

## **Measuring Fiscal Sustainability for Practical Use in Short-Term Policy Making**

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This study aims to assess the domestic debt sustainability of Turkey by constructing a risk index which is suitable for practical use in short-term policy making. The construction of the index follows a methodology similar to the Garcia and Rigobon's Risk Management Approach (2004). Different from the most fiscal sustainability studies which are carried out for Turkey, this study adopts a new approach in its assessment. It is based on a finite time horizon approach and emphasizes the importance of having a forward-looking measure of fiscal dynamics rather than a test based on past behavior. Within this framework, the main contribution of this paper is to introduce the uncertainty and finite horizon approach into the analysis of the fiscal sustainability of Turkey. A vector-autoregression (VAR) model is used primarily to estimate the joint dynamics of the related macro-variables for the 1990:1-2007:9 periods. Then, the simulated fiscal variables are used to construct the risk index. This index is based on a comparison of a target level of the debt ratio with a simulated debt ratio. Results indicate that the fiscal stance of Turkey has a sustainable outlook through the end of 2007:9.

**Keywords:** Turkey, Fiscal Sustainability, Monte Carlo Simulation, Vector Auto-Regression

## I. Introduction and Literature Review

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 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 the mid-1980s. After a decade, the public debt levels, especially, in emerging markets have reached again terrifying levels which have major effects on their economic performance, so even a simple correlation between public debt and growth in emerging markets shows negative relationship since 1990 (IMF, 2003b). Moreover, such high levels of their current debt raise the risk of future fiscal crises in emerging markets.<sup>1</sup>

A high public debt level has two main negative effects on economic activity.<sup>2</sup> First, it requires high taxes to finance debt and puts upward pressure on real interest rates. This implies, private investment and the certain government expenditures to be crowded out which creates low level of growth.<sup>3</sup> 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.<sup>4</sup> 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. Therefore, a *sustainable* fiscal policy is generally defined as

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<sup>1</sup> 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.

<sup>2</sup> Karagöl (2002) shows that debt service has a significant negative effect on GNP with one year lag in Turkey.

<sup>3</sup> 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.

<sup>4</sup> Inflation is an implicit way of default: Burnside, 2004.

one that can be continued into the future without modification. In other words, a *sustainable* fiscal policy requires that a government should be able to service its debt obligations both today and in the future, in perpetuity without explicit or implicit default and without an adjustment of the primary surplus.

Most of the traditional fiscal sustainability analyses consider 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. Generally, econometric approaches have been used in this present value budget constraint (PVBC) framework. Some of them consist of testing the stationarity of the real debt levels (or the debt ratio)<sup>5</sup> and the others look for cointegration relationship linking the primary deficit, the stock of outstanding debt and interest payments.<sup>6</sup>

However, these 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 (They do not show how the adverse shocks to the variables - interest rates, exchange rates, output - will affect the debt accumulation). 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 can not satisfy

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<sup>5</sup> Hamilton and Flavin (1986); Wilcox (1989), Kremers (1989), Trehan and Walsh (1990,91), Hakkio and Rush (1991); Quintos (1995), Feve and Henin (2000), Martin (2000), Uctum and Wickens (2000).

<sup>6</sup> Hakkio and Rush (1991); Bohn (1991), Haug (1991), Tanner and Liu (1994), Ahmed and Rogers (1995), Telatar and others (2004), Leachman and others (2005)

PVBC. This suggests the need to analyze sustainability allowing for expected changes in fiscal policy with a finite horizon approach.

In traditional analyses, forward looking sustainability indicators<sup>7</sup>, are commonly used as an alternative to econometric approach. These studies try to calculate *the debt stabilizing primary surplus* and to show how far fiscal policy departs from sustainability. 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. As an alternative to these methods, in the literature, there are some other studies which try to investigate the relationship between the debt levels and primary surpluses by constructing economic models.<sup>8</sup> Generally, a positive response of primary balance to the public debt is considered as a signal of solvency in this framework, i.e., increasing primary surpluses are required to offset increasing interest payments.

The methods discussed so far examine the sustainability in an environment where there is no uncertainty. In other words, they do not adequately address the downside risk of adverse future economic and financial outcomes. However, debt sustainability is a forward-looking concept; it cannot be assessed with certainty. There is always the possibility that the adverse shocks to key variables may cause significant changes in outstanding debt. Therefore, sustainability is *probabilistic*.

