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MEASURING FISCAL SUSTAINABILITY FOR PRACTICAL USE IN SHORT-TERM POLICY MAKING

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This study aims to assess the gross domestic debt sustainability of Turkey through construction of a risk index suitable for short-term policy making. Construction of the risk index follows a methodology similar to the Garcia and Rigobon's Risk Management Approach (2004). However, unlike most fiscal sustainability studies carried out for Turkey, our index 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

Potential risks associated with public debt sustainability have long been a concern of policymakers. In the late 1970s, many advanced and emerging economies experienced fast rising debt levels; some of these countries experienced further debt crises in the mid-1980s. After a decade, public debt levels, especially in emerging markets, have again reached calamitous levels A simple correlation between public debt and growth in emerging markets shows negative relationship since 1990 (IMF, 2003b). Moreover, high levels of current debt raises the risk of future fiscal crises in emerging markets.[1]

High public debt has two notable negative effects on economic activity.[2] First, it requires high taxes to finance debt and puts upward pressure on real interest rates. Consequently, private investment and the certain government expenditures will be crowded out, creating low levels of growth.[3] 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 result of these effects, a debt crisis may force the government to default or inflate the debt away;[4] both of which entail large economic and welfare costs.

Fiscal sustainability may be defined various ways but almost always refers to the fiscal policies of a government. Therefore, a *sustainable* fiscal policy is generally defined as one that can be continued into the future without modification. In other words, a *sustainable* fiscal policy requires that a government maintain ability to service its debt obligations in perpetuity without explicit or implicit default or an adjustment of the primary surplus.

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

[3] 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.

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

The traditional fiscal sustainability analyses typically consider representative agent models in which the government satisfies both an intertemporal budget constraint and a per period budget constraint. Thus, solvency requires that the present value of the future primary surpluses must equal to the present value of future primary deficits. Some econometric approaches that have generally been used in this present value budget constraint (PVBC) framework consist of testing the stationarity of the real debt levels (or the debt ratio)[5] and other approaches seek for cointegration relationship linking the primary deficit, the stock of outstanding debt and interest payments.[6]

These sustainability judgments based on the PVBC, however, are made without reference to any economic variables except the debt, projected primary surpluses, deficits, taxation, government expenditure, and the interest rate on government debt. Additionally, 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. 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 unsustainable fiscal policies can satisfy the PVBC, while sustainable fiscal policies cannot satisfy PVBC. This suggests the need to analyze sustainability by allowing for expected changes in fiscal policy with a finite horizon approach.

In traditional analyses, forward looking sustainability indicators[7] are commonly used as an alternative to econometric approach. These studies try to calculate *the debt stabilizing primary*

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[5] 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).

[6] Hakkio and Rush (1991); Bohn (1991), Haug (1991), Tanner and Liu (1994), Ahmed and Rogers (1995), Telatar and others (2004), Leachman and others (2005)

[7] Buiter (1985), Blanchard and others (1990).

surplus and 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. An alternative to these methods is investigation of the relationship between the debt levels and primary surpluses by constructing economic models.[8] 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*.

Several recent methods for bringing uncertainty into the analysis have been proposed in the literature. These studies are primarily broader version of the accounting approach.[9] The common characteristic of 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. Additionally, 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.[10] These studies, particularly those using the 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 gross domestic debt sustainability of Turkey through construction of a risk index suitable in short-term policy making. Construction of the index follows a

[8] Bohn (1998,2005), International Monetary Fund (2003b)

[9] Croce and Juan-Ramon (2003), IMF's Stress Test (2003a)

[10] Garcia and Rigabon (2004), Hostland and Karam (2005), Celasun and others (2006), Taner and Samake (2006).

methodology similar to the Garcia and Rigobon's Risk Management Approach (2004). However, unlike most fiscal sustainability studies carried out for Turkey[11], our index 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.

We first examine 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 vector autoregression (VAR) model is estimated to generate the approximate macroeconomic panorama of 1990s and early 2000s for the Turkish economy. Several possible debt paths are then simulated based on the conditional means and variances of the reduced form residuals. The risk probabilities are subsequently 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.

Section 2 of this study presents an overview of our methodology. Section 3 analyzes the domestic debt sustainability of Turkey. Section 4 relates our conclusions.

