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Revealing Turkey's Public Debt Burden: A Transparent Payments Approach

Ertunç ALİOĞLU
Can ERBİL
Ferhan SALMAN

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by

Ertunc Alioglu[′], Can Erbil[″] and Ferhan Salman[‴]

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Abstract

We postulate a new method of identifying debt which we call Debt Burden (DB). We claim that DB reveals the true debt obligations of the fiscal authority. It is more accurate and transparent. Hence, DB would serve fiscal authority much better in policy making. It is powerful in a sense that it is calculated on a daily basis and can serve as a good policy measure since it includes projections into the future.

[′] Department of Economics, Brandeis University

[″] Department of Economics, Brandeis University and Ecomod

[‴] Corresponding Author, Department of Economics, Boston University and Research Department, The Central Bank of Turkey, Istiklal Cad. No:10 Ulus 06100 Ankara Turkey, ferhan.salman@tcmb.gov.tr, Tel: (+90 312) 311 3921. IED travel grant is kindly appreciated. Also, we would like to thank Nilgun Pehlivan and Ozgur Pehlivan for data. All the views expressed in this study are solely authors' and do not necessarily reflect those of the Central Bank of the Republic of Turkey or it's staff.

1 Introduction

Is there a better approach to measure Turkey's total public debt burden? The more common approach to announce 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 announced on a monthly frequency, which fails to capture fluctuations and the information embodied in the volatility of shorter frequencies.

In this paper, we will concentrate our analysis on daily changes of the total public debt service. 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].

The next section provides some background on debt sustainability, which is followed by Methodology in section 3. Section 4 describes the data. Section 5 presents the results and finally section 6 concludes. The two appendices that are provided at the end summarizes the details mechanical of our methodology and the assumptions used.

2 Background

Most governments engage in debt (both foreign and domestic) thinking that it is a sort of investment which will improve on the current economic situation. In essence government debt has the same principles as any other types of borrowing. However, its consequences are somewhat different.

Debt burden has more effect on developing country economies than it was expected. Because of negatively affected private investments (overhang affect), and public investments (budget deficit), economic growth will become slower than expected. Some indebted countries are trapped to continue transferring funds to the rest of the world by financing the repayment of earlier period obligations with new borrowings (unless it receives high returns from its borrowing, for instance by increasing exports rapidly by reallocating resources).

[1] The political distress, in fact, had only a trigger effect in the crisis: During the National Security Council Meeting on ….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 Incidence" in the recent Turkish political history.

When economists consider the burden of foreign debt, they usually think of the cost to the debtor country of making a transfer to the rest of the world. The debt burden is measured simply as the discounted flow of resources that the debtor country must provide to its creditors. But over and above the transfer burden is the enormous deadweight loss resulting from the way that the current debt overhang discourages investment in the debtor countries.

A recent paper by Karagol (2002) applies a cointegration analysis to investigate the relationship between external debt and growth. The economic literature has indicated several direct and indirect channels through which a large foreign debt affects investment and finally negatively output:

- The "debt overhang effect", which refers to the reduced incentives to invest,
- The high domestic real rates due to the impaired access to international credit,
- The low probability due to the downturn in economic activity; the decrease in public investment that is complementary to private investment[38].

The debt overhang hypothesis indicates that the accumulated debt act as a tax on future output; discouraging productive investment plans of private sector and adjustment efforts on the part of governments. So even after some improvement in the economic production, it can conclude higher debt repayments, because foreign debt acts like a tax on future production and export.

Debt overhang theory is based on the premise that if debt will exceed 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. Sachs (1986) and Kenen (1990) argue that external debt overhang plays an important role in heavily indebted countries. Thus debt overhang is one of the main reasons for slowing economic growth in indebted countries. In addition to that, how a debt overhang discourages private 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.

Karagol (2002)'s results of his causality test prove that debt service has a significant negative effect on GNP with one-year lag. Hence, in the case of Turkey, debt service has a "debt overhang effect" on GNP.

