Revealing Turkey’s public debt burden: A transparent payments approach

Can Erbil a,∗, Ferhan Salman b

a Department of Economics and IBS, Brandeis University, Sachar 215, MS 021, Waltham, MA 02454, USA
b Research and Monetary Policy Department, The Central Bank of Turkey, Turkey

Received 13 June 2005; received in revised form 12 October 2005; accepted 3 March 2006

Abstract

We postulate a new method of measuring debt which we call the debt burden (DB). We claim that DB reveals the true debt obligations of the fiscal authority by taking the intertemporal debt obligations of the government into account. It is more accurate and more transparent than the currently used methods of assessing debt. DB is calculated on a daily basis and it clearly identifies debt risks. It is a superior policy making tool for the fiscal authority. DB also reveals the true stance of fiscal dominance and the associated policy tradeoffs faced by the monetary authority.

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JEL classification: H63

Keywords: Debt burden; Risk; Fiscal dominance

1. Introduction

Is there a better approach to measure Turkey’s total public debt burden? The common approach to determine Turkey’s public debt has traditionally been in the form of revealing the stock of total debt or the approaching interest payments that the government needs to satisfy its current debt service agreements.

The debt service, which is close to our approach, is calculated on a monthly frequency, which fails to capture fluctuations and the information embodied in the volatility of shorter frequencies.

In this paper, we concentrate our analysis on daily changes of the total public debt burden, where we investigate intertemporal government debt obligations to assess future stresses on the
fiscal authority and evaluate the sustainability of government debt. This innovation allows us to investigate episodes of differing volatilities in Turkey’s recent fiscal history.

Our approach clearly reveals periods of financial distress in the years of 2000 and 2001. Although, the crisis of 2001 was presented as an outcome of political conflict, it was rather inherent in the accumulated debt burden for the period that involved the crises.¹

We identify the available policy options. Government can decrease the cost of borrowing by smoothing its borrowing schedule. The benefits vary between US$ 4 and 6 billion which is equivalent to 1.8–2.7% of gross domestic product (GDP). We also propose that DB could serve as a good proxy to assess risk and provide the true characteristics of fiscal dominance and resulting tradeoffs associated with monetary policy.

The next section provides some background on conventional approaches and our approach to debt definitions and issues concerning Turkey’s public debt including its sustainability. Section 3 describes the data which is followed by results and policy discussions in Section 4. Finally Section 5 concludes the paper. The two appendices that are provided at the end summarize the mechanical details of our methodology and the assumptions used.

2. Background

2.1. Conventional approach to burden of debt

Most governments engage in debt (both foreign and domestic) to finance current investment that is expected to generate return for future repayment. In essence, government debt has the same principles as any other types of borrowing. However, its consequences are different.

A high and unsustainable debt burden has significant negative effects on developing economies. On the contrary to its motivation debt may adversely affect private investments (overhang affect) and public investments (budget deficit due to interest payments) and eventually may slowdown economic growth. Some heavily indebted countries are “debt trapped”, being forced to finance the repayment of their earlier period obligations with new borrowings.

When economists consider the burden of foreign debt, they usually think of the cost in terms of transfers from the debtor country to the rest of the world. The debt burden is then measured simply as the discounted flow of resources that the debtor country must provide to its creditors. The costs are not limited to the burden of the debt service, the deadweight loss due to debt overhang discourages domestic investment.

Literature indicated several direct and indirect channels through which a large level of foreign debt affects investment and output. The reduced incentives to invest, the high domestic real interest rates due to the impaired access to international credit, and the decrease in public investment is referred to as the “debt overhang effect”.

Debt overhang theory is based on the premise, that if debt exceeds the country’s repayment ability with some probability in the future, expected debt service is likely to be an increasing function of the country’s output level. The debt overhang indicates that the accumulated debt, acting as a tax on future output, discourages productive investment plans of private sector and adjustment efforts on governments. The extent to which the debt overhang discourages private

¹ The political distress, in fact, had only a trigger effect on the crisis: during the National Security Council Meeting on 19 February 2001, the President of Turkey and the Prime Minister had an argument over the constitution, where the Turkish Constitution became “airborne”. This event is now known as the “Constitution Incident” in recent Turkish political history.
investment depends on how the government is expected to raise the resources needed to finance external debt service and whether private and public sector investments are complementary. Sachs (1986) and Kenen (1990) argue that external debt overhang is seen as one of the main reasons for slowing economic growth in indebted countries.2