Recently, several methods for bringing uncertainty into the analysis have been proposed in the literature. Mainly, these studies are broader version of accounting approach.<sup>9</sup> The common characteristic of all these approaches is the assumption of stability of past trends over the indefinite future and the explicit incorporation of uncertainty by introducing exogenous shocks to the key variables that effect the evaluation of the debt. More recently, several studies apply stochastic simulation methods to assess the debt sustainability and some of them try to provide probability measures for projections of debt levels.<sup>10</sup> These studies; particularly those using the

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<sup>7</sup> Buiter (1985), Blanchard and others (1990).

<sup>8</sup> Bohn (1998,2005), International Monetary Fund (2003b)

<sup>9</sup> Croce and Juan-Ramon (2003), IMF's Stress Test (2003a)

<sup>10</sup> Garcia and Rigabon (2004), Hostland and Karam (2005), Celasun and others (2006), Taner and Samake (2006).

method of probability of default, provide useful analytical tools for policymakers to foresee the wideness of the period available to undertake corrective fiscal policies.

This study aims to assess the domestic debt sustainability of Turkey by constructing a risk index which is suitable for practical purposes in short-term policy making. The construction of the index follows a methodology similar to the Garcia and Rigobon's Risk Management Approach (2004). Different from the most fiscal sustainability studies which are carried out for Turkey<sup>11</sup>, this study adopts a new approach in its assessment. It is based on a finite time horizon approach and emphasizes the importance of having a forward-looking measure of fiscal dynamics rather than a test based on past behavior. Within this framework, the main contribution of this paper is to introduce the uncertainty and finite horizon approach into the analysis of the fiscal sustainability of Turkey.

For this purpose, first, the relationship among the key macroeconomic variables (the debt ratio, and the primary surplus ratio) and non-policy variables (interest rates, exchange rates, output, oil prices) are examined for the 1990:1-2007:9 periods. A near-vector autoregression (VAR) model is estimated to generate the approximate macroeconomic panorama of 1990s and early 2000s for the Turkish economy. Then several possible 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 and the simulated fiscal variables are used to construct the risk index. This index is based on a comparison of a target level of the debt ratio with the simulated debt ratio. The results indicate that the domestic debt strategy of Turkey is sustainable through 2007:9.

This paper is set out as follows. In Section 2 we present an overview of our methodology. In Section 3 we analyze the domestic debt sustainability of Turkey. Finally, Section 4 concludes.

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<sup>11</sup> For a literature review of sustainability analyses for the case of Turkey see Tiftik (2006)

## II. Methodology

Like most of the debt sustainability analyses, our assessment mainly concentrates on the debt accumulation equation

$$d_t = (1 + r_t - g_t)d_{t-1} - p_t \quad (1)$$

where  $d_t$  is the debt to GDP ratio,  $r_t$  is the real interest rate,  $g_t$  is the growth rate of GDP and  $p_t$  is the primary surplus ratio.

Our methodology to assess the sustainability of domestic debt is based on a near-vector autoregression (near-VAR) model.<sup>12</sup> The variables that we have considered are: percentage change in oil prices (op), real GDP growth rate (g), the primary surplus measured as a share of GDP (p), the percentage change in bilateral real exchange rate (against U.S. dollar, e), the (implicit) average real interest factor calculated directly from the budget constraint ( $\tilde{r}$ )<sup>13</sup>, and the real debt shocks as percentage of GDP (skeletons (-) and privatizations (+)) derived from the debt accumulation equation ( $\varepsilon$ )<sup>14</sup>.

Then we estimate a near-VAR comprising the policy variable (p) and the other non-policy variables (op,g,e, $\tilde{r},\varepsilon$ ). Formally, we have

$$\begin{aligned} X_t &= c + B(L)X_t + u_t \\ X &= [\text{op}, g, p, e, \tilde{r}, \varepsilon] \\ u_t &\sim N(0, \Omega) \end{aligned} \quad (2)$$

<sup>12</sup> First, we have estimated a near-VAR since the country specific variables has no effect on the oil prices. Then, we have also estimated a full VAR. This model yielded similar results of near-VAR model.

