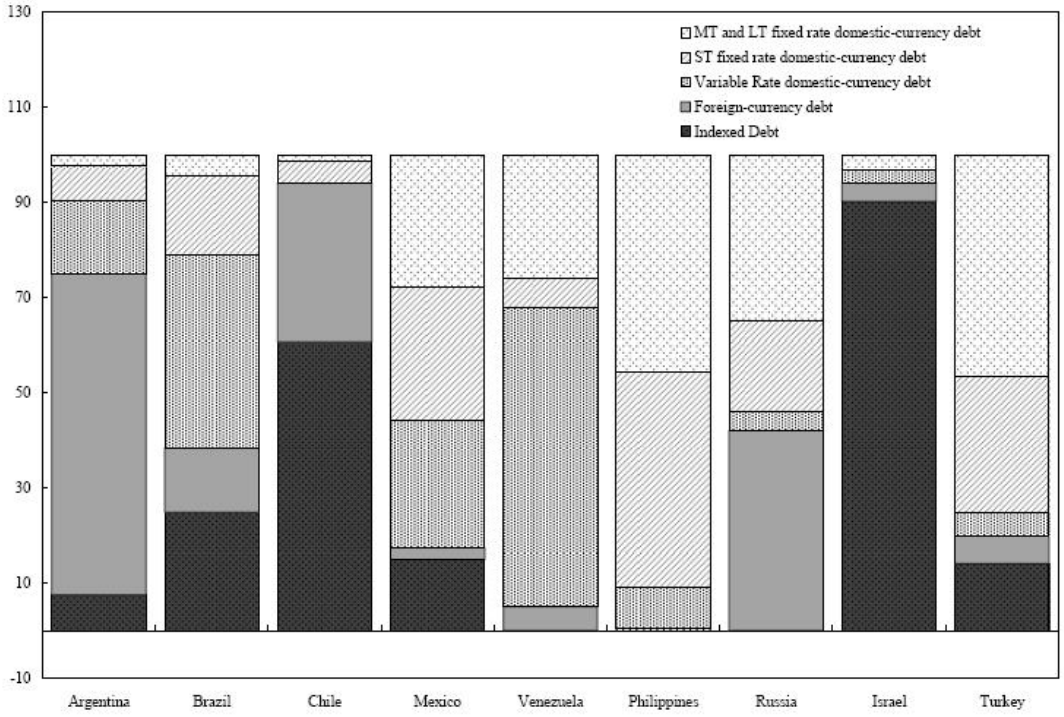
3.2.2 Domestic Debt

Traditionally, developed countries rely on domestic debt markets more than the emerging market economies. However, as a result of financial liberalization programmes in 1990s, the domestically-issued component of total public debt has increased quickly in emerging market countries. Most commonly, bond financing constitutes the main form of domestic borrowing. Indeed, nowadays, the composition of domestic debt is much more similar in developing countries and advanced countries. Nevertheless, some of the domestically issued debt in emerging market economies is short term and has the form of foreign currency debt. This situation constitutes the main difference between advanced countries and emerging market countries.

Domestic debt in developing countries rely on several instruments: (i) local currency long term fixed rate, (ii) local currency short term fixed rate, (iii) floating rate(indexed to a domestic rate), (iv)inflation indexed, (v) foreign currency. However, there are significant variations in the structures of domestic debts among emerging market economies. For instance, long term local currency debt is absent in Latin American countries, but represents more than one half of the total debt for several countries in Emerging Asia and Emerging Europe. Furthermore, in Latin America, some countries, for example Venezuela, borrow mainly through interest rate indexed debt, whereas in others for example Chile, the majority of government debt is indexed to inflation.

Figure (3.2)[6] shows the domestic debt structure of some countries. As can be seen, share of the domestic currency debt of both medium-to long-term maturities and a fixed interest rate is less than 50 percent on average. Indeed, Israel relies mainly on indexed debt whereas Argentina on foreign currency debt.

[6]See Jeanne (2006).



Source: Jeanne-Guscina EM Debt Database 2006.
Note: The figure shows the share of each debt category in total government debt (in percent).
MT = medium-term; LT = long-term; ST = short-term.

Figure 3.2: Structure of Domestic Government Debt in Selected Countries

3.2.3 Determinants of Sovereign Debt Structure

An examination of sovereign debt default episodes in emerging markets reveals that while the level of public debt at the time of a default has varied substantially, in many cases it has been quite low. This indicates that the high level of public debt is not the only (necessary) determinant of a default. In this point, an examination of the debt structures comes forefront in analyzing the origins of defaults. Furthermore, an average composition of the debt is an important concept since there are various sources of financial vulnerability arising from a debt composition which has deep effects on the whole economy in several respects. First, excessive reliance on short-term debt is associated with higher levels of rollover risk due to a parallel rise in debt servicing costs. Moreover, above average dependence on short term debt exposes borrowers to liquidity risk if their assets are illiquid. Second, indexation either to inflation or foreign currency renders liabilities uncertain, especially in crises, from the borrower perspective (IMF and World Bank, 2003).

Existing debt structures in emerging markets are based on excessively on risky forms of debt, such as short term and foreign currency denominated debt. It is widely acknowledged that the short-term and foreign-currency debt are dangerous forms of debt, since they may amplify the economic cycle, they are prone to crises, and they make crises more difficult to manage. As stated by Rogoff (2003), there are many different factors that contribute to the increases in risky forms of debt in emerging economies. First, due to the weak property rights and uncertain debt recovery processes of sovereign debt contracts when defaults occur, investors tend to lend to emerging market economies at too low levels. Second, political economy problems and short horizons of governments in emerging market economies lead the governments to borrow too much. Third, difficulties to implement collective action among creditors raise vulnerability of the debt flows. Finally, creditor moral hazard resulting from the presence of a crisis lending by the International Financial Institutions (IFIs) gives rise to a decline in lending to emerging markets.[7] As a result of these factors, emerging countries willing

[7]Moral hazard: The risk that the existence of a contract will change the behavior of one or

to accept debt placements at either extremely high costs or extremely high risks which at the end reinforce the rise of vulnerability. Briefly, together with the lack of credibility of monetary and fiscal policies, nature of the sovereign debt contracts tend to shift the composition of government's debt toward shorter maturities and foreign currency denomination. Generally, choosing risky forms of debt provides a measure of confidence to investors since such a debt is the one which is the hardest to restructure.[8] This enables sovereign borrowing in large amounts, often beyond what is socially desirable. Unfortunately, choosing risky forms of debt as financing strategy causes deeper problems.

Empirical studies by Rodrik and Velasco (1999); and Bussiere and Mulder (1999) find short term debt to be a principal indicator of vulnerability to the crises. First of all, a short term debt may make governments more vulnerable to debt rollover crises as is the case in 1994-95 Mexician crisis and 1998 Russian crisis. Moreover, it can create vicious circles stemming from the two way interaction between debt levels and interest rate. First, if the debt has a short maturity or bears a floating interest rate, changes both in international interest rates, and in the country's own creditworthiness, will affect the interest bill relatively quickly. Second, as stated by Calvo (1998), a sovereign with a high level of short term debt may thus find itself trapped in a bad equilibrium in which high interest payments lead to a high probability of default which in turn increases the default risk premium and the interest rate. In other words, the relative short average maturity of debt in emerging markets can expand the economic cycle. Generally, increases in interest rates due to the increases in the default and devaluation risk premia are associated with economic downturns in emerging market countries where fiscal policy becomes procyclical rather than countercyclical.

Like short term debt, foreign currency dominated debt make crises more severe. Indeed, foreign currency debt reduces the ability of the monetary and fiscal poli-

both parties to the contract, e.g. an insured firm will take fewer fire precautions.

[8]See: Bolton and Jeanne, 2005.

cies to diminish the impact of a crisis.[9] A depreciation of a local currency often leads to a sharp increase in government debt as a share of domestic GDP. This revaluation amplifies the initial fiscal problem deeply. For example, the contribution of this revaluation was especially large in Argentina and Uruguay. By contrast, it was small in Korea, where the government had little foreign currency debt, and in Turkey, where the real depreciation of the currency was mild compared with Latin America.

3.2.4 Original Sin Hypothesis

As stated in the previous section, most countries are not able to borrow abroad in their own domestic currency and do not borrow at long maturities and at fixed rates, even domestically. In the literature, this situation is called as Original Sin (Eichengreen and Hausmann, 1999), and creates an incompleteness in financial markets leading a currency mismatch or a maturity mismatch. Currency mismatch refers the case where projects that generate domestic currency will be financed with a foreign currency whereas maturity mismatch indicates the case where long-term projects will be financed with short-term loans. In such a situation, macroeconomic and financial instability will be unavoidable in emerging markets. Original Sin has two components. One is the international dimension (inability to borrow abroad in domestic currency) and the other is the domestic dimension (inability to borrow long term in domestic markets). Generally, the latter one is mentioned as Domestic Original Sin and the former one, as International Original Sin. In this scope, literature has focused on external debt composition and domestic debt composition separately and try to find the factors that lie behind of the international original sin and domestic original sin.

Empirical studies mainly focus on a few parameters as being the determinants of the original sin: (i) the level of development, (ii) monetary credibility, (iii) level

[9]Monetary policy cannot be used to inflate foreign currency debt away. The government is faced with the well-known and much-debated dilemma between raising the interest rate and letting the currency depreciate, with both options having adverse effects on domestic balance sheets.

of debt burden, (iv) the exchange rate regime, (v) slope of the yield curve, and (vi) size of the investor base.

The first one is the level of development which is measured generally with GDP per capita. Empirical studies indicate that GDP per capita is significantly correlated with original sin. However, this result is not robust to inclusion of other regressors.[10]

The second determinant of the original sin is the monetary credibility. This is important for both domestic and international original sin. The monetary credibility is proxied usually by inflation. Generally, the ratio of domestic debt to total public debt is higher in countries with lower and less volatile inflation indicating that inflation can change the composition of public debt and make it more risky. Hausmann and Panizza (2003) find that monetary credibility, as measured by lower inflation and the imposition of capital controls are associated with lower domestic original sin in emerging economies. On the international side, their study shows that if the monetary and fiscal authorities are inflation prone, foreign investors will lend only in foreign currency, which is protected against inflation risk, or at short maturities, so that the interest rates can be adjusted quickly to any acceleration of inflation.

The third one is the level of the debt burden. Public indebtness gives rise to an inability to service debt. Thus leads the governments to reduce debt service costs through inflation, unexpected changes in interest rates, explicit taxation, or outright default. Such a situation reduce the credibility. Therefore, governments will tend to have a shorter maturity debt composition to enhance credibility when the debt burden is high. Most commonly, this situation, the ability to service debt, is proxied with an array of macroeconomic indicators including the ratios of the fiscal balance to GDP, primary balance to GDP, government debt to exports and government debt to GDP.[11]

[10] Hausmann and Panizza, 2003.
[11] Hausmann et al. (2003) and Mehl et al. (2005).

The fourth one is the exchange rate regime. As indicated by Hausmann and Panizza (2003), countries with fixed exchange rate regime experience large volatility in their domestic-currency interest rate, while countries that has floating exchange rate regime see larger exchange rate volatility. This creates differences in the structures of borrowing. Empirical studies show that fixed exchange rate regime is the main reason of liability dollarization. Despite these common weaknesses, emerging and developing economies have been able to attract capital because they have often been operating under fixed or pegged exchange rate regimes until the early 2000s.

The fifth one is the slope of the yield curve. In theory, and given the existence of term premia, issuing short-term debt is cheaper than issuing long-term debt.[12] However, refinancing risk is higher for short-term debt and frequent refinancing implies a larger risk of financing with higher interest rates. Therefore, governments face a trade-off between cheaper funding costs, which tilts the duration towards short-term maturities and refinancing risk, which tilts the duration towards longer-term maturities (Broner et al. 2005). Generally, an upward-sloping yield curve is associated with higher long-term borrowing to meet investor demand and, hence, lower original sin.

Moreover, size of the investor base is another determinant of the domestic original sin. This concept actually indicates the level offinancial development which is measured most of the time by a ratio of total domestic credits to GDP. Finally, a special care to the level of openness which is generally measured by total foreign trade, should be taken into account.

As stated in the study by Hausmann and Panizza (2003), there is a positive correlation between international domestic sin and domestic original sin. First, if a country cannot persuade its own citizens to lend in local currency, it cannot convince foreigners to do so, neither. Second, if a country has foreign cur-

[12]Mehl and Reynaud (2005).

rency dominated external debt, real exchange rate movements will have aggregate wealth effects. Therefore, the central bank will intervene into the market in order to reduce the volatility in the real exchange rates tolerating more interest rate volatility. This will limit the development of the domestic long-term market.

3.3 How Can High Public Debt Levels Be Reduced?

Providing debt sustainability, is one of the long-run objectives of a fiscal policy. Therefore, governments should use potential policy options available to them to reduce their debt without giving up their short-run objectives, such as contributing to output stabilization over the business cycle.

The simplest way to reduce the public debt ratio will be through economic growth. As shown by Kopits (2001) fiscal rules can contribute to stability and growth. Governments can adjust their fiscal policies in order to enhance economic growth. Although most of the time, growth is beyond the direct control of the government, political instabilities, which at the end deteriorate the economic growth, can be reduced through correct fiscal policies. Moreover, governments can reduce *public sector borrowing requirement*, PSBR, through increasing revenues and reducing expenses. Rules should be introduced to restrict the size of the budget deficits. Generally, revenue ratios in emerging market economies are quite low relative to advanced countries due to the ineffective tax systems, and large informal sectors (Borensztein at al., 2004). This creates also volatility in government revenues. In the spending side, the interest costs account for a high proportion. In other words, debt servicing cost, which is the main part of government expenses in emerging markets, are more sensitive to exchange rate and interest rate movements. Therefore, governments should consider the effects of their policies on exchange rate and interest rate movements. Moreover, fiscal policymakers can run primary surpluses to maintain the fiscal credibility and reduce the rollover risk of the debt. As a second way to reduce debt, governments can explicitly

default on the debt. However, a government will loss its reputation in the case of default and this will limit its future borrowing. Finally, a policy of selling government assets or privatization can also reduce the debt. However, such a policy does not change the net debt level.

To sum up, governments have several options to reduce public debt levels. However, since fiscal discipline is a long-run objective of the fiscal policy, it first requires political stability which is not the case in most of the emerging market economies. Therefore, as suggested by Wyplosz (2002), the importance of the independent Fiscal Policy Committees, given the task of achieving debt targets and deciding/recommending annual deficits, come forefront.

3.4 Conclusion

The debt structures of the emerging markets are quite different from the ones of the developed countries. Generally, developed countries find it relatively easy to issue long term debt in their own currencies. In contrast, most of the developing countries debt rely on short term and foreign currency debt. However, this situation is associated with a higher frequency of debt crises. Indeed, short term debt and foreign currency debt reduces the ability of the monetary policy and fiscal policy to diminish the impact of crises. Emerging market economies have experienced several debt crises in last two decades: crises in early 1980s and in late 1990s. The latter crises are mainly caused by the short-term commercial bank debts. Therefore, it is essential to monitor such debts. Domestic policies that encourage short-term borrowing should be avoided and excessive short-term borrowing for financing long-term investments should be discouraged.

It is widely acknowledged that the lack of credibility in monetary policy and fiscal policy, together with the nature of sovereign debt contracts lead a tendency to shift the composition of government's debt toward risky forms of debt, such as short term and foreign currency dominated debt. Generally, such a composition

provides a measure of confidence to investors since it is hard to restructure short term and foreign currency dominated debt.

There are various ways to reduce the public debt. First, it can be achieved through economic growth, which most of the time out of the direct control of the policy maker. Second, governments can reduce their PSBR through increases in revenues and reductions in expenses. Indeed, primary surpluses can be run. Finally, effective privatization programs can reduce the debt levels.

Chapter 4

A Brief Outlook on the Turkish Economy

4.1 Introduction

Financing the public sector borrowing requirement, henceforth PSBR, has been one of the most crucial problems of Turkey since 1980s. Following the capital account liberalization in 1989, PSBR financing started to rely on the issues of government debt instruments. Therefore, the share of domestic borrowing in PSBR financing kept increasing. Indeed, fiscal balances and debt dynamics started to deteriorate rapidly after the abolishment of interest ceilings (1989). The uncertain macroeconomic environment besides the lack of monetary and fiscal credibility causes high rate of real interest rates in order to maintain short-term capital flows. Hence, the fiscal policy started to be seen on an unsustainable path.

The main objective of this chapter is to analyze the debt dynamics of Turkey for the 1980-2005 period. In the first section, the problem of excess PSBR and stabilization programs which attempt to reduce both inflation and PSBR are discussed. Second section mainly focuses on the structure of the public debt of Turkey. The main figures of the public sector's fiscal performance and debt dynamics for the 1980-2005 period are presented in this section.

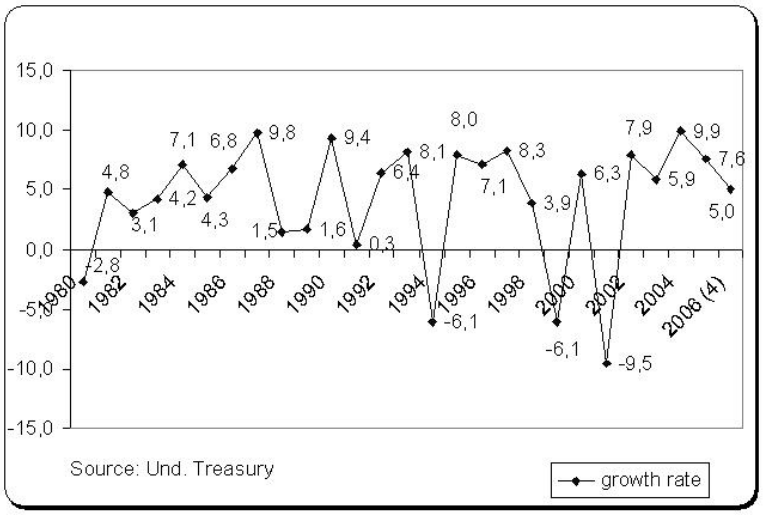


Figure 4.1: Growth Rates

4.2 Stabilization Programs and PSBR

During the past three decades, Turkish inflation has experienced a high and chronic inflation.[1]. From 1989 to 2005, while the average growth rate of GDP was around 4.05 per cent, its standard deviation was 5,98 percentage points (Figure 4.1). Naturally, such a long standing high inflation with erratic and volatile growth rates imposed costs on economy. First of all, a rising share of interest payments due to the very high nominal interest rates (caused by high inflation) reduced profits and wages which led a rise in unemployment levels. Moreover, government balances were affected negatively by high levels of inflation (Figure 4.2). Akcay et al. (2002) point out the long-run relationship between inflation and public sector borrowing requirement (PSBR) which is generally the main determinant of the government balance.[2] By using the Turkish data for 1970-2000

[1]An average annual inflation rate of 20 percent in the 1970s, 35 to 40 percent in early 1980s, 60 to 65 percent in the late 1980s and early 1990s, and around 80 percent in the late 1990s.(Ertugrul A., and Selcuk F. 2001)

[2]The PSBR in Turkey consists of six components: (1) Central government, (2) extra- budgetary funds, (3) local authorities, (4) state economic enterprises, (5)social security institutions, and (6) revolving funds. However, for a measure of the overall public sector deficit and borrowing requirement, the losses of the state banks and the Central Bank must also be included in the PSBR definition.

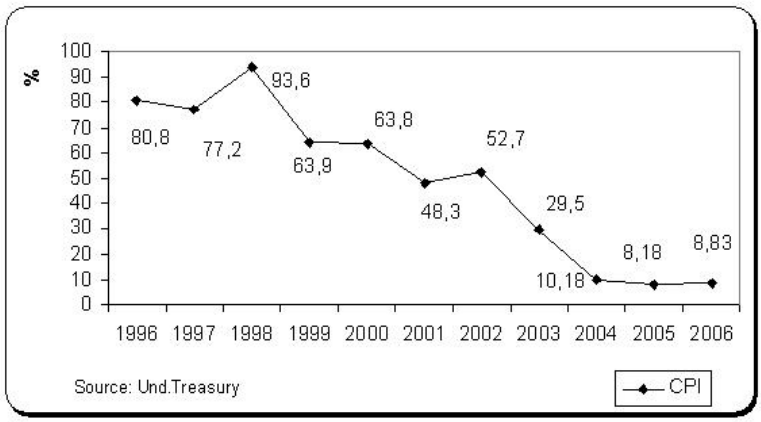


Figure 4.2: Inflation

period, they show that inflation and PSBR are cointegrated. Their study really strikingly indicates that any initiative to reduce the inflation should take into account PSBR since heavy financing of government deficits through borrowing together with a chronic inflation creates a vulnerable economy to both external and internal shocks.

