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Fiscal Dominance and the Maturity Structure of Debt

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Keywords

debt decomposition, fiscal dominance, monetary-fiscal interactions, macroeconomic stabilization

JEL Classification

E43, E61, E63, E65, H63, O23

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Fiscal Dominance and the Maturity Structure of Debt *

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We develop a dynamic model of monetary-fiscal interactions and government debt. We introduce a novel channel of fiscal dominance through the maturity structure. Faced with an expansionary fiscal policy shock, extending debt-maturity under fiscal dominance becomes a strategic tool for maintaining debt sustainability without immediate price-level adjustments by the monetary authority. We show that extending the maturity of debt raises the interest burden of debt. To validate the results empirically, we assemble a novel central government security level dataset between 1999-2022 for India. We find that the probability of issuing a long-term security is approximately 7 percentage points higher in a fiscal dominant regime compared to a monetary dominant regime. Using the approach in Hall and Sargent (2011) for debt-decomposition, we show that the nominal return on marketable and non-marketable debt is the largest component driving public debt increases in periods of fiscal dominance between 1999-2022. Our paper highlights the 'maturity-structure' channel of fiscal dominance, and provides a framework to quantify the impact of fiscal dominance on the interest-rate burden of sovereign debt in a large emerging market economy.

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1 Introduction

In recent years, the global economy has witnessed a substantial increase in sovereign debt, a trend exacerbated by the Great Financial Crisis and the COVID-19 pandemic. In advanced economies, post-COVID debt levels surged due to pandemic-related stimulus measures, with the debt-GDP ratio reaching around 125% in 2021, a significant increase compared to pre-pandemic levels (International Monetary Fund (2021)). Figure 1 plots the interest burden of public debt from 1990 to 2022 in several emerging market economies (EME) and advanced economies (AEs).[1] As Figure 1 shows, the interest burden of public debt in EMEs after 2020 is in excess of 3 % of GDP, and about 1-2 % of GDP for AEs. Figure A1 in the Appendix plots the debt-GDP ratio corresponding to central (federal) government debt of the same group of AEs and EMEs. As can be seen from Figure A1, there has been a sharp rise in central (federal) government debt after 2008, exceeding close to 80 % for EMEs, and about 70 % for AEs, in 2022. Addressing the sharp increase in debt and the interest burden poses a critical challenge to sustaining economic stability and growth, emphasizing the need for fiscal *and* monetary policy coordination.

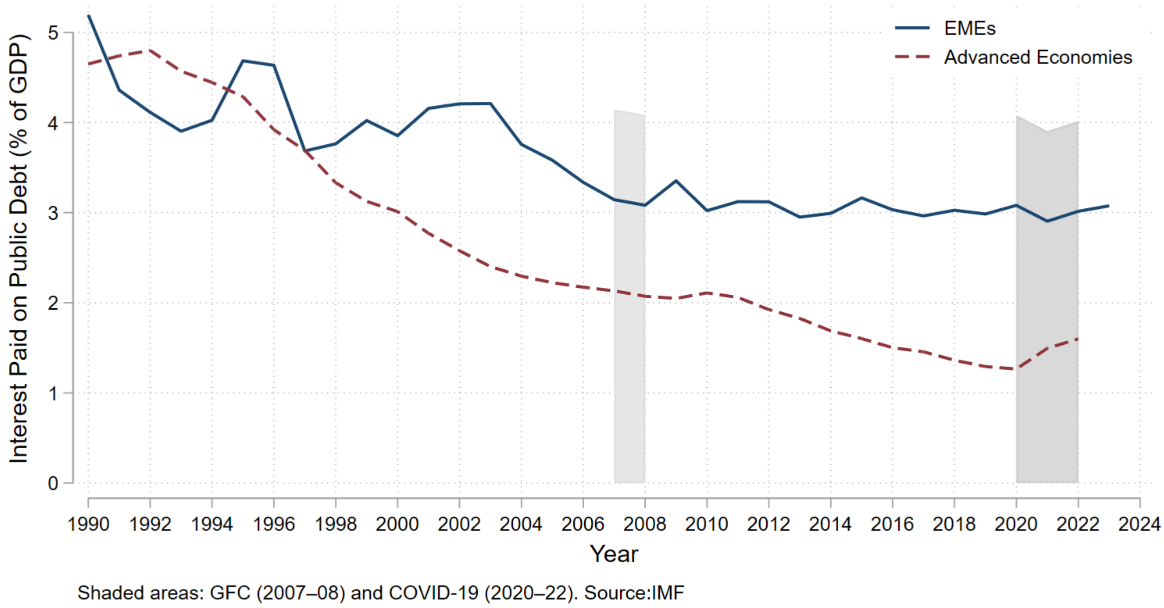


Figure 1: Interest Burden of Public Debt

Reducing the level of public debt and the interest rate burden is an important component of the post-COVID macroeconomic stabilization in both AEs and EMEs. This goal is particularly challenging when the fiscal authority is dominant, or there is *fiscal dominance* (Leeper (1991), Cochrane (2001), Kumhof et al. (2010), Bianchi et al. (2020)). For instance,

[1]The average interest burden of public debt is computed for each year using data from the IMF Global Debt Database. To ensure comparability, the number of countries, for which the data is available, in the EME and AE groups is held constant over time.

Reinhart and Sbrancia (2015) find strong evidence of financial repression and debt liquidation for several advanced and emerging market economies in the post-WWII period.
In this paper, we explore whether a monetary authority's commitment to aggressively combat inflation is sufficient to ensure debt stability. The answer to this question depends on the manner of coordination between the monetary and fiscal authorities. If the monetary authority responds to high inflation by increasing interest rates, and the fiscal authority reduces its spending or takes measures to boost budgetary surpluses, both price and debt stability can be maintained. However, if the central bank's inflation objective (say, under inflation targeting) collides with an inflexible or dominant fiscal policy stance that is unable or unwilling to adjust primary surpluses to stabilize government debt, then the answer to our question is negative.

We show that when the central bank is mandated to maintain price stability, then, under a fiscally dominant regime, it *cannot* use the current price level as a channel to keep debt at a sustainable level. Instead we show that the maturity structure of debt becomes a primary channel for debt sustainability.[2] We show that the presence of fiscal dominance impacts the maturity structure of debt in a way where it is elongated to make the debt valuation equation hold, and the central bank uses future inflation (rather than current inflation) as a tool to maintain the real value of debt at a sustainable level. Using the maturity structure of debt does not substitute for the inflation channel or the financial repression channel of fiscal dominance (Sargent et al. (1981), Leeper (1991), and Woodford (2001)), which are standard in the literature. We show that the maturity structure channel operates in addition to the inflation channel and financial repression channel of fiscal dominance.

There are several reasons why the maturity structure of debt, in the context of monetary-fiscal policy coordination, is important. Notably, during crises, sovereigns often increase the issuance of short-term debt, as observed in previous studies (Ali Abbas et al. (2011); Chen et al. (2019)). This characteristic of debt has implications for the interest burden faced by the government (Greenwood and Vayanos (2014)) as shown in Figure 1. The maturirty structure channel makes future inflation an important factor for debt sustainability. We feel that an analytical characterization of the maturity-structure of debt during fiscal dominance is missing in the literature. We show that the maturity structure of debt becomes an important debt stabiliation tool for the central bank, especially in EMEs, which often

[2]If the central bank is mandated to keep inflation under check, then in a fiscally dominant regime it might not be able to use inflation to keep the real value of debt at a lower level. If the central bank (or debt management office) issues nominal debt, then the only way to have non-explosive debt in the face of dominant fiscal policy is to have falling real interest rates when inflation rises(Cochrane (2001), Woodford (2001)), but this goes against the mandate of keeping inflation at check. For more details, see Leeper and Walker (2012), Bianchi (2020), and Cochrane (2022b).

serves as the debt manager of the government.[3]

To formalize ideas, we develop a simple theoretical model that follows Cochrane (2001) and Leeper and Walker (2012), extending these to explicitly incorporate a maturity structure in the government's portfolio choice. Assuming a geometric maturity structure with a constant decay parameter (Cochrane, 2001), we derive a debt valuation equation that links the present value of future primary surpluses to the current real market value of government debt. Following Kumhof et al. (2010), we specify two policy rules: a monetary policy rule based on a standard Taylor rule, and a fiscal policy rule in which taxes adjust to stabilize debt at its steady-state level. Using Leeper (1991), we identify combinations of active and passive policy behaviors based on the responsiveness of each authority. An active monetary policy implies a strong interest rate response to inflation (i.e., a Taylor coefficient greater than one), while passive monetary policy features a muted response. Similarly, passive fiscal policy implies that taxes adjust to stabilize debt, whereas active fiscal policy allows for persistent spending deviations without regard for debt sustainability. Using these rules, we derive the debt valuation condition under fiscal dominance—defined as the combination of passive monetary policy and active fiscal policy, and monetary dominance-defined as the combination of active monetary policy and passive fiscal policy.

Defining regimes allows us to analyze the impact of an exogenous government spending shock on the maturity structure of debt under alternative policy regimes (e.g., fiscal dominance, monetary dominance). This significance becomes particularly pertinent when the central bank's inflation targeting objective conflicts with that of an inflexible or "dominant" fiscal authority who is entrusted to maintain the real value of debt at a sustainable level. We show that through a well-devised debt management policy, the central bank can strategically shift the burden of debt repayment to the future while simultaneously raising interest rates to curb inflation rising out of increased fiscal expenditure. When the debt comes up for repayment in the future, then the central bank uses *future inflation* as a tool to erode the real market value of debt.[4]

To see the impact of an exogenous spending shock on the maturity structure of the government's debt position, we use the debt valuation equation and ask the question: what is

[3]This phenomena is quite common in many emerging market economies including India, where the debt management office (DMO) is housed within the central bank. See Stella and Lonnberg (2008), and Demirgüç-Kunt et al. (2013).

[4]This phenomena is also explained in Cochrane (2022a) who shows that how the maturity structure of debt can lead to a gradual rise in prices rather than a sudden one-time price level jump due to increase in the primary deficit of the government. Our analysis draws on this argument but unlike him, we use the market value of debt in analyzing the role of maturity structure. Additionally, through our theoretical model, we explicitly illustrate the intricate interplay between the maturity structure of debt and fiscal dominance in explaining this "maturity structure" channel.

the average value of maturity required to maintain the debt valuation equation following a shock in time period t under a fiscal and monetary dominance? Under monetary dominance, where the central bank responds strongly to fiscal shocks, inflation expectations and interest rates rise sharply, leading to a fall in bond prices. In this setting, the burden of adjustment falls on future primary surpluses, and the maturity structure plays only a limited role, as the monetary authority anchors inflation expectations and borrowing costs.

By contrast, under fiscal dominance, where monetary policy reacts weakly to fiscal imbalances, the maturity structure becomes a key adjustment margin. A longer maturity structure allows the government to smooth the effects of fiscal shocks over time by deferring repayment obligations and reducing immediate inflationary pressures. This leads to smaller increases in short-term interest rates and prevents a sharp decline in bond prices. The analysis reveals that when the central bank accommodates fiscal shocks, extending debt maturity becomes a strategic tool for maintaining debt sustainability without immediate price-level adjustments.

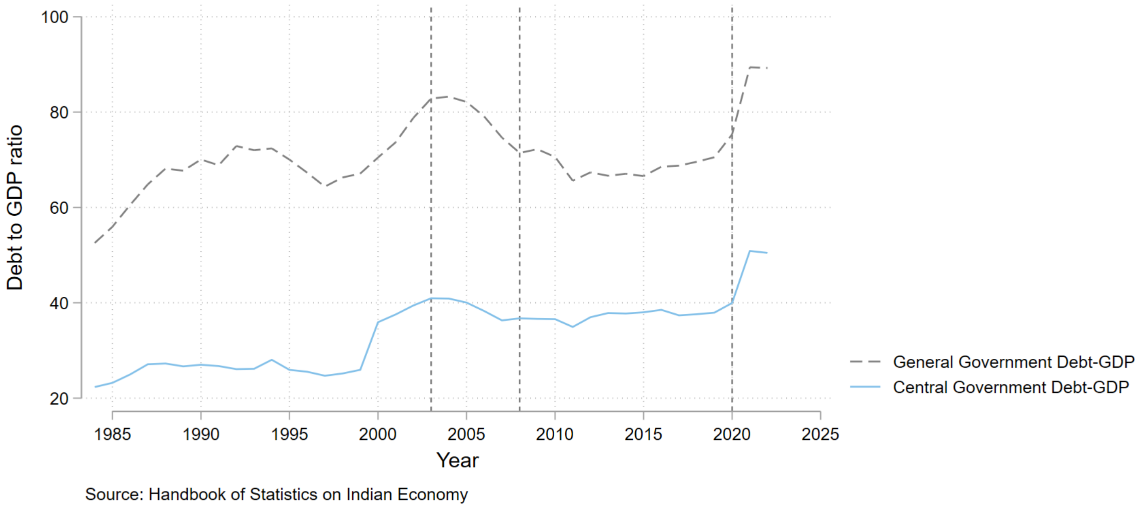


Figure 2: Evolution of the Debt-GDP Ratio, India

We test the empirical validity of these insights by constructing a novel panel dataset of auction-level issuance records from India, covering detailed security-level characteristics such as maturity, coupon rate, and issuance price, between 1999-2022.[5] Figure 2 plots the evolution of general (centre plus state) and centre debt in India from 1984-1922. General debt rose from approximately 50 % of GDP in 1984 to approximately 90 % in 2021, which reflects the impact of increased borrowing amid the COVID 19 pandemic.[6] While Figure 2

[5]This dataset, described in more detail in Section 3, builds upon ongoing and previous work by the authors on using granular security level data to understand public debt sustainability in EMEs (see Das and Ghate (2022), Ghate and Das (2024), and Das, Ghate and Halder (2025)).

[6]This surge in debt is attributed to fiscal measures and stimulus packages implemented to mitigate the

plots general debt, we confine our empirical analysis to central government issued securities (i.e., central government debt). The aggregate debt in Figure 2 aggregates marketable dated central government securities, which is the focus of our analysis, and we are able to track each security's trajectory over its lifespan.[7] We merge this security-level data with macroeconomic indicators such as the lagged debt-to-GDP ratio, inflation, and an economic uncertainty index to analyze how fiscal pressures shape the maturity structure of new government securities.

Our empirical results indicate that higher (central) debt-to-GDP ratios are strongly associated with a greater likelihood of issuing long-term securities, consistent with efforts to mitigate roll-over risk during periods of fiscal strain. However, this relationship is significantly influenced by the prevailing policy regime. During periods of fiscal dominance, characterized by the absence of inflation targeting and weak fiscal rules (i.e., active fiscal, and passive monetary regimes), the fiscal authority is especially inclined to issue longer-maturity debt. In contrast, under monetary dominance—where inflation targeting is in place and fiscal discretion is constrained—this tendency is notably weaker. Our preferred specification using our dataset on India, shows that the probability of issuing a long-term bond is approximately 7 percentage points higher under fiscal dominance than under monetary dominance, underscoring the regime-dependent nature of debt maturity choices.

Next, we check how other factors — namely, inflation, nominal interest rates, and the GDP growth rate, affect the evolution of the overall debt-GDP ratio, and quantify the contribution of these factors in conjunction with the maturity structure across different policy regimes. We use our granular security-level dataset to perform an accounting debt-decomposition analysis using the Hall and Sargent (2011) methodology. Using Leeper (1991) to classify periods of fiscal and monetary dominance, we show that the nominal return on marketable and non-marketable debt is the largest component driving public debt increases in periods of fiscal dominance between 1999-2022. In other words, we find evidence that periods of fiscal dominance are characterized by the elongation of maturity, and a high interest burden of sovereign debt, consistent with the theoretical model.