<sup>13</sup> We use  $\tilde{r}_t$  as a proxy of  $r_t - g_t$  ;

$$\tilde{r}_t = ((d_t - p) / d_{t-1}) - 1$$

<sup>14</sup> To compute the debt shocks (or skeletons), we take the actual debt/GDP ratio (d) and the realizations of the (implicit) average real interest factor (r) and compute

$$\varepsilon_t = d_t - (1 + \tilde{r}_t)d_{t-1} + p$$

where  $X$  vector denote these endogenous variables and  $u_t$  is a vector of well-behaved error term with zero mean and covariance matrix  $\Omega$ .  $B(L)$  represents the coefficients of lags.<sup>15</sup>

Once the parameters 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  $X$  can be computed using the coefficients from the near-VAR. This simple procedure, which uses Monte Carlo methodology to determine several paths of the debt, can be summarized as follows:

First, a simulated sample of  $X$  is obtained from:

$$X_t = c + \hat{B}(L)X_t + \eta_t \quad (3)$$

where  $\eta_t = Wv_t$  and  $W$  is the Cholesky decomposition matrix of  $\Omega$ , such that  $\Omega = WW'$ , and  $v_t$  is a vector of identically and independently distributed random shocks drawn from a standard normal distribution,  $v_t \sim N(0, I)$ . It should be noted that the procedure is not sensitive to the ordering of the variables in the near-VAR since we are not trying to examine the causal relationships between shocks and the variables. (See Garcia and Rigabon, 2005; and Celasun and others, 2006)<sup>16</sup>. As the next step, the corresponding debt ratio path can be computed recursively using debt accumulation equation and debt shocks:

$$d_t = (1 + r_t - g_t)d_{t-1} - p_t + \tilde{\epsilon}_t \quad (4)$$

Then, using this simulated sample, the probability distribution of the debt ratio for each month of projection can be obtained. Observing the changes in the probability distributions corresponding

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<sup>15</sup>  $B(L)$  notation is used for simplicity. The lag length in each equation is not the same since we estimate a near VAR model.

<sup>16</sup> We also compute debt ratios under by changing the order of the variables in near-VAR. In each case, results are almost the same as expected.

to different projection periods will offer insights on the sustainability of the debt. For example, if the probability distribution curve shifts up through time, it indicates that the continuation of the current fiscal policy leads to an expansion in the level of debt. This scenario necessitates a change in fiscal policy.

Besides constructing the probability distribution, the simulated sample of key variables can be used to compute risk probabilities, i.e. probabilities that the simulated debt to GDP ratio exceeds a given threshold which was deemed to be risky.

This approach offers two main advantages: First, as the underlying methodology is not interested in estimating the contemporaneous causality between the macro variables, the near-VAR is used only to produce the best simulations on the joint dynamics of the variables. Second, this approach enables us to incorporate the variables, which are not in debt accumulation equation, into the assessment. Hence, we can control the effect of them on the variables in the debt accumulation equation, so their impact on debt dynamics. For example, the exchange rate and the oil prices can be included in the near-VAR although they are not the part of debt accumulation equation.

### **III. Domestic Debt Sustainability of Turkey**

In the post 1989 period, there was a heavy deterioration in deficit dynamics of Turkey. Public sector borrowing requirement (PSBR) as a ratio of GDP averaged 5.4 per cent during 1975-1988 periods, but shifted to 9.4 per cent for 1989-2005 periods. Moreover, there was a radical change in financing of the PSBR. After the abolishment of interest rate ceilings, PSBR financing started to rely mostly on 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 whereas foreign borrowing started to decline. In addition, the two financial crises of April 1994 and February 2001 led to a significant devaluation of the Turkish Lira, an increased risk premium, and a lowered maturity of the domestic debt. The sharp increase in the real interest rates accelerated the accumulation of the debt stock. As a result, by the end of 2001, Turkey had a public debt which was around 101 percent of the GDP, which placed it at the top most indebted



countries in the world.<sup>17</sup> 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 which targeted 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 both wage remuneration and public employment were applied to reduce PSBR and enhance *credibility* of Turkey ensuring reduction in the country risk perception.

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

Our analysis mainly focuses on a vector of six endogenous variables. The data series are monthly for the sample period 1990:1 2007:9. All the data is obtained from the CBTR Electronic Data Delivery System (EDDS).<sup>18</sup> The total number of observations is 213. First, the individual series are tested to find whether they are stationary or not. The tests used are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both tests contain an intercept.