Figure (4.3) shows the public sector primary balance and budget balance starting from early 1980s. The primary balance was negative until 1994 which indicates the lack of control in PSBR. In following years, there is a recovery in primary balance due to the austerity policies whilst the budget balance continued to deteriorate from early 1980s to 2002. So far, stabilization programs during the last twenty years have become unseccesful in Turkey.[3] Some of them targeted only to reduce inflation, and some targeted to reduce both inflation and PSBR simultaneously.

[3]The underlying elements of Turkish macroeconomic history for the last two decades are deeply discussed by Akyuz and Boratav (2002); Boratav, Yeldan, Kose (2002); Yeldan(2002); Ertugrul and Selcuk (2001); Cizre-Sakallioglu and Yeldan (2000).

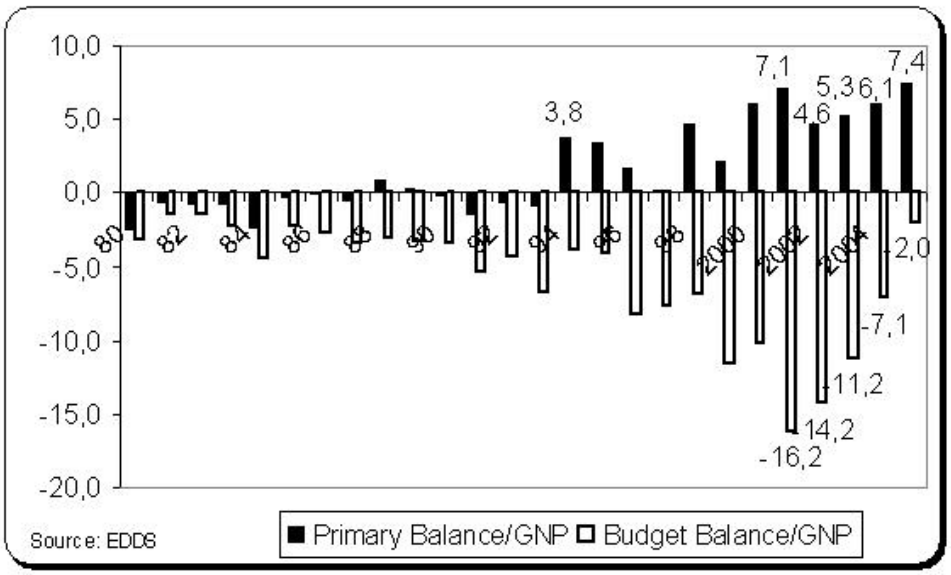


Figure 4.3: Government Balance and Primary Balance (as a percent of GNP)

An early attempt to reduce inflation and PSBR - with an intention to liberalize the economy- began on January 24, 1980 in response to a deep debt and balance-of-payment crisis beginning in the late 1970s.[4] Following the January 24 program, the PSBR as a per cent of the gross national product (GNP) decreased immediately, from 8.8 per cent in 1980 to 4 per cent of GNP in 1981, and stayed less than 5 per cent until 1987. However, disinflation programs of the late 1980s and early 1990s were adopted without any serious effort to reduce PSBR. Instead, new ways were searched for financing the PSBR. In 1986, borrowing from the domestic market through sale of government securities started in order to finance PSBR. Unfortunately, the PSBR started to increase after 1987 and reached 10 per cent of GNP at the end of the 1980s. Towards the end of the decade the economy had run out of steam and public sector deficits and inflation had come back with full force. In 1989, capital account was liberalized targeting to facilitate the financing of public sector deficits without "crowding out" private investment. However, interest rates on government debt increased through the capital liberalization,

[4]Turkey experienced a debt crisis in 1978 and rescheduled a large amount of its external debt through Paris Club. Turkey became indebted to Paris Club consecutively three times in order to solve its debt and balance of payment problems, in 1978, 1979 and 1980.

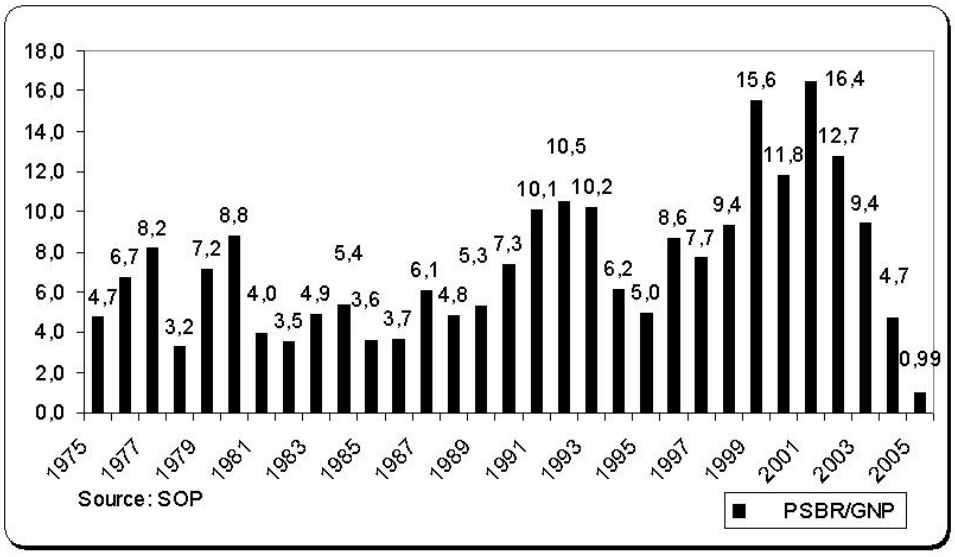


Figure 4.4: PSBR (as a percent GNP)

which aggravated the fiscal policy. In 1994, due to the unsustainable nature of the fiscal policy and the external deficit, the economy experienced a major crisis. A new stabilization program, which was announced on April 5, 1994; aimed at lowering expenditures and raising taxes to obtain a primary surplus and then two months later, a stand-by arrangement was approved by International Monetary Fund (IMF) and ceased in 1995. After that PSBR started to increase again. Until the July 1998, no acute stabilization program was implemented by the government. Under the guidance of an IMF Staff Monitored Program (SMP), a new program began in 1998. Following July 1998 program, some improvements were observed concerning inflation rate and fiscal imbalances. However, interest rates did not decline. Unfortunately, the Russian crisis in August 1998, the general elections in April 1999, and two devastating earthquakes in August and October 1999 deteriorated the fiscal balance of the public sector. The PSBR reached to over 15,6 per cent in 1999.

In December 1999, an exchange rate based stabilization program was launched in order to reduce persistently high inflation rates and to achieve sustainability in the debt dynamics. Essentially, the program which has been backed and su-

pervised by the IMF, have been relying on a nominally pegged exchange rate system for disinflation and aimed at restoring fiscal balances with structural adjustments. In addition, the privatization revenues and a recovery in the growth of the economy were expected to help to lower the interest expenditures. Following the commencement of the program the inflation rates as well as interest rates started to decline, and the primary surplus to GDP ratio, needed for the sustainability of the debt stock, was obtained at attainable levels. Moreover, the disinflation program through eliminating the exchange rate risk and reducing default risk provided an arbitrage opportunity for the foreign investors at the ongoing market interest rates since the expected return now exceeded the sum of the risk-free return and the default risk premium. Hence the capital inflow started to take place. However, this optimistic scheme did not continue so long. In the last quarter of 2000, some economic indicators started to deteriorate. Following the real appreciation of Turkish Lira, deterioration in trade balance and current account deficit, enlargement in bank's open positions in foreign exchange rate (FX) were observed. All of which started to render the financial system highly vulnerable to external shocks. Hence, after the November 2000, the February 2001 liquidity crisis emerged and the program failed.[5] As Alper (2001) indicates, the reasons behind the failure of the program can be summarized as follows;

- Unsuccessful government policies in maintaining the stream of good news and sustaining capital inflows,
- Not enough backing of the program by the IMF in terms of providing enough insurance against exchange rate risk,
- Existence of "no-sterilization" rule, which may be a "design flaw" in the program, since it led to interest rate undershooting initially, [6]

[5]The details of the stabilization program and the following crises are deeply analyzed by Akyuz and Boratav, 2002; Alper, 2001; Alper and Onis, 2003, Ertugrul and Yeldan, 2003; Yeldan, 2002; Keyder, 2001; Uygur, 2001.

[6]The program fixed the Bank's stock of the net domestic assets (NDA). As a consequence, the monetary expansion linked to changes in the net foreign assets (NFA), so to changes in the foreign exchange flows which indicates that the Central Bank was committed to the strict rule of no-sterilization throughout the program.

- Exclusive reliance on short-term capital inflows as the source of liquidity generation mechanism,
- The fragile banking system structure, [7]
- Adverse external developments [8]

In May 2001, backed by IMF and World Bank, a new stabilization program based on floating exchange rates was adopted. This program, referred as "Transition to the Strong Economy Program" (TSEP), relied on contractionary monetary policy aiming price stability and fiscal austerity that targets achieving a 6.5 per cent surplus for the public sector as a ratio to the gross domestic product. Some structural reforms such as privatization, abolition of subsidies, reductions in wage remuneration and in public employment were applied to reduce PSBR and enhance "credibility" of Turkey ensuring reduction in the country risk perception.[9]

4.3 Public Debt in Turkey

The Turkish public debt can be categorized under two primary headings: domestic debt and external debt. Domestic debt is any kind of debt that is issued both in the domestic currency (YTL), and foreign currency through domestic financial markets whereas external debt is any kind of debt in the international markets based on bank loans and bond issues. External debt can also be arranged into two groups: public sector external debt and private sector external debt. The main component of the public sector external debt is the government's consolidated external debt. Loans from international sources and government bonds are

[7]The banking sector was too weak to support *quasi currency board* regime, (See Ertugrul and Yeldan, 2003).

[8]The rise of the interest rates in the United States by 100 basis points, the increase in the international energy prices and finally the loss in the relative strength of the Euro versus the US are the main adverse developments which effect liquidity mechanism of the program.

[9]See Pamukcu and Yeldan (2005); and Dervis et al. (2004).

the main instruments of borrowing for Turkish government in international markets.[10] Government bonds are the ones that are issued to domestic and foreign residents both in YTL and foreign currency through fixed and floating auctions. However, Turkey has not been successful to borrow in international markets with YTL. In Turkey, for domestic borrowing the following instruments are used: (i) floating rate note auctions, (ii) FX denominated fixed rate notes auctions, (iii) fixed coupon YTL auctions, (iv) FX denominated floating rate auctions, (v) FX denominated zero coupon auctions, (vi) zero coupon YTL auctions, (vii) direct sales, i.e, non-auction sales. Generally, the biggest part of the domestic borrowing is materialized through zero coupon YTL Auctions.

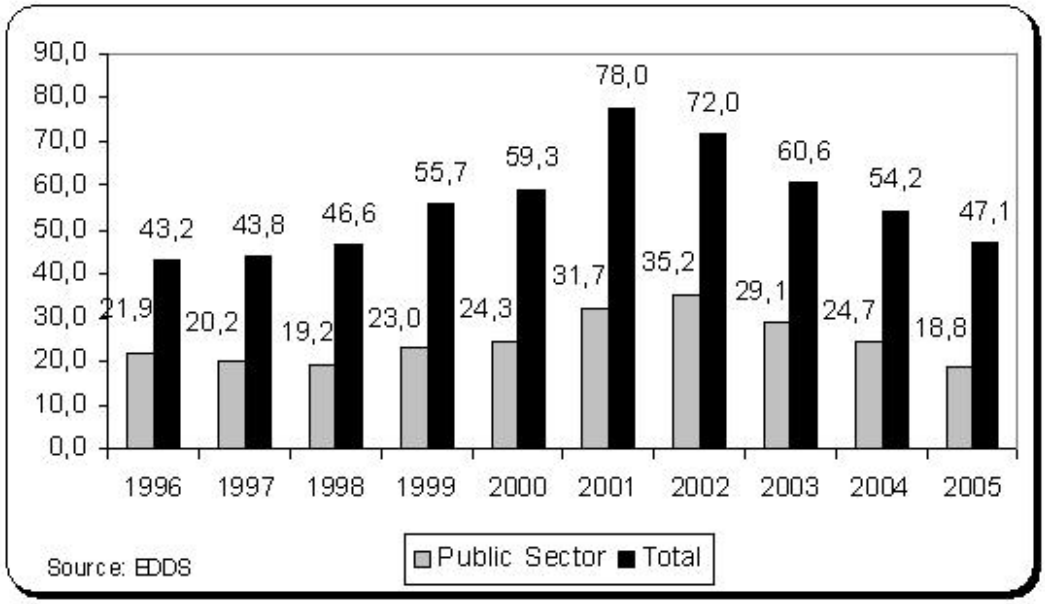


Figure 4.5: Total and Public Sector External Debt (as a percent of GNP)

[10]There are mainly four international sources of loans for Turkey: (1) Multilateral Agencies, (2) IMF Credits, (3) Bilateral Lenders, and (4) Commercial Banks.

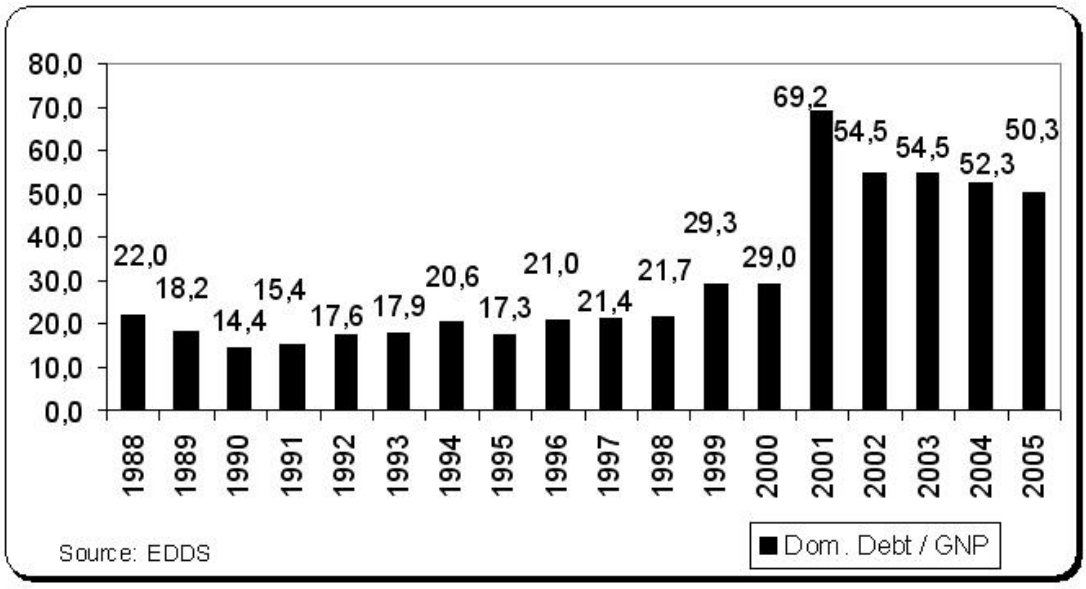


Figure 4.6: Total Domestic Debt (as a percent of GNP)

Figure (4.5) shows the total external debt[11] and the public external debt of Turkey for 1996-2005 period. Public external debt is the sum of the external debts of general government, state owned enterprisers, local administrations, extra budgetary funds, universities and the central bank. The upsurge in total external debt in the crisis year (2001) was due to the major devaluation of Turkish Lira against foreign currencies and more importantly due to the increases in official foreign borrowing. The empirical studies indicate that the Turkish total external debt is not problematic. Indeed, Öner and Utkulu (2006), in their most recent study, show that Turkish external debt is weakly sustainable.

In Turkey, domestic debt includes securitized and unsecuritized debt. The central bank advances to the treasury constitute unsecuritized part of the domestic debt. Borrowing through unsecuritized debt has not been materialized since 1998 due to the legal arrangements between the treasury and central bank. Figure (4.6) projects the total domestic debt of Turkey for 1988-2005 period. The bank recapitalization in 2001 is the main reason for the dramatic increase in domestic

[11]Total external debt is the sum of private external debt and public external debt

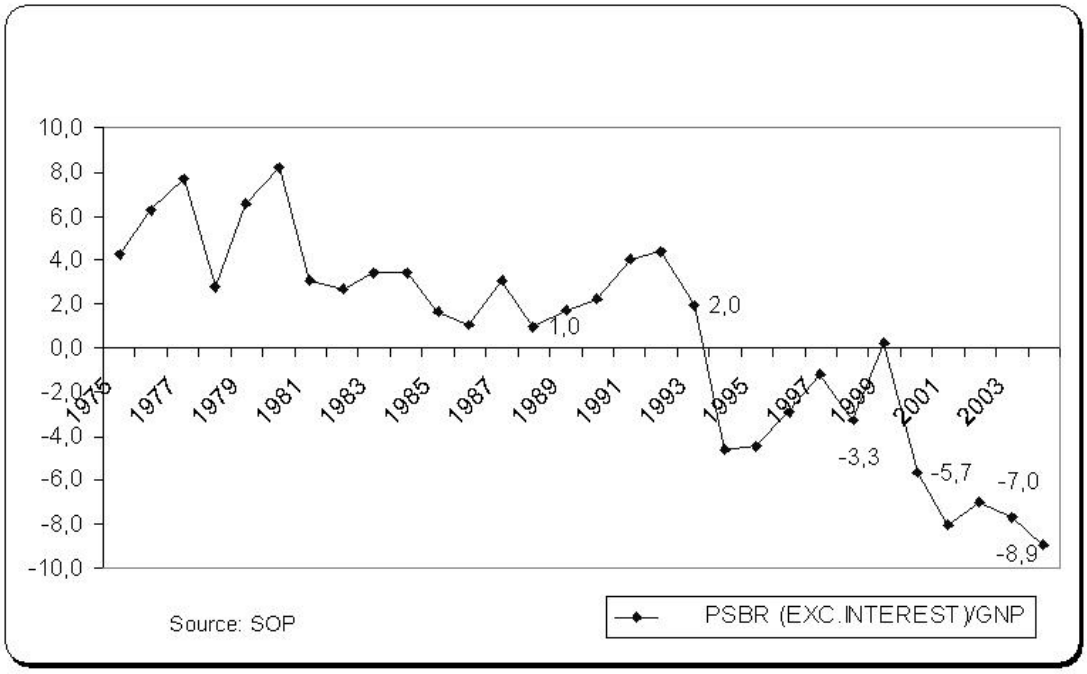


Figure 4.7: PSBR Excluding Interest Payments (as a percent GNP)

debt stock.

Figure (4.7) indicates the size of the problem from a different viewpoint. When interest payments are excluded from PSBR, a surplus has been observed in PSBR since 1994. This was mainly the result of the austerity measures following 1994 stabilization program. However, such improvements did not lead to a recovery in the PSBR including interest payments. Actually, this was related with the high levels of interest payments.