While the empirical application of our paper primarily focuses on India, our framework and discussion holds relevance for a broader spectrum of emerging market economies (EMEs). Many EMEs share similar characteristics in terms of fiscal challenges, monetary

pandemic's economic fallout, resulting in a fiscal deficit of around 9.3% of GDP in 2021-22 (World Bank (2021)).

[7]Using marketable debt is crucial for our analysis, as the maturity structure channel of fiscal dominance operates through changes in the market value of debt, which is affected by the market price. This approach explicitly incorporates capital gains and losses, driven by factors such as investor sentiment, risk profiles, and liquidity dynamics (Hall and Sargent (2011)). See also Campbell et al. (2016) and Gagnon et al. (2018).

policy trade-offs, and the management of sovereign debt. The issues of fiscal dominance, debt sustainability, and the interplay between fiscal and monetary authorities are not unique to India but are prevalent concerns in other EMEs as well. We contribute to this literature by proposing a new channel of fiscal dominance, the maturity-structure channel, which is relevant for fiscal and monetary policy coordination in EMEs .

Related Literature Our paper contributes to a voluminious literature on monetary and fiscal interactions (see Leeper (1991), Cochrane (2001), Sims (2011), Bhattarai et al. (2014), Leeper and Leith (2016), Cochrane (2018), Bianchi and Melosi (2017), Bianchi and Ilut (2017), Barthélemy et al. (2024)).[8] In the context of fiscal dominance and the optimal maturity structure of debt, (Chafwehé et al., 2021) show that a conventional response to a shock, such as reducing interest rates to counter a demand contraction, loses efficacy when monetary policy becomes subservient to fiscal policy. This is because shocks transmitted through the government's budget can impact inflation. Our model focuses on the maturity-structure channel of fiscal dominance and characterizes how the maturity structure of sovereign debt changes under fiscal dominance.

In other papers, Bianchi and Melosi (2014), Leeper and Leith (2016), Leeper and Li (2017), and Leeper and Zhou (2021) attribute a significant role to inflation within an optimal monetary-fiscal policy. Recent contributions by Cochrane (2018), Cochrane (2022a) and Cochrane (2022c) study how expectations regarding future primary surpluses and deficits can induce changes in the present real value of the debt-GDP ratio. They assign significance to anticipated and prolonged shifts in price levels, as opposed to abrupt price changes to meet the government's budget constraint. However, a major portion of this literature has concentrated on aggregate debt levels. Given that the aggregate debt is itself made up of securities of varying maturities, the maturity structure of debt is another channel through which the government can act and meet its budget constraint. Our focus is on the maturity-structure of debt.

Our paper also contributes to the literature on how fiscal or monetary dominance is transpired. In a fiscally dominant regime, inflation has conventionally been seen as the primary means to maintain sustainable debt levels. Additionally, financial repression has

[8] A large strand of literature focuses on monetary and fiscal policy interactions on sovereign debt dynamics. Leeper and Plante (2010) analyzes the effects of simple monetary-fiscal policy rules during a credit crunch, emphasizing the importance of policy coordination. Cochrane (2019) explores the relationship between interest rates and fiscal sustainability, highlighting the implications for monetary-fiscal policy coordination while Schmitt-Grohé and Uribe (2017) investigates whether optimal capital-control policy should be counter-cyclical in open-economy models with collateral constraints. Brandao-Marques et al. (2024) present a cross country evidence of the impact of debt surprises on the conduct of monetary policy.

been explored as another channel in this context (Reinhart and Sbrancia (2015), Kumhof et al. (2010), De Resende (2007), De Resende and Rebei (2008)). We propose another channel, which is complementary to the other channels studied in the literature, that materializes through the maturity structure.

Our paper contributes to the literature on using large granular security level data to address questions of debt-stabilization in EMEs, a "bottom-up" approach. Building on Das and Ghate (2022) (see also Das, Ghate and Halder (2025)), we employ the framework of Hall and Sargent (2011) to analyze our granular-level dataset to explore the potential impact of fiscal dominance on the maturity structure of debt. Notably, our analysis centers explicitly on the market value of debt, as opposed to the face value of debt. While Cochrane (2022c) also undertakes a decomposition at the security level to assess the role of debt's maturity structure in the US context, his analysis employs the face value of debt and does not explicitly capture the role of monetary fiscal coordination. Finally, our paper contributes to a small empirical literature that documents the elongation of maturity during fiscally dominant regimes (Basilio et al., 2022; Debuque-Gonzales et al., 2022) using time series data in the context of the Philippines. This work lacks theoretical foundations. Rather than using aggregate time series data, our granular data-set is a pooled cross-section which allows us to exploit the heterogeneity in granular security level data.

The remainder of this paper is organized as follows. Section 2 develops a dynamic model of households and government borrowing to examine the role of debt maturity structure under different policy regimes. Section 3 describes the security-level dataset and outlines key stylized facts about India's debt dynamics. Section 4 details the empirical strategy and reports the main regression results. Section 5 explains the debt decomposition methodology and presents the corresponding results.

2 The Model

We present a simple model based on Cochrane (2001) and Leeper and Walker (2012) by introducing the maturity structure of debt in the monetary-fiscal policy mix. The economy consists of a representative household with an infinite planning horizon, and a government. We abstract from production and firms and instead focus on an endowment economy. The economy is cashless and financial markets are complete.

2.1 Households

The economy is populated by a continuum of identical households. Each household has preferences defined over consumption and optimally chooses consumption c_t, and buys or sells nominal assets, $B_t(t+j)$, which denotes the face value of nominal bonds maturing in period $t+j$ at price $Q_t(t+j)$. The household receives lump sum transfers from the government, T_t, and pays lump sum taxes, τ_t. A representative household chooses sequences of $\{c_t\}, \{B_t\}$ to maximize lifetime utility

$$\mathbf{E}_0 \left\{ \sum_{t=0}^{\infty} \beta^t U(c_t) \right\} \tag{1}$$

with the subjective discount factor $0 < \beta < 1$, subject to the flow budget constraint

$$P_t c_t + P_t \tau_t + \mathbf{E}_t[B_t] = P_t y + P_t T_t + B_{t-1} \tag{2}$$

where B_{t-1} represents the portfolio of bonds outstanding in period $t-1$, i.e.,

$$B_{t-1} = B_{t-1}(t) + \sum_{j=1}^{\infty} Q_t(t+j) B_{t-1}(t+j)$$

The first term on the right hand side of the above expression represents the face value of bonds issued in $t-1$ that are to be paid off in t (short-term one-period bonds), while the second term denotes the face value of all other bonds that will mature in period $t+j$. P_t represents the general price level in the economy required to purchase one unit of good in the economy in period t. The expectation term on B_t denotes uncertainty about the future bond price. The variable, y, denotes the constant endowment that every household receives. For the household, investment in bonds maturing in different time periods are like different assets to invest in with different prices.

The first order condition of the household's problem entails the following expression for bond prices

$$Q_t(t+j) = \mathbf{E}_t \left[\Lambda_{t,t+j} \frac{P_t}{P_{t+j}} \right] \tag{3}$$

where $\Lambda_{t,t+j}$ is the stochastic discount factor,

$$\Lambda_{t,t+j} = \beta^j \frac{U'(c_{t+j})}{U'(c_t)}$$

Under the assumption of a constant endowment, equation 3 becomes

$$Q_t(t+j) = \mathbf{E}_t \left[\beta^j \frac{P_t}{P_{t+j}} \right] \tag{4}$$

thereby linking bond prices with the ratio of price levels in the economy. Denoting R_t to be the gross nominal short-term interest rate, we can link R_t to the price of bond as

$\frac{1}{R_t} = \mathbf{E}_t[Q_t(t+1)]$. With equation 4 this gives us the standard Fisher equation

$$\frac{1}{R_t} = \mathbf{E}_t\left[\beta\frac{P_t}{P_{t+1}}\right] = \mathbf{E}_t\left[\beta\frac{1}{\pi_{t+1}}\right] \tag{5}$$

where π_{t+1} is the gross inflation rate between periods t and $t+1$. Since the model is frictionless, changes in the price level sequence do not affect equilibrium consumption.

2.2 Government

The government in our model issues bonds of varying maturities, collects taxes and provide a lump-sum transfer to households. Government bonds sold at t pay the gross nominal interest rate, R_t, in period $t+1$. The period t nominal flow budget constraint of the government is given by

$$B_{t-1}(t) + \sum_{j=1}^{\infty} Q_t(t+j)B_{t-1}(t+j) + P_tT_t = \sum_{j=1}^{\infty} Q_t(t+j)B_t(t+j) + P_t\tau_t \tag{6}$$

which can be written as

$$B_{t-1}(t) - \sum_{j=1}^{\infty} Q_t(t+j)\left[B_t(t+j) - B_{t-1}(t+j)\right] = P_tS_t \tag{7}$$

where $S_t = T_t - \tau_t$ denotes the real value of the primary surplus. Dividing both sides of equation 7 by P_t and using the no arbitrage condition for bond prices in equation 4, we have

$$\frac{B_{t-1}(t)}{P_t} - \sum_{j=1}^{\infty} \beta^j \mathbf{E}_t\left[\frac{1}{P_{t+j}}Q_t(t+j)\left[B_t(t+j) - B_{t-1}(t+j)\right]\right] = S_t \tag{8}$$

which shows that the real primary surplus must equal bond redemptions plus net repurchases. Upon imposing the bond and goods market equilibrium condition, the household's transversality condition, and taking expectation on both sides, we have

$$\frac{B_{t-1}(t)}{P_t} + \sum_{j=1}^{\infty} \beta^j \mathbf{E}_t \frac{B_{t-1}(t+j)}{P_{t+j}} = \sum_{j=0}^{\infty} \beta^j \mathbf{E}_t s_{t+j} \tag{9}$$

Equation 9 is a present value condition that equates the real value of outstanding debt with the present value of surpluses discounted by the household's discount factor, β, and is also known as the debt valuation equation (Cochrane, 2001; Leeper and Walker, 2012).[9]

[9] The household's transversality condition is given by

$$\lim_{T\to\infty}\left[\Lambda_{t,T}\frac{B_{T-1}}{P_T}\right] = 0$$

Equation 9 is derived from the optimizing behavior of the households combined with the government flow budget constraint and is therefore, an equilibrium condition. Before we describe the equilibrium we discuss about the maturity structure briefly.

Following Cochrane (2001), we assume a geometric maturity structure which is a tractable way to analyze the maturity structure of debt. Specifically, we assume

$$B_{t-1}(t+j) = \phi^j B_{t-1} \tag{10}$$

where $0 \leq \phi \leq 1$ is the constant rate of decay per period. A geometric maturity structure can be viewed as a setup where the coupon payments of a long term bond portfolio decay at the rate ϕ (Woodford, 2001; Eusepi and Preston, 2018).[10] In that case the average maturity of debt is given by

$$\frac{1}{(1-\beta\phi)}$$

For a higher rate of decay ϕ, the average maturity increases. Given this maturity structure, the flow budget constraint of the government becomes

$$B_{t-1}\left[1 - \sum_{j=1}^{\infty} Q_t(t+j)\phi^j\right] = P_t s_t + B_t \sum_{j=1}^{\infty} Q_t(t+j)\phi^{j-1}$$

We define

$$Q_t = \sum_{j=1}^{\infty} Q_t(t+j)\phi^{j-1}$$

as the total price of the portfolio consisting of bonds with a geometric maturity structure. Using the definition of the no arbitrage condition in equation 4 and making use of the definition of R_t, we can write Q_t as

$$Q_t = \sum_{j=0}^{\infty} \phi^j \mathbf{E}_t \prod_{k=0}^{j} \frac{1}{R_{t+k}} \tag{11}$$

Using the Fisher relation in equation 5, the above equation can be written as

$$Q_t = \sum_{j=0}^{\infty} \phi^j \mathbf{E}_t \prod_{k=0}^{j} \frac{1}{R_{t+k}} = \sum_{j=0}^{\infty} (\beta\phi)^j \mathbf{E}_t \prod_{k=0}^{j} \frac{1}{\pi_{t+k+1}} \tag{12}$$

[10] A declining geometric structure of public debt is also used by Andreolli (2023), who shows that in the data, public debt promises are approximately geometrically declining as maturity increases.

Equation 12 relates the sequence of future short-term rates and expected inflation along with the maturity structure of debt to bond prices. This equation will be important in analyzing the role of monetary and fiscal policy. A higher value of the nominal gross interest rate ($\mathbf{E}_t R_{t+k}$) or rate of inflation ($\mathbf{E}_t \pi_{t+k}$) in the future, means that bond prices fall in period t, and the impact is higher for a higher value of average maturity (higher ϕ). With this specific maturity structure, the present value equation of government debt, or the *valuation equation* can be written as

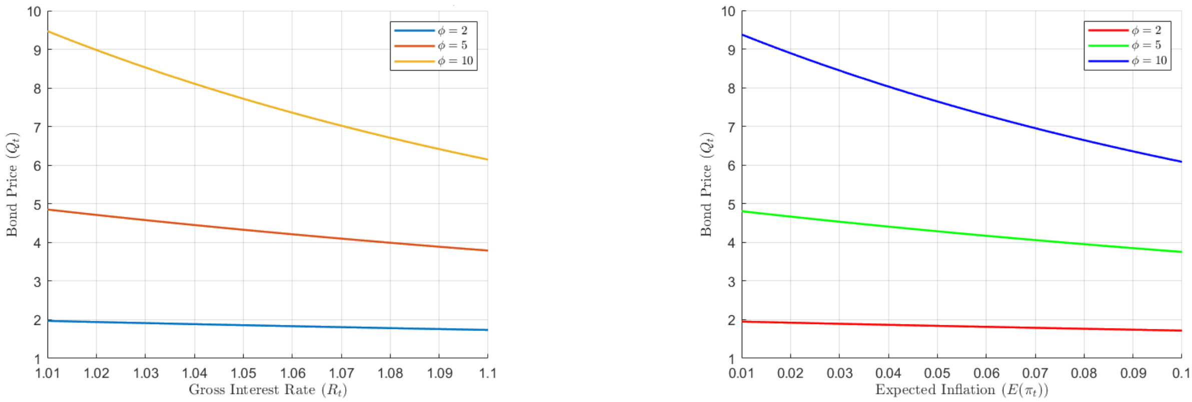
$$\frac{[1+\phi Q_t]\, B_{t-1}}{P_t} = \sum_{j=0}^{\infty} \beta^j E_t s_{t+j} \tag{13}$$

which relates the market value of current outstanding debt to the expected stream of future primary surpluses, the current price level, and expected future price levels (through Q_t).[11] Equation 13 shows that any change in the present value of future surpluses—including those occurring not just in the current period but also in future periods—can be absorbed through adjustments in nominal interest rates, and thus in expected inflation. This reduces the pressure on current inflation to satisfy the debt valuation condition. As we will demonstrate, this effect becomes more pronounced with longer debt maturities.[12]

Figure 3 plots the relationship between bond prices and the interest rate (panel (a)), and inflation (panel (b)), for varying levels of maturity, denoted by ϕ. There exists a negative relationship between the interest rate and the bond price, and this relationship becomes steeper as the average maturity increases. This implies that the impact of a rise in interest rates on bond prices is amplified when debt maturity is elongated. Similarly, the deflationary impact of higher inflation on bond prices is more pronounced when the maturity structure is longer. Taken together, these dynamics illustrate how the maturity structure amplifies the responsiveness of bond prices to changes in interest rates and inflation, and thus plays a crucial role in determining equilibrium outcomes. As it turns out, Equations 5 and 13 together form a system of two equilibrium conditions in four unknown variables. To close the model and determine equilibrium, we introduce the monetary and fiscal policy rules.