2.2. Intertemporal approach to debt burden and sustainability

What if the government decides to pay the principal and accrued interest of its debt at a specific time in the future? We believe that this question is more appropriate to describe the sustainability of debt. Investors at any point in time, among other factors, consider total debt obligations of the government in deciding the risk premium that they require for lending.3 In this respect, our method resembles the investigation of intertemporal government debt obligations. To demonstrate this, we need to address the question of whether the government will meet its principal and/or interest payments of the debt in the future and if so, what will be the size of these payments.

We can characterize each bond issue with several parameters. Let’s denote $B$ as the size of the issue, $b$ as the date of the issue and $s$ as the payment date of the principal with accrued interest. And let’s denote $t$ as the time dimension. Date $t$ could be before, during or after this particular bond issue. Therefore, the value of a bond $i$ at time $t$ ($\text{VB}_{i,t}$) can be represented by the following formula:

$$\text{VB}_{i,b,s,t} = B_{i,b}(1 + r_i)^{t-b}$$  \hspace{1cm} (1)

for $t = 1, \ldots, T$. This states that if the treasury would like to honor the outstanding bond issue with its accumulated interest, $\text{VB}_{i,t}$ is the magnitude of the payment that it will make. Notice that (1) assumes away renegotiation of debt in terms of interest and rescheduling of payments. However, Eq. (1) can be used to determine a renegotiation of principal and interest payments. As explained in the data section, treasury has a variety of auction instruments which may appear to have different formulas for accumulated interest, although this is the case, each of these bond issues can still be represented by (1), it is simply a labeling issue.

The next step is to determine the total accumulated debt, this is done by Eq. (2), we simply sum over all outstanding bonds at time $t$ for $t = 1, \ldots, T$:

$$\text{DB}_t = \sum_{i=1}^{I} \text{VB}_{i,b,t}$$  \hspace{1cm} (2)

We call (2) debt burden (DB) which includes both the debt stock and the debt service components of public borrowing. Note that $\text{DB}_t$ is independent of base year $b$ for each outstanding bond issue. Moreover, $\text{DB}_t$ does not include any bond issue that matured before time $t$. $\text{DB}_t$ can be interpreted as the value of the outstanding debt obligations of the government.4

2 Karagol (2002) claims that debt service has a significant negative “debt overhang effect” on the GNP of Turkey.
3 There are exceptions, as Bulow and Rogoff (1989) suggests, a debtor who is in difficulty can negotiate to fulfill the interest portion of the debt and renegotiate the payment of the principal at a future date.
4 Debt obligations are different from debt stock. Notice that debt stock does not include interest obligations therefore may understate the obligations of each issue.
2.3. Turkey’s debt burden

The recent increase in the frequency and severity of financial crisis in developing countries can be seen as proof of how crucial it is to have an efficient functioning debt management office with sound strategies for indebted developing countries, like Turkey. The debt management office has significant functions in the treasury department, and specifically focuses on the management of debt. It mainly monitors the major variables of debt, i.e. interest rates, maturity, and the exchange rate. Monitoring also requires the treasury to take necessary measures to better identify and reduce risk that can arise during sudden changes in the economic and political environment. After the 2001 financial crisis, the Undersecretariat of Turkish Treasury (UT) established a debt management office to manage debt more efficiently.

The goal of the department is to reduce the total debt stock by increasing the consolidated budget balance\(^5\) (Ates, 2002). Attaining budget surpluses reduce government obligations and provide more flexibility in management of the debt stock.

As stated in UT reports of 2003, Turkey’s debt consists of instruments with 49.3% fixed and 50.7% variable interest rate. In addition, 51.2% of total debt is contingent on Turkish Lira, and 48.8% contingent on foreign currency. During 2003, average maturity of debt increased and average cost of reissues declined.

The favorable conditions in the global financial markets (falling interest rates), and the improvements in the Turkish economy (falling inflation, falling interest rates and high growth rate), decreased the cost of borrowing (both domestic and external) during 2003. Since 50% of external and domestic debt includes variable interest rates, they are still vulnerable to any future changes in interest rates and we argue that these changes and their rapid effect on the economy should also be forecasted. Moreover, foreign exchange risk also needs to be considered since almost 50% of the total debt is denominated in foreign currency.