II. Methodology

Our debt sustainability analyses concentrates on the debt accumulation equation

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

[11] For a literature review of sustainability analyses for the case of Turkey see Tiftik (2006)

where d_t refers to the gross domestic 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.[12]

Our methodology to assess the sustainability of domestic debt is based on a vector autoregression (VAR) model. 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 ($\tilde{r}$)[13], and the real debt shocks as percentage of GDP (skeletons (-) and privatizations (+)) derived from the debt accumulation equation (ε)[14]. Then we estimate a VAR comprising the policy variable (p) and the other non-policy variables $(\text{op,g,e},\tilde{r},\varepsilon)$. Formally, we have

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

In this model, X vector denotes these endogenous variables and u_t is a vector of well-behaved error term with zero mean and covariance matrix Ω. B (L) represents the coefficients of lags.[15] We assume that the country specific variables do not affect world oil price levels; the lagged values of the country specific variables are not included in the oil price equation. Hence right-

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[12] It is common in recent literature to use net debt stocks, which by definition gross debt minus liquid assets, rather than gross debt stocks. However, because of the data limitations our study based on the assessment of gross debt stocks.

[13] We use $\tilde{r}_t$ as a proxy of $r_t - g_t$;

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

[14] 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

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

[15] B (L) notation is used for simplicity. The lag length in each equation is not the same since we estimate a near VAR model.

hand sides of the equations in the system are not identical. Therefore, we will call this system as a near-VAR model rather than full VAR model.[16]

Once the parameters are estimated from the historical data, several paths of the shocks can be generated using the Cholesky 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 procedure, utilizes Monte Carlo simulation to determine several paths of the debt and can be summarized as follows:

First, the simulated sample of X is obtained from the following model:

$$X_t = c + \hat{B}(L)X_t + \eta_t \qquad (3)$$
$$\eta_t = W\upsilon_t$$

In this equation, W refers to the Cholesky 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 ($\upsilon_t \sim N(0, I)$). 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. (Garcia and Rigabon, 2005; Celasun and others, 2006)[17]. As the next step, the corresponding debt ratio path can be computed recursively using debt accumulation equation and debt shocks:

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

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 to different projection periods will offer insights on the sustainability of the debt. For example, if

[16] We have also estimated a full VAR. This model yielded similar results of near-VAR model.

[17] 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.

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 GNP ratio exceeds a given threshold which was deemed 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, we incorporate the variables not used in the 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

After 1989 period, there was a heavy deterioration in the deficit dynamics of Turkey. Public sector borrowing requirement (PSBR) as a ratio of GDP averaged 5.4 per cent during 1975-1988, but shifted to 9.4 per cent for the 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 new government debt instruments with which the government found it easier to finance its borrowing requirements domestically. Therefore, the share of domestic borrowing in PSBR financing kept increasing whereas foreign borrowing started to decline. Additionally, 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. Consequently, by the end of 2001, Turkey had a public debt which was around 101 per cent of the GDP, placing it in the top most indebted countries in the world.[18] In May 2001, backed by IMF and World Bank, a new stabilization program based on floating exchange rates was adopted. The program, referred as "Transition to the Strong Economy Program" (TSEP), relied on contractionary monetary policy of 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 the *credibility* of Turkey.

In the following six years, there were significant improvements related to the level of debt stock, the maturity structure, and the interest expenses but reliable and sustainable levels had not yet been achieved. 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 focuses on a vector of six endogenous variables. The data series are monthly for the sample period 1990:1 2007:9.[19] All the data is obtained from the CBRT Electronic Data Delivery System (EDDS).[20] The total number of observations is 213. The individual series are tested for stationarity. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used; both tests contain an intercept.[21]

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[18] 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).

[19] GDP data is not available on a monthly basis. Therefore, we used basic cubic spline curve fitting techniques to obtain the monthly GDP series from the quarterly GDP series.

[20] Central Bank of the Republic of Turkey (CBRT)

[21] The definition of the primary balance, hence primary surplus, changed two times in the past (2004:1 and 2006:1). Therefore, we put special care on the primary surplus series. In order to catch the timing of this definition changes, we used Zivot and Andrews (1992) sequential endogenous structural break test which uses a different dummy variable for each possible break date. By allowing breaks both in the intercept term and in the trend term, and by shortening the length of the sample recursively, we searched for the significant structural break points in the full sample of primary surplus data set. This simple exercise indicates the significant endogenous break points based on Zivot-Andrews test results do not match with the timing of the definition changes. Hence, we concluded that these

Table 1 : Unit Root Tests

		# of lags	ADF Test	PP Test
op	Level	4	-7.544*	-12.024*
	Difference			
g	Level	4	-6.304*	-8.157*
	Difference			
r	Level	4	-4.698*	-12.911*
	Difference			
e	Level	4	-4.865*	-9.037*
	Difference			
ε	Level	0	-2.884**	-2.898**
	Difference			
p	Level	4	-1.538	-1.448
	Difference	4	-6.048*	-13.406*

"***": significant at the 10% level.