The results of the ADF and PP tests are given in Table 1. All the series, except the primary surplus ratio, are stationary. Primary surplus ratio follows a I(1) process. Therefore, we use the first difference of this variable in the rest of the paper. The lag length, L, for each equation is set to thirteen.<sup>19</sup> To isolate distinct economic regimes, intercept and trend dummies are used based

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<sup>17</sup> 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-Sakallioğlu and Yeldan (2000).

<sup>18</sup> Central Bank of the Republic of Turkey (CBTR)

<sup>19</sup> The lag length in each equation was chosen using three criteria: AIC, Schwartz Information Criterion (SIC) and the t-ratio for the coefficient of the last lag. A general-to-specific procedure was implemented, starting with an

on the prior knowledge of the Turkish economy. Therefore, the estimates include two crisis dummies. One of them equals to unity for the crisis period 1994:4-1994:10 and zero otherwise; and the other crisis dummy equals to unity for the period 2001:1-2002:1 and zero otherwise. Moreover, seasonal dummies are used where it is necessary.<sup>20</sup>

**Table 1 : Diagnostic Tests**

			# of lags	ADF Test	PP Test
<b>op</b>	<b>Change in the oil price (%)</b>	Level	4	-7.544*	-12.024*
		<i>Difference</i>			
<b>g</b>	<b>GDP growth</b>	Level	4	-6.304*	-8.157*
		<i>Difference</i>			
<b>r</b>	<b>real interest rate</b>	Level	4	-4.698*	-12.911*
		<i>Difference</i>			
<b>e</b>	<b>exchange rate (\$)</b>	Level	4	-4.865*	-9.037*
		<i>Difference</i>			
$\varepsilon$	<b>shocks</b>	Level	0	-2.884**	-2.898**
		<i>Difference</i>			
<b>p</b>	<b>primary surplus</b>	Level	4	-1.538	-1.448
		<i>Difference</i>	4	-6.048*	-13.406*

\*\*\*: significant at the 5% level.

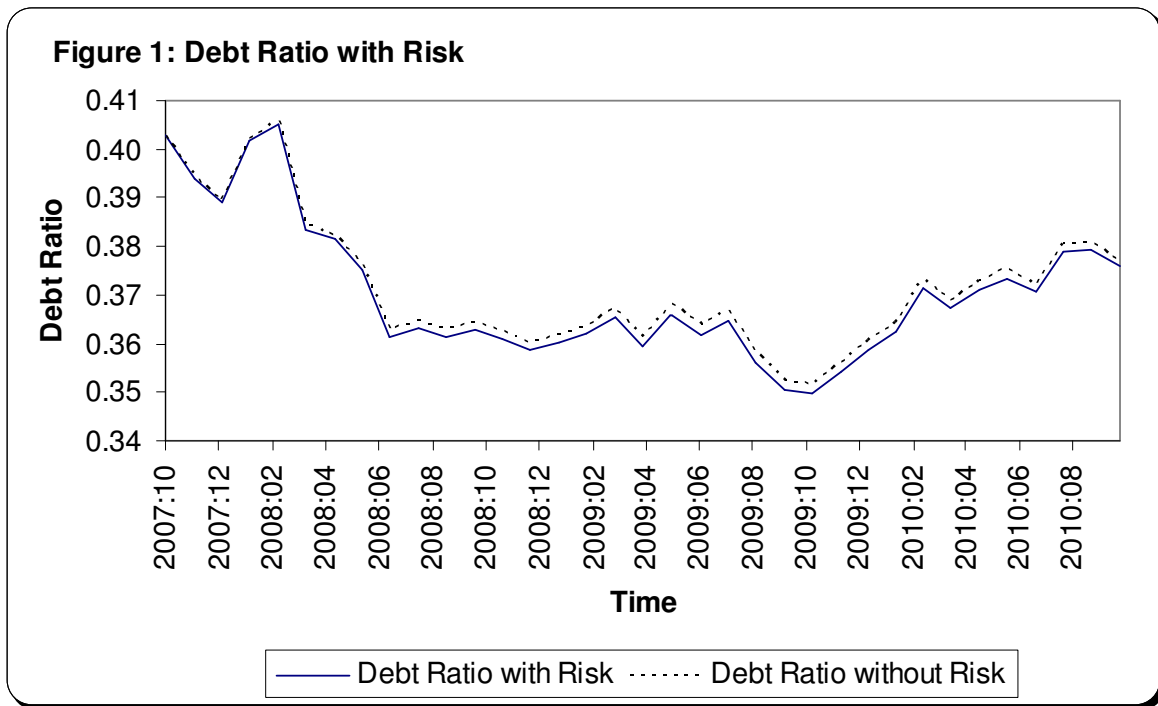
\*\*: significant at the 1% level.