3. Data

The Turkish Government’s consolidated debt can be categorized under two primary headings: domestic and external debt. Domestic debt is debt issued in both the national currency, Turkish Lira (TL), and foreign currency through domestic financial markets.\(^6\) Whereas, external debt is issued to foreign residents both in TL and foreign currency, however Turkey has not been successful in borrowing in international markets with TL.\(^7\) Moreover, with growing financial markets and new instruments emerging, the variety of instruments used in auctions has grown in the 1999–2003 period.\(^8\)

\(^5\) They exclude interest payments.

\(^6\) As of 1 January 2006 the official currency of the Republic of Turkey is the YTL. The conversion from TL to YTL was 1 million to 1. YTL simply dropped six zeros on the TL. The circulation of YTL began on 1 January 2005 although the TL was also still in circulation.

\(^7\) The stabilization policies, reform process and recent political stability reduced risks in the Turkish economy. However, with returns on the YTL denominated Turkish bonds still comparably high, the YTL began to attract investments in world financial markets. In 2005, some foreign banks issued YTL denominated bonds.

\(^8\) Switching auctions, floating rate notes (FRN) auctions, foreign currency (FX) denominated floating rate notes auctions, discounted FX denominated treasury auctions, fixed coupon TL denominated treasury auctions, discounted TL denominated treasury auctions, non-auction sales are all used for domestic issues. For foreign issues, fixed coupon foreign currency denominated treasury auctions, loans from International Institutions and foreign governments and treasury guaranteed credits are used.
Our data set is compiled from UT sources for the period 1998–2003. The calculations are performed on a daily basis. To convert daily figures to monthly figures we averaged them in a month.

Table 1 provides some details on the Turkish public debt stock, it provides us with a clear picture of the rapid growth of debt and instruments during the period. Contrary to expectations, the impact of the Russian crisis averaged out by high inflation rates in that year helped the government to get rid of a significant portion of the interest burden. However, declining inflation and the 2001 Turkish financial crises became the primary determinants of positive and significantly high real interest rates and lower maturities afterwards.9

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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<tr>
<td># of auctions</td>
<td>31</td>
<td>59</td>
<td>39</td>
<td>89</td>
<td>124</td>
<td>85</td>
</tr>
<tr>
<td>TL</td>
<td>31</td>
<td>59</td>
<td>36</td>
<td>66</td>
<td>92</td>
<td>73</td>
</tr>
<tr>
<td>US$</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>22</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Euro</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Average maturity (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TL</td>
<td>1028</td>
<td>1019</td>
<td>819</td>
<td>696</td>
<td>1051</td>
<td>899</td>
</tr>
<tr>
<td>US$</td>
<td>1825</td>
<td>730</td>
<td>1401</td>
<td>528</td>
<td>528</td>
<td>528</td>
</tr>
<tr>
<td>Euro</td>
<td>1826</td>
<td>993</td>
<td>654</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average interest rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TL</td>
<td>−0.01</td>
<td>−0.05</td>
<td>0.02</td>
<td>0.00</td>
<td>0.27</td>
<td>0.18</td>
</tr>
<tr>
<td>US$</td>
<td>0.02</td>
<td>0.07</td>
<td>0.04</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euro</td>
<td>0.02</td>
<td>0.05</td>
<td></td>
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</tr>
</tbody>
</table>

Table 4. Results and policy discussion

To motivate a discussion on the performance of DB to UT debt stock we present Graph 1 for the sample period. We expect DB to lay above debt stock since interest burden is included on principal payments. Figures are in billion US dollars at the end of the calendar year. We observe the total debt stock of Turkey has tripled since 1998.

The difference between debt stock and DB is more significant during times of financial distress. We observe that real interest payments drive a significant wedge. As of December 2003, DB is around US$ 230 billion whereas the Treasury’s stock figure is around US$ 200 billion. This accounts for a 15% wedge. In Graph 2, we present the percentage difference between debt burden and UT debt stock. An average of 10% difference can be observed between the two calculations. Given the size of the debt stock, this difference accounts for US$ 20 billion, also corresponding to 8% of the gross domestic product (GDP).