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

"*": significant at the 1% level.

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 an I (1) process. Therefore, we used the first difference of this variable for the remainder of our analysis. The lag length, L, for each equation was set to 13.[22] To isolate crises periods, intercept and trend dummies were used based on the prior knowledge of the Turkish economy. Therefore, the estimates include two crisis dummies. One of them equals to 1 for the crisis period 1994:4-1994:10 and 0 otherwise; and the other crisis dummy equals to 1 for the period 2001:1-2002:1 and 0 otherwise. Seasonal dummies were used where it is necessary.[23]

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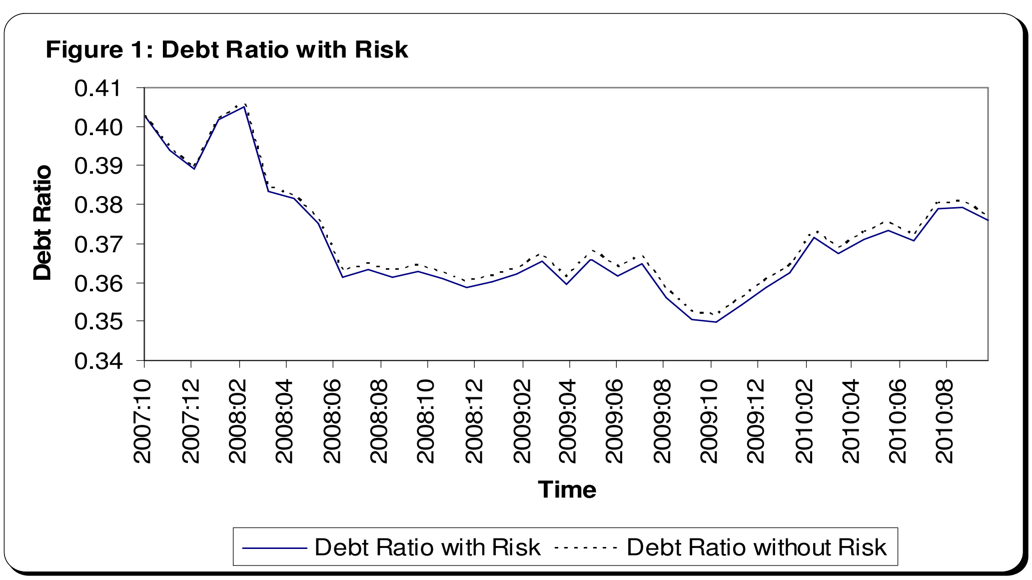
changes in the definition do not affect data generating process of primary surplus and so we used the monthly primary surplus series directly without any filtering.

[22] 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 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.

[23] In order to determine the period for the crisis dummies we performed Likelihood ratio (LR) tests. In other words, starting from the shortest period of length, if the LR test indicated that crisis dummies were insignificant, then the length of the period was increased by one month; until the LR test indicated that the crisis dummies were jointly significant. Moreover, we used seasonal dummies in growth equation. However, alternative formulations regarding the seasonal dummies yield almost the same results.

A sample of 10.000 randomly drawn shocks (υ_t) were 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 were generated for each of the projection month. The results were used to obtain the simulated value of the forcing variables. Then, the probabilistic distributions were constructed for each projection year using the sample of 10.000 domestic debt ratios which were generated according to (4), using the simulated sample of forcing variables obtained from near-VAR.

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 ratio 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. After the financial crises of 2001, Turkey has experienced high GDP growth and real appreciation of the Turkish Lira both of which helped to reduce the debt ratio. The simulations based on the covariance matrix Ω 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. That is, in the absence of these shocks, the debt will be higher. Therefore, we will call these shocks as beneficial shocks.

