Revisiting the Interest Rate Effects of Federal Debt*

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ABSTRACT

This paper revisits the relationship between federal debt and interest rates in the U.S. A common approach is to regress long-term forward interest rates on long-term projections of federal debt. We show that issues regarding nonstationarity have become more pronounced over the last 20 years, significantly biasing recent estimates. Estimating the model in first differences rather than in levels addresses these concerns. We find that a 1 percentage point increase in the debt-to-GDP ratio raises the 5-year-ahead, 5-year Treasury rate by about 3 basis points. Roughly half of the interest rate response is driven by a higher nominal term premium.

Keywords: fiscal sustainability, federal debt, federal deficit, term premium, neutral rate
JEL Classifications: E43, E63, H63

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1 INTRODUCTION

The U.S. is currently facing a historically high federal debt-to-GDP ratio, with projections from the Congressional Budget Office (CBO) indicating continued fiscal deterioration. Federal debt was relatively stable from 1975 to 2005, averaging 36% of GDP. Since then debt has risen to 100% of GDP, and by 2055 it is projected to increase to 156% of GDP according to the March 2025 report.

This paper quantifies the effects of federal debt on interest rates in the U.S. This relationship is not only of academic interest but also central to fiscal sustainability assessments and budget forecasting.[1] In particular, the CBO relies on estimates of how sensitive interest rates are to federal debt when constructing its long-run projections for debt service costs and fiscal gaps. Those projections are, in turn, widely used by think tanks and market analysts to assess the U.S. fiscal outlook and its potential economic impact. Understanding this relationship is also important for setting monetary policy, as shifts in federal debt could affect estimates of the neutral interest rate.

Estimating the impact of federal debt on interest rates is empirically challenging, since correlations between these two variables can be confounded by business cycle dynamics and changes in monetary policy. For example, deficits often rise during recessions due to automatic stabilizers and discretionary fiscal stimulus, while interest rates tend to fall in response to monetary easing. These dynamics can obscure the underlying relationship between federal debt and interest rates.

Laubach (2009) developed a novel methodology that aimed to address these identification issues by regressing long-term forward interest rates on long-term projections of fiscal variables. Specifically, he used 5-year-ahead projections from the CBO for debt and deficits, which are likely to be less influenced by short-run cyclical factors, and nominal interest rates such as the 5-year-ahead, 10-year Treasury rate, which are more reflective of long-term interest rate expectations than current rates. The analysis was based on an irregularly spaced sample from 1976 to 2006 that corresponds to the releases of the CBO's projections, which are typically provided twice a year. The method has been applied to more recent data by Gamber and Seliski (2019), Neveu and Schafer

[1] See, e.g., D'Erasmo et al. (2016), Jiang et al. (2024), and Mian et al. (2025) for recent work on fiscal sustainability.

(2024) and Chadha et al. (2025), and has become a cornerstone in policy institutions like the CBO.

We revisit and extend this influential approach along several dimensions. First, we demonstrate that econometric issues related to nonstationarity have become much more pronounced over the past 20 years. The Laubach model seeks to control for stochastic trends in the nominal interest rate by including a measure of expected inflation in the model. We show that this approach is no longer sufficient when extending the sample to 2025. This problem was first pointed out by Bauer and Rudebusch (2020) in the context of term structure models and is due to the evolution of real interest rates. Similarly, projections of debt and deficits, which were arguably stationary prior to 2007, have since followed a nonstationary trajectory. Both of these developments raise concerns about the reliability of the estimates and inference when the regression model is specified in levels.

Second, we re-estimate the relationship between federal debt and long-term interest rates using a first-difference specification and an updated sample from 1976 to 2025. We find that a 1 percentage point increase in the debt-to-GDP ratio generates a statistically significant increase of about 3 basis points in the 5-year-ahead, 5-year Treasury rate. While this estimate is larger and more precisely estimated than in recent studies such as Neveu and Schafer (2024), it is remarkable how similar the results are to the Laubach (2009) estimates even after changing the model and accounting for the steady increase in federal debt over the last 20 years. Our findings are robust to the sample period, including additional controls, and using longer-term forward interest rates and alternative fiscal projections from the Office of Management and Budget (OMB). We also consider the effects of changes in federal deficits. A 1 percentage point increase in the primary deficit-to-GDP ratio raises the 5-year-ahead, 5-year Treasury rate by about 13 basis points. As we discuss later, the larger effect of an increase in the primary deficit closely aligns with the persistence of primary deficits.

When we estimate the model in levels, the effect of an increase in the federal debt or deficit on interest rates is much smaller, potentially even negative. This shows that the breakdown of the cointegrating relationship between nominal interest rates and expected inflation biases the estimates downward. In addition, the estimates from the model in levels are highly sensitive to the control variables in the model, while the estimates from the first difference specification are stable.

Third, we construct a new dataset of 10-year-ahead fiscal projections from the CBO.[2] These forecasts, available since 1995, should be even less sensitive to short-run cyclical conditions. Using these projections, we calculate expected interest rates further out on the yield curve and find similar estimates for the responses to federal debt and deficits, but with much tighter confidence intervals.

Finally, we decompose the effects of federal debt on nominal interest rates into movements in expected short-term real rates and term premia. This is an advancement over earlier applications of this methodology, which focused exclusively on long-term nominal rates. Using estimates from a term structure model, we find that about half of the interest rate response to debt is due to an increase in the nominal term premium. This finding aligns with recent high-frequency identification studies, which show that bond markets quickly and disproportionately adjust term premia in response to fiscal news, and can be rationalized by various theoretical mechanisms in the literature.