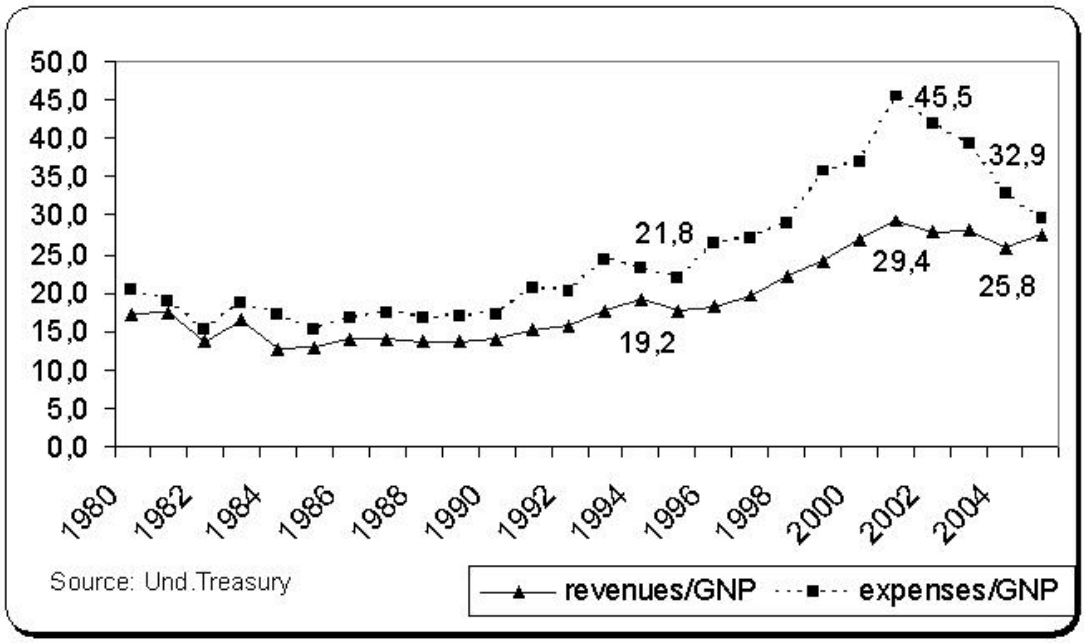


Figure 4.8: Consalidated Budget Total Revenues and Expenditures (as a percent of GNP)

Total expenditures and total revenues of the consolidated budget moved together until 1998 (Figure 4.8). Following 1998, the difference between them became larger, reached a pick in 2001 which was mainly due to the abnormal upsurge in PSBR. After the announcement of TSEP, the difference between them started to decline.

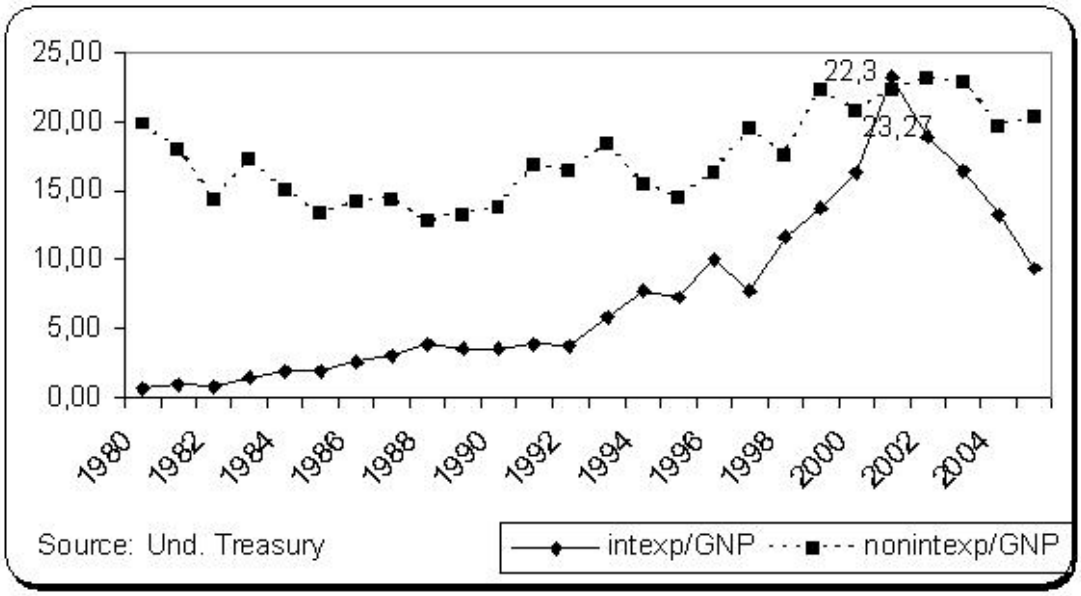


Figure 4.9: Interest and Non-Interest Payments (as percent of GNP)

Figure (4.9) reveals that consolidated budget interest expenditures as a per cent of GNP had an upward trend in 1980s and 1990s while non-interest expenditures as a per cent of GNP had a more stable outlook. It should also be noted that the interest payments reached such high levels that they went over the non-interest payments in 2001. This figure demonstrates clearly the heavy interest burden in the economy for the post-1989 period.

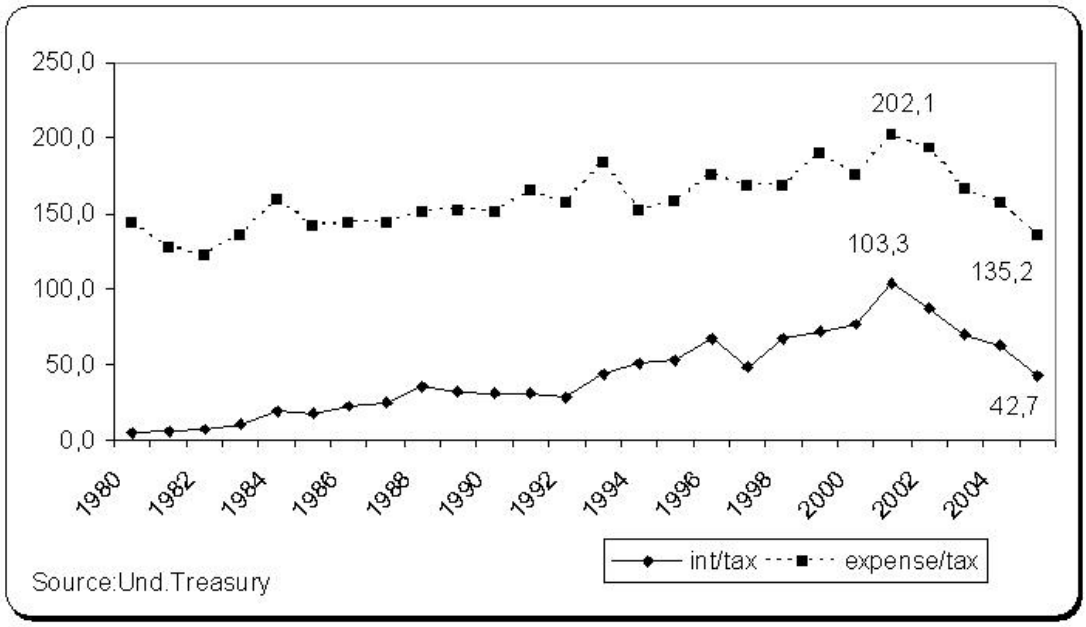


Figure 4.10: Interest and Non-Interest Payments (as a percent of Tax Revenues)

Figure (4.10) shows interest payments and total expenses of the consolidated budget as a percent of the tax revenues. Firstly, it is remarkable that expenses could not be covered by tax revenues through the economic history. Moreover, the ratio is so high that much of the time, expenses are almost 1.8 times higher than the tax revenues. Actually, this situation refers the main reason of high budget deficits. Secondly, the data reveals the sharp increase in the ratio of interest payments to tax revenues which reached 100.3 percent in 2001. Especially, this figure indicates the dimension of the aggravation in the economy. In 2001, tax revenues were not able to cover neither the interest expenses nor total expenses. Briefly, although the government has not overspent since 1994, i.e, government has had surpluses in PSBR- excluding interest expenses since 1994, the rising interest payments swell the government's budget expenditures.

In the rest of this section, the analysis especially focuses on the domestic debt because of the increasing fragility of domestic debt stock in the last decade. In

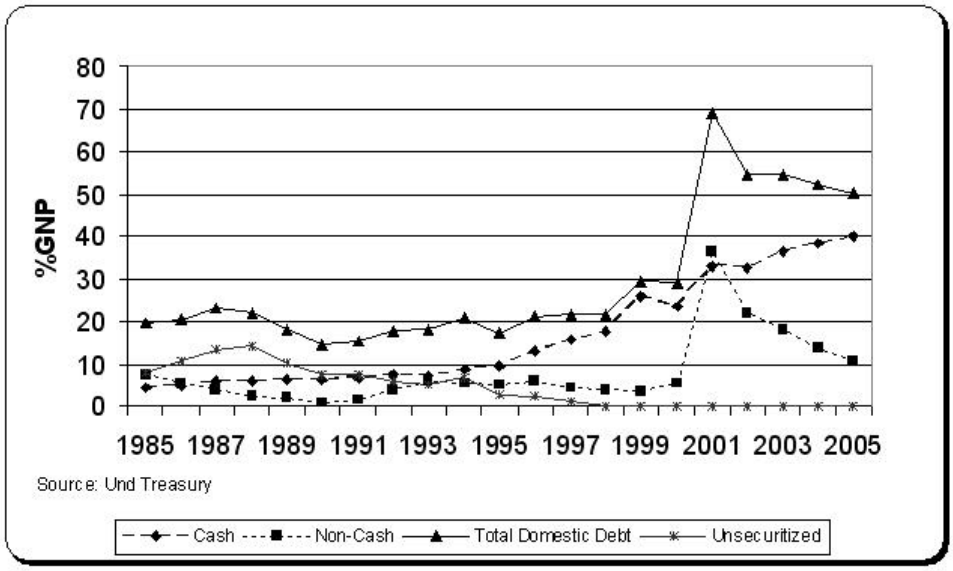


Figure 4.11: Cash and Non-Cash Stock (as a percent of GNP)

Turkey, domestic debt stock has accumulated because of securitized borrowing.[12] The treasury bills and bonds are government debt securities that have constituted securitized domestic debt stock. Securitized debt stock includes cash and non-cash debt stock. Cash debt stock accumulates due to cash sales auctions to private sector such as private banks and private sectors. Non-cash debt stock accumulates as a result of the private placement bills and bonds given to public sector only. Thus, the cash debt represents the debt of the government to the market whilst the non-cash debt corresponds to the public-to-public debt. As can bee seen from Figure (4.11), the cash debt stock has an upward trend. It has increased continuously since 1989 whereas non-cash debt stock has been more volatile. Especially, following the 2001 financial crisis, it reached to 36.4 percent of the GNP.

The securitized debt stock[13] was only 8.1 percent in 1989. It has grown rapidly in the following years and due to the increase in salaries of public employees,

[12]The central bank advances to the treasury is called unsecuritized part of domestic debt.

[13]Cash plus noncash stock.

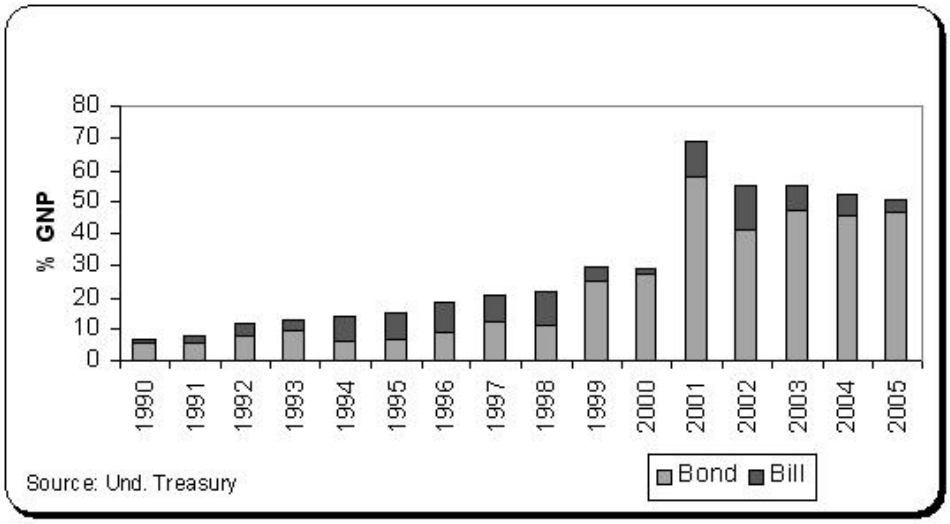


Figure 4.12: Domestic Borrowing Through Bonds and Bills (as a percent of GNP)

it reached to 18.5 in 1996. Moreover, augmentation in PSBR accelerated the increase in the securitized debt stock ratio. High real interest rates on cash borrowing led to a jump in debt stock 1999 to 29.3 percent of the GNP. The securitized debt stock increased dramatically to 69.2 percent after the 2000 and 2001 financial crises. The bank recapitilization in 2001 led to a dramatic increase in non-cash debt stock. The government preferred to finance the bank recapitalization through borrowing from public. At the end of 2001, the non-cash debt stock reached 36.4 percent of GNP whereas the cash debt stock increased from 23.4 percent of GNP in 2000 to 32.8 percent. After 2001, the share of the cash stock has continued to increase whereas the share of the non-cash debt stock has started to decline.

Beside the stock of debt, the maturity of debt is also an important concept. Short term debt is a dangerous form of debt. It makes emerging market economies prone to crises and renders these crises more difficult to manage.[14] Figure (4.12) displays the portion of domestic borrowing as a percent of GNP which was materialized through treasury bills and government bonds. As illustrated in the figure

[14]See Jeanne and Guscina, 2006.

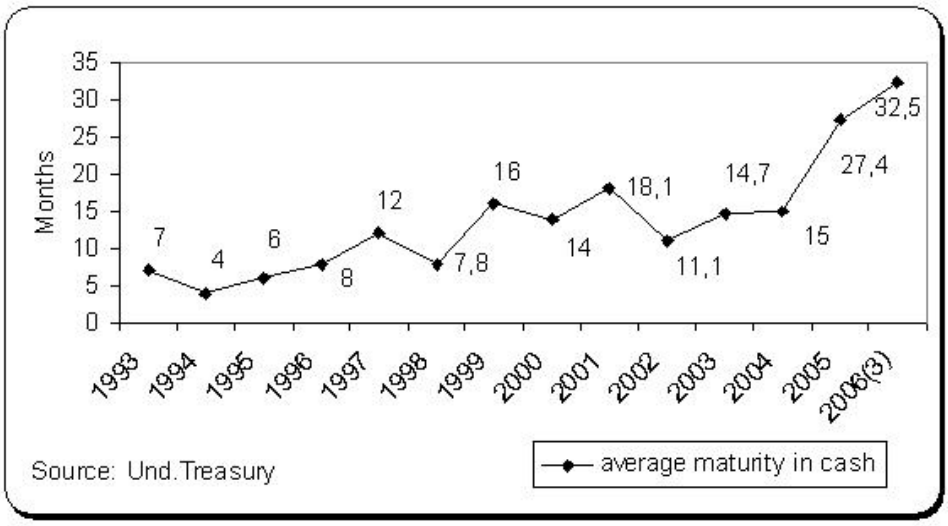


Figure 4.13: Average Maturity of Cash Borrowing

(4.12), borrowing through government bonds is the dominant one. Although, at a first glance, choosing bonds as a financial instrument seems appropriate, the average maturity is not at reliable levels. As can be seen from Figure (4.13), the underlying characteristic of the domestic debt management has been its short-termism. The uncertain macroeconomic environment, lack of monetary and fiscal credibility, and related worries about the possibility of implicit or explicit default were the main reasons for short-termism in average maturity. Although there was a significant increase in average maturity in 2005, it has been 13.8 months on average since 1993.

It is stated in Treasury report of 2005 that Turkey's debt consists of approximately 45.4 percent fixed and 54.6 percent variable interest rates. In addition, the total debt is 84.5 percent contingent on Turkish Lira, and 15.5 percent contingent on foreign exchange. Figure (4.14) displays the improvements in the structure of the domestic borrowing after the 2001 stabilization program. However, since roughly 50.0 percent of domestic debt includes floating interest rates, it is still vulnerable to any future rises in interest rates.

Beside the average maturity increase in 2005, average cost of new borrowings

	2002	2003	2004	2005
Fixed	**36,3**	**43,7**	**51,5**	**45,4**
Floating	**63,7**	**56,3**	**48,5**	**54,6**
YTL	**67,9**	**78,1**	**82,4**	**84,5**
Fixed	25,1	35,3	42,3	41,4
Floating	42,8	42,8	40,1	43,1
FX	**19,0**	**12,7**	**13,4**	**13,2**
Fixed	10,9	8,4	9,2	3,9
Floating	8,0	4,3	4,2	9,3
FX Indexed	**13,2**	**9,2**	**4,2**	**2,3**
Fixed	0,3	0,0	0,0	0,0
Floating	12,9	9,2	4,2	2,3

Figure 4.14: Currency and Interest Rate Composition of Domestic Market Borrowing (as a percent)

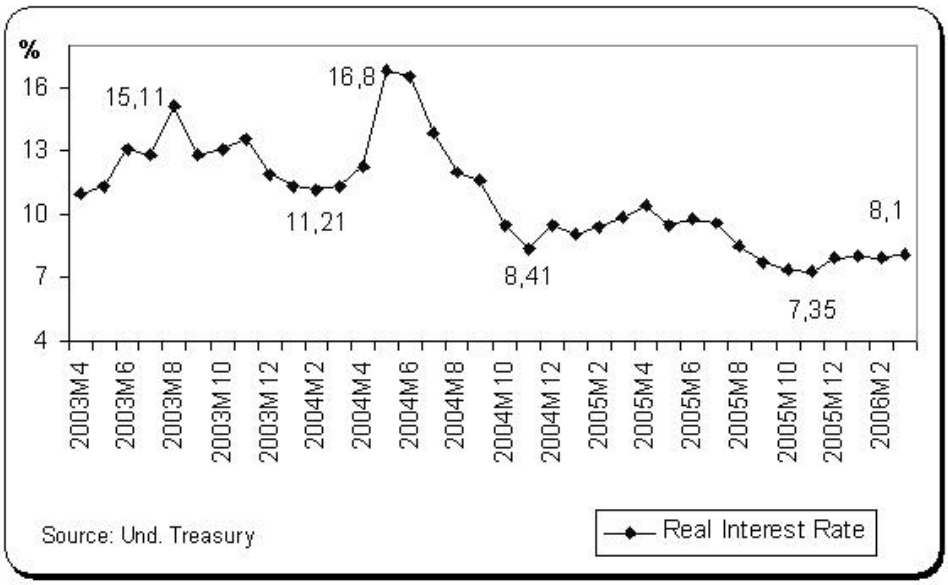


Figure 4.15: Real Interest Rate of Total Domestic Debt Stock

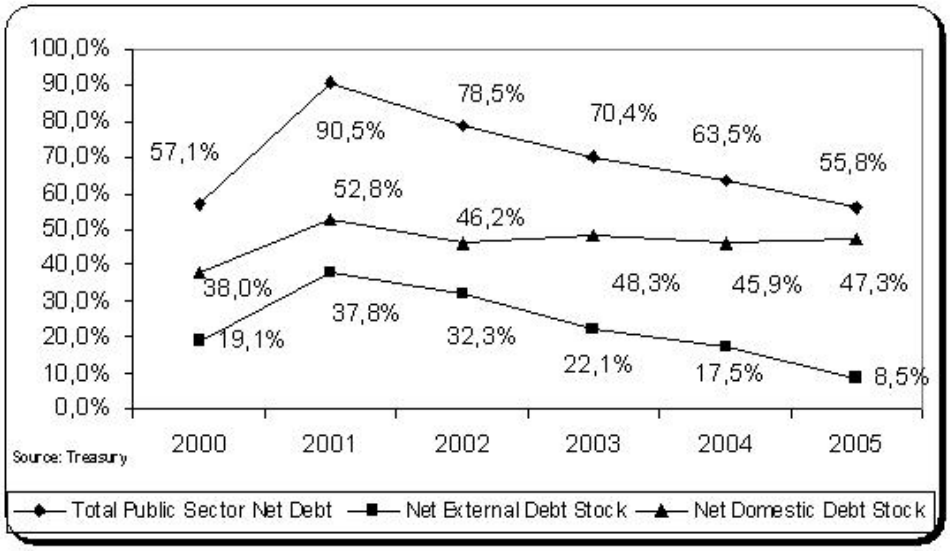


Figure 4.16: Public Net Debt Stock (as a percent of GNP)

declined. The good conditions in the global financial markets, and the improvements in Turkish economy, decreased the cost of borrowing during 2005. Figure (4.15) shows the real interest rate of total domestic debt stock for the last three years. It was at 16.53 percent on June 2004 and declined to 8.1 percent on March 2006.