A sample of 10.000 randomly drawn shocks,  $v_t$ , is generated from a standard normal distribution of six variables, for each of the forcing variables, and for each month in the projection period. After multiplying this sample with the Cholesky decomposition matrix,  $W$ , the disturbances of the forcing variables is generated for each of the projection month. The results were used to obtain the simulated value of the forcing variables. Then, the probabilistic distributions are constructed for each projection year using the sample of 10.000 domestic debt ratios which are generated according to (4), using the simulated sample of forcing variables obtained from near-VAR.

equation for which a large enough lag length,  $p$ , was specified. In all applications, maximum lag length was chosen to be 13. If there was no agreement among the criteria's, then the result of the criterion resulting with no autocorrelation in the residuals was chosen. The autocorrelation in the residuals was tested using the Ljung-Box statistic. If significant autocorrelation was found, the lag length was increased until it was eliminated.

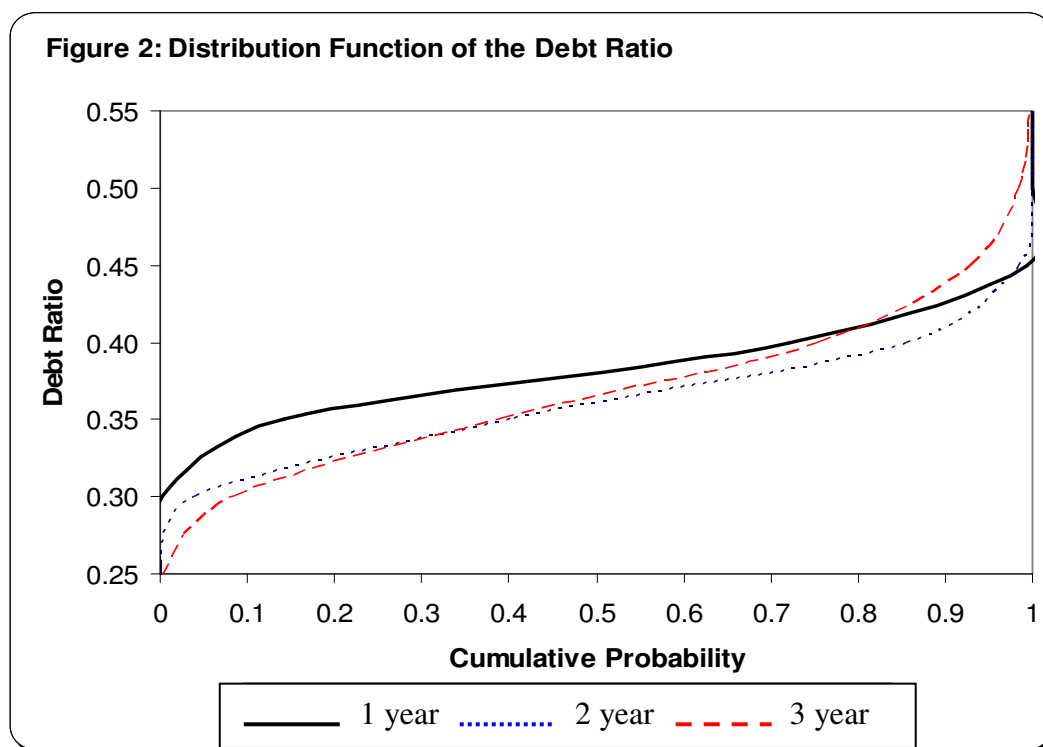
<sup>20</sup> For example, in growth equation. however, alternative formulations regarding the seasonal dummies yield almost the same results.