Since borrowing provides additional resources that the economy could not generate by itself, it creates demand for commodities or investments. If a country basically uses the borrowed foreign capital for production rather than consumption (imports), it can generate more goods (exports) and revenues (foreign currency) in the future. Thus these revenues enable them to fulfill their debt service obligations and purchase imports easier in the future.

International borrowing has two faces. It gives the incentives for economy to enlarge beyond its domestic limits; it also causes a high degree of unsteadiness into the system. Afxentiou and Serletis (1996) argued that if foreign loans were converted into capital and other necessary inputs, development would occur. On the other hand, if the borrower countries misallocate resources or waste them on consumption, then economic development is negatively effected.

Hence, sound debt management strategies become crucial for indebted developing countries like Turkey.

The recent raise in the frequency and severity of financial crisis in developing countries can be seen as another proof of the important role of an efficient functioning debt management office for highly indebted countries, like Turkey.

Debt management office has significant functions in the treasury department, and specifically focuses on the debt structure of the country. It mainly monitors the major variables of debt structure such as, interest rates, maturity, and exchange rate. Monitoring provides reducing the risk that can rise during sudden changes in the economic and political environment. Since Turkey's public debt is significant it is vital to manage the public debt of the country more efficiently. Turkey does not have a debt management office but recently new government implemented new debt management regulations that provide efficiency.

The Treasury Department has traditionally monitored the debt burden of Turkey. The goal of the department is to reduce the total debt stock by increasing the consolidated budget balance (Ates, 2002) (excluding interest payments). Increasing that balance will reduce the obligations and provide more flexibility in management of the debt stock.

As stated in Treasury reports of 2003, Turkey's debt consists of approximately 49.3% fixed and 50.7% variable interest rate. In addition, the total debt is 51.2% contingent on Turkish Lira, and 48.8% contingent on Foreign exchange. We can also see that during 2003, average maturity increased and average cost of new borrowings declined.

The good conditions in the global financial markets (falling interest rates), and the improvements in Turkish economy (falling inflation and interest rates), decreased the cost of borrowing (both domestic and external) during 2003.

However, since roughly 50% of external and domestic debt includes variable interest rates, they are still vulnerable to any future changes in interest rates and we expected changes and their rapid effect on the economy should be forecasted. Moreover, foreign exchange risk needs also to be considered because approximately, 50% of the total debt is in foreign currency.

3 Methodology

Our approach is to calculate a fiscal gap which is derived from an intertemporal budget constraint. What if the government decides to pay the principal and accrued interest of its debt at a specific time in the future? Wouldn't this question be more appropriate to describe the sustainability of debt. Investors at any point in time, among other factors, consider total obligations of the government in deciding the risk premium that they determine. But in some cases 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.

In this respect, our approach resembles the investigation of intertemporal government obligations rather than annual budget figures in describing the stance of fiscal policy. The current legislate which determines the size and the magnitude of annual budget does not necessarily correlate with the government obligations that will appear in the future. This issue has recently been re-emphasized in Kotlikoff (1986, 1988 and 1993) and Gokhale and Smetters (2003). Therefore, it is imperative to look at the future obligations of the government in determining the sustainability of the government debt.

Our method is to project components of the government obligations (government debt and expenditures) and revenues (taxes, seigniorage, privatization, Central Bank assets) and make an assessment about the future stresses that the fiscal authority will face. This allows us to determine the direction of the upcoming fiscal liabilities. The most important component of the fiscal gap is to determine the future debt obligations of the government. To demonstrate that 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.