Figures (4.16) and Figure (4.17) display the public net debt stock and the consolidated public debt as a percent of GNP. Generally, gross debt (total stock of outstanding debt) is used in analyses of debt. However, using gross domestic debt has a main drawback. It does not take into account financial assets that could be quickly liquidated to repay debt. It is more common in recent literature to use net debt stocks, which is by definition gross debt minus liquid assets, rather than gross debt stocks. As it can be seen from figure (4.16) net public debt is significantly different from the total public debt (Figure 4.6). Following the 2001 crisis, the total public debt and also both domestic debt and external debt declined sharply. At the end of 2005, the total public debt of Turkey was 68.2 percent of GNP whereas domestic debt and external debt were 50.3 and 17.8 percent of GNP, respectively.

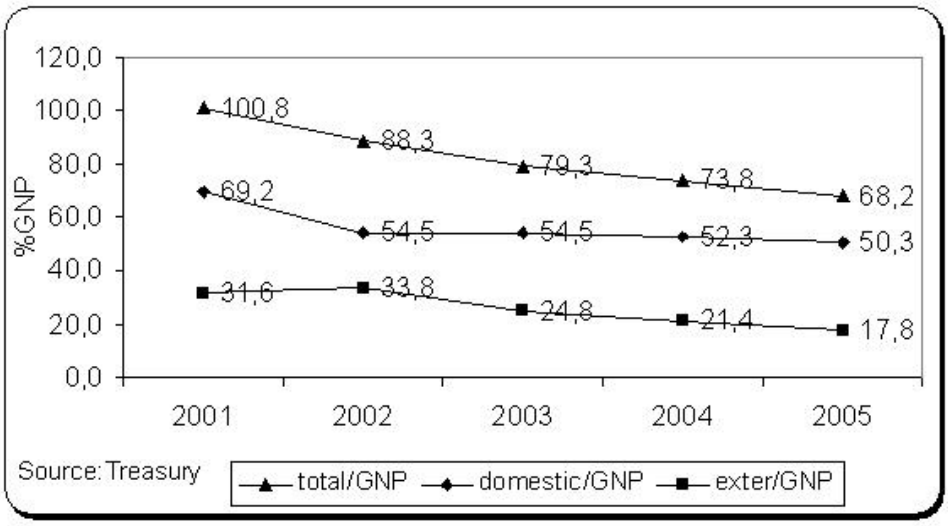


Figure 4.17: Consolidated Debt (as a percent of GNP)

4.4 Conclusion

In the post 1989 period, there was a heavy deterioration in deficit dynamics of Turkey. PSBR as a ratio of GDP averaged 5.4 per cent during 1975-1988 period, but climbed to 9.4 per cent for 1989-2005 period. Moreover, there was a radical change in financing of the PSBR. After the abolishment of interest ceilings, PSBR financing started to rely almost on the issues of government debt instruments and after the introduction of new financial instruments, the government found it much easier to finance its borrowing requirements domestically. Therefore, the share of domestic borrowing in PSBR financing kept increasing and foreign borrowing declined. In addition, the two financial crises of April 1994 and February 2001 led to a significant devaluation of the Turkish Lira, increased the risk premium, lowered the maturity of the domestic debt. The sharp increase in the real interest rates accelerated the accumulation of the debt stock. By the end of 2001, Turkey had a public debt which was around 101 percent of the GDP[15], which placed it at the top most indebted countries in the world. Although, in the following four years, there have been significant improvements related to the level of debt stock, the maturity structure and the interest expenses are not at reliable and

[15]de Bolle et al (2006).

sustainable levels yet. Most of the debt is still based on short-term government debt instruments which are generally accepted as a dangerous form of debt for highly debted emerging market economies. Moreover, the huge amount of interest expenses because of the high real interest rates is still a big problem. This situation necessitates to generate primary surpluses in order to build the credibility in order to maintain the capital flows and to restructure the debt stock.

Chapter 5

Empirical Methods for the Assessment of Fiscal Sustainability

5.1 Introduction

This chapter analyzes three alternative empirical methodologies to assess fiscal sustainability of domestic debt: These are first, the Wilcox's (1989) approach; second the Uctum and Wickens's (2000) approach that are based on econometric tests of the borrowing constraint; and thirdly, a new methodology (Garcia and Rigobon, 2004), that incorporates the effects of uncertainty of inflation, exchange rate, interest rate and output growth, on the evolution of debt, with a particular index of debt sustainability based on the stochastic properties of the debt dynamics. The main purpose of this chapter is to provide a comprehensive explanation and to make a comparison of those three approaches before applying those to assess the domestic debt of Turkey.

5.2 Two Traditional Sustainability Tests

Government deficits have become a focus of professional interest and political debate since early 1980s. Governments face a present value borrowing constraint (PVBC) which states that the current debt should be offset by the sum of expected future discounted primary surpluses. In the literature, two approaches have been used to analyze the sustainability of fiscal policy in PVBC framework.

The first approach consists of testing the stationarity of the debt while the second one looks for a cointegration relationship linking the primary deficit, the stock of outstanding debt and interest payments. In this section, two of these approaches are examined. The first one is the Wilcox's test (1989) and the other is the Uctum and Wickens's test (2000).

5.2.1 Wilcox's Test (1989)

Wilcox (1989) proposes a method within PVBC framework in order to test the sustainability of the debt. Different from the study by Hamilton and Flavin (1986), Wilcox allows for stochastic real interest rates and for nonstationarity in the noninterest surplus.[1] Equation (5.2.1) gives the accounting identity describing the accumulation of government debt:

$$DB_t = DB_{t-1} - S_t \tag{5.2.1}$$

where DB_t is the discounted value of the debt and S_t is the discounted value of the noninterest surplus.[2] Recursive forward substitution applied to equation (5.2.1) yields

$$DB_t = DB_{t+N} + \sum_{j=1}^{N} S_{t+j} \tag{5.2.2}$$

As N gets large, if the DB_{t+N} goes to zero in the limit, then the current value of the debt equals the sum of expected future noninterest surpluses:

$$DB_t = \sum_{j=1}^{N} S_{t+j} \tag{5.2.3}$$

[1]Hamilton and Flavin (1986), in their innovative paper, assumed a fixed real interest rate and required the surplus to be stationary.

[2]Let q_t be the real discount factor from period t back to period zero: $q_t = \prod_{j=0}^{t}(1 + r_j)^{-1}$. Then normalize q_t series such that $q_0 = 1$. Using these normalized discount factors, the discounted debt can be written as $DB_t = B_t q_t$, where B_t is the sovereign debt and r_j is the stochastic real interest rate.

Equation (5.2.3) is the present value borrowing constraint, which holds when the expectation of the discounted debt goes to zero in the limit:

$$\lim_{N \longrightarrow \infty} E_t[DB_{t+N}] = 0 \tag{5.2.4}$$

Wilcox (1989) shows that the intertemporal budget balance holds if and only if the discounted real debt series are stationary with mean zero. Wilcox's test requires a two step procedure. First, the discounted real debt series are tested for stationarity and then if non-stationarity is rejected, the discounted real debt process is tested for a zero mean.

In order to test the real debt process for a zero mean, Wilcox suggests to construct an appropriate ARMA model with a constant and then to test constant term for its significance. If the data rejects the the null hypothesis of a constant term equal to zero, then it is concluded that the fiscal policy is unsustainable.

5.2.2 Uctum and Wickens's Test, (2000)

Uctum and Wickens extend the Wilcox's (1989) method to the case where the discounted rate is stochastic and time varying, and the discounted primary deficit is either strongly or weakly exogenous.[3]Moreover, they build the intertemporal budget constraint more detailed than Wilcox.

Equation (5.2.5), which is the starting point of their test, shows the nominal one-period intertemporal budget deficit:

$$G_t - T_t + i_t B_{t-1} = \Delta M_t + \Delta B_t \tag{5.2.5}$$

where G_t is the government expenditure, T_t is the tax revenue, B_t is the total stock of domestic debt, M_t is the reserve money and i_t is the nominal interest

[3]Discounted primary deficit Z_t is strongly exogenous if it is generated by the process $Z_t = \mu + e_t$ and it is weakly exogenous if it is generated by the process $Z_t = \mu - \alpha X_{t-1} + e_t$, where X_t is the discounted debt, μ is the constant term and e_t is the error term.

rate on government debt. Dividing each term in equation (5.2.5) by nominal GNP gives the budget constraint in terms of proportions of GNP:

$$g_t - t_t + \frac{(i_t b_{t-1})}{(1+g_{Y,t})} = \Delta m_t + \Delta b_t + (m_{t-1} + b_{t-1})(\frac{g_{Y,t}}{1+g_{Y,t}}) \tag{5.2.6}$$

where the lower-case variables (excluding i_t) denote the ratio of corresponding upper-case variables to GNP.

Rearranging equation (5.2.6) yields

$$g_t - t_t + b_{t-1}\frac{(i_t - g_{Y,t})}{(1+g_{Y,t})} = \Delta m_t + \Delta b_t + m_{t-1}(\frac{g_{Y,t}}{1+g_{Y,t}}) \tag{5.2.7}$$

Denoting $(i_t - g_{Y,t})/(1+g_{Y,t})$ by ρ_t, which stands for the nominal interest rate adjusted for the nominal output growth, and denoting $g_t - t_t - \Delta m_t - \Delta b_t + m_{t-1}(g_{Y,t}/(1+g_{Y,t}))$ by d_t which stands for the primary deficit less the reserve money change and seigniorage, each term is scaled by nominal output.[4]

Equation (5.2.7) can be expressed now:

$$d_t + b_{t-1}\rho_t = \Delta b_t \tag{5.2.8}$$

Solving for b_{t-1} equation (5.2.8) can be rewritten in discounted terms as

$$b_{t-1} = \frac{1}{(1+\rho_t)}(b_t - d_t). \tag{5.2.9}$$

Recursive forward substitution applied to equation (5.2.9) yields

$$B_t = E_t \delta_{t,N} b_{t+N} - E_t \sum_{i=1}^{N} \delta_{t,i} d_{t+i} \tag{5.2.10}$$

where $\delta_{t,n} = \prod_{s=0}^{n}(1+\rho_{t+s})^{-1}$ is the time-varying real discount factor n periods

[4]Alternatively, ρ_t can be rewritten as $\rho_t = (i_t - \pi_t - g_{Q,t} - \pi_t g_{Q,t})/(1+g_{Q,t})(1+\pi_t)$ using the identity $(1+g_{Q,t})(1+\pi_t) = (1+g_{Y,t})$, where $g_{Q,t}$ denotes the growth rate of real output and π_t denotes the inflation rate. This ρ_t can be interpreted as the ex-post real interest rate adjusted for real output growth.

ahead, adjusted for real GNP growth rate. Equation (5.2.10) can be rewritten in a similar way, after normalizing discount factor series such that: $\delta_{t,0} = 1$.

As N goes to infinity, if the discounted value of the expected debt-GNP ratio converges to zero in the limit, then the sustainability is satisfied. Hence, the current debt-GNP ratio is offset by the sum of current and expected future discounted surpluses expressed as a portion of GNP:

$$B_t = -\lim_{N \longrightarrow \infty} E_t \sum_{i=1}^{N} \delta_{t,i} d_{t+i} \tag{5.2.11}$$

Uctum and Wickens show that a necessary and sufficient condition for sustainability is that the discounted debt-GNP(or GDP) ratio should be stationary zero mean process. Hence, Equation (5.2.11) is also satisfied.

5.3 A Risk Management Approach

There have been recently a number of attempts to incorporate such uncertainties into the analysis of debt sustainability.[5] One of them is the innovative study of Garcia and Rigobon (2004). Their approach includes the characterization of the evolution of all relevant stochastic variables and the calculation of the different debt paths. Additionally, these variables which have a priori importance on the evolution of debt, such as the exchange rate and the inflation rate, are included in the analysis. The idea is to estimate the conditional means and variances from the data, to simulate the different paths of the debt, and to compute the probability that the debt will reach some level within some time and to measure risk.

Like most of the other debt sustainability studies, Garcia and Rigobon concen-

[5]Barnhill and Kopits (2003); IMF (2003a), Xu and Ghezzi (2003); Mendoza and Oviedo (2004); Garcia and Rigobon (2004); and Mora (2004).

trate on the debt accumulation equation

$$b_t = (1 + r_t - g_t)b_{t-1} + f_t \tag{5.3.12}$$

where b_t is the debt to GNP ratio, r_t is the interest rate, g_t is the growth rate of GNP, and f_t is the primary deficit. Garcia and Rigobon notice that although this equation has been critical in offering insights into various debt restructuring and stabilization programmes, most of the traditional debt sustainability studies which are based on equation (5.3.12), have several shortcomings due to the their approaches. First, the static application of this equation may understate or overstate the implicit risk associated with a given level of indebtedness, to the extent that the variables in this identity are stochastic (uncertain) and perhaps, correlated. Indeed, these studies do not concentrate on the possible evaluation of debt as a result of changes in one of the underlying variables in the debt equation. In other words, they ignore the effects of stochastic shocks. Another drawback of these studies is that they are often predicated on a notion of sustainability, as defined by a constant debt-to-GDP ratio, which may not always be either desirable or practical.[6] Garcia and Rigobon (2004) note that this approach may be of little practical policy use. They suggest that since the purpose of accumulating debt in the first place is to smooth consumption inter-temporally, it would be counter-intuitive to strive to keep the debt to GDP ratio constant. Secondly, and perhaps more contextually relevant for Turkey, if a country faces significant levels of indebtedness or is highly vulnerable to external shocks, then maintaining a constant debt to GDP level would not be a sustainable policy.[7]

In view of these shortcomings, Garcia and Rigobon propose a different measure to assess the debt sustainability that incorporates uncertainty by emphasizing the role of stochastic factors. Further, they study the question of debt sustainability from a risk management perspective and expand the notion of debt sustainabil-

[6] In the sustainability indicator framework, most of the studies accept the constant debt ratio as a criterion of sustainability. See Chapter 2 Section 3.2.

[7] A high level public debt in this case would make the country more vulnerable to external shocks, such as a sudden in capital flows or decline in GDP growth.

ity to studying the stochastic properties of the debt dynamics. Moreover, they also consider the possibility that there are other external variables, such as the exchange rate and the inflation, that could generate comovement in the variables entering the debt accumulation equation. Indeed, they follow finite horizon approach which completes the picture by indicating the scale of future adjustments that countries need to make to put fiscal policy on a consistent path.

Briefly, the main attraction of this measure is that it is easy to compute each period in a mechanical way, and it can be tailored to any time horizon. From a theoretical point of view it has a number of important advantages over existing procedures for determining fiscal sustainability. It is more informative and general than simply looking at whether deficits and debts are stationary or nonstationary processes, or whether the deficit and debt are cointegrated. The greater generality arises from not assuming that interest rates, inflation and GDP growth are constant either in the past or over the forecast period, or that they may change but in a rigid predetermined way. Instead, all variables are modelled in the VAR together. Indeed, it includes uncertainty into the analysis through simulation of different debt paths where the simulations are based on the correlations of the variables.

5.3.1 Methodology of the Risk Management Approach

A reduced-form vector auto-regression (VAR) model is used primarily to estimate the joint dynamics of the related macro-variables. The VAR expresses each variable as a linear function of its own past values, the past values of all other variables being considered and a serially uncorrelated error term. Each equation is estimated by the ordinary least squares (OLS) regression, while the number of lagged values to include in each equation is determined by alternative methods.[8] The error terms in these regressions are the shocks in the variables, taking past values into account. If these variables are correlated with each other, then the

[8]Likelihood Ratio (LR) test, Akaike Information Criterion (AIC), and Schwartz Bayesian Criterion (SBC) can be used for choosing the appropriate lag length.

error terms in the reduced-form model will also be correlated across equations. The mathematical representation of a simple VAR is:

$$x_{1,t} = \phi_{01} + \phi_{1,1}x_{1,t-1} + \phi_{1,2}x_{2,t-1} + \varepsilon_{1,t} \quad (5.3.13)$$

$$x_{2,t} = \phi_{02} + \phi_{2,1}x_{2,t-1} + \phi_{2,2}x_{2,t-1} + \varepsilon_{2,t} \quad (5.3.14)$$

where $E(\varepsilon_{1,t}\varepsilon_{2,s}) = \sigma_{1,2}$ for $t = s$ and zero for $t \neq s$. One could rewrite this in a standard form as

$$\begin{bmatrix} x_{1,t} \\ x_{2,t} \end{bmatrix} = \begin{bmatrix} \phi_{01} \\ \phi_{02} \end{bmatrix} + \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{bmatrix} \quad (5.3.15)$$

or more simply

$$x_t = \Phi_0 + \Phi_1 x_{t-1} + \varepsilon_t \quad (5.3.16)$$

where $E(\varepsilon_t) = 0$,$E(\varepsilon_t, \varepsilon_s) = 0$ for $t \neq s$ and

$$E(\varepsilon_t, \varepsilon_t) = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix} \quad (5.3.17)$$

A general VAR(p) process with a constant term can be written as

$$x_t = \Phi_0 + \Phi_1 x_{t-1} + \Phi_2 x_{t-2} + ... + \Phi_p x_{t-p} + \varepsilon_t \quad (5.3.18)$$

where the error term follow a vector white noise , i.e., $E(\varepsilon_t, \varepsilon_s^{'}) = \Omega$ for $t = s$ and $E(\varepsilon_t, \varepsilon_s^{'}) = 0$ for $t \neq s$.

The VAR is computed using the following macro variables;

$$X_t = c + B(L)X_t + \varepsilon_t \quad (5.3.19)$$

$$X_t \equiv (\pi_t, s_t, g_t, r_t, f_t, b_t) \quad (5.3.20)$$

$$\varepsilon_t \sim N(0, \Omega) \quad (5.3.21)$$

and $\pi_t, s_t, g_t, r_t, f_t,$ and b_t represent the inflation, real exchange rate, nominal growth rate of GNP, nominal interest rate, primary surplus (as a percent of

GNP) and domestic debt (as a percent of GNP), respectively. The reduced-form residuals, ε_t, are distributed multinomial normal with zero mean and covariance matrix Ω, and $B(L)$ represents the coefficients of lags.

The standard practice in VAR analysis is to analyze results from impulse responses, which yield how each variable is affected given a shock at time t. Although impulse responses are examined in these approaches, the primary aim of it is to describe the possible evolution of debt. The only requirement to conduct the analysis of the evolution of the debt is to produce the contemporaneous correlation as the result of a Choleski decomposition.[9]

There is an issue of whether the variables in a VAR model need to be stationary. According to this issue, if the variables in the model are nonstationary, a VAR model in differences should be estimated rather than a VAR in levels. However, these are several drawbacks in some special situations. First, it is most of the time difficult to determine whether the variables are stationary or not. For instance, unit root tests are biased towards accepting the null hypothesis of a unit root in the presence of a structural break. Therefore, a standard unit root test should not be used in case of structural breaks. In literature, there are alternative unit root and cointegration tests which include the effects of the structural breaks in their assessments.[10] However, such tests are commonly not easy to interpret and they are constructed under the assumption of only one structural break, which is not the case most of the time in reality. Second, short samples are likely to make it more difficult to reject nonstationarity if mean reversion only manifests itself over long periods (Trehan and Walsh 1991). Actually, this critique is more important since the data series for basic macro series, such as debt and primary balances, are too short in emerging market economies. Furthermore, in the literature there are several opinions against differencing even if the variables in a VAR model

[9]Any Choleski decomposition, i.e. any ordering of the variables in the VAR, will produce the same reduced form covariance matrix, which explains why the ordering of the triangular factorization determined by the ordering of the variables is not relevant for risk management applications.

[10]Perron, (1989); Zivot and Andrews (1992).

contain a unit root. Sims (1980) argues that goal of a VAR analysis is to determine the interrelationships among the variables, not to determine the parameter estimates. Therefore, he recommends against differencing. Generally, the main argument against differencing is that it "throws away" information concerning the comovements in the data (such as the possibility of cointegration relationships). Moreover, it is known that even in near unit root setups VAR's produce consistent estimates (Rothenberg and Stock, 1997). Similarly, it is argued that the data need not to be detrended (Enders, 1996). In a VAR, a trending variable will be well approximated by a unit root plus drift. However, the common view is that the form of variables in the VAR should mimic the true data generating processes. Taking into account these criticisms, in this study the staniority of the variables is not considered and the cointegrating relations between variables are not examined. Such considerations are thought to be less relevance in using a VAR purely for forecasting and/or simulating. If the data are I(1) and cointegrated then a VAR in levels will implicitly, and hence automatically, take account of any cointegration (See Polito and Wickens (2005); Garcia and Rigobon (2004); Lewis (2004)).