Figure (1) shows both the forecasted and the simulated debt paths using the initial conditions computed at the end of the sample period. For the projection period, the mean primary surplus of the forecasted and the simulated sample is 0.0704 and 0.0701, respectively. There are several important points that one should notice from Figure (1). First, it can be concluded that for Turkey debt sustainability is likely to be much less of a problem in the years ahead. Second, forecasted debt levels are higher than the simulated debt paths which is not surprising. After the financial crises of 2001, Turkey has experienced high GDP growth and real appreciation of the Turkish Lira. Both of them helped to reduce the debt ratio. The simulations based on the covariance matrix  $\Omega$  of the residuals should mimic such a relationship. Hence, the forecasted debt levels, which do not include shocks, are higher than the simulated debt paths. In other words, in the absence of these shocks, the debt will be higher. Therefore, we will call these shocks as beneficial shocks.



One should also notice that the volatility of the debt to GDP ratio is increasing though time. This can be easily detected by observing the distribution function of the debt under different horizons (see Figure (2)). Actually, the variance is increasing not only because of the choice of the horizon but also because of properties of the covariance matrix. Especially, for emerging market

economies, the risk part of debt sustainability becomes predominant. Shocks do not always cancel out for debt accumulation. For example, in a developed economy, an adverse shock to the growth rate is generally accomplished by a decrease in the interest rates. In such a situation, reduction in the interest rates helps the debt sustainability. This is an automatic stabilizer effect (shocks do cancel out) that exists in developed economies. However, in developing countries, a recession usually leads to an increase in real interest rates. Therefore, we get higher volatility as horizon increases (See also Garcia and Rigabon, 2004).



The bottom part of Table (2) presents the simulated debt levels under the alternative policies. In this exercise, we try to find out the required primary surplus ratio to stabilize the debt path. For example, a surplus ratio of 6.5 percent which is fixed through the projection period starts to deteriorate the debt level after one year ahead. The table reveals that, the minimum required primary surplus ratio is nearly 6.6 percent of GDP in order to obtain a debt ratio, around its initial level, at the end of the two year horizon.<sup>21</sup>

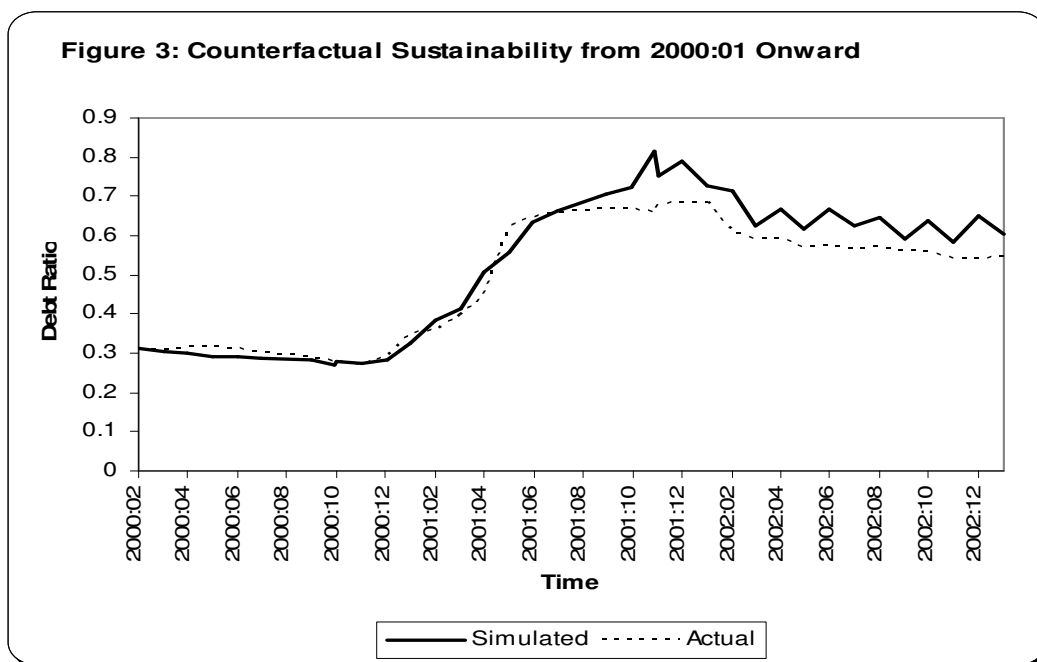
<sup>21</sup> More often, sustainability means that the debt stock (or its ratio to output) does not rise.