[11] In order to derive this equation, we have subsumed the terms in B_t to minimize notational clutter.

[12] Leeper and Walker (2012) and Leeper and Leith (2016) develop a model of the government's valuation equation in a non-endowment economy. In contrast, our paper not only examines the interaction between fiscal and monetary authorities, as in their analysis, but also explicitly emphasizes the role of the debt maturity structure in propagating changes in the market value of debt following a shock. Furthermore, as we elaborate in a later subsection, we show how different combinations of policy regimes alter the fiscal authority's interest burden, thereby underscoring the heightened importance of maturity structure.



(a) Effect of R_t on bond prices Q_t

(b) Effect of inflation on bond prices Q_t

Figure 3: Effect of Expected Interest Rate and Inflation on Bond Prices across Maturities

2.3 Fiscal and Monetary Regimes

The monetary authority consists of a central bank. The monetary authority specifies an interest rate rule that responds to deviations of current inflation from their target value as in Kumhof et al. (2010). Specifically, the monetary authority sets

$$\frac{1}{R_t} - \frac{1}{R^*} = \nu_m \left(\frac{1}{\pi_t} - \frac{1}{\pi^*} \right) \tag{14}$$

where R_t is the short-term nominal interest rate, π^* is the inflation target, and ν_m is the response of the monetary authority to inflation, and R^* is the steady state nominal interest rate.[13] Given the monetary policy rule, it is clear from equation 13, that future monetary policy decisions, through $\frac{1}{R_{t+k}}$ will have an impact on the current valuation equation through bond prices, and therefore with a maturity structure of more than one-period bond, expected future monetary policy by the monetary authority in the form of choices of the short-term nominal interest rate plays a role in determining the current bond price level.

The fiscal authority chooses a tax rule so as to bring lump sum taxes to its steady state value, while keeping the real market value of debt at its steady state level

$$\tau_t - \tau^* = \nu_f \left(\frac{1}{R_{t-1}} \frac{B_{t-1}}{P_{t-1}} - \frac{B^*}{P^* R^*} \right) \tag{15}$$

where τ^* is the tax target, $\frac{B^*}{P^* R^*}$ is the steady state real market value of debt, and ν_f captures

[13] One can also write the rule by taking into account deviations of output from its steady state like in Leeper and Walker (2012). i.e., $\frac{1}{R_t} - \frac{1}{R^*} = \nu_m \left(\frac{1}{\pi_t} - \frac{1}{\pi^*} \right) + \nu_y \left(\frac{1}{y_t} - \frac{1}{y^*} \right)$. In our endowment economy, the last term does not matter. Another equivalent rule could be to use R_{t-1} instead of R^* on the left hand side, but for ease of calculations we have concentrated on the former.

the importance of real value of debt deviations from its target value for the fiscal authority. We assume that transfers follow a stochastic process given as

$$T_t = T^* + \epsilon_t$$

where ϵ_t is an exogenous i.i.d shock. The steady state of the model is given by

$$R^* = \frac{\pi^*}{\beta}; \quad Q^* = \frac{1}{R^*}; \quad s^* = \frac{B^*}{P^* R^*}\left(\frac{1}{\beta} - (1-\phi)\right); \quad \Lambda^* = \beta$$

Next, we discuss the equilibrium solutions and its stability for a special case of monetary policy and fiscal policy interaction, namely fiscal dominance.

2.4 Solution of the Model

Before we solve the model for the specific case of fiscal dominance, we discuss stability and boundedness of the system. Recall the monetary policy rule is given by

$$\frac{1}{R_t} - \frac{1}{R^*} = \nu_m \left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right)$$

Using the Euler equation

$$Q_t(t+1) = \beta \mathbf{E}_t\left[\frac{P_t}{P_{t+1}}\right]$$

and the equation for the bond price

$$R_t = \frac{1}{Q_t(t+1)}$$

we combine these to get the following expression

$$\frac{\beta}{\nu_m}\mathbf{E}_t\left(\frac{P_t}{P_{t+1}} - \frac{1}{\pi^*}\right) = \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \tag{16}$$

The above equationis a first order difference equation. The stability of the solution for this equation depends on the sign of $\frac{\nu_m}{\beta}$. If $\frac{\beta}{\nu_m} < 1$, then a unique solution for Equation 16 is $\pi_t = \pi^*$, which means that inflation is at its target rate, and the monetary authority acts aggressively to deviations of inflation from its target rate (Kumhof et al., 2010; Leeper and Walker, 2012). Therefore, in order to look at the case of fiscal dominance, we assume that the monetary authority does not follow an aggressive rule with $\frac{\nu_m}{\beta} < 1$. Using this we can write 16 as

$$\mathbf{E}_t\left(\frac{1}{\pi_{t+1}}\right) = \frac{\nu_m}{\beta}\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right) + \frac{1}{\pi^*} \tag{17}$$

The following table, using Leeper (1991) as a classifcation, summarizes the different policy regimes based on the different parameter values in the fiscal and monetary policy rules.

Table 1: Classification of Policy Regimes

MP/FP	Active	Passive
Active	$\frac{\nu_m}{\beta} > 1, \nu_f < \beta^{-1} - 1$	$\frac{\nu_m}{\beta} > 1, \beta^{-1} - 1 < \nu_f < \beta^{-1} + 1$
Passive	$\frac{\nu_m}{\beta} < 1, \nu_f < \beta^{-1} - 1$	$\frac{\nu_m}{\beta} < 1, \beta^{-1} - 1 < \nu_f < \beta^{-1} + 1$

Table 1 classifies the four possible combinations of active and passive monetary and fiscal policy regimes based on specific parametric restrictions. The regime characterized by an active monetary policy and a passive fiscal policy (top row, second column) corresponds to the conventional monetary dominance case. In contrast, the combination of passive monetary policy and active fiscal policy (bottom row, first column) represents the regime of fiscal dominance. The other two cells capture scenarios of policy indeterminacy or coordination, depending on the parameter space. In the extreme case of fiscal dominance and $\frac{\nu_m}{\beta} = 0$, the model yields a unique solution given by:

$$\mathbf{E}_t(\pi_{t+1}) = \pi^* \tag{18}$$

which means that the expected value of inflation is equal to the target rate of inflation. Note that this does not entail that actual inflation is at the target level but rather the central bank can only keep expected inflation at the target level. Intuitively, when the fiscal authority is not obliged to keep the debt at the sustainable level by adjusting taxes, the central bank allows current inflation to move to keep the real value of debt closer to the sustainable level and hence the dynamic process of inflation yields constant inflation in an expected sense.

We will solve for the general case of fiscal dominance with $\frac{\nu_m}{\beta} < 1$ and use it write the n-step ahead forecast of equation 16 as

$$\mathbf{E}_t\left(\frac{1}{\pi_{t+n}}\right) = \left(\frac{\nu_m}{\beta}\right)^n \left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right) + \frac{1}{\pi^*}$$

Putting this forecast in the equation for the bond price in equation 11 gives us

$$Q_t = \beta \sum_{j=0}^{\infty} (\beta\phi)^j \mathbf{E}_t \left[\prod_{k=0}^{j-1} \left(\left(\frac{\nu_m}{\beta}\right)^{k+1} \left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right) + \frac{1}{\pi^*} \right) \right] \tag{19}$$

The stability of debt requires the parameter, ν_f, to be between

$$\frac{(1+\phi Q^*)}{\pi^*} - Q^* R^* < \nu_f < \frac{(1+\phi Q^*)}{\pi^*} + Q^* R^*$$

The above condition shows that if the upper bound of the interval is not satisfied, debt will diverge; if the lower bound is not satisfied, the tax rule is not sufficiently responsive to keep debt at a sustainable level.[14] Under fiscal dominance, the lower bound is more likely to be violated, resulting in a muted tax response by the fiscal authority following a spending shock.

Finally, following Leeper and Walker (2012), we assume that the fiscal authority puts zero weight on the deviation of real value of debt from its steady state level, $\nu_f = 0$. In this case, the fiscal rule depends only on steady-state taxes and transfers and the shock on the transfer, ϵ_t. In this case we can write the debt valuation equation 13 as

$$\frac{[1+\phi Q_t]\, B_{t-1}}{P_t} = \frac{s^*}{(1-\beta)} - \sum_{j=0}^{\infty} \beta^j E_t\left(\epsilon_{t+j}\right) \tag{20}$$

where $s^* = \tau^* - T^*$ is the steady state level of primary surpluses. Equation 20 allows to assess how the role of a spending shock at time t, which reduces the primary surplus available to the fiscal authority, affects the debt valuation equation. To satisfy the debt valuation equation in the absence of any other fiscal adjustments, the left-hand side must correspondingly decrease. Since B_{t-1} is predetermined, the adjustment must occur through a fall in Q_t or a rise in P_t. Given that the monetary authority is constrained by its prescribed policy rule (albeit less strictly under fiscal dominance), a significant increase in P_t may not be feasible. In this scenario, a sharper decline in Q_t is required to satisfy Equation 20.

Importantly, for a higher value of ϕ (indicating a longer average maturity of bonds), a relatively smaller increase in R_t (as warranted under a passive monetary stance) is sufficient to induce a fall in Q_t, thereby reducing the left-hand side of the debt valuation equation. Thus, under a fiscally dominant regime, a longer maturity structure facilitates adjustment in debt valuation without necessitating large increases in current price levels.

To outline the the intuition regarding the role of the maturity structure under fiscal dominance more sharply, we describe the case where bonds have at most two years of maturity.

[14] See Appendix D.1 for more details.

2.5 Intuition from a simpler version of the model

We focus on a two-period setting with $j = 1, 2$. Assuming that the government only issues bonds with a maximum maturity of two years, the debt valuation equation, abstracting initially from any regime specification, is given by:

$$\frac{[1 + Q_t]\, B_{t-1}}{P_t} = s_t + \beta E_t(s_{t+1}) + \beta^2 E_t(s_{t+2})$$

where

$$Q_t = \frac{1}{R_t}\left[\phi + \phi^2 E_t(\frac{1}{R_{t+1}}) + \phi^3 E_t(\frac{1}{R_{t+2}})\right] \tag{21}$$

is the price of the bond portfolio and is inversely related to the short-term interest rate, R_t. Applying the Fisher equation, we can relate the bond price to current and future inflation:

$$Q_t = \left[E_t\left(\frac{1}{\pi_{t+1}}\right) + (\beta\phi) E_t\left(\frac{1}{\pi_{t+1}\pi_{t+2}}\right) + (\beta\phi)^2 E_t\left(\frac{1}{\pi_{t+1}\pi_{t+2}\pi_{t+3}}\right)\right] \tag{22}$$

Higher future inflation reduces the present value of bond prices, Q_t, as bondholders expect lower real returns. Consequently, they require a lower price today to hold the bond. This inverse relationship between bond prices and expected inflation is critical for understanding the role of maturity structure: a longer maturity structure allows the fiscal authority to shift inflationary effects into the future, thereby exerting less immediate pressure on current price levels.

Incorporating the fiscal authority's tax and transfer rules, as well as the monetary authority's Taylor rule, the debt valuation equation becomes:

$$\frac{[1 + Q_t]\, B_{t-1}}{P_t} = \Lambda(1 + \beta + \beta^2) + \nu_f\left(\frac{1}{R_{t-1}}\frac{B_{t-1}}{P_{t-1}}\right) + \beta\nu_f\left(\frac{1}{R_t}\frac{B_t}{P_t}\right) + \beta^2\nu_f \mathbb{E}_t\left(\frac{1}{R_{t+1}}\frac{B_{t+1}}{P_{t+1}}\right) - \epsilon_t \tag{23}$$

where

$$\Lambda = \tau^* - T^* - \nu_f \frac{B^*}{P^* R^*}$$

is a constant summarizing steady-state terms. Note that future shocks do not appear in equation 23, as $\mathbb{E}_t(\epsilon_{t+j}) = 0$ for all $j > 0$. Given the model's structural parameters, an increase in the spending shock, ϵ_t, reduces the right-hand side of the equation. An adjustment must therefore occur through either the price level P_t or the bond price Q_t.

Under monetary dominance, a higher ϵ_t leads to rising prices, prompting the monetary authority to increase the nominal interest rate R_t sharply, as per the policy rule in equation 14. From equation 21, this implies a fall in the bond price Q_t, even when the average maturity ϕ is relatively low. The intuition is that a strong monetary response raises borrowing costs, discouraging issuance of long-term debt. In this setting, the fiscal authority behaves passively, and the debt valuation condition can also be satisfied through higher future primary surpluses (i.e., reduced future borrowing), which is reflected in a lower real market value of future debt $\left(\frac{1}{R_{t+1}} \frac{B_{t+1}}{P_{t+1}}\right)$. Thus, under monetary dominance, the maturity structure plays a limited role in satisfying the debt valuation equation.[15]

By contrast, under fiscal dominance, the maturity structure plays an important role. When ϵ_t increases and lowers the right-hand side of Equation 23, the passivity of the monetary authority implies a muted response in R_t, since $\nu_m/\beta < 1$. The fiscal authority, being active, does not adjust spending. Instead, the debt valuation condition is restored through either an increase in the price level P_t, or a decline in Q_t caused by a modest rise in R_t combined with longer maturities. From Equation 21, we see that even a small increase in R_t can cause a substantial decline in Q_t if ϕ is sufficiently large. This result arises from the fact that under fiscal dominance, the fiscal authority refrains from taking corrective action to reduce spending. Consequently, the monetary authority, in its effort to satisfy the debt valuation equation, responds with only a modest increase in the short-term interest rate. Instead, the adjustment occurs through an extension of the maturity of newly issued securities, effectively deferring repayment obligations to the future and preserving the real value of debt by shifting inflationary pressures forward in time. This is the essence of the maturity-structure channel of fiscal dominance.[16]

Interest Burden of Debt While a fiscal expansion under a fiscally dominant regime leads to a lengthening of the debt maturity structure, it also raises the overall interest burden for the fiscal authority. Although the increase in R_t is moderate compared to a monetary-dominant regime, it is accompanied by an increase in ϕ, implying greater issuance of longer-term bonds. As ϕ rises, the fiscal authority shifts repayment obligations to future periods – specifically through increases in B_{t+1} and B_{t+2}. However, since the price adjustment is deferred, interest rates in those periods, R_{t+1} and R_{t+2}, must rise to re-anchor inflation ex-

[15] In fact, the maturity structure may become irrelevant under monetary dominance due to Ricardian equivalence; see Woodford (2001); Leeper and Walker (2012).

[16] This is evident when rewriting the bond price equation under fiscal dominance as:

$$Q_t = E_t \left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right) (\beta\phi) \left(\frac{\nu_m}{\beta}\right) \mathbb{A} \tag{24}$$

where

$$\mathbb{A} = 1 + \beta\phi \left(1 + \frac{\nu_m}{\beta}\right) + (\beta\phi)^2 \left(1 + \frac{\nu_m}{\beta} + \left(\frac{\nu_m}{\beta}\right)^2\right)$$

represents the constant terms. If current inflation deviates only slightly from trend inflation π^*, a sufficiently large ϕ is required to generate a large enough decline in Q_t.

pectations. The combination of higher bond stocks and rising interest rates in these future periods results in a higher cumulative interest burden.[17] Thus, fiscal dominance raises the financing needs of the government by increasing its future interest obligations.