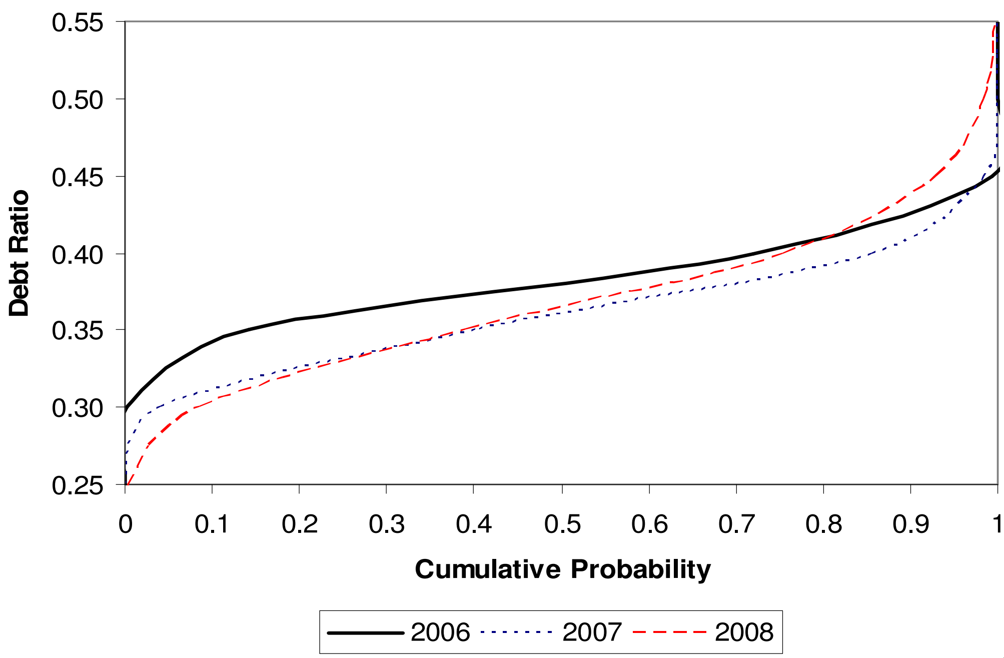


One should also notice that the volatility of the debt to GDP ratio is increasing as the length of the horizon increases. This can be easily detected by observing the distribution function of the debt under different horizons (Figure (2)). Although we did not focus to analyze the properties of the variance-covariance matrix throughout this study, observing the effects of a shock to one of the variables on the other variables (impulse responses) indicates that the effects are explosive on average after some period.[24] Therefore, we believe that the variance of the simulated debt to GDP ratios is increasing not only because of the choice of the horizon but also because of the properties of the structure of the covariance matrix. These may be also related with issues concerning data quality. Garcia and Rigabon (2004) stated these characteristics of the variance covariance matrixes and issues related with data quality are very common in emerging market economy studies.[25] Additionally, according to the related literature, having increasing volatility suggests that the risk part of the debt sustainability becomes predominant in studies based on emerging market economies. Shocks do not always cancel out for debt accumulation due to the characteristics of the variance –covariance matrix. 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 like Turkey, a recession usually leads to an increase in real interest rates. Therefore, we get higher volatility as horizon increases so we decided to set our forecast period as 24 months for the remainder of our study in order to construct more accurate and less volatile simulated samples.

[24] This study aims to construct a simple reduced form VAR model rather than a structural VAR model. Hence, although the characteristics of the variance-covariance provide some intuition about the behavior of the variables, they do not imply any causal relationship between variables. Therefore, we believe that analyzing the characteristics of the variance-covariance matrix is out of scope of this study.

[25] For further discussion about that issues see also; Celasun and others (2006), Taner and Samake (2006), Tiftik (2006).

Figure 2: Distribution Function of the Debt Ratio



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 per cent 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 per cent of GDP in order to obtain a debt ratio, around its initial level, at the end of the two year horizon.[26]

[26] More often, sustainability means that the debt stock (or its ratio to output) does not rise.

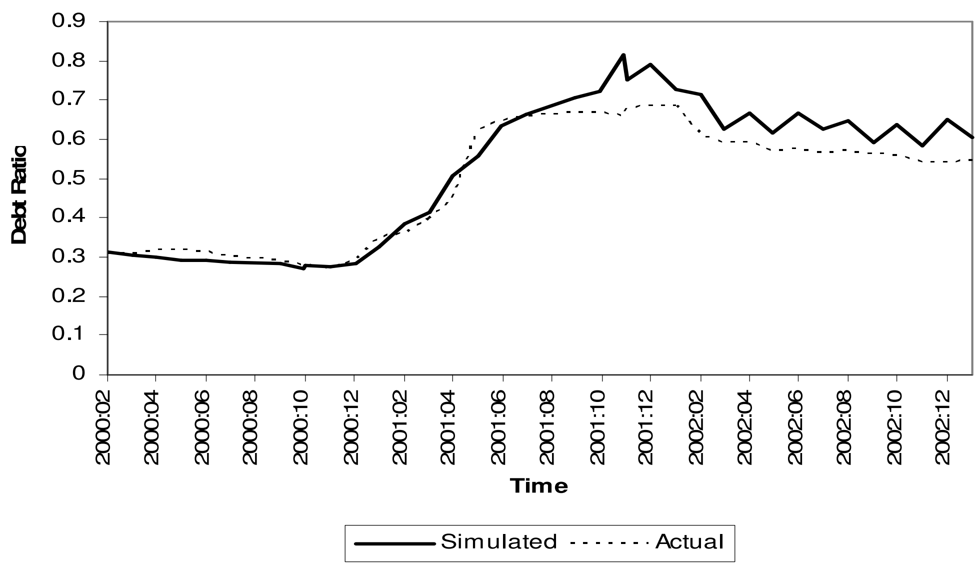
Table 2: Sustainability Analysis from 2007:9 Onward