**Table 2: Sustainability Analysis from 2007:9 Onward**

<b>Initial Debt Ratio</b>		2007:09					
			41,32 %				
<b>Primary Surplus Ratio</b>		2003	5,22 %				
		2004	6,08 %				
		2005	7,37 %				
		2006	6,97 %				
<b>Simulated Debt Ratio (on Time Horizon)</b>							
		3 months	6 months	9 months	12 months	18 months	24 months
<b>Primary Surplus Ratio (%)</b>							
<b>Under the Base Line Scenario</b>							
Mean	6,93	38,91%	38,40%	36,17%	36,26%	35,87%	34,94%
Minimum	5,86						
Maximum	7,61						
Std. Error	0,47						
<b>Under the Alternative Policies</b>							
Scenario 1	6,30%	38,31	38,37	38,01	41,64	45,42	45,71
<b>Scenario 2</b>	<b>6,50%</b>	<b>37,76</b>	<b>37,29</b>	<b>36,45</b>	<b>39,71</b>	<b>42,63</b>	<b>42,42</b>
<b>Scenario 3</b>	<b>6,60%</b>	<b>37,45</b>	<b>36,66</b>	<b>35,60</b>	<b>38,52</b>	<b>41,01</b>	<b>40,54</b>
Scenario 4	6,75%	37,01	35,81	34,31	36,89	38,77	37,91
Scenario 5	7,00%	36,33	34,47	32,46	34,41	35,45	33,83
Scenario 6	7,25%	35,56	33,08	30,49	31,89	31,70	29,50

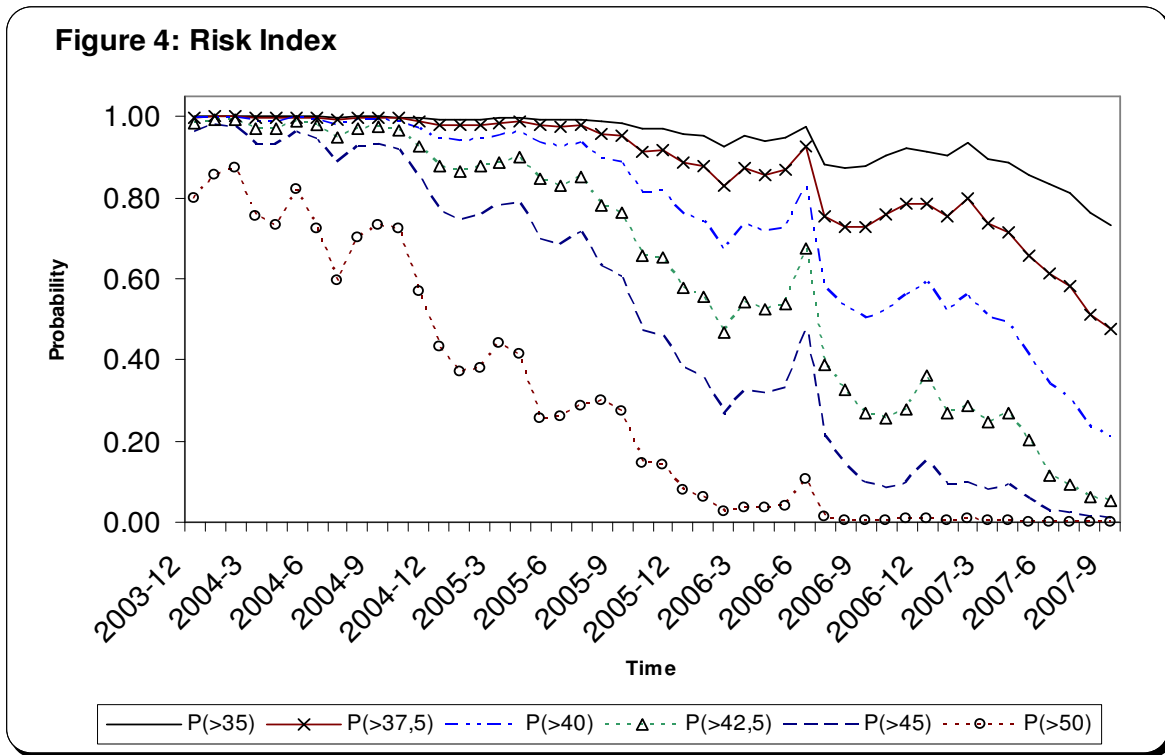
Figure (3) summarizes what the model might have said if it had been used in 2000. Using the data available until 2000:1, we obtain simulated debt path for the projection period 2000:2 – 2002:12. The Figure (3) indicates that debt to GDP ratio of Turkey is increasing, so it has become unsustainable through the end of 2000:1. Indeed, the simulated debt ratio rises dramatically from 30.05 percent to the level of 66.89 percent at June 2001. Starting from 2001:6, we observe significant differences between the simulated and the actual debt paths. This is mainly because of the policy change after financial crisis of February 2001. Obviously, this change is not captured by our econometric model since it is only based on the historical data up to 2000:1.<sup>22</sup>