We observe a growing trend in the DB, however we need to normalize this figure with respect to some macroeconomic aggregate to control for the growth rate of the economy. M2Y, which is the monetary aggregate that includes currency in circulation, checking and savings deposits both in TL and foreign currency, serves this purpose. Moreover, M2Y can be used as an indicator

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9 We prefer the present maturity in terms of days since our methodology is based on daily calculations.
Graph 1. Our calculations vs. treasury (billion US$) (a).

Graph 2. Our calculations vs. treasury (%) (b).
Graph 3. Debt burden/M2Y.

for debt sustainability. Note that the treasury issues require an increase in demand for money. Graph 3 presents the ratio of M2Y to DB. This ratio more than quadrupled in the analysis period. Although we observe a slowdown in the latter period due to the current disinflation program, this ratio has the potential to grow.

The impetus for our analysis lies on our calculations with daily data. Our claim is that monthly data is not as transparent as daily data. In addition, monthly data does not present the true cost of the burden. We will take two steps to address these issues. Graph 4 displays the daily DB, notice the fluctuations in this high frequency data. Most of these fluctuations are caused by the preparation of the treasury for the upcoming payments. Since government income is insufficient to pay for the change in debt and government expenditures, the treasury holds frequent auctions in order to borrow to pay the amortizing debt. As indicated in Table 1, the number of auctions grew significantly until the end of 2002 where it reached a level of 124 auctions.\footnote{This number reflects only domestic market borrowing.} The decline in the number of auctions in 2003 is not surprising. As a result of the IMF stand-by agreement in 2001, IMF credit was used to substitute domestic issues. However, on the aggregate, DB is a comprehensive measure which would make this substitution irrelevant.\footnote{We are leaving the substitution of external to domestic borrowing for another project. There is an extensive literature on this topic especially related to the Asian financial crises.}
An important result of Graph 4, that was also apparent in Graph 1, is the acceleration of debt burden in the past 2 years. Due to declining inflation and stable nominal interest rates, on average UT paid 27 and 18% real interest rate on domestic issues in the years 2002 and 2003, respectively (Table 1).

Graph 4 also clearly identifies the two financial crises in November 2000 and February 2001. They are captured by the sharp drops and increases in the DB measures during these periods. Monthly data averages these two sets of spikes, one from financial distress and the other from UT preparations for upcoming auctions. Hence, any approach utilizing monthly data could not capture the costs associated with volatility in higher frequencies. Table 2 displays the difference in both volatility figures. Daily volatility is higher than monthly volatility. In order to compare the four standard deviation measures, we normalized standard deviations with the average of the sample. The last row represents the volatility comparisons.

<table>
<thead>
<tr>
<th>Monthly debt stock</th>
<th>Monthly debt burden (DB)</th>
<th>Monthly difference (2-1)</th>
<th>Daily debt burden (DB)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>48868</td>
<td>55109</td>
<td>7992</td>
</tr>
<tr>
<td><strong>S.D.</strong></td>
<td>102466</td>
<td>112907</td>
<td>10441</td>
</tr>
<tr>
<td><strong>Average/S.D</strong></td>
<td>0.48</td>
<td>0.49</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Table 3  
Calibration exercise

<table>
<thead>
<tr>
<th></th>
<th>US$ billion</th>
<th>% of M2Y</th>
<th>% of CBR</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual savings (1/3 reduction in volatility)</td>
<td>4447</td>
<td>4.3</td>
<td>13.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Annual savings (1/2 reduction in volatility)</td>
<td>6738</td>
<td>6.5</td>
<td>20.0</td>
<td>2.7</td>
</tr>
</tbody>
</table>

The first two columns are calculated on a monthly basis. Monthly DB has a slightly higher volatility than monthly debt stock. When we deduct the first column from the second one, the difference has 50% more volatility. This points to the higher interest rate volatility that is inherent in DB.

The next step is to extend the volatility analysis to capture the costs associated with daily volatilities. In order to do that, we have to figure out the contribution of DB volatility to the cost of financing. A good proxy for the cost of financing is the EMBI+ published by JPMorgan. The index is a weighted average of the prices of outstanding bonds, therefore it represents the return on investment on the debt instrument and also the associated risks. We take the change in the cumulative total return index for Turkey as our endogenous variable.12 Our explanatory variable is the lag value of change in EMBI+ index and the daily volatility in DB.