Once the parameters in Equation (5.3.19) are estimated from the historical data, several paths of the shocks can be generated using the Choleski decomposition of the reduced form residuals. Indeed, the path of the variables in X_t can be computed using the coefficients from the VAR. This simple procedure uses Monte Carlo to determine several paths of the debt.

A simulated sample of X is obtained from:

$$X_t = c + \hat{B(L)}X_t + \eta_t \tag{5.3.22}$$

where $\eta_t = W\upsilon_t$, and W is the Cholesky's decomposition matrix of Ω, such that $\Omega = WW'$, and υ_t is a vector of identically and independently distributed random shocks drawn from a standard normal distribution, $\upsilon_t \sim N(0, I)$.

As next step is obtained the probability distribution of the debt ratio for each

projection period. Observing the changes in the probability distributions corresponding to different projection periods gives conclusive results about the sustainability of the debt. For example, if the probability distribution curve shifts up through the time, it indicates that continuation of the current fiscal policy leads an expand in the level of debt. This situation necessitates a change in fiscal policy.

Besides constructing probability distribution, the simulated sample of X is used to compute risk probabilities, i.e., probabilities that the simulated debt to GNP ratio exceeds a given threshold deemed risky. The time-series of such probabilities is then used to investigate whether or not it is correlated with the market risk assessment, measured by the spread on debt.[11]

According to Garcia and Rigobon, Risk Management Approach offers some advantages. First, because their approach is not interested in estimating the contemporaneous causality between the macro variables, the VAR is used only to produce the best predictor on the joint dynamics of the macro variables. Second, variables and shocks that are not part of the debt accumulation equation can also have an impact on debt dynamics. Thus, the exchange rate and the inflation can be included as variables in the VAR although they are not the part of debt accumulation equation.[12] Third, the procedure can be used to estimate rolling regressions in order to asses the predictive power of the model and perform out of sample tests.

[11]Risk probabilities can be compared with EMBI+ index or ELMI+ index or an index which is constructed using different weights of EMBI+ and ELMI+ indices.

[12]Even if variables are not included, it is possible that the VAR could summarize their effect. Their impact on the debt dynamics will show up either as GDP, inflation or real exchange rate movements. Thus, the fact that the variable has been excluded from the VAR does not mean that its effect has not been summarized in the variance-covariance matrix of the reduced form residuals (Garcia and Rigobon, 2004).

5.4 Conclusion

Like the analyzes of Wilcox, and Uctum and Wickens, traditional fiscal sustainability analyzes, based on testing whether the intertemporal budget constraint is satisfied or not, have several shortcomings. First, they do not take into account the effects of uncertainty in their assessments. Most of these methods use the modelling framework of perfect foresight based on deterministic processes ignoring the effects of stochastic shocks to the system. In other words, these methods ignore the vulnerability of public debt to adverse shocks. In reality, exogenous shocks to primary balance (for example, due to the contingent liabilities, bank recapitalization) have implications for the conduct of future fiscal and monetary policy. Further, especially emerging market governments face considerable uncertainty due to the interest rate and the exchange rate movements. Such uncertainties should be incorporated into the analysis of debt sustainability. Indeed, sensitivity (stress) test should be carried out with respect to arbitrary changes in selected variables in order to assess fiscal sustainability and vulnerability.

Second, most of the time, these tests result in contradictory and misleading conclusions. For example, Hamilton and Flavin (1986), Trehan and Walsh (1988, 1991) show that fiscal policy is sustainable for the US economy, whereas Kremers (1988) and Wilcox (1989) find no evidence for sustainability. This is mainly because of the limitations in coverage. They usually focus on only debt and primary balance and ignore the effects of exchange rate movements, interest rate and inflation.

Third, all of these tests of sustainability are based on the assumption that the process generating deficits and debt will continue into the future. In practice, however, it may be necessary to alter fiscal policy in order to achieve sustainability. The infinite horizon approach gives a long term picture of fiscal policy but is silent about the details of the adjustment that is required if it is unsustainable. Moreover, following the infinite horizon approach requires to forecast future deficits, inflation, growth and interest rates in order to complete the present value of expected future deficits.

Fourth, in interpreting the results of these studies which are carried out for emerging market economies, the shortness of the samples should be borne in mind. Short samples are likely to make it more difficult to reject nonstationarity if mean reversion only manifests itself over long periods (Trehan and Walsh 1991). Generally, tests relate to the very long run and hence are of limited practical use for short-term decision-making. Therefore, methods like these are not suitable for assessing the emerging markets debt.

Finally, apart from the obvious standard criticisms of unit root tests for short samples, having no conclusive results indicates that the infinite horizon approach which most of the time ignores uncertainties leads misleading results, especially for emerging market economies. Moreover, such traditional methods say little about the probability with which a government might become insolvent, or the risks to fiscal sustainability.

For example, Wilcox concentrates on the relationship among debt stock, primary balance, inflation and interest rate whereas Uctum and Wickens focus on debt stock, primary balance, growth rate of GNP, inflation and interest rates. Both tests, however, do not take account of exogenous shocks caused by the underlying variables. In other words, they ignore uncertainty. Moreover, they follow infinite horizon approach and test the PVBC by classical unit root tests. Obviously, such methods are not suitable for assessing a emerging market's debt since they do not cover even the effects of exchange rate movements which actually have non-negligible effects on the total stock of debt of emerging countries.

In contrast, new approaches to assess fiscal sustainability like the methodology of Garcia and Rigobon capture the effect of volatility (uncertainity) in the economy, as well as their incidence on fiscal and financial variables. The results, particularly those expressed in terms of the probabilities of default, constitute useful analytical tools for policy makers to foresee the wideness of the period available to undertake corrective fiscal policies. Indeed, in the study of Garcia and Rigobon,

there is no requirement to commit to a particular structural model or distribution of the residuals. This is crucial in countries such as Turkey and Brazil because the standard triangular assumption imposed in monetary economy is rarely satisfied. It is hardly the case that decisions of the policy in a particular time do not affect prices, output, or exchange rates contemporaneously. Their methodology, by concentrating on the contemporaneous covariance of the residuals, allows to study the path of the debt to the typical mixture of shocks that have hit the economy of a emerging market economy. Moreover, they follow finite time horizon approach in their methodology differing from the traditional sustainability analyzes.

Actually, their approach has also a few shortcomings. First, it ignores the possible cointegrating relations among the variables. Therefore, it may be desirable to re-model the approach using cointegrated VAR methodology. Second, shortness of the samples may restrict to construct the true model for emerging market economies since adding extra variables reduces the degrees of freedom. Further, most of the time, data series of the underlying variables (debt, inflation, etc.) are not so smooth for these economies and such a situation will cause problems and requires assumptions in the construction of the model. Finally, this approach does not suggest a way about the inclusion of the variables into the system.

Chapter 6

Analysis of Domestic Debt Sustainability for Turkey: A Risk Management Approach

6.1 Introduction

The recent literature on the debt of emerging market countries suggests that the domestic debt is a more interesting object of inquiry than the international debt. Hence, this chapter applies and analyzes three methodologies, which are already developed in Chapter 5, to assess the fiscal sustainability of the domestic debt of Turkey. First two of these tests are the stationarity tests which captures the past behavior of the domestic debt stock and assess the sustainability within the PVBC framework. On the other hand, the last one is a new approach which captures the volatility (uncertainity) in its assessment by Monte Carlo experiments based on the correlation of the underlying variables.

6.2 Sustainability Analysis for Turkey with Traditional Approaches

In this section two traditional sustainability analyzes are applied to assess the fiscal policy of Turkey. The first approach is the one of Wilcox (1989) and the second

one is the Uctum and Wicken's (2000) approach. Both of these approaches analyze the sustainability of domestic debt levels in Turkey within PVBC framework.

6.2.1 Application of Wilcox's Test

In this section an application of the Wilcox's test (1989) will be carried out for the Turkish macro-economic data. Wilcox shows that the intertemporal budget balance holds if and only if the discounted real debt series are stationary with mean zero. Wilcox's test requires a two step procedure. First, the discounted real debt series are tested for stationarity and then if non-stationarity is rejected, the discounted real debt process is tested for a zero mean.

The data are collected from the CBTR Electronic Data Delivery System (EDDS). The total number of observations is 68. The variables that are used in the analysis are (1) The Nominal Domestic Debt Stock; (2) Wholesale Price Index; (3) The Nominal Interest Rate. The data series are quarterly for the sample period 1989:1-2005:4. The nominal interest rate is proxied by the weighted average of 3-month deposit rate and the inflation is proxied by the changes in Wholesale Price Index (WPI). Further, the nominal quarterly domestic debt stock is deflated by quarterly WPI, respectively.

The real discount factor q_t is obtained using the the formula (6.2.1)

$$q_t = \prod_{j=0}^{t} (1 + r_j)^{-1} \tag{6.2.1}$$

where r_t denotes the real interest rate. The real interest rate is obtained by using Fisher equation: $r_j = r_j^n - \pi_t$, where r_j^n denotes nominal interest rates and π_t denotes the inflation. In finance, this equation is primarily used in *yield to maturity* calculations of bonds. Then the discount factor for 1989:1 is normalized to unity.[1]

[1]Wilcox(1989) calculates the discount ratio by using real return on gold rather than real interest rate.

Figure (6.1) shows the undiscounted and the discounted values of the real domestic debt for the period 1989:1 to 2005:4. The discounted value of the debt is computed by multiplying the undiscounted values by real discount factors. The undiscounted values of real debt increased continuously through the sample period. In 2001, the undiscounted value of the real debt rose sharply. On the other hand, the discounted values of the real debt increased less rapidly in 2001 and than started to decline.

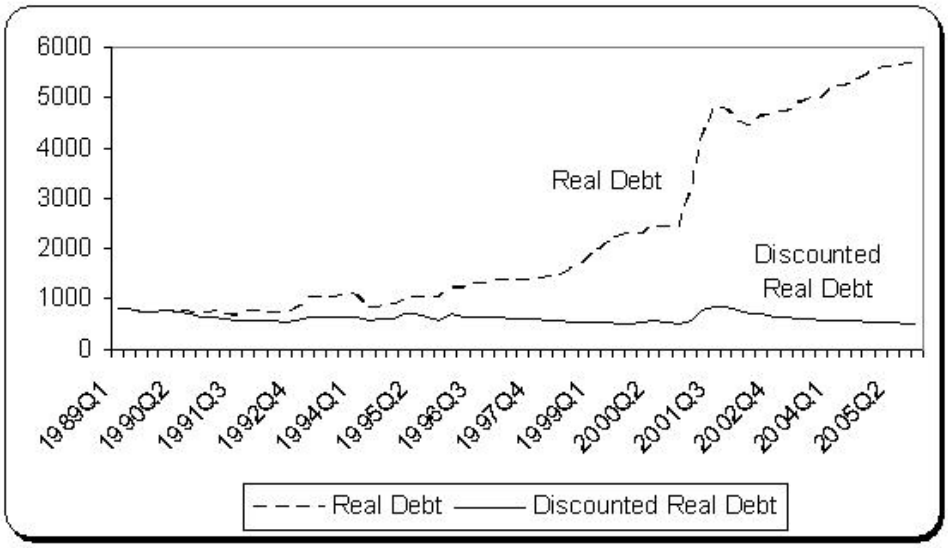


Figure 6.1: Real Domestic Debt

Then the issue whether the discounted values of real debt are stationary is checked. The ADF test statistic is -3,41 and Phillips-Perron test statistic is -2,80 where only a one lagged change in discounted debt and a constant term included in the regression equation.[2] Both ADF and Phillips-Perron test reject the null hypothesis of non-stationarity at the 5 percent and at the 10 percent significance level, respectively. Therefore, the null hypothesis of non-stationarity of the discounted values of real debt is rejected.

[2]LM test indicate that the residuals are not autocorrelated.

$$d_t = 608.65 + 1.347d_{t-1} - 0.776d_{t-2} + 0.277d_{t-3}$$

Next, the discounted real debt process is tested for a zero mean. For these purpose, an AR(3) model, which leads serially uncorrelated residuals, is selected. The t statistics of the constant term is 18.207 which is significant at the usual levels. Hence, the null hypothesis of zero mean is rejected. Therefore, according to Wilcox's test, the domestic debt stock of Turkey is unsustainable.[3]

6.2.2 Application of Uctum and Wickens's Test

Uctum and Wickens show that a necessary and sufficient condition for sustainability is that the discounted debt-GNP ratio should be stationary zero mean process.

The variables that are used in the analysis are (1) The Nominal Domestic Debt Stock; (2) The Wholesale Price Index; (3) The nominal GNP; (4) The nominal Interest Rate. The data series are quarterly for the sample period 1989:1-2005:4. The nominal interest rate is proxied by the weighted average of 3-month deposit rate and the inflation is proxied by the changes in WPI. Moreover, the twelve month moving averages of the nominal GNP series are used rather than original nominal GNP series which are very volatile. All the data series are collected from the CBTR Electronic Data Delivery System (EDDS). The total number of observations is 68.

The time-varying real discount factor n periods ahead $\delta_{t,n}$ is obtained using the the formula (6.2.2)

$$\delta_{t,n} = \prod_{s=0}^{n} (1 + \rho_{t+s})^{-1} \tag{6.2.2}$$

where ρ_t denotes the nominal interest rate adjusted for the nominal output growth.[4] Then the discount factor for 1989:1 is normalized to unity.

[3] t-statistic for d_{t-1} is 10.91, for d_{t-2} is -4.15 and for d_{t-3} is 2.304. All of these coefficients are individually significant.

[4] See Chapter 5 Section 2.2

Figure (6.2) shows the undiscounted and discounted values of the real domestic debt as a percent of GNP for the period 1989:1 to 2005:4. The discounted value of the debt ratio is computed by multiplying the undiscounted values by real discount factors. As denoted by Uctum and Wickens, the test for sustainability amounts to a judgment whether a reasonable forecast trajectory for the discounted debt would converge zero. Under the assumption that discounted debt can be treated as a univariate process, a qualitative judgment can be made from the plot of the discounted debt. Inspection of the data (Figure 6.2) reveals that the discounted debt ratio is mean reverting. The plot of the discounted debt suggests that the fiscal policy was unsustainable during the early 2001 crisis. The later part of the sample period, however, suggests that the policy was sustainable, since the discounted value of the debt generally was decreasing.

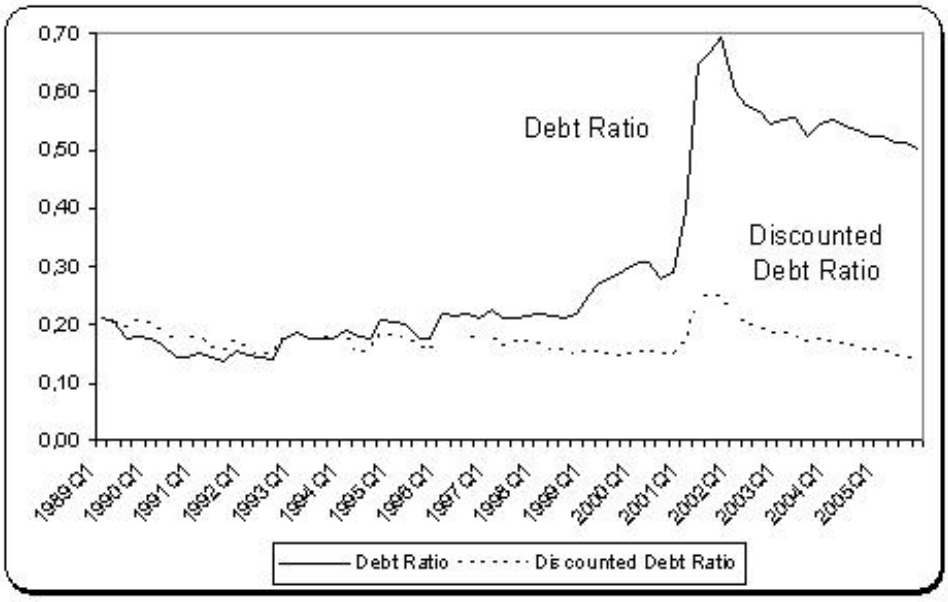


Figure 6.2: Government Domestic Debt (as a percent of GNP)

Next, ADF and Phillips-Perron tests for the undiscounted debt are conducted. The tests were performed on actual data for the period 1989:1 to 2005:4. The general conclusion to emerge from these tests is that the discounted debt ratio is

mean reverting. The null hypothesis is rejected at the 5 percent significance level for the debt ratio with the ADF test and Phillips-Perron test.[5]

Briefly, Uctum and Wicken's test indicates that the domestic debt stock of Turkey is sustainable as long as the discounted debt ratio continues to decline to zero.

6.3 Sustainability Analysis for Turkey with Risk Management Approach

This section follows the risk management approach employed by Garcia and Rigobon (2004) in the computation and in the assessment of the Turkish central government's domestic debt dynamics. Their approach includes the characterization of the evolution of all relevant stochastic variables and the calculation of the different debt paths. Additionally, variables that have a priori importance on the evolution of debt, such as the exchange rate and the inflation rate, are included in the analysis. The idea is to estimate the conditional means and variances from the data, to simulate the different paths of the debt, and to compute the probability that the debt will reach some level within some time and measure risk. An assessment of sensitivity of debt burden is conducted by constructing a risk measure, which is derived from the likelihood of the debt to GDP ratio exceeding a given threshold over a specific time-horizon. Moreover, the analysis reveals whether changes in the GDP growth rate, fiscal balances and interest rate are indicative of an improvement or deterioration in the debt sustainability dynamics for the medium-term.

[5]The ADF test statistic is -3,21 and PP test statistic is -2,94 where one lagged changes in discounted debt ratio and a constant term included in the regression equation. LM test indicates that the residuals are serially uncorrelated.

Table 6.1: Descriptive Statistics

Series	Obs.	Mean	Std. Error	Min	Max
Domestic Debt	68	0.305	0.170	0.136	0.692
Primary Balance	68	0.030	0.028	-0.015	0.074
Interest Rate	68	0,152	0,054	0,05	0,321
Growth Rate	68	0,166	0,304	-0,305	0,758
Exchange Rate	68	118.723	18.385	81.215	169.321
Inflation	68	0,114	0,073	0,0	0,506

6.3.1 Data and Model Selection

Compiling a data set is a major challenge for any study of public debt of Turkey, like other emerging market economies. The data employed for the analysis of debt dynamics in Turkey are: (1) The Domestic Debt Stock; (2) The Nominal GNP Growth Rate; (3) The Primary Balance; (4) The Nominal Interest Rate; (5) The Effective Exchange Rate and (6) The Inflation Rate.[6]

The data series are quarterly for the sample period 1989:1 2005:4. The domestic debt stock and the primary balance are represented as a share of GNP at current prices. The nominal interest rate was proxied by the weighted average of 3-month deposit rate. The niflation rate is measured through WPI. All the data is obtained from the CBTR Electronic Data Delibery System (EDDS). The total number of observations is 68. The descriptive statistics of the data series used are presented in Table (6.1).[7]

The series are tested to find whether they are individually stationary or not. Figure (6.4) presents the corresponding ADF and Phillips-Perron test statistics for the null hypothesis of nonstationary. All the series, except the inflation rate series, are nonstationary. As mentioned in Chapter 5, one problem that might arise from using a VAR is that if the variables are nonstationary but cointegrated

[6]Any increase in effective exchange rate corresponds to an appreciation in YTL.

[7]In this analysis, data series of the growth rate and the interest rate are in nominal terms since using these variables in real terms caused serially correlated residuals in the VAR estimations.