Together, our findings provide updated and compelling evidence on the macro-financial consequences of rising federal debt. In particular, they underscore the importance of fiscal sustainability for long-term borrowing costs and highlight the channels through which debt affects interest rates. Holding all else equal, our estimates indicate that the projected 56 percentage point increase in federal debt over the next 30 years would raise long-term interest rates by about 170 basis points.

Related Literature A large literature examines how fiscal policy—particularly federal debt and deficits—affects long-term interest rates. Laubach (2009) is a key reference that proposes using long-term forward rates and long-horizon budget projections to mitigate endogeneity concerns arising from cyclical dynamics and monetary policy. He found statistically significant effects of debt and deficits on long-term interest rates. Laubach's results were updated in two influential CBO studies, Gamber and Seliski (2019) and Neveu and Schafer (2024), which guide the debt sensitivities in the CBO's budget projections. Our estimates are 65% larger than the most recent estimates.[3]

Gale and Orszag (2004) and Engen and Hubbard (2004) also examine how federal debt affects U.S. interest rates using econometric models that include forward-looking and contemporaneous

[2] Canzoneri et al. (2002) is the only study that we are aware of that has used 10-year-ahead CBO projections. However, they concentrate on how interest rate spreads, rather than the level of interest rates, respond to federal deficits.

[3] For the 5-year ahead, 10-year rate we estimate 3.3 basis points. Neveu and Schafer (2024) estimate 2 basis points.

variables. They find that a 1 percentage point increase in the debt-to-GDP ratio raises real interest rates by 3 to 5 basis points, depending on the model. Their analysis highlights the importance of considering both debt and deficits and accounting for macroeconomic controls. International studies including Kinoshita (2006), Ardagna et al. (2007), Kumar and Baldacci (2010), and Gruber and Kamin (2012) document heterogeneous responses across countries, with larger effects in settings characterized by weaker fiscal credibility, emphasizing the role of perceived debt sustainability.

Recent studies use high-frequency identification methods to examine how fiscal news affects interest rates. Cotton (2024), who uses deficit surprises in the Monthly Treasury Statement, and Gomez Cram et al. (2025a), Phillot (2025), and Wiegand (2025), who examine yield movements around CBO cost releases, Treasury auctions, and legislative developments, consistently find that fiscal news primarily affects the 10-year Treasury yield through term premia. Our paper extends this literature by decomposing Treasury rate responses to changes in fiscal projections into term-premium and expected short-rate components, while addressing concerns about nonstationarity.

Outline The paper proceeds as follows. Section 2 describes the econometric issues that surfaced over the last 20 years. Section 3 presents our estimation results, highlights the contribution of the term premium, and discusses the theoretical explanations driving our results. Section 4 concludes.

2 Econometric Issues

Our objective is to determine the effects of federal debt and deficits on long-term nominal interest rates. It is difficult to isolate the effects of changes in fiscal policy from the other drivers of interest rates, such as the state of the business cycle. Automatic stabilizers and fiscal stimulus raise deficits in recessions while monetary easing lowers interest rates, creating a seemingly negative relationship. To help address this concern, Laubach (2009) uses long-horizon expectations of interest rates and federal debt or deficits. The analysis is based on the following regression model:

$$E_t i_{t+k}^{(n)} = \beta_0 + \beta_1 E_t f_{t+k} + \beta_2 E_t \pi_{t+k} + \delta' \mathbf{u}_t + \varepsilon_t, \tag{1}$$

where $E_t i_{t+k}$ is the expected interest rate on an n-period Treasury security, $E_t \pi_{t+k}$ is the expected inflation rate, and $E_t f_{t+k}$ is the expected fiscal position k-years ahead, and $\mathbf{u}_t$ are extra control variables (current or expected). Our primary interest is in the sign, size, and significance of β_1, which provides an estimate for the sensitivity of nominal interest rates to changes in the fiscal position.