Investor behavior is persistent. This, in turn, determines the rate of return. However, if we believe in the rational expectations (RE) theory, a forward-looking investor will use all available information out there before making a decision. Therefore, an investor, acting upon RE, will use the future developments in DB to determine the expected return on bonds. We provide evidence to the contrary for forward-looking behavior. The results for the former argument are provided below:

\[
\Delta \text{EMBI}_t = c + 0.14 \Delta \text{EMBI}_{t-1} + 0.04 \Delta \log \text{DB}_{t-3} + \text{error}_t
\]

The figures in parenthesis are the \(t\)-statistics. Coefficients are significant at 10% level. \(\text{DB}_{t-3}\) is the only significant variable among the lags which provides evidence towards UT’s preparation motive for the upcoming auction a few days in advance. Given the regression results we can calibrate the benefits of volatility smoothing (Table 3).

An associated monetary gain that reduced the volatility by one-third and one-half would be US$ 4.4 and 6.7 billion, respectively. The columns represent the gain as a percentage of M2Y, Central Bank Reserves and output. A reduction in volatility by one-half can induce a gain of 2.7% of the GDP.

As we suggested before, DB is a successful indicator of the analysis of risk since it can predict the two financial crises with high precision. We also mentioned that it is a better definition of the public debt burden and therefore of fiscal dominance. A country with a high level of public debt with low maturity causes concerns of debt sustainability. Therefore, prices in financial markets will be partly determined by the stance of fiscal policy and inherently by the debt burden.

In the presence of fiscal dominance there exists a tradeoff for the monetary policy. Monetary policy by itself will not suffice to maintain price and financial stability. The tradeoff lies in the

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12 EMBI+ and DB on the levels has a unit root, first differencing solves this problem. Levels are not cointegrated, therefore we can run the regression (3).
inability to control inflation and the DB simultaneously. An increase in the interest rates will lead to high short-term interest rates which is the policy tool of the Central Bank. However, higher interest rates translate into higher DB. Since DB can be used as a good measure for financial risk, a rise in its level will induce capital outflows, thereby depreciating domestic currency and increasing inflation. To sustain a prudent monetary policy one needs either fiscal discipline or a decrease in the DB.

Furthermore, all of our DB calculations were completed in the Microsoft Excel environment. Availability of such an intuitive policy tool which operates in a user-friendly environment with a large access base has a big appeal for policy makers. In addition, the coherence and ease of operation of the DB measure is such a setting would further motivate policy makers to manage and interpret data and simulate outcomes.

One simulation that we set up is the alternative interest rate and maturity scenarios for predicting future constraints implied by the DB, we can safely conclude that decreasing the volatility is the key in the short-run to ease the burden of fiscal policy on monetary policy. Moreover, it generates extra resources for the policy maker to sustain debt and employ a sound fiscal policy. In the medium to long-run, DB addresses that the level of debt has to be reduced which can be done by either reducing short-term interest rates or actively paying back the debt through generating tax revenues or lowering government expenditures. The latter is not a surprising result; however it clearly indicates the consistency of the DB measure with the alternative definitions of fiscal stance. Still DB remains to be a comprehensive measure.

5. Conclusion

Our results indicate that focusing on daily volatility would have significant gains for the country. The methodology we use is more transparent since it reveals every development of the “debt burden” of the fiscal authority. The data set is robust and presents the characteristics of high frequency data with thick tails and excess skewness. This may allow us to examine research topics such as fiscal dominance in monetary policy making, determinants of interest and exchange rate volatility and the impact of treasury auctions on the secondary markets.

We are confident that daily analysis provides policy makers with a strong policy tool in risk management and crisis prediction. In this respect, our methodology is an excellent candidate for sound policy making. Moreover, we can also use our innovative DB approach in suggesting sustainability of debt through intertemporal budget constraint calculations since it includes all principal and interest obligations of the government.

Acknowledgements

IED travel grant is kindly appreciated. Also, we would like to thank Nilgun Pehlivan and Ozgur Pehlivan for data and Ertunc Alioglu for excellent research assistance.

References


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13 Less volatile.
14 We omit these robustness results to save space.