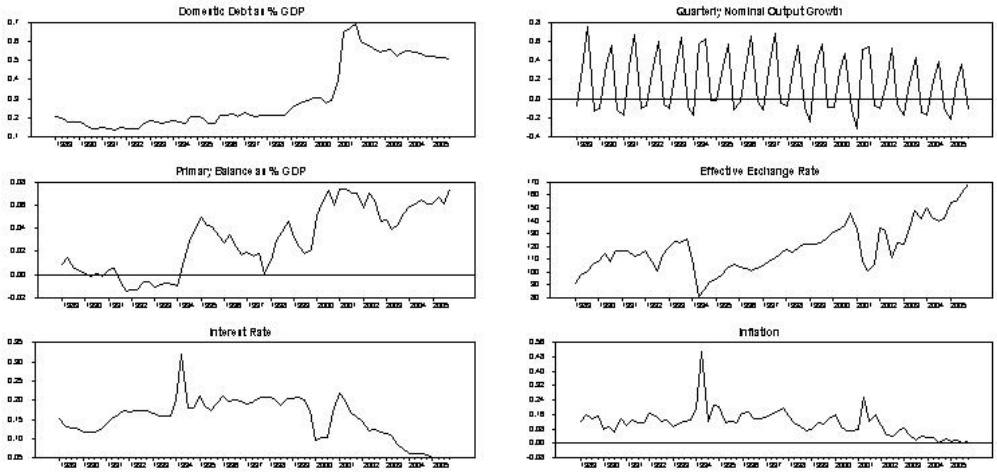


Figure 6.3: Graphs of the Six Principal Series

we should run an error correction model. Unfortunately the data used in this study is extremly short, and there is little hope that the standard tests are strong enough to give a definite answer. Therefore, we compute a VAR in levels like Garcia and Rigobon (2004).

In determining the optimal lag structure, in addition to the Likelihood Ratio (LR) test, the model selection criterions of Akaike Information (AIC) and Schwartz Bayesian (SBC) are used. The lag length, L, for the VAR is set at six, which is supported by both the Likelihood Ratio test and the Akaike Information Criterion (Table 6.2). Further, residuals are checked for the serial correlation. Ljung-Box Q-Statistics indicate that the residuals obtained from the VAR with six lags are serially uncorrelated. Table (6.3) shows the Q-statistics for intervals of four periods. Values in the table indicate the significance level of the null hypothesis of no serial correlation.

Table 6.2: Lag Selection Tests

Lags	AIC	SBC	LR (Significance)
8	-2180.33	-1564.59	0.58910
7	-2047.85	-1507.51	
7	-2069.91	-1525.31	0.16918
6	-1982.88	-1514.27	
6	-2008.68	-1536.46	0.02599
5	-1946.43	-1550.79	
5	-1978.32	-1579.69	0.45944
4	-1978.42	-1656.95	
4	-2018.46	-1694.62	0.04110
3	-2001.99	-1755.87	
3	-2035.52	-1787.64	1.13e-10
2	-1935.54	-1765.94	

Table 6.3: Ljung-Box Q-Statistics for Serially Uncorrelated Residuals

	Inflation	GNP Growth
Q(4)	0,883	0,773
Q(8)	0,799	0,437
Q(12)	0,387	0,593
	Exc. Rate	Primary Surplus
Q(4)	0,959	0,462
Q(8)	0,996	0,507
Q(12)	0,464	0,456
	Interest Rate	Debt Ratio
Q(4)	0,992	0,743
Q(8)	0,957	0,785
Q(12)	0,330	0,188

		Trend	# of lags	ADF Test	PP Test
Debt Ratio	Level	No	1	-1,15	-0,83
	Difference	No	0	-5,60*	-5,68*
Primary Surplus Ratio	Level	Yes	0	-0,96	-0,98
	Difference	No	0	-6,99*	-7,10*
Nominal Interest Rate	Level	No	0	-1,92	-1,95
	Difference	No	0	-8,96*	-9,10*
Nominal Growth Rate	Level	No	4	-0,87	-9,57**
	Difference	No	6	-6,68*	-14,18*
Effective Exchange Rate	Level	No	1	-1,63	-1,51
	Difference	No	1	-6,91*	-7,07*
Inflation	Level	Yes	0	-5,65*	-5,79*
	Difference	-	-	-	-

(*) indicates the rejection of the null hypothesis of non-stationarity at 1% level of sinificance. Each equation includes a constant term.
(**) Schwert (1987) shows that Phillips Test tends to reject the null hypothesis of a unit root too often if the process under consideration contains moving average components, which is the case in primary balance ratio. Therefore, we ignore PP test result for the primary balance ratio series.

Figure 6.4: Unit Root Test Results

6.3.2 Covariance of Reduced-form Residuals

It is assumed that the ordering of the equations is as follows: inflation, effective exchange rate, nominal interest rate, nominal GNP growth rate, primary balance and domestic debt stock. This order implies that inflation affects all the variables contemporaneously, while changes in domestic debt take effect with a lag. An inspection of these impulse response functions indicates that this ordering yields a reasonably satisfactory description of debt dynamics. Moreover, Granger causality tests are conducted to determine the order of variables. However, this tests did not suggest a specific ordering.[8]

Table (6.4) presents the covariance of the reduced-form residuals in the lower triangular region and the corresponding correlations in the upper triangular region. Some patterns of correlation are worth emphasizing. First, the domestic debt ratio is positively correlated with inflation, which may indicate that an increase

[8]Stock and Watson (2001) point out that structural inference and policy analysis are inherently more difficult because they require differentiating between correlation and causation; this is known as the identification problem in the econometrics literature. They note that this problem can be addressed by relying on economic theory and institutional knowledge.

Table 6.4: Covariance/Correlation Matrix

Cov/Cor	Inf.	Exc.R.	Int.R.	G.R.	Pri.B.	Dom.Debt
Inf.	0,002	-0,670	0,778	0,603	0,139	0,316
Exc.R.	-0,138	23,481	-0,599	-0,125	-0,098	-0,460
Int.R.	0,0005	-0,047	0,0003	0,371	-0,115	0,270
G.R.	0,001	-0,03	0,0003	0,003	-0,132	0,078
Pri.B.	0,00003	-0,002	-8,63e-6	-0,00003	0,00002	-0,120
Dom.Debt	0,0002	-0,034	0,00007	-0,00006	-8,47e-6	0,0002

in inflation deteriorates the sustainability of debt. Further, it is negatively correlated with exchange rate appreciation. Indeed, as expected, interest rates are positively correlated with domestic debt. An increase in interest rates will expand the interest costs, and this requires generally more borrowing. Moreover, the domestic debt is also positively correlated with growth rate which may indicate the existence of procyclical fiscal policy in Turkey. In emerging market economies, this situation is more common. Generally, emerging market economies tend to borrow in booms[9]. Furthermore, the domestic debt is negatively correlated with primary surplus indicating that higher primary surpluses cause a decline in domestic debt.

Second, inflation is negatively correlated with exchange rate appreciation indicating that inflation scares lead to a depreciation in YTL. Further, inflation rates are positively correlated with interest rate. Third, primary surplus is negatively associated with the interest rates and the growth rate. These are compatible with standard Keynesian fiscal multiplier effects. Finally, exchange rate appreciation is negatively correlated with growth rate and primary surplus as expected.[10]

[9]See Chapter 2

[10]These correlations reflect partial correlations and therefore in this discussion, for example, the real exchange rate depreciation is assumed to have happened without inflation. The final effect has to be computed by looking at impulse responses.

6.3.3 Impulse Responses

In this section, a triangular decomposition of the reduced-form shocks is utilized to analyze the possible impact of a shock to one of the variables on the other variables. This exercise will provide some intuition about the behavior of the debt, but it is always subject to the critique that it crucially depends on the identification assumptions. Figure (6.5) shows the impulse responses within corresponding error bands derived from shocks to all variables. The responses of a single variable to the different shocks are represented in a single row.

One difficulty with impulse responses reported below is that they are not standardized to account for differences in the units of measure. The following impulse responses are obtained by dividing each response by the standard deviation of the appropriate residual variance. In Figures from (6.6) to (6.11), the impulse responses of all the shocks are presented.

Figure (6.6) illustrates the impulse response to a one standard deviation increase in the inflation. This shock lasts for approximately 6 quarters. The increase in the inflation leads a very significant depreciation in the exchange rate. For the period corresponding to the inflation rate shock, the GNP growth rate increases. Further, the interest rate increases on impact. The primary surplus increases over the following 8 quarters, however, then it declines sharply. Similarly, the debt ratio increases initially and then starts to decline significantly.

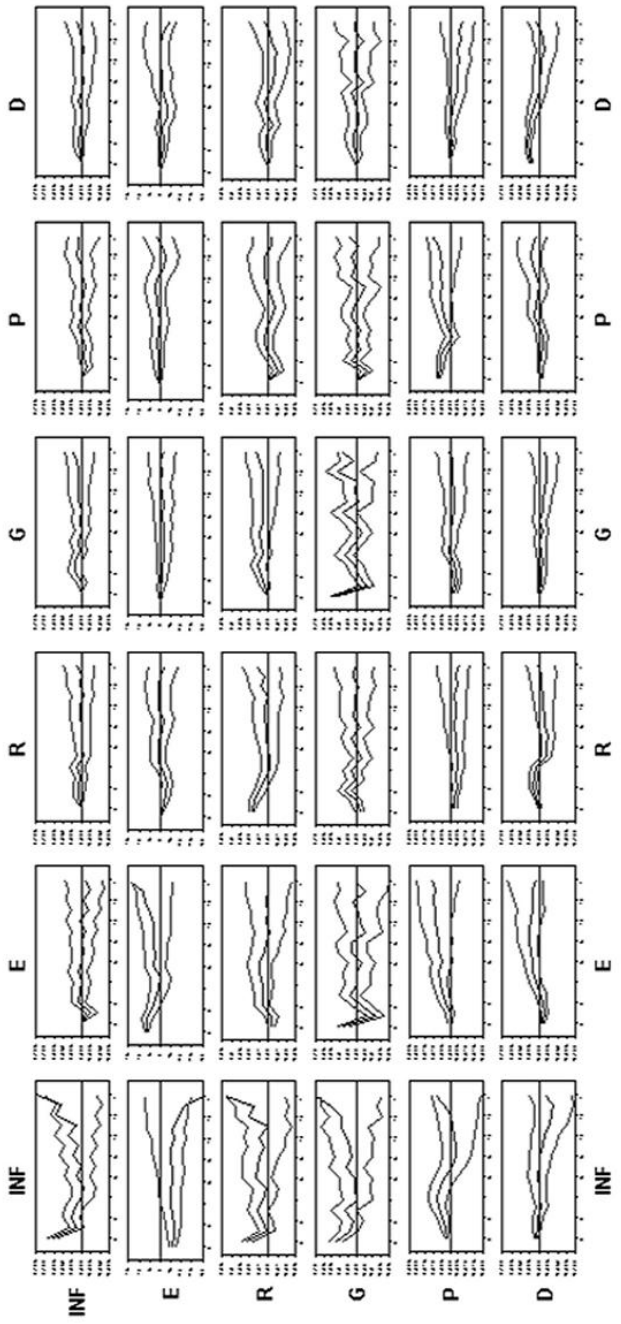


Figure 6.5: Impulse Responses with Confidence Bands

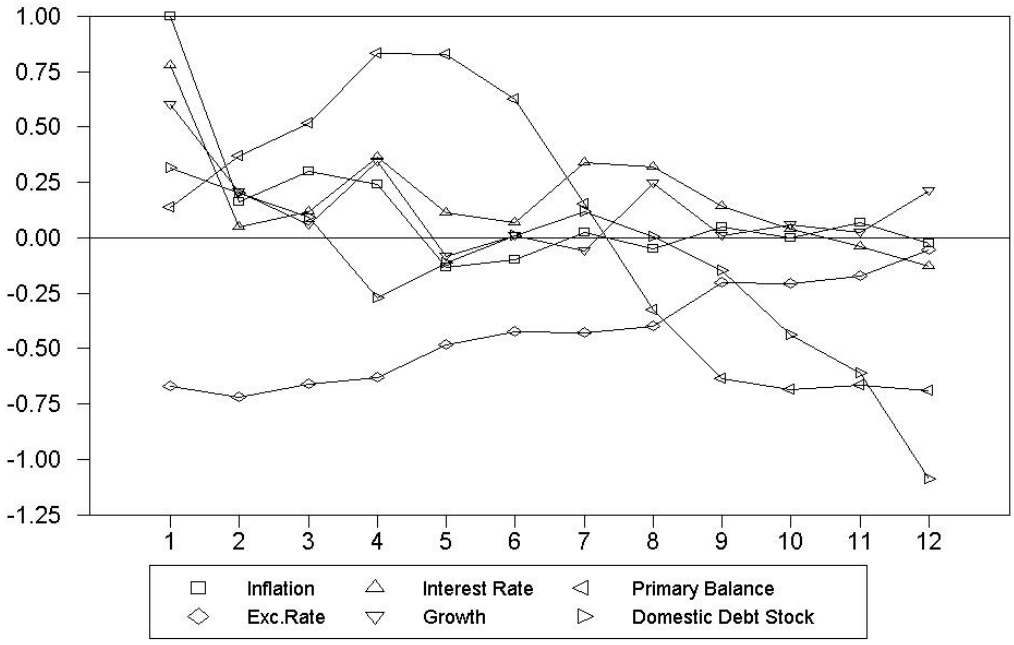


Figure 6.6: Impulse Responses to an Increase in the Inflation

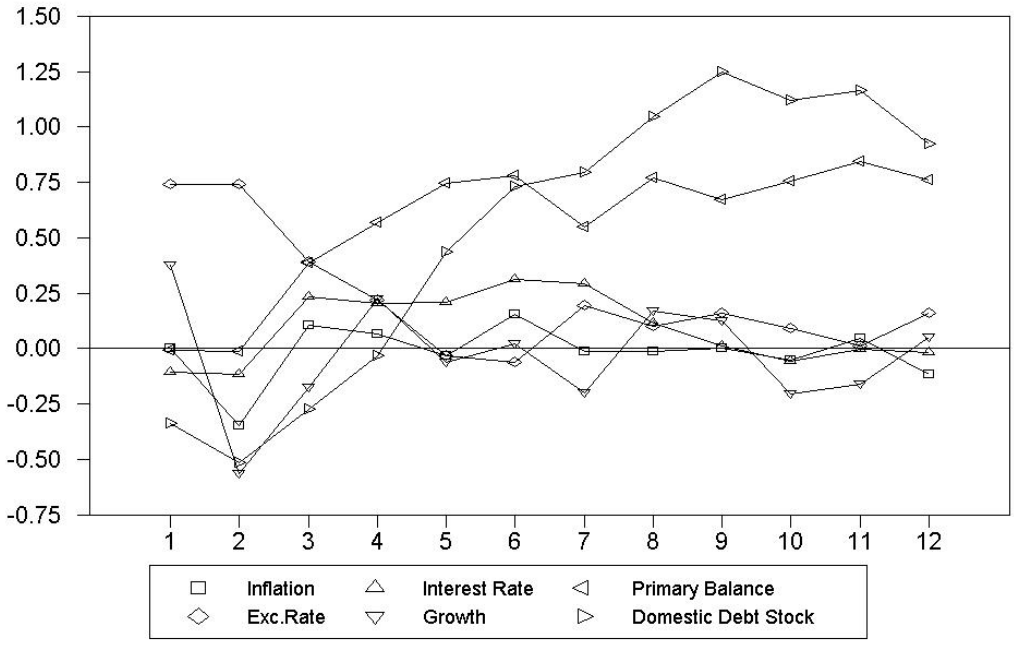


Figure 6.7: Impulse Responses to an Increase in the Exchange Rate

Figure (6.7) shows the impact of an increase in the effective exchange rate. This shock lasts approximately 5 quarters. The simulations indicates that one standard deviation increase in exchange rate is accompanied by a decline in inflation rate and interest rate. However, these impacts do not continue so far. After the third quarter both the interest rate and the exchange rate start to increase. Further, the GNP growth rate increases initially on impact, but then declines and follows a volatile path around its initial value through the simulation period. The exchange rate shock has the most significant effect on the primary surplus. Primary surplus increases sharply through the projection period. Finally, as expected, an appreciation in exchange rate is accompanied by a decline in debt ratio. This impact continues until the exchange rate returns its initial level. Then debt ratio starts to increase.

Figure (6.8) depicts the impulse response to an increase in the interest rate. This shock lasts approximately 5 quarters. The innovation from an increase in interest rates results in an increase in the inflation and a depreciation in the exchange rate. These impacts continue until the interest rate returns to its initial level. The GNP growth rate declines initially as expected, and follows a volatile path around its initial value. The primary surplus declines sharply. It is below its initial value through the projection period. Finally, the debt ratio increases significantly, due to the increasing interest costs which requires more borrowing. After the 6 quarters, it returns its initial value and starts to decline.

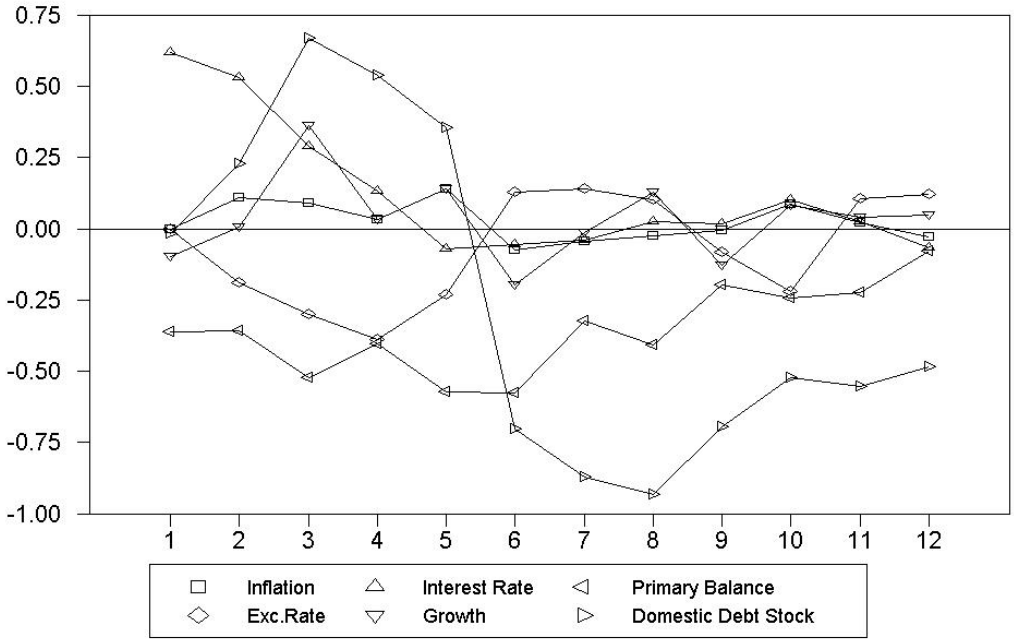


Figure 6.8: Impulse Responses to an Increase in the Interest Rate

Figure (6.9) displays the impulse responses from an increase in the GNP growth rate of quarterly output. This shock lasts through the simulation period and follows a volatile path around its initial value. Actually, this is due to the seasonality. As can be seen, the increase in the growth rate is associated with a subsequent increase in the inflation rate and a real exchange rate depreciation. The real exchange rate is below its initial value through the projection period. Indeed, the inflation increases subsequently that is not expected at a first glance. However, it should be noted that impulse responses show the final effects, i.e., an increase in the interest rates starting from the second quarter may lead a subsequent increase in inflation. Moreover, primary surplus declines contemporaneously and reaches its initial value after 5 quarters, but again starts to decline. Finally, the domestic debt ratio declines subsequently on impact. It is below its initial value through the simulation period.