The key takeaway from our model is the central role that the maturity structure of debt plays in satisfying the debt valuation condition under a fiscally dominant regime. In contrast, under monetary dominance, the maturity structure plays a limited role, consistent with the standard Ricardian Equivalence framework. The testable hypothesis regarding the relationship between fiscal shocks and the maturity structure of public debt under different policy regimes is:

H: Under fiscal dominance, an increase in government spending is associated with an extension of the maturity structure of public debt.

Interpretation: When spending increases and monetary policy is passive, the government shifts toward issuing longer-term debt to satisfy the debt valuation condition without requiring immediate inflationary adjustments. When the monetary authority reacts aggressively to fiscal shocks and the fiscal authority behaves passively, the maturity structure remains largely unchanged, and debt valuation is instead achieved through monetary tightening and expectations of future fiscal adjustments.

In the following Section, we provide empirical evidence to support these insights. Using a granular security-level dataset for India, we are able to track the evolution of the maturity structure of the government's debt portfolio over time. We show that during sub-periods classified as fiscally dominant (using Leeper (1991)) within our sample, changes in government spending are systematically associated with adjustments in the maturity structure — highlighting the maturity structure's relevance as a policy tool in such regimes.

3 Data and Stylized Facts

We utilize a comprehensive annual panel dataset on central government securities in India from 1999 to 2022, incorporating its key components: nominal interest rates, inflation, real GDP growth rates, and primary deficits or surpluses. At the security level, we compile auction-level data for all central government securities issued by the Reserve Bank of India (RBI). This dataset includes detailed information on price, face value, coupon rate, maturity, issuance date, and maturity date for both newly issued and reissued securities. To

[17] In particular, the government's interest payment in period t is $R_{t-1}B_t$, while in period $t+1$ it becomes $R_tB_{t+1} + R_{t+1}B_{t+2}$, both of which increase due to maturity extension and rising rates. Hence, the fiscal authority faces a growing interest cost under fiscal dominance. The same argument holds for longer maturity bonds, and hence the longer the maturity, the more will be the interest burden under a fiscally dominant regime.

enrich this, we obtain yield data from the Subsidiary General Ledger (SGL) transactions of government-dated securities across various maturities, sourced from the Reserve Bank of India (RBI). We use the end-of-March yields for each year and maturity, merging them with our auction-level data to calculate the average yield to maturity (YTM) for each security. We then compute the market value of each security using yield curve data from the RBI and the methodology outlined in Hall and Sargent (2011). For our analysis we used only cetral government securities, leaving out other forms of borrowings like foreign bonds and inflation indexed bonds, since they do not constitute a major proportion of the total instruments issued for borrowing (around 5-6% as per Status Paper, 2023). After considering only government securities our dataset consists of around 7,610 security year combination.[18]

For our empirical analysis, we focus exclusively on newly issued securities, as our primary interest lies in how the debt management office adjusts to changes in government spending through new bond issuances. This category encompasses bonds that are repurchased and reissued with modified features or nomenclature, which we treat as distinct securities in our study. This gives us around 209 unique newly issued securities across the sample period of study. Data on central government debt and GDP are sourced from various issues of the Economic Survey, available annually, while CPI inflation data are obtained from the Organization for Economic Cooperation and Development (OECD) CPI and WPI series. Primary deficit/surplus data are drawn from the Reserve Bank of India (RBI). To account for uncertainty, we incorporate the Economic Policy Uncertainty Index for India, based on Baker et al. (2016), from the FRED database, and the World Uncertainty Index, from Ahir et al. (2022). This allows us to capture global influences on government and debt management decisions. These indices, originally at monthly (Economic Policy Uncertainty) and quarterly (World Uncertainty) frequencies, are converted to annualized values for consistency with our annual dataset.

Table 2 presents summary statistics for key economic and bond market variables for new bond issuances. The average coupon rate in our sample is approximately 8.61%, with an average maturity of 12.32 years. The mean face value of bonds is around INR 290 billion, while the average market value is slightly lower at INR 267 billion.[19] The average RBI bond price stands at INR 68 (per 100 INR). Macroeconomic indicators show a mean central government debt-to-GDP ratio of 37.3% over our sample period , a primary deficit of 1.56% of GDP, and average CPI inflation of 6.81%. The average Repo rate (the short term

[18]See Appendix B for further details.

[19]In our paper we have used local currency (INR) to measure the value of debt. Using the average spot INR to USD exchange rate, the mean face value of bond turns around to be USD 5.30 billion, while the average market value is around USD 4.89 billion.

policy rate of the Reserve Bank of India) is 6.71%, and the average bond yield is 5.69%.[20] The economic uncertainty index has a mean of 86.71, reflecting substantial variability in macroeconomic conditions across the sample period.[21]

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.
Coupon Rate (%)	206	8.610	2.462
Maturity (in years)	206	12.32	8.91
Face Value (INR bn)	206	289.98	345.02
Price (per 100 INR)	188	68.08	43.38
Market Value (INR bn)	188	267.47	343.36
Debt-to-GDP Ratio (%)	206	37.32	7.24
Primary Deficit/GDP (%)	206	1.56	1.54
CPI Inflation (%)	206	6.81	3.08
Repo Rate (%)	148	6.71	1.23
Average Yield (%)	206	5.69	3.13
Economic Uncertainty Index	170	86.71	32.02

Notes: This table reports the descriptive statistics for some of the important variables based on the security level data on newly issued securities. Yield and maturity variables are reported in percentages and years, respectively. Face value and market value are in billions of Indian Rupees. Price of a bond is the notified amount in the auction and is presented as per 100 INR. Data for Debt-to-GDP ratio, Primary Deficit to GDP ratio, CPI inflation, Repo Rate, Economic Uncertainty Index are of annual frequency.

Stylized Facts Figure 4 displays the maturity profile of outstanding central government securities as a percentage of the total outstanding securities. The key takeaway from the Figure is the steady increase in long-term securities (maturities exceeding 20 years) as a percentage of the total outstanding securities over the last 2 decades. Additionally, short-term debt (maturities less than 1 year) constitutes less than 10% of the total outstanding debt. This figure underscores the government's commitment to extending the maturity structure of its debt. One noteworthy observation from this graph is the U-shaped curve for securities with maturities between 10 and 20 years, which experienced a sharp increase following the Global Financial Crisis (GFC). In India, the 10-year government security is the most actively traded, leading to a substantial liquidity premium, making it a cost-effective choice for the government to issue more to meet the demand.

[20] The yield on a bond of a particular maturity is matched with the year-end yield for the corresponding maturity provided by the RBI.

[21] Appendix C reports the summary statistics for the entire auction level dataset.

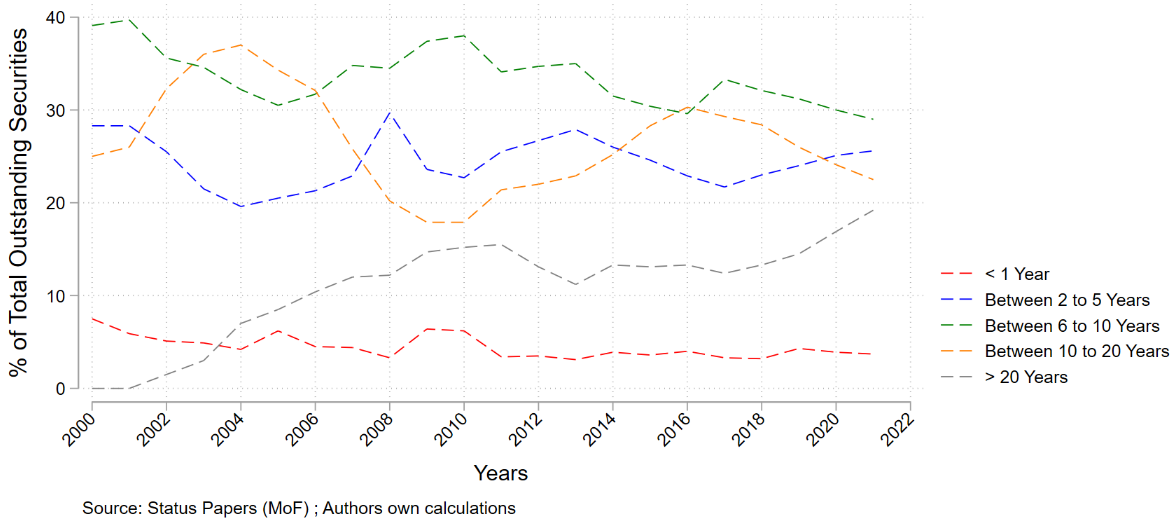


Figure 4: Maturity profile of outstanding securities

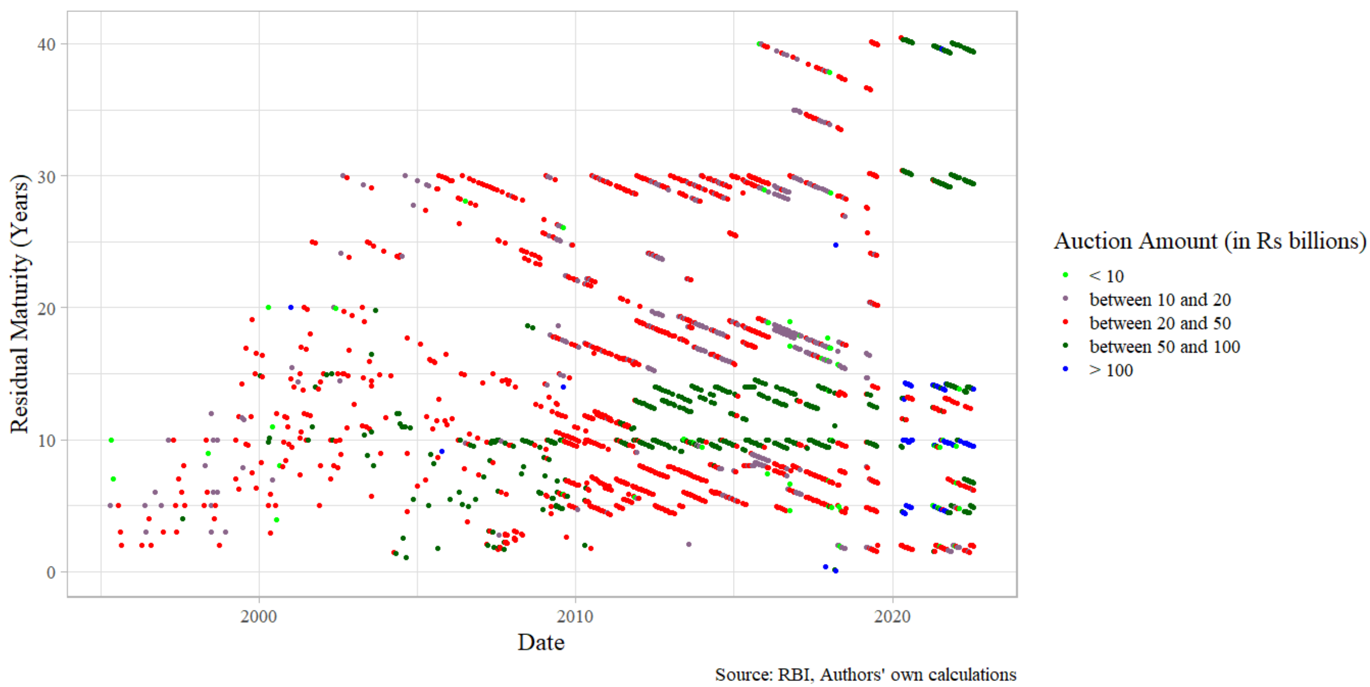


Figure 5: Auction of new issuances and reissuances of central government dated securities

Figure 5 illustrates the maturity periods of securities auctioned between 1995 and 2022. Each dot on the graph represents either the auction of issuance of a new security or its reissuance, with the date on the x-axis and residual maturity on the y-axis.[22] Notably, a distinct pattern emerges resembling a saw-tooth shape.[23] This pattern reflects that securities initially auctioned with a maturity period of j years are subsequently repurchased and reissued with a $j - \epsilon$ maturity, therefore not bundling the securities within one maturity bracket. Since 2006, the frequency of longer-term securities auctions has increased, with some securities having maturity periods of up to 40 years, marking the longest maturity. Over time, there is a rising trend in the proportion of securities with maturities exceeding 10 years being auctioned.

We weigh the maturity period of each auction in Figure 5 with the auctioned amount (denoted in Rs. billion). One notable feature is the significant presence of large auctioned amounts in the higher maturity bucket (see the bunching of red and green dots in the Figure). This shows that not only is the government reissuing more debt with a longer maturity (residual), but it is also doing so for larger auctioned amounts, indicating the extent of borrowing undertaken by the government with a longer maturity period.

Another notable feature from Figure 5 is the increase in the auction of new securities in the highest maturity bracket of 30-40 years. One of the reasons for this pattern is the endeavor of the DMO, housed in the Reserve Bank of India, to minimize rollover risk associated with increased borrowings to support rising spending needs due to the COVID-19 pandemic. The auction data shows that the overall average maturity of debt has been rising for the past 16 years. Also, as per the Status Paper on Government Debt (2020-2021 p. (iii)) the debt management strategy of the government is as follows:

"It has been the endeavour of the Government to elongate the maturity profile of its debt portfolio with a view to reduce the roll-over risk."

This clearly spells out the maturity lengthening followed by the DMO on behalf of the government. This aspect bears significance due to the reasons outlined in the Status Paper, which encompasses objectives such as minimizing rollover risk and broadening the investor base to include pension funds and insurance funds.

[22] Our auction-level dataset allows us to identify the exact dates when a security is issued or reissued. This enables us to track individual securities over time and observe how government buybacks, followed by reissuance, affect the maturity structure of the debt.

[23] Bigio et al. (2023) show the same pattern exists for Spain using auction-level granular level data, and argue that this pattern is quite common in the other bond markets where the government tries to take advantage of the continuous issuances in several maturities and not bunching them in just a single maturity.

