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Revisiting the Interest Rate Effects of Federal Debt

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Revisiting the Interest Rate Effects of Federal Debt*

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Abstract

This paper revisits the relationship between federal debt and interest rates. A common approach in the literature is to regress an expected interest rate on a projection of federal debt. We show that issues related to nonstationarity have become more pronounced over the last 20 years, raising significant concern about the reliability of estimates from this model. We argue that estimating the model in first differences rather than in levels addresses these concerns. Our preferred specification indicates that a 1 percentage point increase in the debt-to-GDP ratio raises the 5-year-ahead, 5-year Treasury rate by 3 basis points. About three-quarters of the increase in interest rates is driven by term premium rather than expected short-term real rates.

Keywords: fiscal policy, federal debt, federal deficit, interest rates, term premium

JEL Classifications: E43, E63, H63

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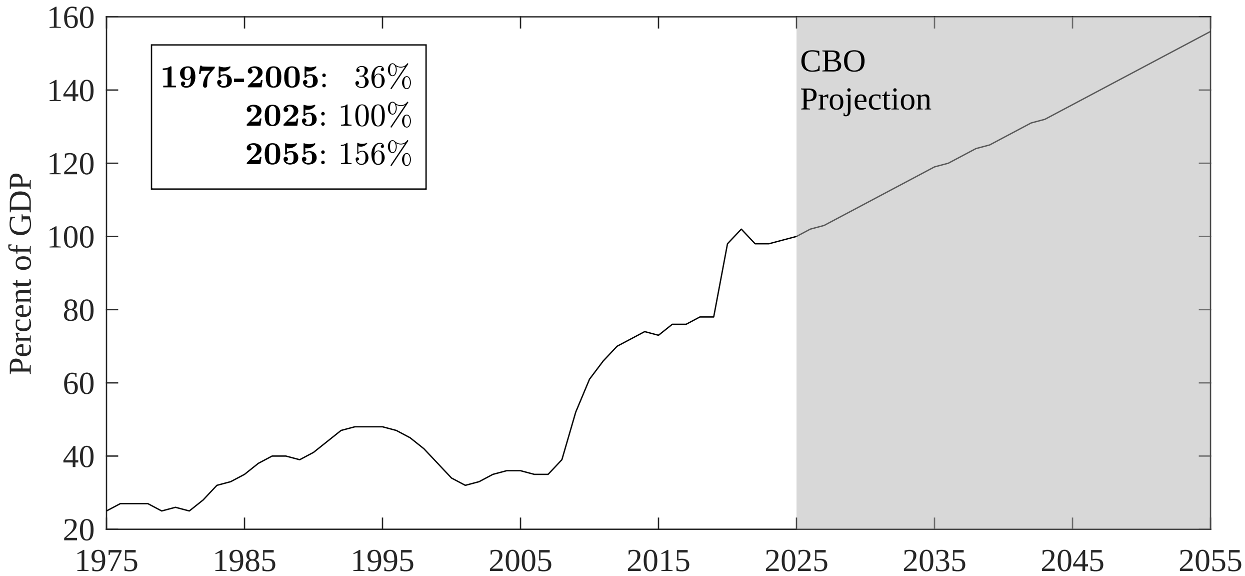
Figure 1: Actual and projected federal debt held by the public



Notes: The projection is from the March 2025 Long-Term Budget Outlook published by the CBO.

1 INTRODUCTION

The US is currently facing a historically high federal debt-to-GDP ratio, with projections from the Congressional Budget Office (CBO) indicating continued fiscal deterioration in the coming decades (see Figure 1). Debt was relatively stable from 1975 to 2005, averaging 36% of GDP. Since then it has risen to 100% of GDP, and by 2055 it is projected to climb to 156% of GDP.

This paper seeks to quantify the effects of federal debt on interest rates. This relationship is not only of academic interest but also central to fiscal sustainability assessments and budget forecasting. In particular, the CBO relies on estimates of how sensitive interest rates are to 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 others to assess the fiscal outlook for the US and its potential economic impact.[1] The relationship between debt and interest rates is also important for

[1]Federal debt can raise interest rates by crowding out private investment, as increased government borrowing replaces or crowds out productive private capital. Both Laubach (2009) and Engen and Hubbard (2004) highlight this mechanism within a neoclassical framework, where higher debt reduces the capital stock and raises the marginal product of capital. Additionally, forward-looking markets may respond to projected fiscal imbalances by demanding higher yields to compensate for future inflation or default risk, particularly when deficits are expected to persist.