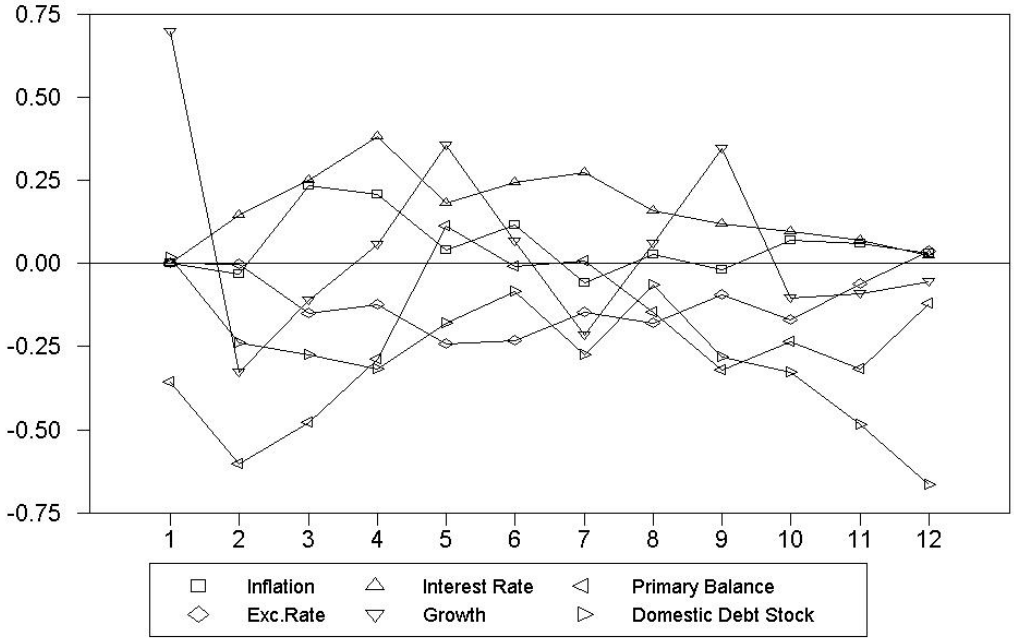


Figure 6.9: Impulse Responses to an Increase in the Growth Rate of Quarterly Output

In Figure (6.10), the impulse response to a one standard deviation increase on the primary surplus ratio is depicted. This shock lasts approximately 5 quarters. As can be seen, the increase in the primary surplus ratio is associated with a contemporaneous decrease in domestic debt ratio. However, the debt ratio returns its initial value approximately after 5 quarters and after that it increases sharply. The primary surplus shock has subsequent effects on inflation, interest rate, exchange rate and growth rate due the identification assumptions such as the real exchange rate appreciates, the inflation reduces in the subsequent periods. However, the growth rate declines firstly on impact and follows a volatile path around its initial value through the projection period.

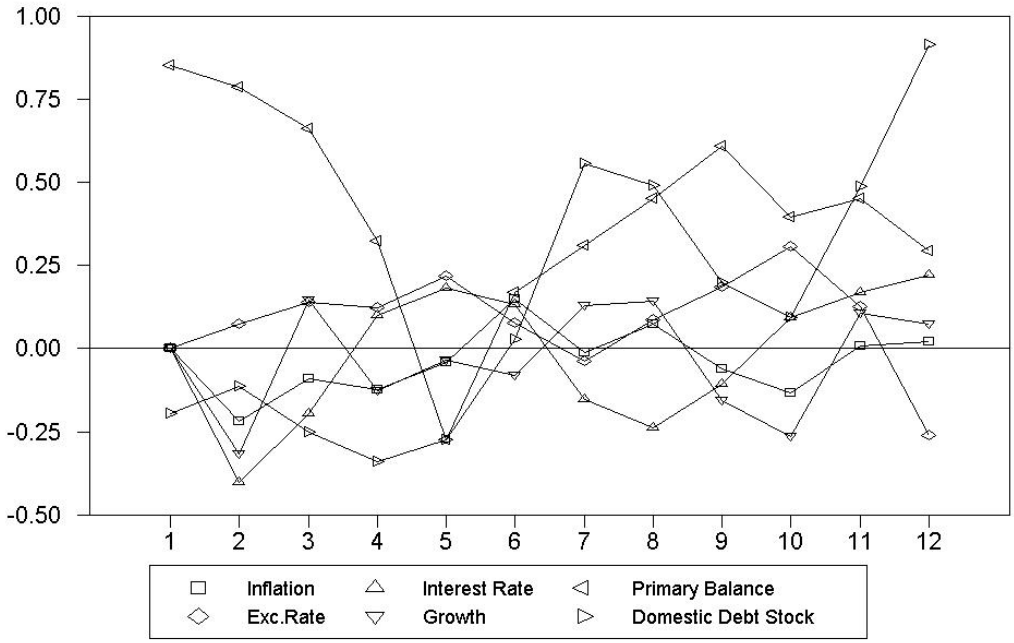


Figure 6.10: Impulse Responses to an Increase in the Primary Surplus Ratio

In the figure (6.11) the impact of a one standard deviation increase in the domestic debt ratio is studied. This shock lasts approximately 7 quarters and it has subsequent effect on other variables due to the identification assumption. First, the inflation rate increases on impact. After 5 quarters, it declines below its initial value. Further, a positive debt ratio shock leads a depreciation in real exchange rate. Moreover, the interest rate increases initially, but after the 5 quarters, it starts to decline. Similar to the other cases, the growth rate follows a volatile path through the projection period. Differing from the other cases, the path is less volatile. Finally, surprisingly, the increase in the domestic debt ratio is associated with a subsequent deterioration in primary surplus ratio which indicates that the lack of fiscal sustainability.

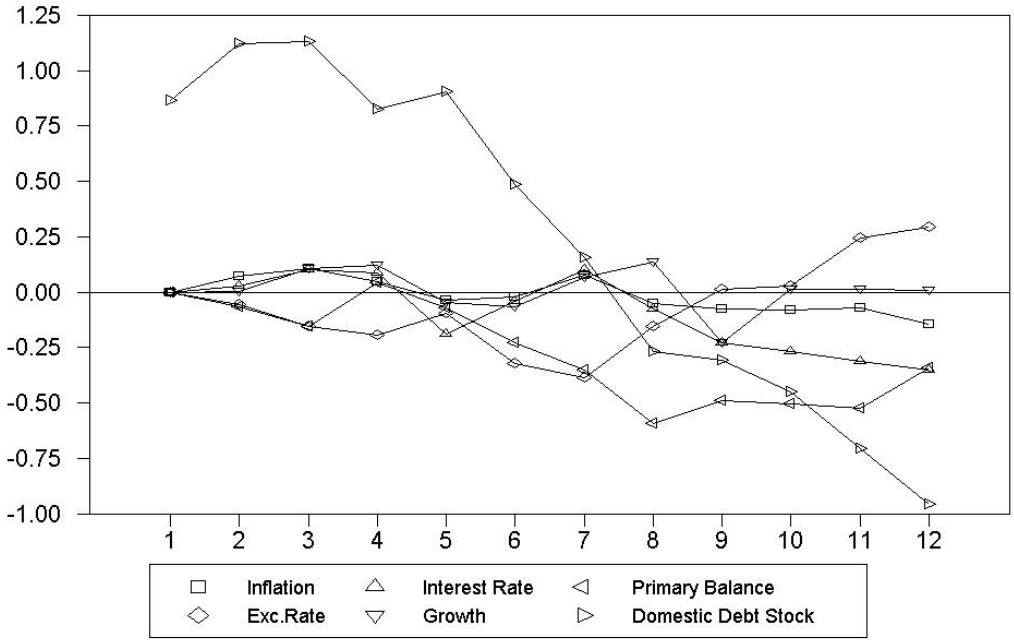


Figure 6.11: Impulse Responses to an Increase in the Domestic Debt Ratio

6.3.4 Assessment of Debt Sustainability

The assessment of the sustainability of Turkey's public debt burden is conducted by constructing probabilistic distributions for the domestic debt ratio. Further, an index is derived from the likelihood of the simulations of the debt to GDP ratio exceeding a given threshold over a specific time-horizon. Both of them are used to test the sensitivity of the fiscal policy.

First, a simulated sample of X is obtained from:

$$X_t = c + \hat{B(L)}X_t + \eta_t \tag{6.3.3}$$

where $\eta_t = W\upsilon_t$, and W is the Cholesky's decomposition matrix of Ω, such that $\Omega = WW'$, and υ_t is a vector of identically and independently distributed random shocks drawn from a standard normal distribution, $\upsilon_t \sim N(0, I)$.

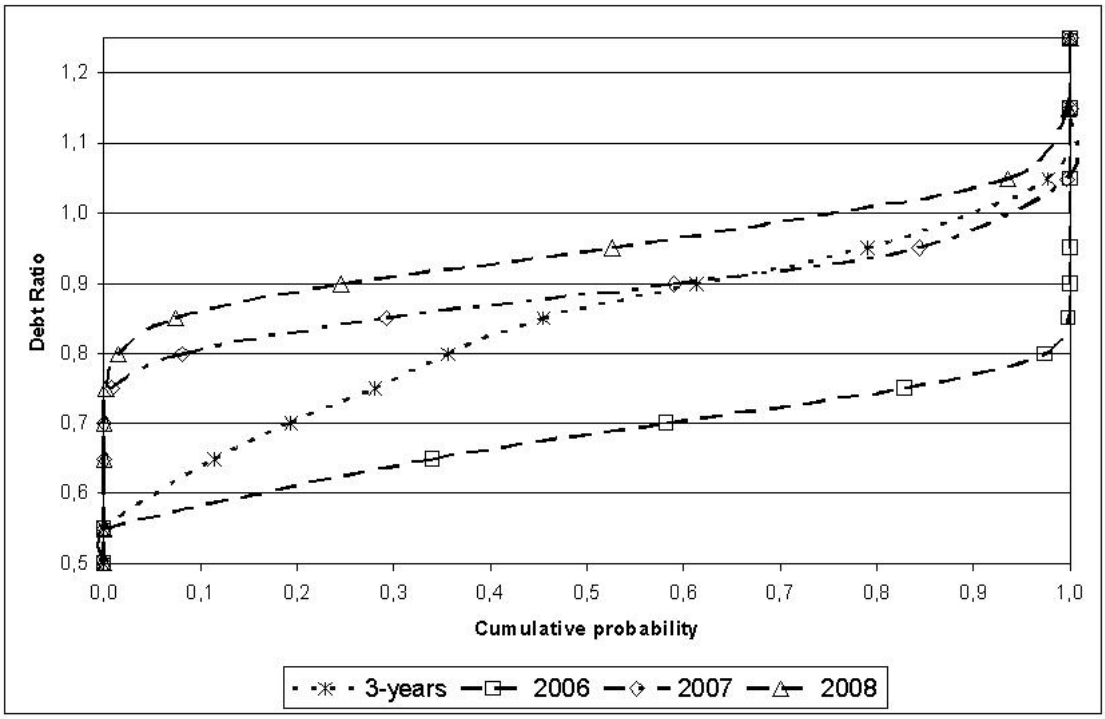


Figure 6.12: Distribution Function of the Debt Ratio

A sample of 100.000 random shocks, υ, is generated from a standard normal distribution of six variables, one for each of the forcing variables, and for each of the years in the projection period 2006-2008. After multiplying this sample for the Cholesky's decomposition matrix, W, a sample of size 100.000 for the disturbances of the forcing variables, for each one of the these years is generated according to (6.3.3). Also, the results were used to obtain the forecasted value of the forcing variable in each year. Then, the probabilistic distributions are constructed for each projection period using the sample of 100.000 domestic debt ratios which are generated according to (6.3.3).

Figure (6.12) shows the distribution functions of the domestic debt ratio for the years 2006, 2007 and 2008. In addition, a separate distribution function for the debt ratio is calculated based on these three years forecasts. As can be seen, the cumulative probability of the debt ratio is less than the 50 percent of the GNP is zero in all cases. The mean projected values of the forcing variables exhibit an increasing path for the domestic debt ratio. Moreover, the distribution function of the domestic debt ratio shifts up significantly through the projection period. In other words, it is expected that the debt ratio in 2007 and 2008 will be higher than the 2006's, and this situation creates sustainability concerns which is measured by the distribution function of the domestic debt ratio.

Although, the model reveals an increase in the debt ratio in the following years, it also shows a contemporaneous increase in primary surplus ratios. In the literature, a positive response of primary balance to the public debt is generally considered as a signal of solvency. This approach is referred as a reaction function approach.[11] In the following table we show the simulated values of primary surplus ratio and debt ratio for 25, 50, and 75 percent fractiles. Table (6.5) indicates that an increase in debt ratio is associated with an increase in the primary surplus ratio indicating a medium-term solvency.

Besides constructing probability distributions, the simulated sample of X is used

[11]See Bohn (1998)

Table 6.5: Fractiles

Time	**Pri.Balance**			**Debt Ratio**		
Fractiles	**25**	**50**	**75**	**25**	**50**	**75**
2006:1	0,080	0,085	0,090	0,555	0,571	0,587
2006:2	0,094	0,101	0,109	0,580	0,608	0,637
2006:3	0,099	0,110	0,122	0,626	0,668	0,710
2006:4	0,092	0,107	0,122	0,652	0,701	0,751
2007:1	0,091	0,111	0,131	0,719	0,777	0,835
2007:2	0,089	0,112	0,135	0,757	0,825	0,892
2007:3	0,092	0,115	0,138	0,790	0,867	0,943
2007:4	0,091	0,116	0,140	0,791	0,876	0,961
2008:1	0,093	0,117	0,142	0,791	0,888	0,984
2008:2	0,098	0,123	0,149	0,785	0,889	0,993
2008:3	0,094	0,120	0,146	0,787	0,897	1,008
2008:4	0,093	0,119	0,146	0,797	0,913	1,027

to compute risk probabilities, i.e., probabilities that the simulated debt to GNP ratio exceeding a given threshold deemed as risky. The idea is to compute the VAR with the available data up to quarter t, and compute the path of the domestic debt afterwards for 12 quarters. Using these paths a statistic on the domestic debt can be computed, such as a statistic of the risk probability that the domestic debt to GNP ratio is larger than 80 percent. Then, this exercise can be repeated for quarter $t + 1$. This rolling exercise produces a path for several statistics of the domestic debt.

Figure (6.13) presents the results for the probabilities of reaching a domestic debt larger than 60,70,75,80 and 85 percent of GNP in the following 12 quarters. The interpretation can be given as the following: Assume that the appropriate VAR model is estimated, and the covariance matrix of the shocks are computed. Further, the Monte Carlo simulations (100.000 replications of 12 quarters) are generated. With the simulated paths, the domestic debt ratio for each of them is computed by using the estimates from the VAR. Then, the number of times that the domestic debt ratio reaches some threshold (say, 80 percent of GNP) in any quarter of the next 12 quarters are computed. For instance, for the first quarter

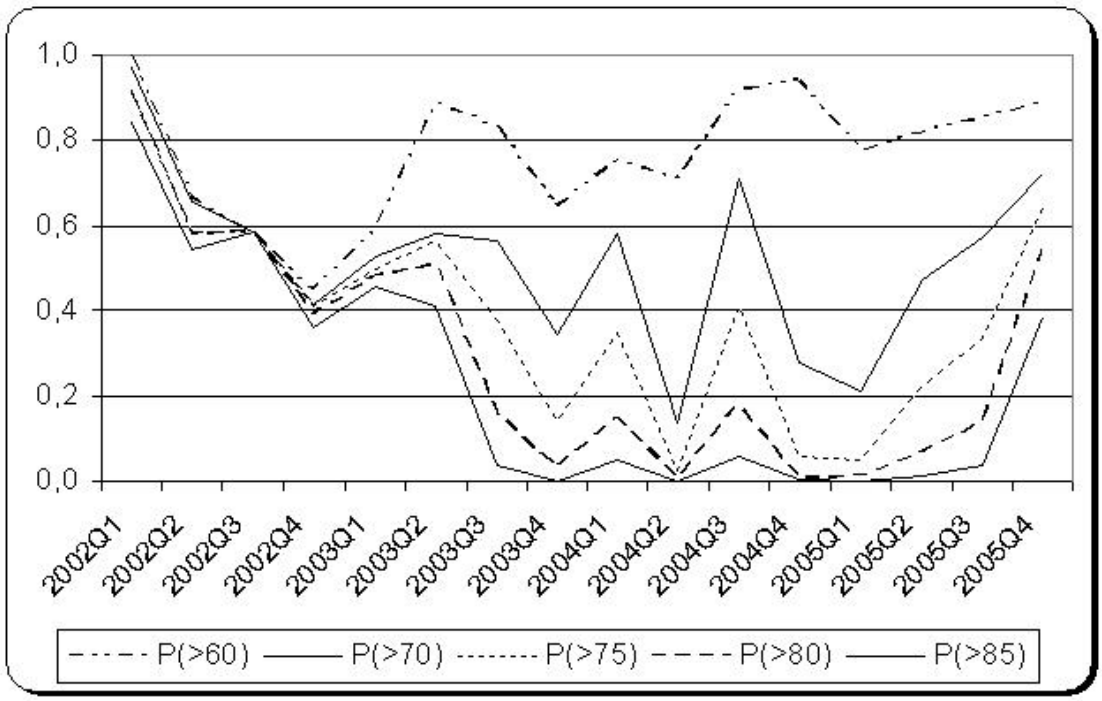


Figure 6.13: Probability of Debt to GNP Ratio Reaching More than Threshold in the Following Three Years

of 2003, given the initial conditions at that time, the probability of the domestic debt to GNP ratio being larger than 80 percent is 48.2 percent while it has a 45.5 percent chance of being larger than 85 percent of GNP. In other words, at that time it is clear that the existing situation in Turkey implies a risky path of the debt. In other times, such as in the first quarter of 2004, these probabilities are much smaller. As noted by Garcia and Rigobon (2004), the exercise performed here is similar to a stress test. It should also be noted that this is a out-of-sample exercise. More clearly, these simulated paths are constructed by using only the information from the past.

The time-series of such risk probabilities are then used to investigate whether or not they are correlated with the market risk assessment, which is measured by the spread on debt. In this study, the risk probabilities are compared with

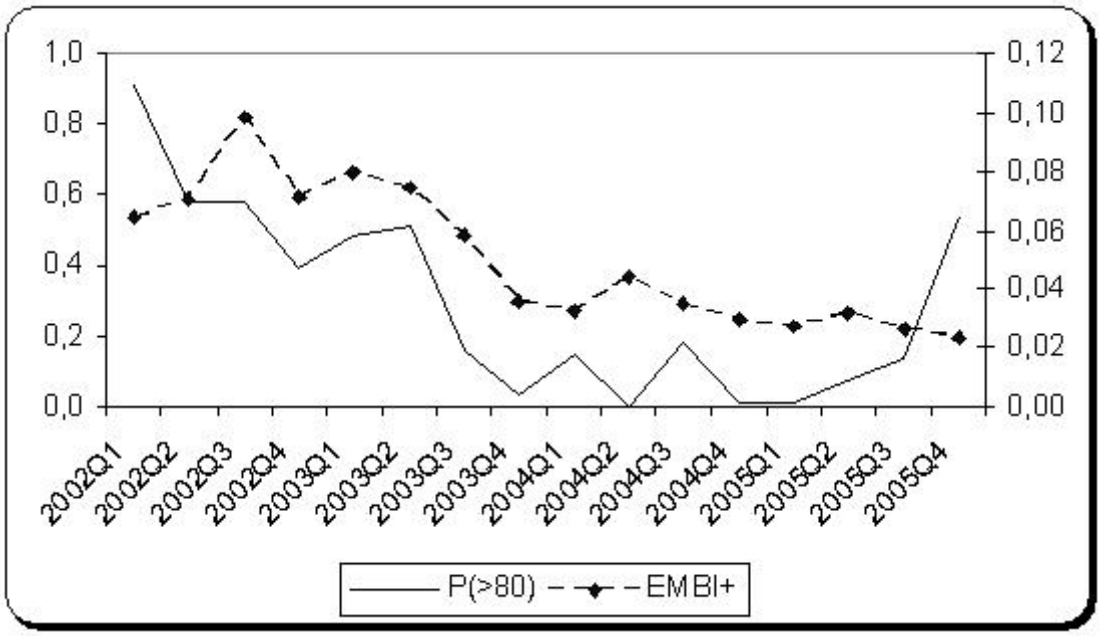


Figure 6.14: Probability of Domestic Debt to be Larger than 80 Percent of GNP at any Time in the Following 3 Years, and the EMBI+ Spread

EMBI+ index, and ELMI+ index, respectively.[12]

Figure (6.14) shows the close relationship between the probability of a domestic debt to GNP ratio in excess of 80 percent and the EMBI+ yield. As can be seen, the probability of the domestic debt exceeding 80 percent and the spread on EMBI+ are closely related. The actual correlation between two series is 65.2 per cent on levels and 18.4 per cent in changes.

Figure (6.15) shows the relationship between the probability of a domestic debt to GNP ratio in excess of 80 percent and the ELMI+ yield. They are closely related. The correlation between these two series is 76.6 percent on levels and 30.4 percent in changes.