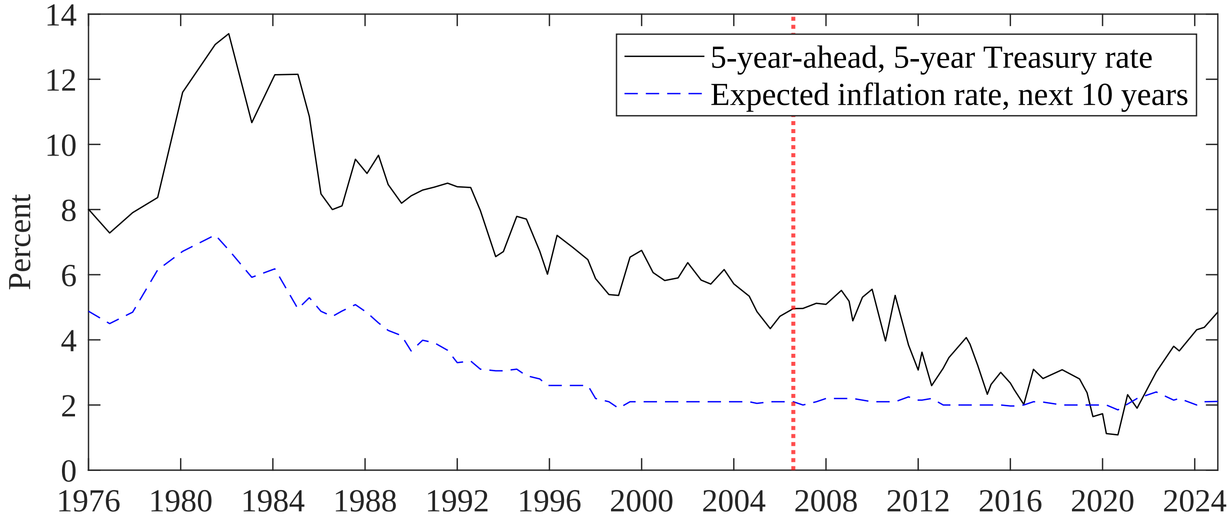
Laubach (2009) found evidence that nominal interest rates and inflation expectations are cointegrated. The results from unit root tests also led him to treat the fiscal projections as stationary. We reinvestigate these conclusions and provide evidence that the statistical properties of the data have changed over the last 20 years. We focus on the 5-year-ahead, 5-year Treasury rate (5y5y), but the results are robust to using other forward rates. All rates are end-of-period, zero-coupon yields in annual percentages. More information about their construction is provided in Gürkaynak et al. (2007). Following Laubach (2009), we use the perceived target rate (PTR) of inflation used in the FRB/US model, which captures market participants' and professional forecasters' expectations for PCE inflation over the next 10 years. The main fiscal variables are the CBO projections of federal debt and deficits 5-years ahead, measured as a percent of GDP (or GNP before 1992). The online appendix provides more information about these projections and the other data sources.

2.1 COINTEGRATION To motivate our analysis, Figure 1 plots the 5y5y Treasury rate alongside the PTR expected inflation rate over the next 10 years. Both series trended down since the early 1980s, but the 5y5y rate exhibited substantial variation even after expected inflation leveled out in the late 1990s. This points to declines in expected short-term real rates, consistent with estimates in the literature (see, e.g., Del Negro et al., 2017; D'Amico et al., 2018; Holston et al., 2017; Laubach and Williams, 2003), and raises major concerns about whether regressing the 5y5y rate on expected inflation is sufficient to deal with the trends in the data. Bauer and Rudebusch (2020) raised a similar concern in the context of term structural models for the 10-year Treasury rate.

We investigate this issue by regressing the 5y5y Treasury rate on expected inflation using dynamic OLS (see Stock and Watson, 1993).[4] The residuals, plotted in the online appendix, are highly autocorrelated, and an Augmented Dickey-Fuller test fails to reject the null of a unit root.

[4]The model includes 3 leads and lags of the change in expected inflation based on the Akaike Information Criterion.

Figure 1: Comovement between nominal interest rates and expected inflation



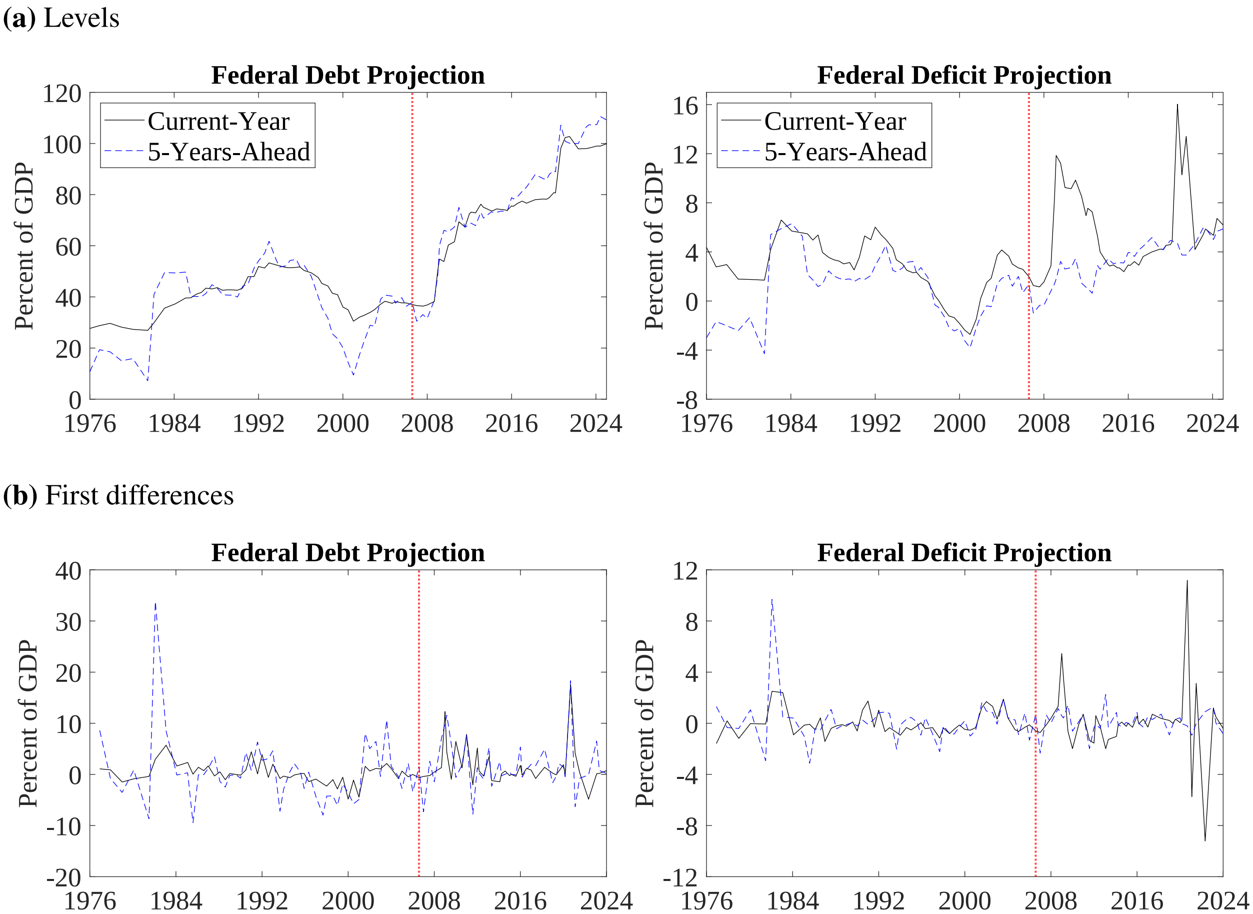
Notes: The dashed vertical line represents the last data point in the Laubach sample.