Each bond issue is characterized by several parameters. Let's denote B as the size of the issue, b as the date of the issue, s is the payment date with of the principal with accrued interest. And let's denote t as the date that we stand. Date t could be before, during or after this particular bond issue. Therefore, the value of a bond i at time t ($VB_{i,t}$) can be represented by the following formula

$$VB_{i,b,t} = B_{i,b}(1+r_i)^{t-b} \tag{1.1}$$

for $t=1,\ldots,T$. This states that if the Treasury would like to honor the outstanding bond issue with its accumulated interest, $VB_{i,t}$ is the magnitude of the payment that it will make. Notice that (1.1) assumes away renegotiation of debt in terms of interest and rescheduling of payments. However, (1.1) can be used to determine a renegotiation of principal and interest payments. As explained in the data section, Treasury has a variety of instruments of auctions 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 (1.1), it is simply a labeling issue.

The next step is to determine the total accumulated debt, this is done by Equation (1.2), we simply sum over all outstanding bonds at time *t for t=1,… ,T*.

$$DB_t = \sum_{i=1}^{I} VB_{i,b,t} \tag{1.2}$$

We call (1.2) Debt Burden (DB) which includes both the debt stock and the debt service components of public borrowing. Note that DB_t is independent of base year b for each outstanding bond issue. Moreover, DB_t does not include any bond issue that matured before time t. DB_t can be interpreted as the value of the outstanding debt obligations of the Government.[2]

Given 1.1 & 1.2 we can write the intertemporal budget constraint[3] of the government as follows.

$$\left(T_t + S_t + P_t + \Delta NR_t\right) + DB_t = G_t + DB_{t-1} \tag{1.3}$$

for t=1,…,T.

Here T is the tax revenues, S is the seigniorage revenues, P is the revenues from privatization and liquidization of other public assets such as land, buildings etc., NR is the net reserves of the Central Bank[4], G is the government expenditure. The first component on the left hand side is the revenues where as the right hand side is the payments that the government has to make in every period. Therefore, if the time period t is a year, then the government decides on the current period debt as the excess of payments over revenues.[5] In our analysis we can interpret DB_{t-1} as the principal, interest or principal and interest obligations of the government where as DB_t is simply the necessary borrowing requirement that government faces to balance budget. Therefore, sustainability of the debt is simply the size and magnitude of DB_t with respect to macroeconononomic fundamentals, such as money supply, GDP, tax revenues etc.

4 Data

The Turkish Government's consolidated debt can be categorized under two primary headings: Domestic Debt and External Debt. Domestic debt is any kind of debt that is issued both in the national currency, Turkish Lira (TL), and foreign currency through domestic financial markets. Whereas, external debt is the one that is issued to foreign residents both in TL and foreign currency, however Turkey has not been successful to

[2] Debt obligations is different than debt stock. Notice that debt stock does not include interest obligations therefore may understate the obligations of each issue.
[3] Or annual budget if we use time period as one year
[4] Central Bank total reserves minus Dresdner account minus Central Bank's total external debt obligations.
[5] This must fluctuate around 0, we are looking for deviations from zero in higher magnitudes.

borrow in international markets with TL. Over the course of last 4 years, the variety of instruments used in auctions have grown.

For domestic issues the following instruments are used: Switching Auctions, Floating Rate Notes (FRN) Auctions, FX Denominated Floating Rate Notes Auctions, Discounted FX Denominated Treasury Auctions, Fixed Couponed TL Denominated Treasury Auctions, Discounted TL Denominated Treasury Auctions, Non - Auction Sales

For foreign issues the following instruments are used: Fixed Couponed foreign currency Denominated Treasury Auctions, Loans from International Institutions and Foreign Governments, Treasury Guaranteed Credits.

Our data set is daily gathered from the Undersecretariat of Treasury for the period 1998 – 2003. The calculations are done on a daily basis. To convert the daily figures to monthly figures we averaged daily figures within a month. The rest of the details with respect to calculations and assumptions are presented in the appendix. Appendix 1, presents a more detailed analysis of Equations (1.1) and (1.2). Note that different type of instruments have different methods of calculations, however, all these methods can be represented with the above two equations. Appendix 2 provides details with respect to our assumptions for forecasts.