Initial Debt Ratio		2007:09	0.4132					
Primary Surplus Ratio		2003	0.0522					
		2004	0.0608					
		2005	0.0737					
		2006	0.0697					
		Time Horizon						
		3 months	6 months	9 months	12 months	18 months	24 months	
Primary Surplus Ratio								
Mean	0.0693	0.3891	0.3840	0.3617	0.3626	0.3587	0.3494	
Minimum	0.0586							
Maximum	0.0761							
Std Error	0.0047							
Alternative Policies on Primary Surplus								
	0.0630	0.3831	0.3837	0.3801	0.4164	0.4542	0.4571	
	0.0650	0.3776	0.3729	0.3645	0.3971	0.4263	0.4242	
	0.0660	0.3745	0.3666	0.3560	0.3852	0.4101	0,4054	
	0.0675	0.3701	0.3581	0.3431	0.3689	0.3877	0.3791	
	0.0700	0.3633	0.3447	0.3246	0.3441	0.3545	0.3383	
	0.0725	0.3556	0.3308	0.3049	0.3189	0.3170	0.2950	

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.[27]

[27] In line the "Lucas critique", changes in policies might not be captured by the econometric models.

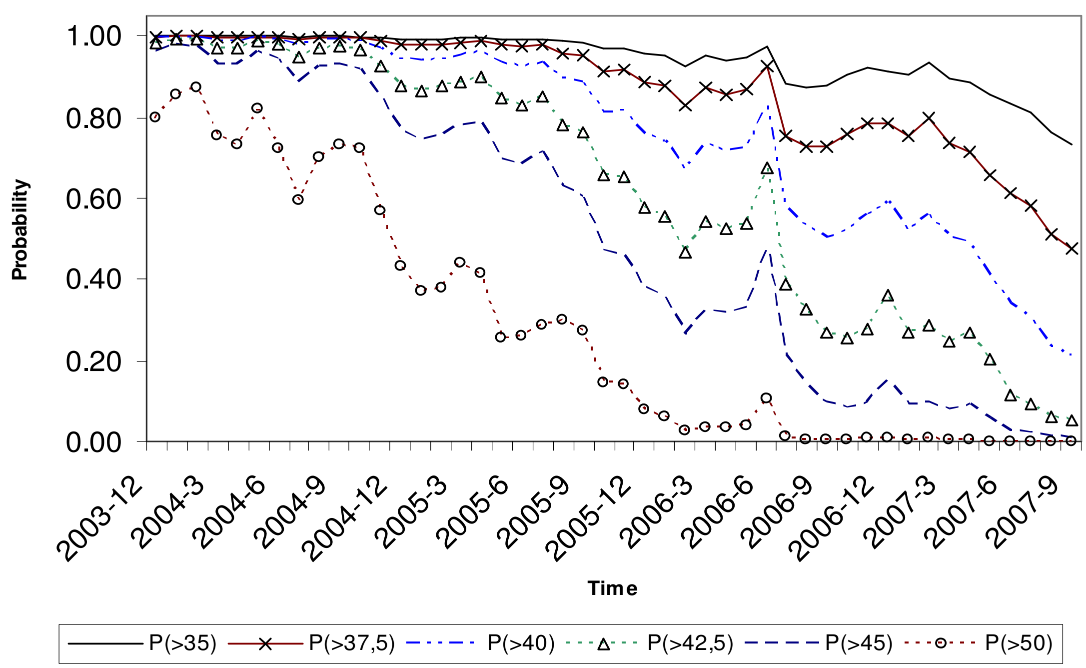
Figure 3: Counterfactual Sustainability from 2000:01 Onward



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 recursive 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. 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.

Figure 4: Risk Index



The time-series of such risk probabilities are then used to investigate correlation 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.[28] For example, 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.

$$EMBI_t^+ = 0.413 * P(>45)_t$$
$$(0,028)$$

[28] 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

We 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 used 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.

The analysis of 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, the stochastic characteristic of the main variables can be captured by Markov chains, as an alternative. The use of Markov 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 providing estimates with a 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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