To formally test for cointegration between the 5y5y Treasury rate and expected inflation, we apply the Phillips and Ouliaris (1990) test to both the full sample (1976Q1–2025Q1) and the Laubach (2009) sample (1976Q1–2006Q3), with results reported in the online appendix. For the Laubach sample, we reject the null hypothesis of no cointegration, consistent with Laubach (2009) and supportive of a levels specification. In contrast, over the full sample, we can no longer reject the null hypothesis of no cointegration, due to significant changes in the data over the last two decades.[5]

2.2 STATIONARITY Next, we examine the stationarity of the federal debt and deficit projections plotted in Figure 2a. In the Laubach sample, these series are highly autocorrelated but not explosive: projected debt rose sharply in the 1980s but returned to roughly its 1970s level by the early 2000s, and the total and primary deficit projections show a similar pattern. Over the past 20 years, however, projected debt and deficits have persistently trended upward, with longer-horizon projections from the CBO pointing to continued fiscal deterioration. Augmented Dickey-Fuller tests on the two samples broadly confirm this visual evidence (see the online appendix). For the debt projections, the test fails to reject the null hypothesis of a unit root in both samples, with a

[5]We also considered specifications that included the 5-year ahead CBO projection for real GDP/GNP growth and the 5-year ahead debt projection to potentially alleviate this issue. However, the test results were unchanged.

Figure 2: Federal debt and deficit projections



Notes: The dashed vertical line represents the last data point in the Laubach sample. The horizontal axis denotes the fiscal year in which the projection was made by the CBO.

much larger p-value in the full sample. For the deficit projections, evidence of stationarity is weak: we reject the unit-root null at the 10% level only for the primary deficit in the Laubach sample. By contrast, Figure 2b shows that the first differences of all projection series are stationary.

2.3 DISCUSSION Our examination of the data and econometric tests raises significant concerns about bias in the coefficient estimates and problematic inference about their statistical significance when the regression model is specified in levels. These concerns could be addressed if one had the necessary controls to explain movements in the expected real rate. However, that task is exceedingly difficult given the wide range of hypotheses put forward to explain its movements, including demographics (e.g., Carvalho et al., 2016; Eggertsson et al., 2019), the global savings glut (e.g., Caballero et al., 2017), trend growth (e.g., Laubach and Williams, 2003), and inequality (e.g., Auclert and Rognlie, 2018). We address these econometric issues by estimating a regression model in first differences rather than levels. This approach alleviates the need to control for stochastic trends in interest rates, renders the fiscal projections stationary, and helps strip out common trends and level shifts—such as those arising from monetary-policy regime changes or movements in term and risk premia—that could otherwise confound level regressions and generate spurious correlations.

3 Interest Rate Response to Federal Debt and Deficits

Our baseline regression model is given by

$$\Delta E_t i_{t+5}^{(5)} = \beta_0 + \beta_1 \Delta E_t f_{t+5} + \beta_2 \Delta E_t \pi_{t+10} + \delta' \Delta \mathbf{u}_t, \tag{2}$$

where $\Delta E_t i_{t+5}^{(5)}$ is the change in the 5y5y Treasury rate, $\Delta E_t f_{t+5}$ is the change in the CBO's 5-year ahead debt or deficit projection, and $\Delta E_t \pi_{t+10}$ is the change in the expected inflation rate over the next 10 years, as measured by the perceived target rate of inflation.[6] Gamber and Seliski (2019) and Neveu and Schafer (2024) include Federal Reserve and foreign official holdings of U.S. Treasuries as additional control variables. Both variables are available from the Flow of Funds and converted to shares of GDP (real GNP growth before 1992). As shown in the online appendix, these variables sharply increased after the Great Recession and can potentially account for some of the demand-side factors that influenced interest rates independently of the fiscal position.

Laubach (2009) proposes two other control variables. The first is the 5-year-ahead CBO projection for real GDP/GNP growth, which is a proxy for long-run consumption growth expectations that affect the real interest rate in an Euler equation. The second is the dividend yield, which is a proxy for risk aversion. A higher dividend yield may reflect higher expected excess returns on stocks, which would signal greater risk aversion and a flight to safe assets that lowers Treasury yields. The dividend yield is calculated from the Flow of Funds as domestic nonfinancial corporate dividends divided by the value of corporate equity held by households and non-profit organizations.