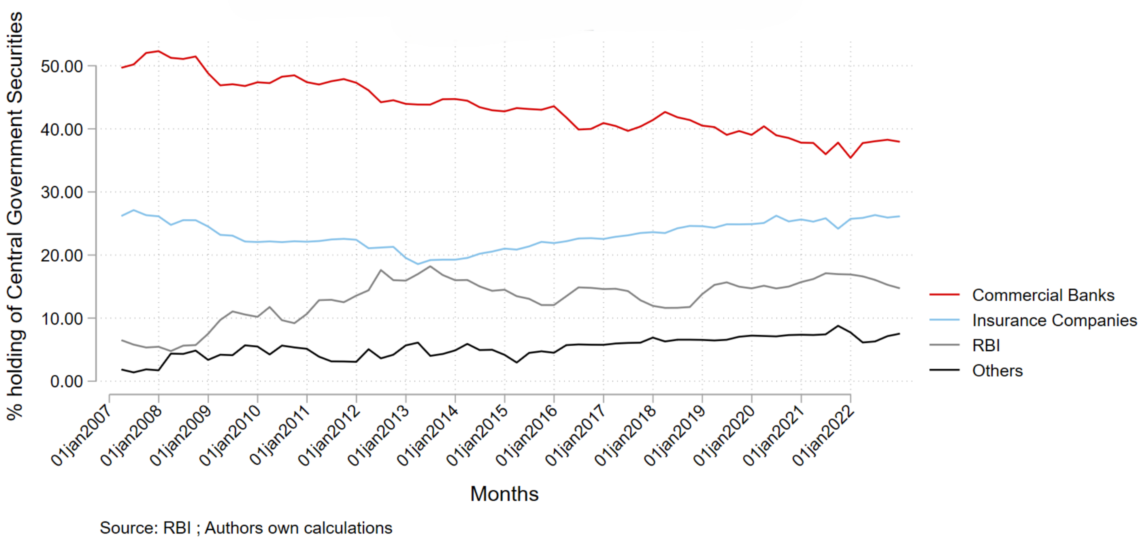


Figure 6: Ownership Pattern of Central Government Debt

Since the ownership of the debt matters equally as much as its evolution and composition, Figure 6 illustrates the ownership pattern of central government debt using monthly data from RBI, spanning from 2007 to 2022. Notably, commercial banks have historically been the primary holders of securities (with the percentage of holding in the range between 40 to 50 % over time); however, their share has dwindled over the past six years. In contrast, the shares of insurance companies and pension funds have been on the rise.[24] This shift bears weight as insurance companies and pension funds exhibit a preference for longer maturity bonds, whereas commercial banks tend to favor short-term securities. With the elongation of the debt maturity structure, insurance companies are poised to become the primary investors in these securities. Consequently, the implications of a lengthened debt maturity structure will have a substantial impact on these debt holders. Nonetheless, it is important to recognize that commercial banks and other institutional investors still possess a significant portion of these securities, underscoring the tight nature of the bond market. As a result, any repercussions stemming from a lack of coordination between the monetary and fiscal authorities will disproportionately affect these institutional investors.

4 Empirical Strategy

Our empirical strategy utilizes the granular auction-level securities data to assess how different policy regimes influence the DMOs selection of newly issued securities. In the regression analysis, we leverage detailed annual issuance data, capturing characteristics such

[24]Though RBI permits retail investors to invest in these securities, their share remains minimal. This pattern is consistent when considering the public holding of these securities.

as maturity structure, price, face value, and coupon rate, alongside macroeconomic variables like the debt-to-GDP ratio, CPI inflation, and economic uncertainty. Our dataset is structured as a pooled cross-section, where each security appears only once upon issuance. Focusing exclusively on newly issued securities (including re-issuances) rather than the complete life-cycle enables us to better capture policy-induced changes in fiscal management practices.

Our central testable hypothesis is: how do shifts in government expenditures influence the maturity profile of new securities when there is fiscal dominance? We adopt a binary dependent variable framework using a Logit model. Specifically, we define a threshold maturity of 15 years to distinguish between relatively short-term and long-term securities.[25] Formally,

$$Y_{i,t} = \begin{cases} 1, & if \ \ maturity_{i,t} \geq 15 \text{ years} \\ 0 & if \ \ maturity_{i,t} < 15 \text{ years} \end{cases}$$

Here, $maturity_{i,t}$ denotes the maturity of security i issued in year t, and $Y_{i,t}$ is our discrete dependent variable. Thus, we estimate the probability of issuing a long-term security as:

$$Pr(Y_{i,t} = 1|\mathbf{X}) \tag{25}$$

with $\mathbf{X}$ denoting the array of independent variables including the security specific characteristics, and other important macro variables. We model Equation 25 through the following Logit specification:

$$\begin{aligned} log\left(\frac{Pr(Y_{i,t}=1)}{1-Pr(Y_{i,t}=1)}\right) &= \alpha + \beta_1 \left(debt/GDP\right)_{t-1} + \gamma \mathbf{Z}_t + \varsigma \mathbf{X}_{it} \\ &+ \phi_1 \mathbf{1}_s + \phi_2 \mathbf{1}_s \times \left(debt/GDP\right)_{t-1} + \varepsilon_{it} \end{aligned} \tag{26}$$

The left hand side of Equation 26 denotes the log odds ratio of issuing a new security with maturity at least as large as 15 years; $(debt/GDP)_{t-1}$ denotes the value of the fiscal government debt-to-GDP ratio in the previous year and is our key explanatory variable of interest; $\mathbf{Z}_t$ denotes annual frequency time varying covariates, namely lagged inflation (Inf_{t-1}), the weighted average maturity, the total market value of all securities, and the economic policy uncertainty index; $\mathbf{X}_{it}$ is a vector of the security specific covariates, namely the price of the security and the associated coupon rate. We take the lagged values of inflation and the debt-GDP ratio since the auction of securities happens over the complete financial year and therfore it makes sense to see the impact of a change in the spending patterns of the govern-

[25] We also estimate our results with other threshold value for robustnesss: 5 years to maturity and 10 years to maturity. See Appendix C.

ment in the year $t-1$ on the maturity of new issuances. Controlling for weighted average maturity and total market value is essential since debt management decisions regarding maturity structure depend critically on existing debt burdens and market sentiment. For instance, if the current average maturity is already high, issuing additional long-term debt further defers principal repayments but increases interest rate risks.

The variable $\mathbf{1}_s$ is an indicator variable indicating distinct policy regimes in which the security has been issued, $s \in \{FIT, Fisc.rule\}$. $s = FIT$ denotes the period starting from the adoption of the Flexible Inflation Targeting (FIT) regime by the Reserve Bank of India, which we take to be the de-facto year of 2014 and onwards (Ghate and Kletzer, 2016; Ghate and Ahmed, 2023). *Fisc.rule* denotes the sub-periods in our sample when the fiscal authority had a legal mandate (which may not be strictly binding in nature) to keep the fiscal deficit under check via a glide path (for example, the Fiscal Responsibility and Managment Act (FRBM), 2003) or important committees were set up to reduce the fiscal deficit to GDP ratio in a time bound manner (Kelkar Committee Report, 2012). Although fiscal rules were announced alongside proposed timelines for achieving consolidation targets, in practice, the reduction in the fiscal deficit-to-GDP ratio often began with a lag.[26]

To identify periods of fiscal or monetary dominance, we classify our sample based on combinations of active or passive behavior of monetary and fiscal policy, following Leeper (1991). Table 3 summarizes this classification. Our analysis considers two sub-periods of fiscal rule implementation: 2004–2008 and 2014–2018.[27] These periods are characterized as fiscal dominance, with an active fiscal authority unconstrained by mandates on spending or deficits, accompanied by a passive monetary authority without strict inflation targeting. Similarly, the first row with an active monetary authority under FIT and a fiscal authority that is required to reduce the fiscal deficits to meet the target (passive fiscal) is defined as the monetary dominance regime (regime M). The final row of Table 3 identifies periods

[26]The FRBM Act (2003) specified a target to reduce the fiscal deficit-to-GDP ratio to 3% by 2009. However, in the aftermath of the global financial crisis, government spending increased, and the fiscal deficit began rising from 2008 onward. Consequently, we restrict the first fiscal rule period to end in 2008. In the second phase of the fiscal rule announcement in 2013, the roadmap emphasized reducing the fiscal deficit from 5.3% in 2012–13 to 3% by 2016–17. Nonetheless, the actual decline began only in 2014 and continued until 2018, after which the deficit began rising again.

[27]The period 2018-2022 contains the onset of COVID-19 after March 2020, after which fiscal policy and monetary policy were expansionary globally to help stimulate the economy. While monetary policy was passive, and fiscal policy was active, especially after 2020, the sub-period can be classifed as fiscal dominance (although after 2020). The large policy response by Central Banks and Finance Ministries, however, was due to COVID, a once in a century pandemic. We focus on the first two sub-periods (2000-2004 and 2008-2014) for analysis and discussion, as fiscal dominance in these period resulted from discretionary policy choices that led to sub-optimal outcomes. Nonetheless, the last period, 2018-2022, saw a rise in debt and an elongation in maturity, as we will later see in Section 5, Table 7, supporting the prediction of our theoretical model. Our empirical results would only strengthen if we included the sub-period 2018-2022 as a period of fiscal dominance in our empirical analysis in Section 4.

without binding fiscal rules or inflation targets.

Table 3: Policy Regimes

Condition	Regime
Fiscal.rule = 1, FIT = 1	passive fisc + active money (M) (2014-2018)
Fiscal.rule = 1, FIT = 0	passive fisc + passive money (Both P) (2004-2008)
Fiscal.rule = 0, FIT = 1	active fisc + active money (Both A) (2018-2022)
Fiscal.rule = 0, FIT = 0	**active fisc + passive money (F)** (2000-2004 & 2008-2014)

Table 4 presents the results from our Logit regressions (Equation 26). The dependent variable is the log-odds of issuing long-term securities (defined as having maturity equal to or exceeding 15 years). Column (1) shows that an increase in the previous year's debt-to-GDP ratio positively and significantly influences the odds of issuing long-term securities. This result aligns with the intuition that issuing longer-term securities helps defer principal repayment, thereby reducing rollover risk. Columns (2) and (3) examine whether this relationship differs during periods when either Flexible Inflation Targeting (FIT) or Fiscal Rules are implemented. In both columns, the coefficient on $(debt/GDP)_{t-1}$ remains positive and significant, reinforcing the idea that mitigating rollover risk is a critical factor influencing maturity choices. However, column (2) highlights a negative and significant coefficient on the interaction term $\mathbf{1}_{FIT} \times (debt/GDP)_{t-1}$. This finding suggests that under FIT, the monetary authority actively manages inflation within mandated targets, causing interest rates to rise following increased fiscal spending. Consequently, the debt management office has less incentive to issue long-term securities, as higher interest rates would increase borrowing costs. In column (3), the interaction between fiscal rules and debt-to-GDP, $\mathbf{1}_{Fiscalrule} \times (debt/GDP)_{t-1}$, is positive but statistically insignificant. This result implies that the log-odds of issuing long-term securities during fiscal rule periods do not significantly differ from periods without such rules.

Column (4) includes a triple interaction term $\mathbf{1}_{NonFiscal} \times \mathbf{1}_{NonFIT} \times (debt/GDP)_{t-1}$, examining periods identified as fiscal dominance (no binding fiscal rules or FIT). The significantly positive coefficient indicates that under fiscal dominance, higher debt-to-GDP ratios strongly increase the likelihood of issuing long-term securities compared to other regimes. This is our most preferred specification and this empirical finding motivates our theoretical framework in Section 2, explaining why fiscal authorities extend debt maturity under fiscal dominance. Intuitively, during increased fiscal spending without monetary policy constraints, authorities either allow inflation to rise — thus sustaining the real value of debt — or extend debt maturity, decreasing the market price of new issuances and thus the total market debt valuation.

Column (5) presents our baseline specification incorporating time fixed effects without interactions to control for unobserved time-specific factors. Column (6) serves as a robustness check by excluding the economic uncertainty index, which proxies unobservable macroeconomic factors. Our results remain consistent across both columns (Columns (3) and (6)), underscoring the robustness to alternative specifications. This also highlights that during periods identified as fiscal dominance, the debt management office pursued an elongation of the maturity structure of new securities. [28]

While the Logit model estimates demonstrate that the maturity structure tends to lengthen during fiscally dominant regimes, it is important to note that these estimates reflect changes in the log-odds of issuing a long-term security. To better interpret the economic magnitude of these effects, we compute average marginal effects from our preferred specification (Column (4) in Table 4). These are reported in Table 5. We find that under a fiscally dominant regime—defined by the absence of both fiscal rules and inflation targeting mandates (*Non-FR* = 1, *Non-FIT* = 1)—the probability of issuing a long-term security is approximately 7 percentage points higher than under a monetary dominant regime (*Non-FR* = 0, *Non-FIT* = 0). This provides strong empirical evidence that the prevailing policy regime significantly influences the government's debt management strategy.

Taken together, these findings suggest that fiscal authorities actively adjust the maturity composition of new debt in response to the policy environment. Under fiscal dominance, where monetary policy is passive and fiscal constraints are absent, the preference for issuing longer-term securities becomes more pronounced—likely as a means of preserving fiscal space and anchoring investor expectations. The empirical results align with this theoretical intuition. As shown in Table 4, the Logit model estimates indicate that the maturity structure systematically varies across regimes. For instance, Column (2) shows that during periods of inflation targeting (monetary dominance), newly issued securities tend to have shorter maturities. In contrast, Column (4) demonstrates that under fiscal dominance, the probability of issuing long-term debt increases significantly, underscoring the role of the maturity structure as an active policy lever in a fiscally dominant context.

In the next Section, we supplement the regression based analysis by applying the debt decomposition framework of Hall and Sargent (2011). This allows us to examine how differ-

[28]The difference in sample sizes between Columns (1)–(4) and (5)–(6) arises from the availability of the uncertainty index, which starts from 2003 for India.

ent components of debt evolve under different policy regimes. Specifically, we analyze subsample periods classified according to regime type (as in Leeper (1991)) to assess the relative importance of inflation, nominal returns, and primary deficits in explaining changes in debt (market value) levels. Consistent with our theoretical model, we expect inflation and nominal returns to play a more prominent role during periods of fiscal dominance, while primary deficits are expected to have a larger contribution during periods identified as monetary dominance. Importantly, we are able to quantify how the marketable return and non-marketable returns from debt (from each tranche) influences aggregate debt evolution.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	long_mat	long_mat	long_mat	long_mat	long_mat	long_mat
$(debt/GDP)_{t-1}$	0.12*	1.22**	0.18**	5.60*	0.55***	5.55***
	(0.07)	(0.51)	(0.09)	(2.92)	(0.19)	(2.56)
$\mathbf{1}_{FIT} \times (debt/GDP)_{t-1}$		-1.06**				
		(0.47)				
$\mathbf{1}_{Fiscalrule} \times (debt/GDP)_{t-1}$			0.90			
			(0.61)			
$\mathbf{1}_{NonFiscal} \times \mathbf{1}_{NonFIT} \times (debt/GDP)_{t-1}$				4.31*		3.60*
				(2.45)		(2.07)
Observations	139	139	139	139	158	173
Pseudo R^2	0.169	0.213	0.210	0.260	0.307	0.337
$\mathbf{Z}_t$	✓	✓	✓	✓	✓	✓
$\mathbf{X}_{it}$	✓	✓	✓	✓	✓	✓
$\mathbf{1}_{FIT}$		✓		✓		✓
$\mathbf{1}_{Fiscalrule}$			✓	✓		✓
Time F.E.					✓	
Uncertainty Index	✓	✓	✓	✓		

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
This table presents results from logit regressions analyzing the relationship between the government debt-to-GDP ratio and the probability of issuing long-term securities (with maturity $\geq$ 15 years). The sample covers periods under different fiscal and monetary policy regimes as indicated by the interaction terms. Robust standard errors, clustered at the appropriate level, are shown in parentheses. Columns vary by the inclusion of policy indicators (FIT, Fiscalrule), uncertainty index, and time fixed effects. All regressions control for macroeconomic covariates ($\mathbf{Z}_t$) and security-specific characteristics ($\mathbf{X}_{it}$). The uncertainty index is from Ahir et al. (2022).