Table 1 provides some details about the Turkish public debt stock, it provides us a clear picture for the rapid growth of debt in the period of analysis. On the contrary to expectations, the impact of Russian crisis averaged out by high inflation rates in that year that helps the government to get rid of a significant portion of the interest burden. However, declining inflation and 2001 Turkish financial crises became the primary determinants of positive and significantly high real interest rates and lower maturities.[6]

TABLE 1 – DOMESTIC DEBT SUMMARY

	1998	1999	2000	2001	2002	2003
# of Auctions	**31**	**59**	**39**	**89**	**124**	**85**
TL	31	59	36	66	92	73
USD	0	0	3	22	21	8
EURO	0	0	0	1	11	4
Average Maturity-DAYS						
TL	1028	1019	819	696	1051	899
USD			1825	730	1401	528
EURO				1826	993	654
Average Interest Rate						
TL	-0.01	-0.05	0.02	0.00	0.27	0.18
USD			0.02	0.07	0.04	0.06
EURO				0.02	0.05	0.06

[6] We prefer the present maturity in terms of days since our methodology is based on daily calculations.

5 Results

As explained in the methodology section, our results will differ from the debt stock figures announced by the Republic of Turkey Undersecretariat of Treasury (UT from now on). The reason of this discrepancy is the innovation of our method. We include the interest burden as well as the principal payments to identify the real total debt burden of Turkey on a daily basis. The UT calculates the debt stock by only considering the outstanding debt stock excluding the forthcoming interest payments. In this paper we incorporate both debt stock and debt service into one measure that we call debt burden (DB). We claim that DB reveals the true debt obligations of the fiscal authority. It is more accurate and transparent. Hence, DB would serve fiscal authority much better in policy making. Graph 1 presents this difference for the 1998 – 2003 period on a monthly basis. Figures are in billion US dollars at the end of the calendar year. The total debt stock of Turkey nearly tripled since 1998.

The first thing to note on Graph 1 is the difference between the two figures and this difference becomes more significant during times of financial distress. We observe that real interest payments drive a significant wedge. As of December 2003, Debt Burden is slightly around 230 billion US dollars where as Treasury's stock figure is around 200 billion US dollars. The difference is 15%. This difference is clearly seen in Graph 2, which is the percentage difference between Debt Burden and Treasury Debt Stock. An average of 10% difference can be observed in between two calculations. Given the size of the debt stock this difference accounts for 20 billion US dollars, also corresponding to 8% of 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 also can be used as an indicator for debt sustainability. Note that Treasury issues requires an increase in demand for money. If money market clears than in equilibrium M2Y will match the demand. 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 current disinflation program this ratio has potential to grow.

The motivation of our analysis lies on the daily nature of our calculations. Our claim is that, monthly data is not as transparent as the daily data. In addition, it 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 on this high frequency data. Most of these fluctuations are caused by the preparation of the Treasury for the upcoming payments. Since Government income is far from covering the change in debt, Treasury holds auctions frequently in order to borrow to pay the amortizing debt. As indicated on Table 1 the number of auctions grew significantly until the end of 2002 where it reached a level of 124 auctions just to borrow from domestic markets. This number excludes the external borrowing. The decline in the number of auctions in 2003 is not surprising. As a result of IMF stand-by agreement in 2001, IMF credit was used to substitute domestic issues.

However, on the aggregate this does substitution is irrelevant for the focus of our analysis.[7]

An important result of Graph 4, that was also apparent in Graph 1, is the acceleration of debt burden in the past two years. Due to declining inflation and stable nominal interest rates, on average UT paid 27 and 18 percent real return on domestic issues in the years 2002 and 2003, respectively (Table 1). This in turn is reflected as a convex trend line in Graph 4.