[6] The online appendix shows that our results are robust to using 5-year ahead, 5-year forward inflation from the SPF.

Our baseline model includes the first difference of the four control variables, which are stored in $\Delta\mathbf{u}_t$. The model is estimated using data from 1976 to 2025 that aligns with the CBO's projections.

3.1 BASELINE ESTIMATES The first three columns of Table 1 show the estimates from our baseline specification. The rows show the coefficients and robust standard errors for each variable.[7] Our primary focus is the interest rate response to a change in the fiscal projection (β_1). We estimate that a 1 percentage point increase in the debt-to-GDP ratio generates a 3 basis point increase in the 5y5y rate. The coefficient is statistically significant with a p-value below 0.02 and more precisely estimated than recent estimates. We also consider the 5-year-ahead, 10-year Treasury rate (5y10y), which is used in the literature. As shown in the online appendix, the results are similar to those from our baseline model: a 1 percentage point increase in the debt-to-GDP ratio generates a 3.3 basis point increase in the 5y10y rate, and the estimates are statistically significant a with p-value below 0.01. This estimate is 65% larger than the 2 basis point estimate in Neveu and Schafer (2024), which determines the debt sensitivity of interest rates underlying the CBO's budget projections.

As discussed in Laubach (2009), in some theoretical models the fiscal variable of interest is not the debt but the deficit. We find that a 1 percentage point increase in the total deficit-to-GDP ratio is associated with a 17 basis point increase in the 5y5y rate. One potential concern with this estimate is that the total deficit is a function of interest rates, since it includes (net) interest spending on the debt. However, our results for the primary deficit-to-GDP ratio show that excluding interest spending has little effect on the estimates, consistent with those reported in Laubach (2009). A 1 percentage point increase in the primary deficit-to-GDP ratio is associated with a 13 basis point increase in 5y5y rate. The estimates from all specifications are significant at a 10% level or higher.

The estimated coefficient on the primary deficit-to-GDP ratio is about 4 times larger than the coefficient on debt-to-GDP ratio. If the increase in the deficit was temporary, then it would lead to a one-time, one-for-one increase in debt. In that case, the debt and deficit coefficients would likely be similar. However, if the increases in the deficit are persistent, then an increase today leads to a series of future increases, causing debt to accumulate over time. Therefore, the more persistent the

[7] HAC standard errors are computed using a quadratic spectral kernel where the bandwidth fits an AR1 process.

Table 1: Estimates of the interest rate effects of federal debt and deficits

	Forward Variables Baseline Specification			**Current Variables** Naïve Specification		
Dependent Variable	5y5y	5y5y	5y5y	10y	10y	10y
Independent Variable	Debt5	Def5	PrDef5	Debt0	Def0	PrDef0
Fiscal Variable (β_1)	3.00	16.83	13.08	2.32	-1.27	-2.84
	(1.21)	(7.20)	(7.32)	(2.78)	(4.51)	(4.56)
Expected Inflation (β_2)	126.17	123.93	119.75	134.11	128.23	126.99
	(46.36)	(43.01)	(50.32)	(49.52)	(49.99)	(49.33)
Fed Holdings (δ_1)	-4.14	-1.76	-2.76	-4.95	-2.10	-1.17
	(4.58)	(4.61)	(5.12)	(5.26)	(5.93)	(6.15)
Foreign Holdings (δ_2)	-26.51	-25.78	-25.61	-34.93	-32.20	-30.94
	(11.66)	(11.11)	(11.82)	(12.56)	(13.14)	(13.24)
Expected Real GDP (δ_3)	-13.60	0.96	-8.78	-16.48	-12.30	-10.25
	(22.20)	(20.34)	(22.13)	(21.20)	(23.74)	(23.54)
Dividend Yield (δ_4)	9.98	9.18	10.46	6.49	6.50	6.40
	(14.80)	(13.90)	(15.08)	(16.07)	(15.39)	(15.21)

Notes: The baseline specification uses the 5-year-ahead, 5-year Treasury rate and 5-year ahead fiscal projections. The naïve specification uses the 10-year Treasury rate and current year fiscal projections. Def is the projected deficit and PrDef is the projected primary deficit. The sample is from January 1976 to January 2025. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.

deficit, the larger the effect on long-term interest rates. The fact that the estimated coefficient on the deficit is much larger than the coefficient on debt suggests that market participants expect the deficit to be highly persistent. From 1976 to 2024, the autocorrelation of the primary deficit was 0.75. This value suggests that a 1 percentage point increase in the primary deficit-to-GDP ratio leads to a $1/(1-0.75)=4$ percentage point increase in the debt-to-GDP ratio, in line with our estimates.

The steady increase in debt over the last 20 years raises the question of whether the interest rate response has changed over time. To answer this question, we re-estimate the model with all controls using a recursive window, starting with the Laubach sample and then adding one observation at a time until the full sample is estimated. The online appendix plots the sequence of coefficients, highlighting the marginal contribution of recent data. We find that the coefficient increased after the global financial crisis, but has since been remarkably stable, hovering around 3 basis points.[8]

[8] We also run rolling window regressions. We start with the Laubach sample and then shift the regression window forward for each data point, while keeping the sample size constant. The results are similar to the recursive estimates.