Table 4: Logit Regressions with 15-year threshold

Comparison	Marginal Effect	Std. Error
Fiscal Dominance vs. Monetary Dominance Regime	0.07***	0.018

Notes: The table reports the difference in the marginal effect of the debt-to-GDP ratio on the probability of issuing securities with maturity ≥ 15 years between the fiscal dominance regime and the monetary dominance regime. Standard errors calculated via the delta method. Significance levels: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5: Average Marginal Effect: Impact of $(debt/GDP)_{t-1}$

5 Debt Decomposition

To supplement our results in the previous Section 4, we use the methodology of Hall and Sargent (2011) to decompose changes in the debt-to-GDP ratio for India, leveraging our granular security-level dataset, to highlight the role of the maturity structure under different policy regimes. This section outlines the decomposition algorithm and details the main steps undertaken.[29]

We start by writing the period-by-period government budget constraint:

$$\frac{B_t}{Y_t} = (r_{t-1,t} - \pi_{t-1,t} - g_{t-1,t})\frac{B_{t-1}}{Y_{t-1}} + \frac{def_t}{Y_t} + \frac{B_{t-1}}{Y_{t-1}} \tag{27}$$

where Y_t is real GDP at time t, B_t is the real value of securities issued by the fiscal authority, and $r_{t-1,t}, \pi_{t-1,t}, g_{t-1,t}$ are the nominal interest rate, inflation rate, and the growth rate of real GDP from period t-1 to period t respectively.[30] Equation (27) shows that the value of debt-to-GDP in time period t is equal to the sum of the nominal interest rate payments net of growth and inflation (the first term on the RHS) and the primary deficit-to-GDP ratio of this time period and the debt-to-GDP ratio of the previous time period (second and third terms respectively).

To quantify how the maturity structure of debt affects the debt-GDP ratio's evolution, we redefine the budget constraint. Let $\tilde{B}^j_{t-1}$ be real values of nominal marketable debt with maturity j at $t-1$, where we use the yield curve from RBI to compute bond prices and the corresponding market value. The variable, $\tilde{r}^j_{t-1,t}$, denotes the net nominal holding period return between $t-1$ and t on the debt maturity j. Using these definitions the budget

[29] For formal derivations of the equations used, see Das, Ghate and Halder (2025).

[30] We abstract away from inflation-indexed securities as well as securities denominated in foreign currency as the proportion of these securities is minimal ($\approx 7\%$ and $\approx 5\%$ respectively (Status Paper 2022)).

constraint is given by:

$$\frac{\tilde{B}_t}{Y_t} = \sum_{j=1}^{n} \tilde{r}^j_{t-1,t} \frac{\tilde{B}^j_{t-1}}{Y_{t-1}} - (\pi_{t-1,t} + g_{t-1,t}) \frac{\tilde{B}_{t-1}}{Y_{t-1}} + \frac{def_t}{Y_t} + \frac{\tilde{B}_{t-1}}{Y_{t-1}} \tag{28}$$

The equation above differentiates between the contributions to the growth of the debt-GDP ratio that are contingent on the maturity of debt j, specifically the nominal interest payments, and those that are not. Next, at each date t we compute the number of rupees the government has promised to pay at each date $t + j$. The coupons are stripped from the coupon bonds and they are valued as a weighted sum of zeroes as any coupon bond can be decomposed into zero-coupon bonds with varying maturity.[31]

To take into account the role played by inflation, growth, and nominal returns, we write equation (28) as:

$$\frac{\tilde{B}_t}{Y_t} = \sum_{j=1}^{n} \tilde{r}^j_{t-1,t} \frac{\tilde{B}^j_{t-1}}{Y_{t-1}} - (\pi_{t-1,t} + g_{t-1,t}) \frac{\tilde{B}_{t-1}}{Y_{t-1}} + \frac{def_t}{Y_t} + \frac{\tilde{B}_{t-1}}{Y_{t-1}} \tag{29}$$

To analyze how these components shape the evolution of debt across time, we iterate the above equation backward from time t to an initial time $t - \tau$:

$$\frac{\tilde{B}_t}{Y_t} - \frac{\tilde{B}_{t-\tau}}{Y_{t-\tau}} = \sum_{s=0}^{\tau-1} \left[\sum_{j=1}^{n} \left(\tilde{r}^j_{t-1,t} - \pi_{t-s-1,t-s} - g_{t-s-1,t-s} \right) \frac{\tilde{B}^j_{t-s-1}}{Y_{t-s-1}} + \frac{def_{t-s}}{Y_{t-s}} \right]. \tag{30}$$

This final expression shows that starting from an initial point $t - \tau$, the change in the market value of debt-to-GDP ratio can be decomposed into a series of period-by-period contributions. These contributions are weighted by the maturity-specific debt-to-GDP ratios, highlighting how nominal returns, inflation, growth, and primary deficits interact with the composition of debt. In particular, the decomposition emphasizes how the maturity structure shapes the sensitivity of debt dynamics to economic shocks and policy regimes. We take Equation 30 to our assembled dataset and analyze the evolution of debt and the interplay of monetary-fiscal policy interaction in its evolution.

[31] This follows from the term structure of interest rates and for details please see Hall and Sargent (2011, 1997).

5.1 Debt Decomposition Results

Table 6 presents our decomposition findings based on the compiled data, utilizing equation 30. The decomposition is sensitive to the time-periods chosen and our choice of sub-periods follows from anecdotal or "narrative" approach for identifying the policy regimes. [32] Our analysis is divided into distinct sub-periods, each reflecting the evolution of the debt-GDP ratio over time, delineating it into its components and the policy regimes in place.

For the entire period of analysis (2000-2022), we consider the sub-periods: 2000-2004, 2004-2008, 2008-2014, 2014-2018 and 2018-2022. Of these sub-periods, as mentioned in Section 4, we consider 2000-2004 and 2008-2014 to be periods when the fiscal authority was "active" and the monetary authority was "passive" or the regime was "F". During these periods the fiscal authority in India ceased to adhere to the fiscal rules, i.e., the FRBM (Fiscal Responsibility and Budget Management) Act of 2003, and monetary policy had not yet adopted FIT.

The sub-periods (2004-2008), (2014-2018) happen to be periods when the fiscal authority may not have been active. During (2004–2008), the FRBM Act was being followed, such that both the Centre and the States in India were busy adopting the FRBM norms laid down by the Act thereby undertaking a passive stance. At the same time the monetary authority was passive too. Hence, the regime in this sub-period is taken to be one where both authorities were passive (thus, in Table 6 the third row reads, Both P or Both passive).[33]

The sub-period (2014-2018) is considered to be one where the monetary authority had adopted FIT (de facto from 2014 onwards, see Ghate and Ahmed (2023)) and thereby mandated to keep the inflation on target. Hence the stance of monetary policy is taken to be active. At the same time, during this sub-period the fiscal authority managed to keep the fiscal deficit within the target set by the FRBM Act and hence was passive. Therefore, we consider the regime in place during this sub-period to be M (active monetary authority and passive fiscal authority).[34]

[32] An alternative way to identify regimes is to consider an estimated DSGE framework as in Traum and Yang (2011) and Davig et al. (2004).

[33] Monetary policy during this period followed the Multiple Indicator Approach, without adherence to a single nominal anchor. See Ghate and Ahmed (2023).

[34] Note the FRBM Act was refurbished in 2018 with a target to reduce fiscal deficit to 3% and the central government debt to GDP ratio to be reduced to 40% by 2021.

The periods of fiscal dominance within this period are highlighted in Figure 7 below which plots the Indian fiscal-deficit to GDP ratio between 1995-2022 against the debt-GDP ratio over the same period for the central government. The grey-shaded areas, 2000-2004, and 2008-2014, denote the periods of fiscal dominance. As seen in Section 2, elongating the maturity structure of debt raises the interest burden of debt. We are interested in quantifying to what extent the interest rate component on marketable and non-marketable debt raises the debt-GDP ratio during periods of fiscal dominance.

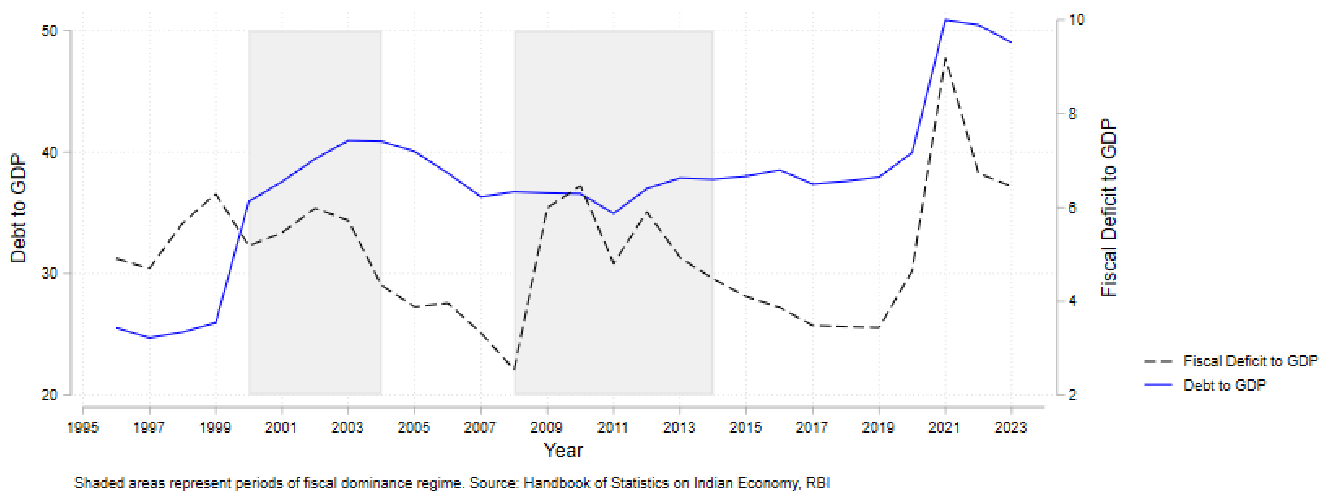


Figure 7: Debt to GDP and Fiscal Deficit to GDP ratio, India, 1995-2022

Across the entire sample (2000-2022), the debt-GDP ratio grew by 28 percentage points as in Table 6. This increase was driven predominantly by the nominal return component, which exerted a significant upward influence on debt. This thereby confirms that the interest burden is an important factor affecting the debt dynamics in an EME like India. Notably, bondholders realized a net positive real return, as is evident from the positive real return component in the first column. Conversely, inflation and economic growth contributed to mitigating the rise, thereby reducing the debt-GDP ratio; confirming the fact that there are periods when debt devaluation did occur due to inflation.

Upon dissecting the decomposition for various sub-periods, a recurring pattern emerges. Across most sub-periods, the dominant factors influencing the change in debt-GDP ratio remain the nominal return and inflation components. With the exception of the 2004-2018 sub-period, the debt-GDP ratio increased in all other sub-periods. Notably, in the years following the COVID pandemic, the debt-GDP increased by approximately 13 percentage points in just a couple of years. While again nominal return and inflation are the major components, negative growth rate of GDP actually led to an increase in the real value of debt-GDP.[35] The key takeaway from our decomposition result is the important role played by the nominal interest rates and inflation in the evolution of debt-GDP ratio in India.

We find empirical support for the insights from our model in the decomposition exercise. If we look at the results from the lens of policy regimes, for all F regimes (i.e, 2000-2004, 2008-2014) the nominal return, both marketable and non-marketable stand out as important contributors in adding to the debt burden. Note that the interest component on the marketable portion of debt during the periods of fiscal dominance (2008-2014, 2014-2018) was about 50% of the total marketable nominal return. Similarly, about 52% of the inflation component for the entire period (2000-2022) comes from the two fiscally dominant periods.[36]

The outcomes of the security-level decomposition, structured by maturity tranches, are illustrated in Table 7. We categorize the analysis into four maturity tranches: 1-2 years, 2-10 years, 10-15 years, and 15+ years. The reason for choosing these maturity tranches is to help understand the maturity structure channel as the Indian government deliberately raised the debt maturity over the course of the period under consideration.

A salient observation from Table 7 is that inflation and the short-rate component (1-2 year) of the marketable nominal return collectively contribute to more than half of the changes in the debt-GDP ratio across the entire sample period and within the sub-periods. One reason for the relatively higher contribution from the 2-10 years tranche is that most of the issued debt is within 10 years maturity in India.

Following the discussion pertaining to Table 6 we observe a sizeable contribution of marketable nominal returns from the maturity tranches of 2-10 and 10-15 years under regime F. Specifically, during 2000-2004 about 80% of the marketable nominal return comes from the longer maturity returns. The same is true for the sub-period 2008-2014, wherein, of the 12.7% marketable nominal return about 65% is due to the nominal returns under 2-10 and 10-15 years. A similar result follows when we look at the inflationary component across the regime F periods.[37]

The debt-decomposition results are in line with idea of our model of fiscal dominance

[35]The component of growth rate is positive which denotes that negative growth during these years actually led to an increase in the debt-GDP rather than reducing it.

[36]From Table 6 nominal return on the marketable debt in 2004-2008 and 2014-2018 was 28.9%, that when compared with the overall periods return (57.4%) works out to be about 50%. We can calculate the inflation component the same way.

[37]From Table 7 we get close to 80% of nominal returns by adding 9.2% and 3.7% and dividing by 16.2%.

wherein with a longer maturity structure of debt, the fiscal authority has an additional channel to affect debt dynamics besides using inflation to devalue debt. A consequence of using the maturity structure of debt is higher interest rate burden. It should also be pointed out that due to higher inflation during regime F, there are instances when long-term bond holders have received negative real returns. This is evident from the real returns on longer-term securities that were rendered negative during 2008-2014. Note that the real returns on 2-10 years, 10-15 years and 15+ years were negative during 2008-2014, another aspect of fiscal dominance. In India, since the insurance and pension funds hold longer term government securities, the negative real return on higher maturity securities implies that it were the insurance and pension funds that suffered the most.

		Period					
Start		**2000**	**2000**	**2004**	**2008**	**2014**	**2018**
End		**2022**	**2004**	**2008**	**2014**	**2018**	**2022**
Policy Regimes			***F*** Active Fiscal Passive Monetary	***Both P*** Passive Fiscal Passive Monetary	***F*** Active Fiscal Passive Monetary	***M*** Active Monetary Passive Fiscal	***Both A*** Active Fiscal Active Monetary
Debt-GDP							
	Start	19.7	19.7	40.7	33.5	34.7	37.3
	End	47.7	40.7	33.5	34.7	37.3	47.7
	Change	28.0	21.0	-7.2	1.2	2.6	10.3
Marketable debt							
	Nominal return	57.4	16.2	4.0	12.7	13.6	11.0
	Inflation	-43.4	-4.2	-6.6	-18.3	-6.4	-8.0
	Real return	13.6	11.6	-2.5	-5.1	6.8	2.8
	Growth rate	-36.8	-5.3	-11.6	-7.9	-8.1	-3.8
Non-marketable debt							
	Nominal return	29.8	12.3	8.8	3.7	3.1	1.9
	Inflation	-5.9	-0.3	-0.9	-2.5	-0.7	-1.6
	Growth rate	-4.8	-0.4	-1.5	-1.1	-0.9	-0.8
Primary Deficit/GDP		29.4	3.4	-0.7	13.4	2.3	11.0
Total		25.7	21.7	-8.5	-0.0	2.9	9.7

Note: This table presents the outcomes of the decomposition analysis conducted using Equation 30. It outlines the evolution of the debt-GDP ratio over time, highlighting the contributing components. The sub-periods are classified as different regimes according to Table 3. Policy Regime ***F*** denotes an "active" fiscal and "passive" monetary regime; ***Both P*** denotes both fiscal and monetary policy are "passive"; Policy Regime ***M*** denotes an "active" monetary and "passive" fiscal policy; ***Both A*** denotes both fiscal and monetary policy are "active".