<sup>22</sup> In line the “Lucas critique”, changes in policies might not be captured by the econometric models.



The simulated sample of the key variables is then used to compute risk measures, i.e., probabilities that the simulated debt to GNP ratio exceeds a given threshold. To do this, first a near-VAR with the available data up to a month is estimated. Then, projections of the domestic debt ratio using the sample of simulated key variables (10,000 replications of 24 months) are computed. Finally, using this path, several statistics on the domestic debt are obtained, such as a statistic of the risk probability that the domestic debt to GNP ratio is larger than 40 percent. Then, this exercise is repeated for the following months. This rolling exercise produces a risk measure of the domestic debt.

Figure (4) presents the results for the probabilities of reaching a domestic debt larger than 35, 37.5, 40, 42.5, 45, and 50 percent of GNP in the following 24 months. Figure (4) is interpreted as follows: For instance, for the 2003:12, given the initial conditions at that time, the probability of the domestic debt to GNP ratio being larger than 45 percent in the following two years is 98.5 percent while it has a 79.8 percent chance of being larger than 50 percent of GNP. In other times, such as in the first month of 2006, these probabilities are much smaller (74.3 and 36.9, respectively). Clearly, the existing situation in Turkey has a sustainable outlook through the end of 2007:9. Indeed, the probability of the domestic debt to GNP ratio being larger than 40 percent in the following two years is only 21.2 percent.



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. The actual correlation between our risk measures and commonly used EMBI+ Turkey spread is found as positive.<sup>23</sup> For instance, the correlation between EMBI+ index and our  $P(>50)$  index is 0.83 percent on levels and 0.32 percent in changes. For  $P(>45)$  and  $P(>40)$  indices; it is 0.80 and 0.69 percents in levels and 0.27 and 0.15 percents in changes, respectively. Indeed, a simple regression analysis shows that our  $P(>45)$  index has strong predictive power on the future EMBI+ spreads. The t-statistic for the  $P(>50)$  variable is 14.56 and the uncentered R square of the regression is 82.49 percent.

$$EMBI_t^+ = 0.413 * P(> 45)_t$$

(0,028)

<sup>23</sup> 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.

#### **IV. Conclusion**

In this paper we have examined the fiscal stance of Turkey under uncertainty. Our study differs from literature in the several ways. First, it is a forward looking model and applies to a finite horizon under uncertainty. Therefore, the results provided are useful and important for policy makers in both shaping and timing of the sound fiscal policies. Indeed, this approach enables the policy makers to foresee the effects of the alternative policies. Second, the advantage of this methodology is that there is no requirement to commit to a particular structural model or distribution of the residuals. This is crucial in emerging countries since it is hardly the case that policy decisions in a particular time do not affect prices, output, or exchange rates contemporaneously. This method, by concentrating on the contemporaneous covariance of the residuals, allows us to study the behavior of the debt to the typical mixture of shocks that might hit the Turkish economy. Finally, the approach engaged in this study is easy to implement, i.e. it is just an out-of-sample exercise.

In summary, our findings indicate that the fiscal stance of Turkey is sustainable through the end of 2007:9. Moreover, the results show that the minimum required primary surplus ratio should be around 6.6 percent of GDP in order to keep the debt ratio stable around 41 percent in the two years ahead.

As a further study, the analysis in this paper can be developed in several ways. First, in order to obtain more accurate projections, a Bayesian VAR framework can be employed. 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 uncertainty 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.



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