Table 2: Alternative model estimates of the interest rate effects of federal debt and deficits

	5-Year-Ahead, 5-Year Treasury Rate					
	First Differences			Levels		
Federal Debt	3.18 (1.22)	3.00 (1.21)	2.66 (1.21)	1.27 (0.90)	0.67 (0.80)	−3.32 (0.94)
Total Deficit	16.85 (5.94)	16.83 (7.20)	17.15 (5.97)	11.78 (5.99)	8.49 (5.51)	−15.73 (16.70)
Primary Deficit	14.02 (6.38)	13.07 (7.32)	13.43 (6.65)	10.89 (9.53)	3.97 (7.59)	−31.96 (19.23)
Treasury Controls	Yes	Yes	No	Yes	Yes	No
Extra Controls	No	Yes	No	No	Yes	No

Notes: Estimates based on regressions of the 5-year-ahead, 5-year Treasury rate on alternative fiscal projections. The rows are debt and deficit projections 5-years-ahead as a percent of GDP (or GNP before 1992). The First Differences columns correspond to a regression model where all variables enter in first differences. The Levels columns correspond to the Laubach regression model where all variables enter in levels. All regressions include expected inflation as a control. The Treasury controls are Federal Reserve and foreign official holdings of Treasury securities as a share of GDP. The extra controls are the 5-year-ahead projection of real GDP growth (or GNP growth before 1992) and the dividend yield. The sample is from January 1976 to January 2025. The estimates are in basis points. The values in parentheses are robust standard errors.

3.2 ALTERNATIVE SPECIFICATIONS A key innovation of Laubach's approach is to estimate the model with forward variables in order to reduce the influence of factors that contaminate the underlying relationship between long-term interest rates and federal debt and deficits. The last three columns of Table 1 show the estimates from a naïve specification based on current variables. Specifically, we regress the 10-year Treasury rate on current-year projections for debt and deficits, which are plotted in Figure 2. Using current-year projections, rather than realized values allow us to maintain the same timing convention as our baseline regression. Under the naïve specification, the responses of the 10-year Treasury rate to the current-year deficit and primary deficit are both negative. While the responses to current-year debt are positive, they are smaller than under our baseline specification, and none of the estimates are statistically significant. Consistent with Laubach (2009), these results emphasize the importance of using forward variables in the model.

Given the stark changes in the cointegrating relationship between long-term interest rates and expected inflation and the nonstationary trajectory of federal debt and deficits over the last 20 years, we emphasize that it is crucial to not only use forward variables, but also to estimate the model in first differences. As shown in Table 2, estimating the model in levels generates starkly different results. The coefficient on federal debt is biased downwards and not statistically different from zero. Excluding Federal Reserve and foreign official holdings of Treasury securities produces a large, negative coefficient, which is also noted in Neveu and Schafer (2024). Similar issues arise when we use the total or primary deficit projection. In contrast, under the first-difference specification the coefficient estimates on the fiscal projections are stable and always statistically significant.

3.3 ESTIMATES USING QUARTERLY DATA A limitation of using CBO projections is that they are irregularly released, typically only twice per year. However, interest rate data is available at a monthly frequency and all of the other independent variables are available at a quarterly frequency. To increase our sample size and account for the changes in interest rates and other variables that occur in between the CBO projections, we transform the fiscal projections into quarterly series by linearly interpolating the missing values. Given the high serial correlation in the actual fiscal projections, this approach likely provides a good approximation of the missing CBO projections. We also followed Shumway and Stoffer (1982) to generate a filtered series for the missing debt projections. For the interest rate series, we first assigned the monthly values during the months of the CBO projections to the corresponding quarters. We then populate the rest of the series with the end-of-quarter values from each quarter in which there was no CBO projection. These alternative approaches provide quarterly series from 1976Q1 to 2025Q1 and roughly double our sample size.

The analogues to Table 1 are provided in the online appendix. The estimated interest rate responses to changes in federal debt and deficits are very similar to our baseline estimates. A 1 percentage point increase in federal debt continues to raise the 5y5y Treasury rate by about 3 basis points. Another benefit of quarterly data is that we can better control for past changes in interest rates. We find that including a lag in the dependent variable also had little effect on our estimates.

3.4 LONGER HORIZON PROJECTIONS To further reduce the potential influence of cyclical factors, we also collect 10-year-ahead CBO projections for federal debt and deficits. These projections

Table 3: Longer horizon estimates of the interest rate effects of federal debt and deficits

	Federal Debt		Total Deficit		Primary Deficit	
	5y5y	10y5y	5y5y	10y5y	5y5y	10y5y
Fiscal Variable (β_1)	3.47 (1.61)	2.77 (0.89)	23.63 (9.43)	20.51 (6.55)	21.82 (12.62)	21.24 (9.74)

Notes: The estimates in the 5y5y columns are based on a regression of the 5-year-ahead, 5-year Treasury rate on projections of federal debt and deficits 5-years-ahead. The estimates in the 10y5y columns are based on a regression of the 10-year-ahead, 5-year Treasury rate on projections of federal debt and deficits 10-years-ahead. All of the budget projections are expressed as a percent of GDP (or GNP before 1992). The regressions are based on a sample from August 1995 to January 2025. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.

are only available starting in August 1995 but still leave a decent sample size for our analysis.[9] To align with the 10-year projections, we construct a 10-year-ahead, 5-year Treasury rate (10y5y).