Table 6: Debt decomposition for Central Government Securities

			Period					
Start			**2000**	**2000**	**2004**	**2008**	**2014**	**2018**
End			**2022**	**2004**	**2008**	**2014**	**2018**	**2022**
Policy Regimes				***F*** Active Fiscal Passive Monetary	***Both P*** Passive Fiscal Passive Monetary	***F*** Active Fiscal Passive Monetary	***M*** Active Monetary Passive Fiscal	***Both A*** Active Fiscal Active Monetary
Debt-GDP	Start		19.7	19.7	40.7	33.5	34.7	37.3
	End		47.7	40.7	33.5	34.7	37.3	47.7
	Change		28.0	21.0	-7.2	1.2	2.6	10.3
Marketable debt	Nominal return		57.4	16.2	4.0	12.7	13.6	11.0
		1–2 years	14.3	2.6	2.1	4.1	3.1	2.4
		2–10 years	31.0	9.2	2.3	6.8	6.9	5.9
		10–15 years	9.1	3.7	-0.2	1.4	2.2	2.1
		15+ years	3.0	0.7	-0.2	0.4	1.4	0.7
	Inflation		-43.4	-4.2	-6.6	-18.3	-6.4	-8.0
		1–2 years	-12.9	-1.2	-1.8	-5.6	-1.9	-2.3
		2–10 years	-22.6	-2.3	-3.4	-9.6	-3.3	-4.0
		10–15 years	-5.2	-0.5	-1.0	-1.9	-0.8	-1.1
		15+ years	-2.8	-0.1	-0.4	-1.1	-0.5	-0.6
	Real return		13.6	11.6	-2.5	-5.1	6.8	2.8
		1–2 years	1.4	1.4	0.3	-1.4	1.2	0.0
		2–10 years	8.2	6.6	-1.0	-2.5	3.4	1.7
		10–15 years	3.3	3.0	-1.2	-0.6	1.3	0.8
		15+ years	0.7	0.6	-0.5	-0.5	0.9	0.2
	Growth rate		-36.8	-5.3	-11.6	-7.9	-8.1	-3.8
		1–2 years	-10.4	-1.5	-3.1	-2.4	-2.3	-1.1
		2–10 years	-19.2	-2.9	-6.0	-4.2	-4.2	-1.9
		10–15 years	-4.8	-0.7	-1.8	-0.8	-1.0	-0.5
		15+ years	-2.4	-0.2	-0.8	-0.5	-0.6	-0.3
Non-marketable debt	Nominal return		29.8	12.3	8.8	3.7	3.1	1.9
	Inflation		-5.9	-0.3	-0.9	-2.5	-0.7	-1.6
	Growth rate		-4.8	-0.4	-1.5	-1.1	-0.9	-0.8
Primary Deficit/GDP			29.4	3.4	-0.7	13.4	2.3	11.0

Note: This table presents the outcomes of the decomposition analysis by maturity. The overall structure follows Table 6, with returns and dynamics broken down by bond maturity. The sub-periods are classified as different regimes according to Table 3. Policy Regime ***F*** denotes an "active" fiscal and "passive" monetary regime; ***Both P*** denotes both fiscal and monetary policy are "passive"; Policy regime ***M*** denotes an "active" monetary and "passive" fiscal policy; ***Both A*** denotes both fiscal and monetary policy are "active".

Table 7: Debt decomposition for Central Government securities by maturity structure

6 Conclusion

The surge in sovereign debt on a global scale, post the Great Financial Crisis and especially after the COVID-19 pandemic, has necessitated a comprehensive exploration of the factors that can alleviate the burden of debt. Factors like the nominal interest rates, economic growth, inflation, and the primary deficit/surplus play a pivotal role in influencing changes in the debt-GDP ratio. The increase in sovereign debt has led to large interest rate burdens for AEs and EMEs. An unexplored aspect is the role that the maturity structure of debt plays under fiscal dominance in impacting debt-sustainability.

We develop a dynamic model of monetary-fiscal interactions, government debt and introduce a novel channel of fiscal dominance through the maturity structure. Our model is motivated by the desire of policy makers to use the maturity structure of debt as a tool to accommodate the impact of a government spending shock on debt. Under fiscal dominance, where monetary policy reacts weakly to fiscal imbalances, the maturity structure becomes a key adjustment margin. We show that elongating the maturity structure increases the interest burden of debt. Elongating the maturity structure allows the government to smooth the effects of fiscal shocks over time by deferring repayment obligations and reducing immediate inflationary pressures. This leads to smaller increases in short-term interest rates and prevents a sharp decline in bond prices.

Importantly, the "maturity structure channel" operates in addition to the inflation channel and financial repression channel, the latter two being standard in the literature on fiscal dominance. We show that when the monetary authority is faced with an expansionary fiscal shock, extending debt maturity becomes a strategic tool to maintain debt sustainability without immediate price-level adjustments, and this raises the interest burden of debt.

We test our results empirically in a large EME, India, using a novel panel dataset which contains auction level data for central government securities, between 1999-2022. Under fiscal dominance, where monetary policy is passive and fiscal constraints are absent, we find that the preference for issuing longer-term securities becomes more pronounced. Identifying periods of fiscal domaince in India between 1999-2022, we find that the probability of issuing a long-term security (whose maturity is greater than 15 years) in a fiscally dominant regime is approximately 7 percentage points higher than under a monetary dominant regime. This provides strong empirical evidence that the prevailing policy regime significantly influences the government's debt management strategy. We supplement these results with a debt decomposition exercise using the approach in Hall and Sargent (2011) which tracks the maturity structure of debt explicitly. We find that the nominal return on marketable debt and non marketable debt is the predominant factor driving debt-GDP increases in episodes of fiscal dominance, consistent with the model.

Our research not only sheds light on the impact of fiscal dominance on debt-GDP dynamics via the interest rate burden of debt, but also presents a comprehensive empirical analysis using a novel dataset for a large EME, India. Our findings underline the intricate interplay of various factors in shaping debt dynamics under fiscal dominance, and have significant implications for both debt management and monetary policy in economies with large levels of public debt. As governments across the world grapple with the challenges of rising debt levels, our results hold relevance for policymakers and researchers aiming to foster economic stability and fiscal sustainability.

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Fiscal Dominance and the Maturity Structure of Debt

Online Appendix

A Figures

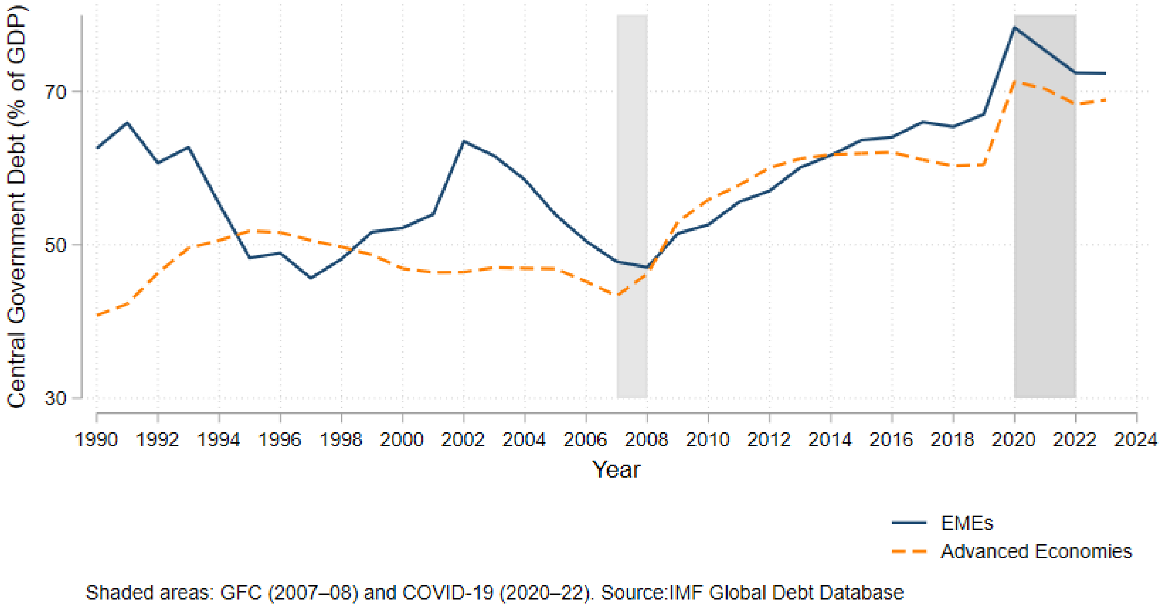

Figure A1: Central Government Debt as % of GDP

Note: This Figure plots the central government debt as a percentage of GDP for selected EMEs and AEs. The number of countries in each of these groups are the same as used to prepare Figure 1 except for Cambodia in the EME group, for which data is not available for all the years. Data is sourced from the IMF Global Debt Database.

B Data

Steps of preparing the dataset for decomposition

In this section, we provide the complete steps as to how we assembled the data and the subsequent process to make it usable for the accounting decomposition.

- We assembled the data for all the Central government securities issued by the government from 1999 on wards from the Status Paper of government debt, issued by the Ministry of Finance.
- The RBI on the behalf of the Ministry of Finance resorts to issuing of securities and act as the debt manager for the government, the next section in this appendix gives some details as to how does RBI carry out the task.
- Since a coupon bond is a stream of promised coupons plus an ultimate principal payment. We regard such a bond as a bundle of zero-coupon bonds of different maturities and price it by unbundling it into the underlying component zero-coupon bonds, one for each date at which a coupon or principal is due, valuing each promised payment separately.
- In this way we can get the Coupon or **C** matrix, which gives the coupon payments for all the securities over all the years for all the maturities and the **P** matrix, which is the principal matrix that gives the principal payments for all the years over the whole maturity horizon.
- So in a way we have stripped the coupons from each bond and price a bond as a weighted sum of zero-coupon bonds of maturities.
- By adding these two matrices, namely the P matrix and the C matrix, we can get the total payments outstanding for the central government as a weighted sum, with weights being given by the various maturity tranches.
- From the yield to maturity (YTM) data for the Subsidiary General Ledger (SGL) transactions in government dated securities for various maturities, we obtained the "price" of each security, which in our description is defined as the number of time t rupees that it takes to buy a rupee at time t + j. In this respect note that all the securities under our consideration are rupee denominated securities.
- We also calculate the value of currency measured in goods per rupee as the inverse of the price in the base year (this becomes our v_t).
- By multiplying q_{t+j}^t with v_t and s_{t+j}^t, we get the real value of the marketable bond in year t. Then by summing them over all the maturities, we get the total real value of government debt outstanding in period t.

- We combined this data with other variables used for decomposition like GDP that is obtained from the Economic Survey, CPI inflation which is obtained from OECD and the data for primary deficit/surplus is obtained from RBI.

- The schematic chart below gives a snapshot as to how the real value of the marketable debt is calculated.

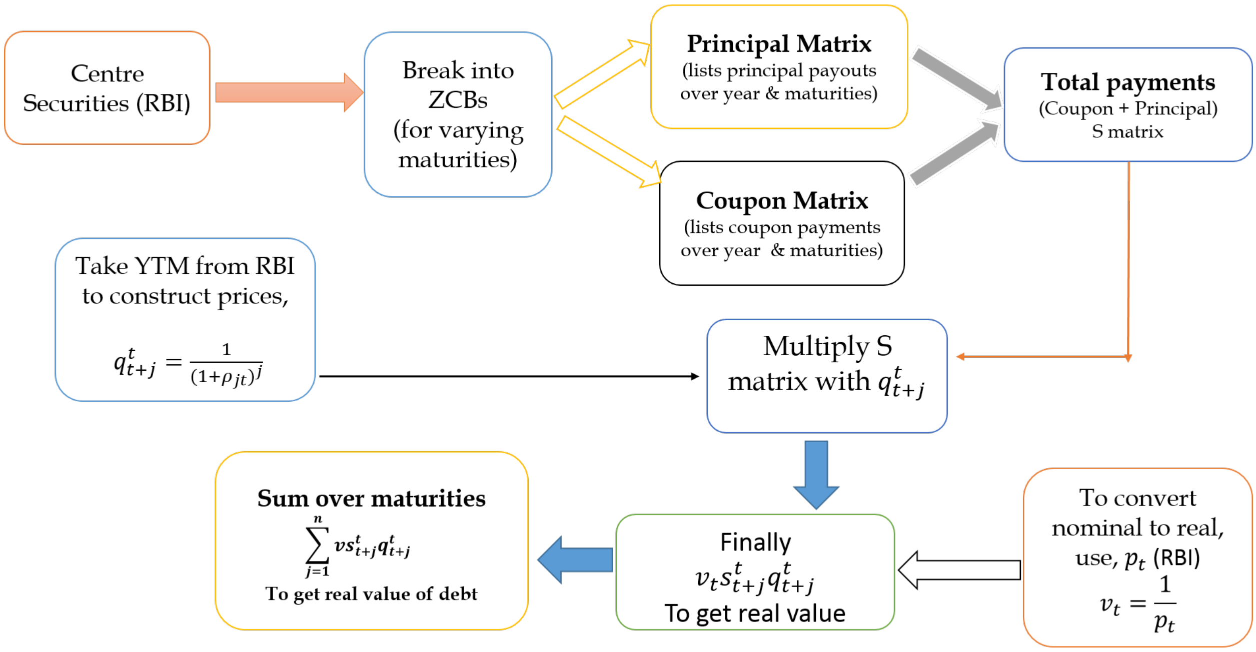

Figure A2: Schematic Flow Chart showing calculation of real value of government debt

How does the RBI issues securities?

Here we look at how the Reserve Bank of India (RBI) issues the central government securities. [38]

The RBI acts as the banker and the debt manager to the government. A Government Security (G-Sec) is a tradable instrument issued by the Central Government or the State Governments acknowledging the obligation of the government's debt.

In India, the Central Government issues both, treasury bills and bonds or dated securities while the State Governments issue only bonds or dated securities, which are called the State Development Loans (SDLs).

The *Public Debt Office (PDO)* of the Reserve Bank of India acts as the registry / depository of G-Secs and deals with the issue, interest payment and repayment of principal at maturity. Most of the *dated securities* are **fixed coupon** securities.

Types of bonds issued

[38] Details can be found here

- Most Government bonds in India are issued as fixed rate bonds.
- Floating rate bonds (FRBs) were first issued in September 1995 in India and have a variable coupon and can carry the coupon, which will have a base rate plus a fixed spread, to be decided by way of auction mechanism.
- Government had last issued a zero coupon bond in 1996.
- Inflation Indexed Bonds (IIBs) - IIBs are bonds wherein both coupon flows and principal amounts are protected against inflation.
- STRIPS: they are essentially zero coupon bonds and they are created out of existing securities only and unlike other securities, are not issued through auctions.

Besides banks, insurance companies and other large investors, smaller investors like Co-operative banks, Regional Rural Banks, Provident Funds are also required to statutory hold G-Secs.