[12]The Emerging Markets Bond Index Plus (EMBI+) tracks total returns for traded external debt instruments in the emerging markets. The instruments include external-currency-denominated Brady bonds, loans and Eurobonds, as well as U.S. dollar local markets instruments. The Emerging Local Markets Index Plus (ELMI+) tracks total returns for local-currency-denominated money market instruments

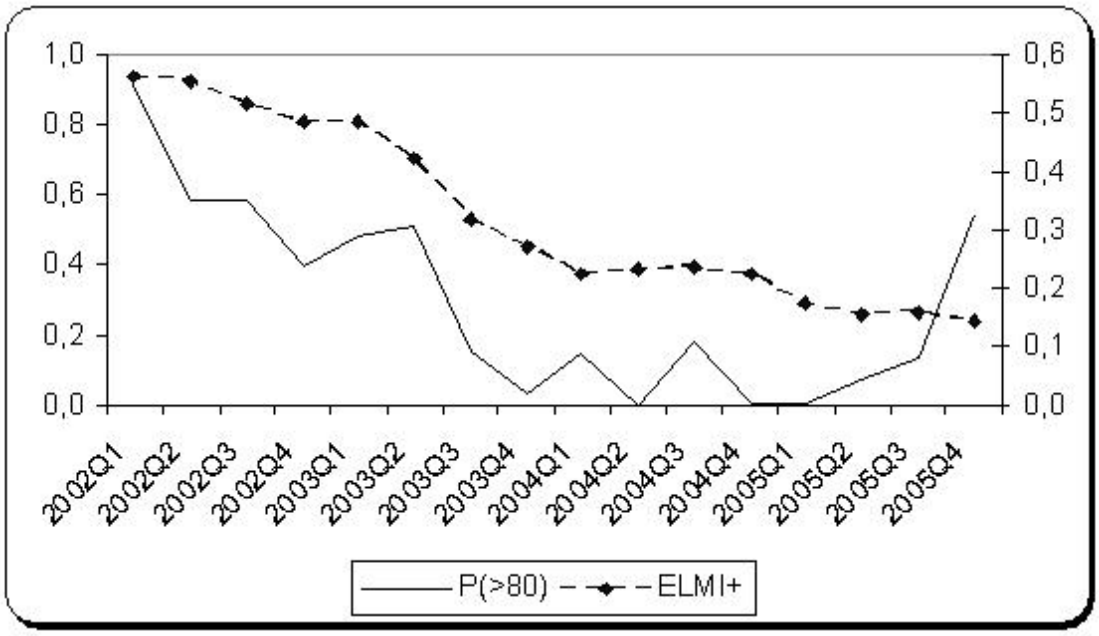


Figure 6.15: Probability of Domestic Debt to be Larger than 80 Percent of GNP at any Time in the Following 3 Years, and the EMBI+ Spread

A simple regression analysis shows that our variable has strong predictive power on the future EMBI+ spreads and ELMI+ spreads. First, an AR(2) model is constructed by using EMBI+ spread and the probability measure obtained from the simulations:

$$s_t = -0.684\Delta s_{t-1} - 0.587\Delta s_{t-2} + 0.151 p_{t-1} \tag{6.3.4}$$

where s denotes the EMBI+ spread and p is the probability that the domestic debt reaches 80 percent in the Monte Carlo exercise. All the coefficients are significant; t-statistic for Δs_{t-1} is -2.605, for Δs_{t-2} is -2.64 and for p_{t-1} is 12.79. The uncentered R square of the regression is 87 percent. Moreover, if the probability measure from the regression is dropped, the coefficient of the Δs_{t-1} and Δs_{t-2} become insignificant and the uncentered R square become 3.7 percent.

Second, ELMI+ spread is regressed on its lagged values and the probability mea-

sure obtained from the simulations:

$$\Delta z_t = 0.366\Delta z_{t-1} - 0.071 p_{t-1} \tag{6.3.5}$$

where z and p denote the ELMI+ spread and probability measure, respectively. Both coefficients are significant; t-statistic for Δz_{t-1} is 2.669 and for p_{t-1} is -2.96. The model has uncentered R square of 61 percent. If p is dropped from the model, uncentered R square declines to 40 percent and more importantly it causes serial correlation.

These results can be interpreted as a strong corroboration that the employed methodology captures highly the bulk of the market perception of the existence default risk for Turkish domestic debt. Indeed, this risk measure is largely correlated with the Turkey's risk spreads. Therefore, these probabilities constitute an alternative method to assess debt sustainability.

As noted by Garcia and Rigobon (2004), one advantage of these methodology which evaluate the path of the debt is that there is no requirement to commit to a particular structural model or distribution of the residuals. This is crucial in countries such as Turkey and Brazil because the standard triangular assumption imposed in monetary economy is rarely satisfied. It is hardly the case that policy decisions in a particular time do not affect prices, output, or exchange rates contemporaneously. This methodology, by concentrating on the contemporaneous covariance of the residuals, allows us to study the behaviour of the debt to the typical mixture of shocks that might hit the Turkish economy.

6.3.5 Explanatory Note

This subsection tries to construct several VAR models in order to see how the changes in the variables affect the original results (Chapter 6, Section 3).

First, the probability distributions of the domestic debt ratio are constructed

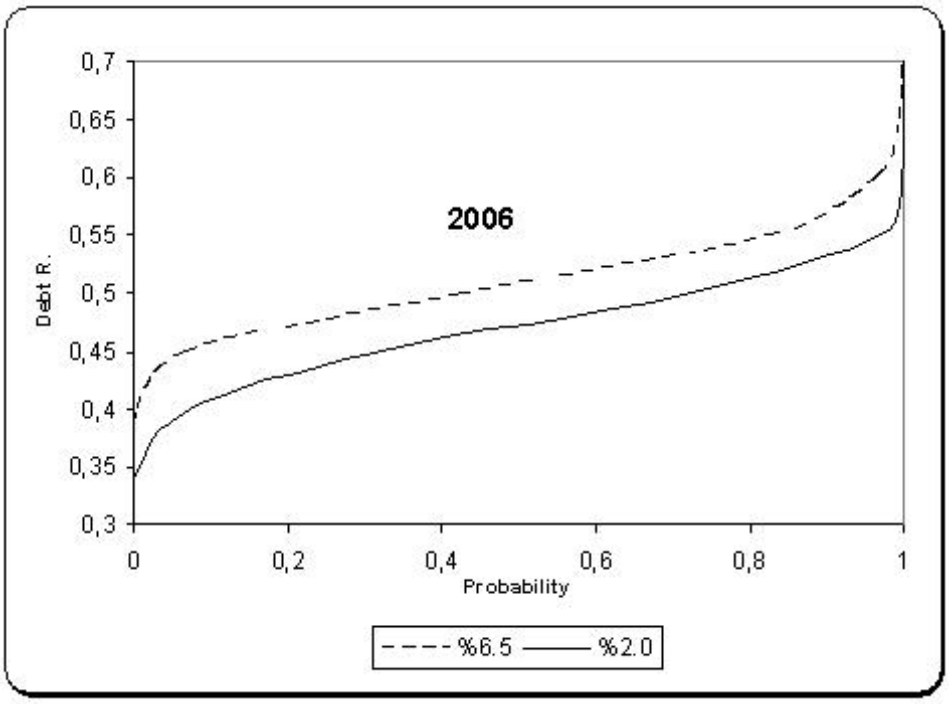


Figure 6.16: Distribution Function of the Domestic Debt Ratio under Different Surplus Ratios

under the assumption of that the primary surplus ratio is exogenous rather than endogenous. For this purpose, an appropriate VAR(4) model is constructed. Real interest rate, real exchange rate, real growth rate and domestic debt ratio are taken as endogenous variables. Moreover, primary surplus ratio is taken as an exogenous variable. The lag length for the VAR(4) is set at 7. Further, each equation includes 3 lags of the primary surplus. Then this VAR is used to construct the distribution functions of the domestic debt ratio for the years 2006, 2007 and 2008. This experiment is repeated for two different primary surplus ratios (2.0 percent and 6.5 percent). Results indicate that the high values of primary surpluses (6.5 percent) are associated with high values of debt ratios (Figure 6.16).[13] However, this result is unexpected since generally high values of primary surpluses are widely acknowledged as an indicator of sustainability. This result is due to the construction of the model: The model does not include the effects of expectations into the assessment. Indeed, optimistic expectations may effect positively interest rates, exchange rates and so the domestic debt ratio. On the other hand, the constructed model follows a simple VAR methodology which does not focus on the relationship of the variables through expectations.

Second, several VAR(5)(with different lag lengths) models are constructed where the real interest rate, the real exchange rate and the real growth rate, the primary surplus ratio and the domestic debt ratio are taken as endogenous variables. However, these models result in serially autocorrelated residuals. Moreover, similar to Garcia and Rigabon(2004), the nominal inflation is added to these models as an endogenous variable, but these models lead also serial autocorrelation in residuals.

Third, an another VAR(6) model is constructed where all the original variables are in nominal terms and are based on year to year changes. However, this model also results in serially autocorrelated residuals.

Finally, the original VAR model is reconstructed after replacing the quarter to quarter nominal growth rates by the year to year nominal growth rates. The

[13]Similar results are observed for the projection years of 2007 and 2008.

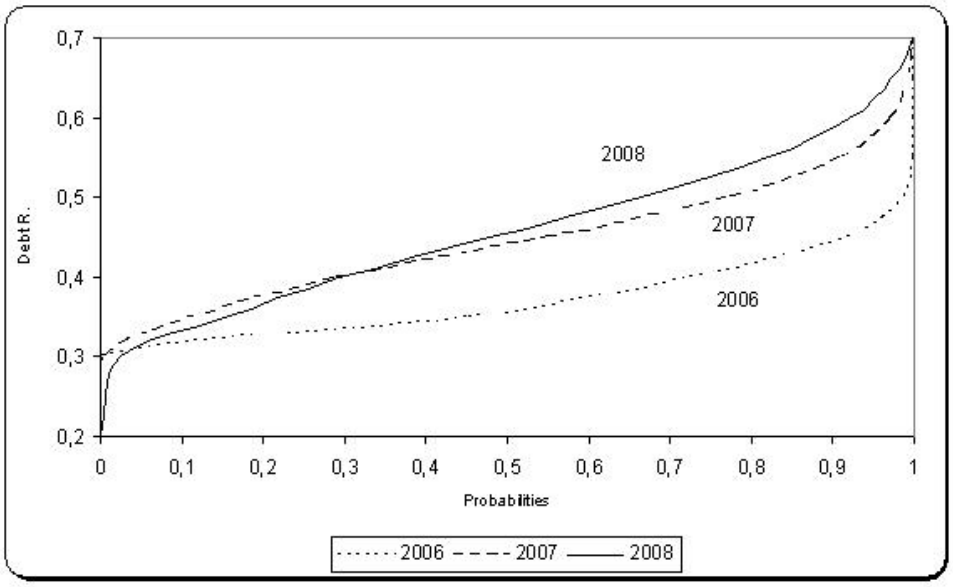


Figure 6.17: Distribution Function of the Domestic Debt Ratio (2)

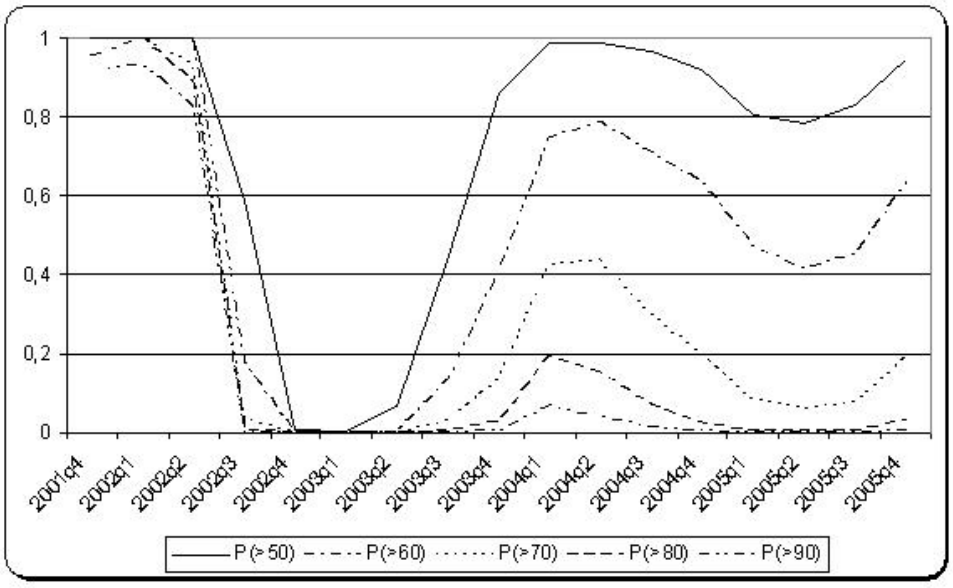


Figure 6.18: Probability of Debt to GNP Ratio Reaching More than Threshold in the Following Three Years (2)

lag length is set at five which leads serially uncorrelated residuals. Figure (6.17) shows the distribution functions of the domestic debt ratio for the years 2006, 2007 and 2008. Although the mean projected values of the forcing variables exhibit an increasing path for the domestic debt ratio similar to results of the original VAR model, the variance of the projected debt ratios in Figure (6.17) are much larger than the ones in Figure (6.12). Moreover, risk probabilities (Figure 6.18) are computed. These risk probabilities are less correlated with EMBI+ and ELMI+ spreads such as the correlation between the probability series of the domestic debt ratio exceeding 80 percent and EMBI+ spread is only 23 percent.

6.4 Conclusion

Results of the Wilcox's test show that the structure of the domestic debt in Turkey does not appear to have been sustainable at the end of 2005. On the other hand, Uctum and Wickens's test suggests that the domestic debt stock of Turkey is sustainable as long as the discounted debt ratio has a trend to zero which is the case towards the end of the 2005. These two tests based on the PVBC framework, give contradictory results, which is the common case in the studies within the PVBC framework. This is mainly due to the structures of these models. Wilcox analyzes the discounted debt values whereas Uctum and Wicken's study the behavior of the discounted debt ratios. These two variables have different scales. Therefore, it is difficult to reject null hypothesis of zero mean in the latter approach.

Analyzing the sustainability of Turkish domestic debt with the methodology suggested by Garcia and Rigobon (2004) gives more detailed results. First, the distribution functions of the domestic debt ratio suggests that an increase in the domestic debt ratio over the following three years is highly likely. Fortunately, this increase gets associated with an increase in primary surpluses which indicates a medium-term solvency.

Second, impulse responses show that any positive shock to the inflation and the interest rate causes an increase in the domestic debt ratio. On the other hand, positive shocks to the real exchange rate, the output growth and the primary surplus lead to a decline in the domestic debt ratio. Indeed, the analysis of impulse responses shows that the changes in the output growth have the greatest effect on the domestic debt ratio which lasts approximately 12 quarters.

Furthermore, the risk probabilities, i.e., probabilities that provide the simulated Debt to GNP ratio exceeding a given threshold as risky, suggest that the risk has decreased since the first quarter of 2002, but it started to increase beginning from early 2005. Further,it reached to the levels of the third quarter of 2003 at the end of 2005.

Finally, this analysis shows that properties of the computed risk probability series are closely related to the EMBI+ and ELMI+ spreads. This result is quite remarkable, since the methodology uses out-of-sample simulations, and it does not use regressors related to the risk aversion of investors, which are very important in the determination of the EMBI+ and ELMI+ spreads. Therefore, these measures constitute an alternative method to assess debt sustainability as suggested by Garcia and Rigobon (2004).

Chapter 7

Conclusion

This thesis attempts to assess the fiscal sustainability of Turkey by using different empirical methods. Firstly the structure of the public debt stocks in emerging market economies is examined. In particular, the evidence shows that the most of the developing countries find it relatively difficult to issue long term debt in their own currencies. Thus, these countries mainly rely on short term debt and foreign currency debt in order to maintain the capital flows. However, such forms of debt are risky since they raise the possibility of future financial crises. Generally, financial crises deteriorate deeply the existing debt levels of emerging market economies. More precisely, levels of debts increase because of sharp depreciation of exchange rates, increases in real interest rates, and contractions in outputs. Further, developing countries generally face with significant difficulties in reducing their exposure to maturity or currency risks after crises.

Secondly, the debt dynamics of Turkey is analyzed. The analysis examination indicates that especially in the post 1989 period, there was a heavy deterioration in fiscal balances dynamics of Turkey. Moreover, a radical change was observed in financing of the PSBR such that PSBR financing started to rely almost only on the issues of government debt instruments in the domestic market. In addition, the two financial crises of April 1994 and February 2001 led to a significant devaluation of the Turkish Lira, increased the real interest rates, lowered the maturity of the domestic debt. These crises caused an increase in public sector debt ratios by the impact of severe exchange rate depreciations. Moreover, new borrowings from external and domestic sources in the context of efforts aimed at resolving these crises raised the debt burden of Turkey, more.

Finally, to assess the sustainability of the government debt of Turkey two tradi-

tional approaches and a new risk management approach are applied. Traditional approaches follow PVBC framework and due to Wilcox(1989) and Uctum and Wickens (2000). These approaches are especially applied to provide comparability with the new risk management approach.

Wilcox's (1989) approach consists of two main components. In the thesis, first the discounted real debt series are tested for stationarity. Then, if these series are found to be stationary, tests for zero mean are carried out. The results of this test indicates that the domestic debt of Turkey has an unsustainable outlook through the end of 2005.

The second framework has been proposed by Uctum and Wickens (2000). They state that a necessary and sufficient condition for sustainability is that the discounted debt-GNP(or GDP) ratio should be stationary zero mean process. The application of this test for the domestic debt of Turkey indicates that the domestic debt is sustainable as long as the discounted debt to GNP ratio has a trend to zero.

The third approach, which is proposed by Garcia and Rigobon (2004), incorporates into the analysis of debt sustainability the effects of stochastic shocks (uncertainity) to output, exchange rates, primary surpluses, interest rates and debt levels. Moreover, this approach can be applied to any time horizon, including a short time horizon. In particular, this approach consists of three main steps. First, a VAR model, which is calibrated to generate the approximate macroeconomic panorama of Turkish economy, is estimated and impulse responses are examined. Second the simulation of several debt paths are obtained. Finally, the simulated debt series are used for computing distribution functions of debt ratios for each projection period. Further, the risk probabilities, i.e., probabilities that the simulated debt to GNP ratio exceeds a given threshold deemed risky, are computed by using these simulated debt ratios.

The computed probability distributions for Turkey's future domestic debt lev-

els indicate that if no fiscal reforms are undertaken, the debt may explode in three years. However, this result should not be interpreted as finding of non-sustainability, since the increase in a debt level is associated with an increase in a primary surplus. Further, impulse responses show that the high rates of output growth and primary surpluses have the greatest positive effects on the evolution of the domestic debt. Hence, in order to reduce the debt levels, i.e. to achieve fiscal sustainability, positive and high levels of primary surpluses should be generated besides maintaining sustainable output growth. Moreover, risk probabilities indicate that during the period of strong economic growth (after 2001), the fiscal position of Turkey improved considerably, but in recent years the fiscal stance in Turkey has been steadily deteriorating. Indeed, this index indicates that a continuation of the present fiscal stances is leading to a fiscal unsustainability in Turkey. Besides, with high probability it is shown that the properties of the computed risk probability series are closely related to the EMBI+ and ELMI+ spreads. Therefore, these measures constitute an alternative method to assess debt sustainability as suggested by Garcia and Rigobon (2004).

In contrast to the fiscal sustainability studies for Turkey following traditional approaches, this thesis adopts the new risk management approach. In this context the main contribution of the thesis is to introduce uncertainty into the analysis of the domestic debt sustainability in Turkey. The results of this new approach, particularly those expressed in terms of default probabilities, provide useful and important guidance for policy makers in shaping corrective fiscal policies.

This methodology can be developed in several ways. First, in order to obtain more accurate projections, a Bayesian VAR framework can be used. In addition, as an alternative, the stochastic characteristic of the main variables can be captured by Markov's chains. The use of Markov's chains to incorporate the uncertainity into main variables may be useful for forecasting and simulation purposes, since it captures the historical sequences in the behavior of the main variables, while at the same time providing estimates with a much lower variance. Finally, it should be noted that the financial crises are associated not only with changes in

the level of public debt, but also in its composition. Therefore, there is need to incorporate the composition of debt in the assessment of fiscal sustainability.

Briefly, fiscal discipline is a long-run objective of the fiscal policy and it is a necessary condition for sustainable development. It requires political stability like most of the emerging market economies. Therefore, the importance of the independent *fiscal policy committees*, given the task of achieving debt targets and deciding or recommending annual deficits gain importance.

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