Using these new series, we regress the 10y5y Treasury rate on 10-year-ahead projections of federal debt and deficits. As a benchmark, we also rerun our baseline regression of the 5y5y Treasury rate on 5-year-ahead projections using the same sample. Table 3 presents the results. The estimates using our baseline 5-year horizon mirror the results in Table 1. When extending the horizon to 10 years, the estimated effects of federal debt and deficits are little changed, but they are much more tightly estimated. In particular, we find that a 1 percentage point increase in the debt-to-GDP ratio generates a 2.8 basis point increase in the 10y5y Treasury rate with a 95% confidence interval that ranges from 1.9 to 3.7 basis points. These tighter estimates align with intuition that using longer-horizon projections reduces the noise that is present in the shorter-run projections.

3.5 OMB PROJECTIONS

A potential concern with using CBO projections in our regressions is that they are based on current law, while current policy may better reflect market expectations. To investigate this concern, some studies have also considered projections from the OMB, which reflect the President's budget request (e.g., Cotton, 2024; Laubach, 2009; Wachtel and Young, 1987). Five-year ahead projections are available at an annual frequency starting in 1983. We hand-collect the projections for federal debt as a share of GDP (or GNP before 1992) and end-of-period forward

[9] Our sample from January 1976 to January 2025 based on a 5-year horizon has 95 observations. The sample based on the 10-year horizon has 65 observations. For comparison, the Laubach sample only had 53 observations.

interest rates from the month that the projection was released. We then re-estimate our regression model and compare the results to the estimates based on the CBO projections using a common sample that begins in 1988 to avoid the potential influence from the Volcker disinflation period.

As shown in the online appendix, the interest rate effects of federal debt are similar across the different projections. For example, a 1 percentage point increase in the debt-to-GDP ratio raises the 5y5y Treasury rate by 3.1 basis points using the OMB projections and by 3.6 basis points using the CBO projections. We obtain similar results when using the 5y10y rate and when using different sample periods. This highlights that our results do not hinge on the CBO's current policy baseline.

3.6 Interest Rate Decomposition

The results presented so far show how federal debt and deficits affect long-term nominal interest rates. A key question for monetary policy is how much of the change in these nominal rates is driven by term premia versus shifts in expected real rates.

As a first pass at the decomposition, we use estimates from D'Amico et al. (2018), which we will refer to as DKW. The DKW model decomposes nominal yields into four components: the expected average future real short rate, expected inflation, the real term premium, and the inflation risk premium. We refer to the sum of the latter two components as the nominal term premium. We focus on the DKW model for two reasons. First, it provides estimates for interest rates and term premia that are expected to prevail over the next 5 to 10 years, allowing us to make direct comparisons to our baseline results. Second, it is the only publicly available model that provides an estimate of the expected *real* short rate, which is often cited as a measure of the neutral rate.

We first estimate our model with all controls using the 5y5y rate as the dependent variable. We then reestimate the model, replacing the 5y5y rate with the expected short rate (r^*), the nominal term premium (tp_n), the real term premium (tp_r), and expected inflation ($E\pi$). The DKW estimates become available in 1983, so we estimate our models on data from August 1995 to January 2025 to align with the sample used in Table 3, but the results are robust to using a longer sample.

The online appendix shows the estimated coefficients and robust standard errors on projections of federal debt and deficits 5-years-ahead. The responses of the expected real short rate, the nominal term premium, and expected inflation roughly sum to the response of the 5y5y Treasury rate.

We find that about 55% of the change in the 5y5y rate comes through the nominal term premium, three-quarters of which is driven by the real term premium. In particular, a 1 percentage point increase in debt raises the nominal term premium by 1.9 basis points, the expected real short rate by 1 basis point, and expected inflation by 0.5 basis points. The results for the deficit are similar.[10]

Our findings are consistent with recent studies that use other approaches to identify the effects of fiscal policy on term premia. Gomez Cram et al. (2025a) show that CBO cost estimate releases have a significant impact on term premia, particularly when the estimates signal large increases in deficits. Employing a high-frequency event study approach, they find that markets respond to such fiscal news by repricing long-term debt. Specifically, after large negative budget proposals, roughly 60% of the rise in long-term nominal yields is attributable to increases in term premia. Other high-frequency approaches, including Cotton (2024), Wiegand (2025), Phillot (2025) and Bi et al. (2025), also generate sizable and immediate effects of fiscal news on the term premium.

3.7 DISCUSSION Our estimates indicate that a 1 percentage point increase in the debt-to-GDP ratio raises long-term nominal interest rates by about 3 basis points, with roughly half of that estimate attributable to a higher nominal term premium. An important question is what these estimates imply for future interest rates. The CBO projects that the U.S. debt-to-GDP ratio will rise by 56 percentage points over the next 30 years. Holding other factors constant, our estimates suggest that the projected increase in debt would boost long-term interest rates by about 170 basis points. Given that the 5-year-ahead, 5-year Treasury rate averaged 4.35 percent in 2024, this would imply a rate of about 6% in 2055. Of this increase, roughly 90 basis points would stem from a higher nominal term premium, while 50 basis points would reflect an increase in expected real short rates.

These findings contribute to the ongoing discussion around the neutral real interest rate. While the neutral rate has declined over recent decades due to factors such as demographic shifts, rising income inequality, and a global savings glut, fiscal policy offsets them by putting upward pressure on short-term real interest rates, a point emphasized in Rachel and Summers (2019). Our analysis helps quantify the size of this response, which could affect the stance of future monetary policy.