How are G-Secs issued

- G-Secs are issued through auctions conducted by RBI on its electronic platform.
- Participants include Commercial banks, scheduled UCBs (Urban Cooperative Banks), Primary Dealers (PDs), Insurance Companies and Provident Funds, who maintain funds account (current account) and securities accounts (Subsidiary General Ledger (SGL) account) with the Reserve Bank of India (RBI).
- All non-members including non-scheduled UCBs can participate in the primary auction through scheduled commercial banks or PDs.
- The RBI, in consultation with the Government of India, issues an indicative half-yearly auction calendar which contains information.
- Auction for *dated securitie*s is conducted on Friday for settlement on T+1 basis (i.e. securities are issued on next working day i.e., Monday).
- The Reserve Bank of India conducts auctions usually every Wednesday to issue T-bills of 91day, 182 day and 364 day tenors. Settlement for the *T-bills* auctioned is made on T+1 day.
- An auction may either be yield based or price based
  - A **yield-based auction** is generally conducted when a **new** G-Sec is issued. Investors bid in yield terms up to two decimal places. Bids are arranged in ascending order and the cut-off yield is arrived at the yield corresponding to the

notified amount of the auction and the cut-off yield is then fixed as the coupon rate for the security. Bids which are higher than the cut-off yield are *rejected*.

– A **price based auction** is conducted when Government of India **re-issues securities** which have already been issued earlier. Bidders quote in terms of price per 100 of face value of the security. Bids are arranged in *descending order* of price offered and the successful bidders are those who have bid at or above the cut-off price.

– Depending upon the method of allocation to successful bidders, auction may be conducted on Uniform Price basis or Multiple Price basis.

– In a **competitive bidding**, an investor bids at a specific price/ yield and is allotted securities if the price/yield quoted is within the cut-off price/yield and are undertaken by well-informed institutional investors such as banks, financial institutions, PDs, mutual funds, and insurance companies.

How does one get information about the price of a G-Sec?

The return on a security is a combination of two elements (i) coupon income and (ii) the gain / loss on the security due to price changes.

Information on traded prices of securities is available on the RBI website here and also in the FBIL website.

The Clearing Corporation of India Limited (CCIL) is the clearing agency for G-Secs. In effect, during settlement, the CCP becomes the seller to the buyer and buyer to the seller of the actual transaction. CCIL also guarantees settlement of all trades in G-Secs.

C Empirical Results

This appendix reports the summary statistics for the entire auction level dataset and the results from the logit regression model in Section 4, using an alternative threshold to define long-term security issuance. Table A1 reports the descriptive statistics for the complete auction level dataset with around 7,407 security-year observations. The average coupon rate is approximately 8.85%, with a mean residual maturity of 8.60 years and an actual maturity of 13.75 years, reflecting the issuance of both short- and long-term instruments. The average face value of securities is around INR 91.9 billion, while the mean market value is slightly higher at INR 108.9 billion. The average price per 100 INR face value is approximately 67.5. On the macroeconomic side, the average debt-to-GDP ratio stands at 37%, and the mean primary deficit is 1.30% of GDP. The average yield is reported as 7.90%, while CPI inflation and the repo rate average 6.78% and 6.73%, respectively. These figures suggest substantial variation in both bond market characteristics and macroeconomic conditions across auctions.

Next we present the results for the logit specification with a different threshold maturity. Specifically, the cutoff for long-term maturity is reduced from 15 years to 10 years. The empirical specification remains consistent with Equation 26, but the dependent variable now measures the log odds of issuing a new security with a maturity exceeding 10 years. The results are summarized in Table A2. As shown in the table, changes in the lagged debt-to-GDP ratio remain positively and significantly associated with the likelihood of issuing securities with maturities greater than 10 years—mirroring the main results based on the 15-year threshold. Columns (2) and (3) explore heterogeneity in this relationship during periods characterized by the presence of Flexible Inflation Targeting (FIT) or binding fiscal rules. In both cases, the coefficient on lagged debt-to-GDP remains positive and significant, reinforcing the interpretation that reducing rollover risk is a key motivation behind the issuance of long-term debt.

Notably, column (2) shows that the interaction between the FIT dummy and lagged debt-to-GDP is negative and significant, consistent with the findings in Table 4. The interaction term involving the fiscal rule dummy also becomes marginally significant, possibly due to the change in cutoff. Importantly, the magnitude and standard errors of this coefficient are comparable to those in the baseline specification. Column (4) presents results for the triple interaction term involving the absence of both FIT and fiscal rules. While the coefficient remains positive, it becomes statistically insignificant under the 10-year cutoff. Overall, the results remain qualitatively robust, suggesting that the key insights from the baseline specification are not sensitive to the choice of maturity threshold.

We also report the results from an OLS specification of our model where the dependent variable is the actual maturity of the newly issued securities compared to a dichotomous variable under the logit specification. Table A3 reports the results from the OLS regression of actual maturity of new securities on the lagged value of debt to GDP ratio and other covariates under different regimes. The independent variables are similar to the logit specifications except now the reported coefficients show the impact of change in the fiscal spending on the actual maturity level of the new securities. The impact of higher spending has a positive impact on the actual maturity, highlighting an elongation of maturity for the new securities. This result is similar to the logit specifications in Table 4 and A2. Qualitatively the results during different sub periods identified as active monetary regime (column 3) or fiscally dominant regime (column 5) are similar to the logit specification, but they are not statistically significant. Overall the OLS specification supports our hypothesis that higher spending by the government will lead to an elongation of the maturity of the new securities but the results are not significant.

Variable	**Obs**	**Mean**	**Std. Dev.**
Coupon Rate (%)	7,047	8.846	2.493
Residual Maturity (Years)	7,090	8.601	15.751
Actual Maturity (Years)	6,168	13.745	9.141
Face Value (INR bn)	7,047	91.913	234.358
Price (per 100 INR)	5,157	67.521	43.539
Market Value (INR bn)	5,157	108.901	261.724
Debt-to-GDP Ratio (%)	7,047	36.997	6.049
Primary Deficit/GDP (%)	7,047	1.295	1.347
Yield (%)	3,325	7.900	1.746
CPI Inflation (%)	7,047	6.779	2.853
Repo Rate (%)	5,481	6.730	1.069
Yield (%)	4,910	5.890	3.337

Notes: This table reports the summary statistics for the important variables using the auction level data for all the securities. Yield and maturity variables are reported in percentages and years, respectively. Face value and market value are in billions of Indian Rupees. Price of a bond is the notified amount in the auction and is presented as per 100 INR.

Table A1: Summary Statistics: Auction Level Data

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	long_maturity	long_maturity	long_maturity	long_maturity	long_maturity	long_maturity
$(debt/GDP)_{t-1}$	0.18***	1.18**	0.22***	5.28*	0.86***	4.89**
	(0.06)	(0.47)	(0.08)	(2.71)	(0.25)	(2.09)
$\mathbf{1}_{FIT} \times (debt/GDP)_{t-1}$		-0.99**				
		(0.44)				
$\mathbf{1}_{Fiscalrule} \times (debt/GDP)_{t-1}$			1.08*			
			(0.62)			
$\mathbf{1}_{NonFiscal} \times \mathbf{1}_{NonFIT} \times (debt/GDP)_{t-1}$				3.58		2.75
				(2.48)		(1.80)
Observations	139	139	139	139	167	173
Pseudo R^2	0.259	0.297	0.304	0.337	0.336	0.257
$\mathbf{Z}_t$	✓	✓	✓	✓	✓	✓
$\mathbf{X}_{it}$	✓	✓	✓	✓	✓	✓
$\mathbf{1}_{FIT}$		✓		✓		✓
$\mathbf{1}_{Fiscalrule}$			✓	✓		✓
Time F.E.					✓	
Uncertainty Index	✓	✓	✓	✓		

Notes: This table presents results from logit regressions examining the relationship between government debt-to-GDP ratios and the probability of issuing long-term securities (with maturity $\geq$ 10 years). Interaction terms indicate policy regimes: Flexible Inflation Targeting (FIT), Fiscal Rules (Fiscalrule), and periods without these constraints (NonFiscal × NonFIT). All specifications include macroeconomic controls ($\mathbf{Z}_t$) and security-specific characteristics ($\mathbf{X}_{it}$). Robust standard errors are provided in parentheses. Columns differ based on the inclusion of policy indicators, uncertainty index, and time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A2: Logit Regressions with 10-year threshold

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	actual_maturity	actual_maturity	actual_maturity	actual_maturity	actual_maturity	actual_maturity
$(debt/GDP)_{t-1}$	0.62**	2.10	0.60**	16.57*	2.83***	16.56**
	(0.27)	(1.36)	(0.26)	(9.33)	(0.65)	(7.82)
$\mathbf{1}_{FIT} \times (debt/GDP)_{t-1}$		-1.46				
		(1.32)				
$\mathbf{1}_{Fiscalrule} \times (debt/GDP)_{t-1}$			2.17			
			(1.68)			
$\mathbf{1}_{NonFiscal} \times \mathbf{1}_{NonFIT} \times (debt/GDP)_{t-1}$				12.80		11.64
				(8.91)		(7.52)
Observations	130	130	130	130	173	173
R^2	0.33	0.34	0.34	0.38	0.47	0.32
$\mathbf{Z}_t$	✓	✓	✓	✓	✓	✓
$\mathbf{X}_{it}$	✓	✓	✓	✓	✓	✓
$\mathbf{1}_{FIT}$		✓		✓		✓
$\mathbf{1}_{Fiscalrule}$			✓	✓		✓
Time F.E.					✓	
Uncertainty Index	✓	✓	✓	✓		

Notes: This table reports results from OLS regressions examining the relationship between lagged debt-to-GDP and actual maturity of the new security. Interaction terms capture the effects of macroeconomic policy regimes, including Flexible Inflation Targeting (FIT), Fiscal Rules (Fiscalrule), and the interaction of non-FIT and non-Fiscalrule periods. All specifications control for macroeconomic variables ($\mathbf{Z}_t$) and security characteristics ($\mathbf{X}_{it}$). Robust standard errors are in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3: OLS Regressions

D Derivation of the Debt Valuation Equation

Following Cochrane (2023) assume that the economy begins with outstanding bonds, denoted as B_{t-1}. At the conclusion of each time period, marked as $t-1$, the government issues nominal one-period debt in the form of B_{t-1}. Each of these nominal bonds assures payment of one dollar at time t. As the new time period, t, commences, the government generates additional currency to cover the maturing debt. Subsequently, as time t ends, the government collects taxes, net of transfers (s_t), and offers newly issued debt (B_t) for sale at a price represented by Q_t. Both of these actions serve to manage the available money supply.

In the context of the flow of money, the government's budget equation can be expressed as:

$$M_{t-1} + B_{t-1} = P_t s_t + M_t + Q_t B_t \tag{A1}$$

Here, M_{t-1} represents the non-interest-bearing money held overnight from the evening of $t-1$ to the morning of time t, P_t signifies the price level, Q_t stands for the one-period nominal bond price, and i_t denotes the nominal interest rate. It's important to note that interest is only paid overnight, specifically from the end of date t to the beginning of $t+1$.

Within the economy, a representative household aims to maximize their utility through the following optimization:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U(c_t) \tag{A2}$$

This occurs within a comprehensive asset market, and the household enjoys a constant endowment denoted as $y_t = y$.

The household's budgetary constraints over each time period closely mirror the government's financial equation but from the household's perspective. As a new time period, t, starts, the household carries over money (M_{t-1}) and nominal bonds (B_{t-1}), receives income ($P_t y_t$), engages in consumption ($P_t c_t$), pays taxes net of transfers ($P_t s_t$), acquires bonds (B_t), and may hold onto money (M_t). The equation representing this household budget is as follows:

$$M_{t-1} + B_{t-1} + P_t y_t = P_t c_t + P_t s_t + M_t + Q_t B_t. \tag{A3}$$

The stipulation here is that the household must maintain non-negative money and bond holdings, which are represented as $B_t \geq 0$ and $M_t \geq 0$.

In terms of the consumer's optimization, the first-order conditions, and the equilibrium, the rate of gross real interest, denoted as R, equals $1/\beta$. The nominal interest rate i_t and bond price, denoted as Q_t, are defined as:

$$Q_t = \frac{1}{1+i_t} = \frac{1}{R} E_t \left(\frac{P_t}{P_{t+1}} \right) = \beta E_t \left(\frac{P_t}{P_{t+1}} \right) \tag{A4}$$

When the nominal interest rate, i_t, is greater than zero, households don't hold any money ($M_t = 0$). When i_t equals zero, money and bonds are perfect substitutes, allowing us to represent them as B_t. Note that interest rates can't be negative in this model. Consequently, we can eliminate money from equation (A1), leading to the flow equilibrium condition:

$$B_{t-1} = P_t s_t + Q_t B_t \tag{A5}$$

By substituting the bond price (equation (A4)) into equation (A5) and dividing by P_t, we get:

$$\frac{B_{t-1}}{P_t} = s_t + \beta B_t E_t \left(\frac{1}{P_{t+1}} \right) \tag{A6}$$

Optimizing household behavior, budget constraints, and equilibrium condition $c_t = y$ also imply the household's transversality condition:

$$\lim_{T \to \infty} E_t \left(\beta^T \frac{B_{T-1}}{P_T} \right) = 0.$$

If the left-hand side of this condition is positive, the consumer can increase consumption at time t, decrease the terminal value, and enhance utility. The requirement of non-negative debt ($B_t \geq 0$) prevents negative values.

We can further iterate equation (A6) to get:

$$\frac{B_{t-1}}{P_t} = E_t \left(\sum_{j=0}^{\infty} \beta^j s_{t+j} \right) \tag{A7}$$

The government determines debt and surpluses $\{B_t\}$ and $\{s_t\}$, with debt B_{t-1} being predetermined at time t. The right-hand side of equation (A7) is independent of the price level in this straightforward model. Consequently, the price level must adjust to satisfy equation (A7). The right-hand side of equation (A7) represents the present value of future primary surpluses, while the left-hand side stands for the real value of nominal debt.

Equation (A7) can also be written to explicitly account for the bond price as

$$\frac{Q_t B_t}{P_t} = E_t \left(\sum_{j=1}^{\infty} \beta^j s_{t+j} \right) \tag{A8}$$

where we have used equation (A5) to explicitly again write the debt valuation equation.

So far in this analysis we have considered one period bonds, issued in period t and repaid or rolled over in period $t+1$. In our model we consider bonds with different maturities. Hence, we can follow a similar approach to derive the debt valuation equation for different maturity levels.

D.1 Stability of Debt

This section derives the condition on the tax rule parameter, ν_f, necessary to maintain debt at a stable level. We begin with the government's flow budget equation, incorporating the maturity structure:

$$B_{t-1}\left[1+\phi Q_t\right] = P_t s_t + B_t Q_t$$

where $s_t = \tau_t + T_t$ denotes the government's primary surplus. Substituting the tax rule (equation 15) yields a first-order difference equation:

$$Q_t b_t = b_{t-1}\left(\frac{1+\phi Q_t}{\pi_t} - \frac{\nu_f}{R_{t-1}}\right) - \tau^* + T_t + \nu_f \frac{b^*}{R^*}$$

where $b_t = \frac{B_t}{P_t}$ is the real value of debt in period t. Following Kumhof et al. (2010), in the neighborhood of the steady state and ignoring the equilibrium responses of endogenous variables to lagged debt, the path of debt is stable if:

$$\left|\frac{\partial b_t}{\partial b_{t-1}}\right| < 1 \quad \Longrightarrow \quad \frac{1+\phi Q^*}{\pi^*} - Q^* R^* < \nu_f < \frac{1+\phi Q^*}{\pi^*} + Q^* R^*$$

where

$$Q^* = \sum_{j=0}^{\infty} \phi^j \left(\frac{1}{R^*}\right)^{j+1}$$

is the steady-state portfolio price, which depends inversely on the steady-state interest rate.