Graph 4 also clearly identifies the two financial crises in November 2000 and February 2001. These are sharp drops and increases in the DB measures over these periods. Monthly data averages these two sets of spikes, one from financial distress and other from UT preparations for upcoming auctions. In this way, it is unable to capture the costs associated with volatility in higher frequencies. Table 2 displays the difference in both volatility figures. As expected daily volatility is higher than monthly. In order to compare the 4 standard deviation measures, we normalized standard deviations with the average of the sample. The last row represents the volatility comparisons.

The first two columns are on a monthly basis, DB has a slightly higher volatility then debt stock over monthly basis, however the difference between the two figures has 50 percent more volatility, that addresses the higher interest rate volatility that is inherent in DB.

Table 2 – Volatility Comparison

	Monthly Debt Stock	Monthly Debt Burden (DB)	Monthly Difference (2-1)	Daily Debt Burden (DB)
Average	48,868	55,109	7,992	53,087
Standard Dev	102,466	112,907	10,441	105,207
Ave/STDEV	0.48	0.49	0.77	1.98

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 on 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 does represent the return on investment on the debt instrument. We take the change in the cumulative total return index for Turkey as our endogenous variable[8]. Our explanatory variables is AR(1) and the daily volatility in DB.

One can expect that investors by looking at yesterday's bond return make their investment decisions therefore naming their prices for the upcoming auctions. This in turn determines the rate of return. However, if we believe in the Rational Expectations (RE) Theory, a forward looking investors will use all available information out there

[7] We are leaving the substitution of external to domestic borrowing for another project. There is an extensive literature on this topic especially during the Asian Financial crises.
[8] EMBI+ on the levels has a unit root, first differencing solves this problem.

before making the decision. Therefore, an investor acting upon RE will use the future developments in DB to determine the expected return on bonds. We provide evidence on the contrary for forward looking behavior. The results for the former argument are provided below.

$$\Delta EMBI_t = c + \underset{(1.83)}{.14}\Delta EMBI_{t-1} + \underset{(1.71)}{.04}\Delta \log DB_{t-3} + error \qquad (1.4)$$

The figures in parenthesis are the t-statistics. Coefficients are significant at 10% level. DBt-3 is the only significant variable among the lags which provides evidence towards UT's preparation motive for the upcoming auction few days in advance. Given the regression results we provide our calibration exercise below (Table 3).

We ask the question of what is associated gain with a 33 percent and 50 percent reduction in the daily volatility. The monetary gain would be 4.4 and 6.7 billion US dollars, respectively. The columns represents the gain as a percentage of M2Y, Central Bank Reserves and output. A reduction in volatility by half will induce a gain of 2.7 percent of GDP.

Table 3 – Calibration Exercise

	$ billion	% of M2Y	% of CBR	% of GDP
Annual savings (1/3 reduction in volatility)	4,447	4.3	13.2	1.8
Annual savings (1/2 reduction in volatility)	6,738	6.5	20.0	2.7

6 Conclusion

Our results indicate that focusing on daily volatility would significant gains to 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 strong and does inherits the characteristics of high frequency data with thick tails and excess skewness. This may allow us to examine research topics of sort fiscal dominance in monetary policy making, determinants of interest and exchange rate volatility. The impact of treasury auctions on the secondary markets and so on.

We are confident that daily analysis will provide a policy maker a stronger policy tool in risk management and crisis prediction. In this respect, our methodology is a good candidate for policy making. Moreover, we can also use our methodology in suggesting sustainability of debt through intertemporal budget constraint calculations since it includes all principal and interest obligations of the government.