[10] When estimating the response of expected inflation, excluding PTR as a control has no effect on our estimates.

3.8 THEORETICAL EXPLANATIONS Our estimates naturally raise questions about what theoretical mechanisms can explain the interest rate response to federal debt and deficits. When the federal government runs larger deficits and accumulates more debt, public saving falls. The impact on interest rates depends on how much private saving rises in response. If households increase saving one-for-one, national saving is unchanged. This implies that Ricardian equivalence holds, government debt does not crowd out private capital, and real interest rates are unaffected. If the private saving response is smaller, then Ricardian equivalence breaks down and government debt partially displaces private capital, raising the marginal product of capital and real interest rates.

Laubach (2009) formalizes this mechanism in a neoclassical model with a Cobb-Douglas production function, $Y = K^{\alpha}L^{1-\alpha}$, where K is the capital stock, L is hours worked, and α is the cost share of capital. In equilibrium, the marginal product of capital, MP_K, is equal to the user cost of capital, $r + \delta$, where r is the real interest rate and δ is the depreciation rate. Thus, the cost share of capital $\alpha = MP_K(K/Y) = (r + \delta)k$, where $k = K/Y$ is the capital-output ratio. If D is the outstanding stock of government debt and $c \in [0, 1]$ is the fraction of capital that is crowded out, then

$$\frac{\partial r}{\partial D} = \frac{\partial r}{\partial k}\frac{\partial k}{\partial K}\frac{\partial K}{\partial D} = \left(-\frac{\alpha}{k^2}\right)\left(\frac{1-\alpha}{Y}\right)(-c) = \frac{\alpha(1-\alpha)c}{k^2 Y},$$

so an increase $\Delta D = 0.01Y$ in federal debt raises the real interest rate by $\alpha(1-\alpha)c/k^2$ basis points.

We set $k = 2.6$ to match the average share of private fixed assets to gross value added by businesses, households, and institutions over our sample. Similarly, we set $\alpha = 0.39$ to match the sample average of the capital share in the nonfinancial corporate sector. There is no consensus on the degree of crowding out, c, but for the range suggested in the literature of $c = [0.5, 0.8]$, this implies roughly 2–3 basis points per 1-percentage-point increase in the debt-to-GDP ratio.[11] Distortionary taxation, finite horizons, foreign capital inflows and liquidity-constrained households are standard reasons why $c < 1$ and higher deficits are not fully offset by higher private saving.[12]

Beyond this neoclassical channel, macro-finance research emphasizes safe-asset demand and

[11] See Neveu and Schafer (2024) for a summary of the estimates in the literature.

[12] Recent work on non-Ricardian fiscal regimes shows how persistent unfunded spending can make public debt risky net wealth, increasing inflation and discount rate risk premia in long-term yields (e.g., Gomez Cram et al., 2025b).

market segmentation in Treasury markets. Convenience-yield and preferred-habitat models such as Krishnamurthy and Vissing-Jorgensen (2012) and Vayanos and Vila (2021) stress that some investors value Treasuries for their safety, liquidity, and collateral services and demand specific maturities. Their inelastic, segmented demand makes Treasury securities scarce, safe, and liquid assets and generates a convenience yield that depresses Treasury yields. As the supply of Treasuries rises, they become less scarce, so convenience yields fall and Treasury yields rise. Similarly, long-term Treasury issuance raises long-duration risk, which must be absorbed by risk-averse arbitrageurs (dealers, asset managers) with limited risk-bearing capacity, so they demand higher compensation, and term premia rise. These asset-demand channels operate independently of capital accumulation and help explain why, in our empirical results, most of the response of long-term interest rates to projected debt comes through term premia rather than expected future short rates.

Finally, the monetary policy regime could shape how Treasury debt supply affects term premia. Large-scale asset purchases and balance-sheet runoff, which are captured in our control variables, reallocate duration risk between the central bank and the private sector, amplifying or dampening the impact of debt on long-term yields and their term-premium component (Hillenbrand, 2025).

4 Conclusion

This paper reexamines the relationship between federal debt and interest rates. A common approach is to regress a long-term forward interest rate on a 5-year-ahead projection of federal debt. We revisit and extend this influential approach along several dimensions. First, we propose using a model in first differences rather than in levels to address econometric issues with nonstationarity that have become much more pronounced over the past 20 years. Second, we re-estimate the relationship between federal debt and long-term interest rates, expanding the sample to include the most recent fiscal projections. We find that a 1 percentage point increase in the debt-to-GDP ratio raises the 5-year-ahead, 5-year Treasury rate by about 3 basis points. Third, we introduce a new dataset of 10-year-ahead fiscal projections and find similar point estimates but with much tighter confidence intervals. Finally, we decompose the effects of federal debt on nominal interest rates into movements in expected short-term real rates and term premia. Roughly half of the interest rate response is driven by a higher nominal term premium. Overall, our findings highlight a robust and economically significant response of long-term Treasury rates to changes in U.S. fiscal imbalances.

Although the forward-rate and long-horizon projection framework substantially reduces cyclical confounding and mitigates simultaneity and omitted-variable concerns, it does not address all endogeneity concerns. Forward rates may still contain some cyclical variation, and long-horizon fiscal projections can respond to near-term developments. Our approach represents progress, but more research is needed to refine estimates of the interest rate sensitivity to federal debt and deficits.

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