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APPENDIX 1 - CALCULATIONS

BONDS WITH COUPON PAYMENTS

COMPOUND ANNUAL INTEREST RATE = R
MATURITY = D
AMOUNT = T
DAILY INTEREST RATE (I) FORMULA = ((1+R)^(1/(365))-1)

DAILY DEBT CALCULATIONS (TO MAKE IT SIMPLE WE ASSUME, THERE IS ONLY ONE COUPON PAYMENT)

1ST DAY = T
2ND DAY = T*(1+I)
3RD DAY = (T*(1+I))*(1+I)
4TH DAY = ((T*(1+I))*(1+I))*(1+I)
.
.
.
.
N TH DAY = ((T*((1+I)^(N-1))) ⟶ LETS CALL THIS NUMBER = T (n)
(N+1) TH DAY *COUPON PAYMENT* = ((Tn)-(Tn-T))*(1+I) ⟶ LETS CALL THIS NUMBER T (n+1)
(N+2) ND DAY = (T (n+1))*(1+I)
.
.
.
.
.
.
END OF PERIOD (LETS SAY 300TH DAY) = ((T (n+1))*(1+I))^(300-(N+1))

THERE CAN BE 1 MONTH, 3 MONTH, 6 MONTH OR ANNUAL COUPON PAYMENTS.

BONDS WITHOUT COUPONS

1ST DAY = T
2ND DAY = T*(1+I)
3RD DAY = (T*(1+I))*(1+I)
4TH DAY = ((T*(1+I))*(1+I))*(1+I)
.
.
.
.
END OF PERIOD (LETS SAY 100TH DAY) = ((T*((1+I)^(100-1)))

BONDS INDEXED TO INFLATION OR OTHER INTEREST RATES

ALL THINGS WILL BE THE SAME AS ABOVE, EXCEPT (I).

- IF WE USE EXPECTED INFLATION (INF) AS INTEREST RATES, (INF) TAKES PLACE OF (I).
- IF WE USE EXPECTED INFLATION (INF) PLUS INTEREST RATES, (I) BECOMES: (I+INF).
- IF WE USE LIBOR RATE (L) AS INTEREST RATES, (L) TAKES PLACE OF (I).
- IF WE USE LIBOR RATE (L) PLUS INTEREST RATES, (I) BECOMES: (L+I).

NOTE: INFLATION AND LIBOR VALUES SHOULD BE IN DAILY VALUES WHILE CALCULATING DAILY DEBT SERVICE.

INTEREST PAYMENTS (FOR ALL KINDS OF BONDS)

BOND	**INTEREST**
1ST DAY = T	1ST DAY = 0
2ND DAY = T*(1+I)	2ND DAY = (T*(1+I))- T
3RD DAY = (T*(1+I))*(1+I)	3RD DAY = ((T*(1+I))*(1+I))- (T*(1+I))
4TH DAY = ((T*(1+I))*(1+I))*(1+I) ((T*(1+I))*(1+I))	4TH DAY = (((T*(1+I))*(1+I))*(1+I))-
.	.
.	.
.	.

WE USED TURKISH LIRA VALUES AND US DOLLAR VALUES, FOR ALL CALCULATIONS. ALSO WE PERFORMED 3 DIFFERENT SCENARIOS FOR DIFFERENT EXCHANGE RATES, INTEREST RATES, INFLATION AND LIBOR RATES.

AFTER CALCULATING ALL THE AUCTIONS, WE ADDED THEM TOGETHER WITHIN THEIR SPECIFIC TIME INTERVALS. THEN WE FOUND OUT HOW MUCH DEBT SERVICE DOES THE GOVERNMENT HAVE FOR SPECIFIC DATES.

Appendix 2 - ASSUMPTIONS

Foreign Bonds: We assumed there are annual coupon payments for foreign bond issues.

Scenarios: We prepared three scenario analysis based on 3 different interest rate, inflation, exchange rate, Libor and Euribor rates

Interest Rates: We made assumptions for future interest rates based on our inflation estimations plus 8%, 7%, 6%, 5%, 4%, 3%, 2% for the years 2004, 2005, 2006, 2007, 2008, 2009, 2010 respectively.

Inflation: There are 3 different assumptions for the future inflation rates. Best case based on the inflation that we expect for the future, worst case is based on the values of other sources. Most likely case is based on the average of these two rates.

We also estimated monthly inflations based on each months weighted average share of historical annual inflation.[9]

[9] We can provide the numbers upon request.