setting monetary policy, as changes in debt could influence 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) introduced a novel methodology that aimed to address these identification issues by regressing expected interest rates on projected fiscal variables. Specifically, he used 5-year-ahead projections from the CBO for debt and deficits, which are likely to be less influenced by the business cycle, and nominal interest rates such as the 5-year-ahead, 5-year Treasury rate, which are more reflective of long-term interest rate expectations than current rates. This approach has been followed by several studies, including Chadha et al. (2013), Gamber and Seliski (2019), and Neveu and Schafer (2024), 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 twenty years. The Laubach model seeks to control for stochastic trends by regressing an expected nominal interest rate on a measure of expected inflation. When extending the data sample to the present, we find that the residuals from such a regression now show signs of nonstationarity, raising significant concern about the reliability of the estimates and inference. This development has occurred because of the evolution of real interest rates over time, an issue that was first pointed out by Bauer and Rudebusch (2020) in the context of term structure models. We argue that estimating the model in first differences rather than in levels can address these econometric issues.

Second, we re-estimate the relationship between federal debt and interest rates using our preferred first-difference specification and an updated sample. We find that a 1 percentage point increase in the projected debt-to-GDP ratio is associated with a statistically significant increase of about 3 basis points in the 5-year-ahead, 5-year Treasury rate. Notably, this estimate is larger and more precisely estimated than in recent studies, including Neveu and Schafer (2024), and it is robust across sample periods and the inclusion of additional controls. 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 13-14 basis points. As we will discuss, the larger effect of an increase in the primary deficit closely aligns with the autocorrelation of past primary deficits.

Third, we introduce a new dataset of 10-year-ahead fiscal projections from the CBO. These forecasts, available since 1996, should be even less sensitive to short-run cyclical conditions. Using these projections, we construct expected rates further out on the yield curve and find similar point estimates for the interest rate effects of fiscal projections, but much tighter confidence intervals.

Finally, we decompose the effects of projected debt on nominal interest rates into movements in expected short-term real interest rates and term premia. This is an important advancement over earlier literature, which focused exclusively on long-term nominal interest rates. Using publicly available estimates from term structure models, we find that about three-quarters of the debt-induced rise in nominal rates is attributable to an increase in the term premium rather than expected short-term real rates. 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.

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 thirty years would raise long-term interest rates by about 170 basis points.

Related Literature A large literature has explored the relationship between fiscal policy and interest rates, with a particular focus on how government debt and deficits affect long-term borrowing costs. Laubach (2009) is a key reference point in this literature because of his proposal to use expected interest rates and long-term budget projections to help mitigate endogeneity concerns arising from cyclical dynamics and monetary policy. He found statistically significant effects of federal debt and deficits on long-term interest rates. His methodology has since been widely adopted in academic and policy settings, including studies by Gamber and Seliski (2019) and Neveu and

Schafer (2024), who extended this framework using updated data and an expanded set of controls.

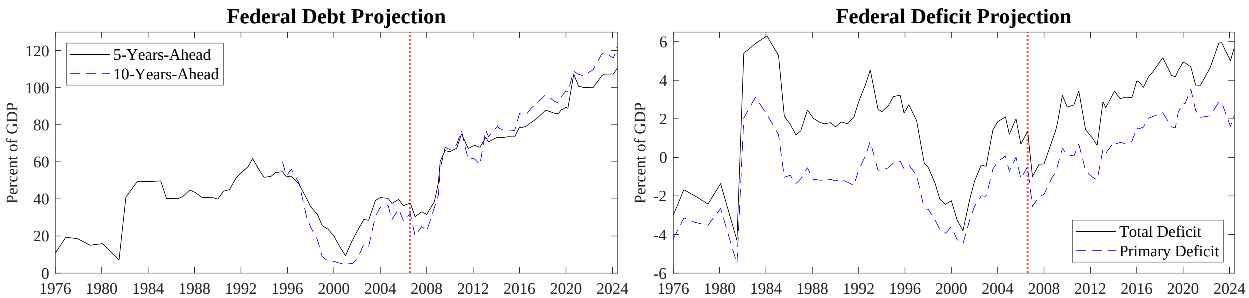
Engen and Hubbard (2004) also examine how federal debt affects US interest rates using a neoclassical framework and various econometric models, including forward-looking and current data. They find that a 1 percentage point increase in the debt-to-GDP ratio raises real interest rates by 3-5 basis points, depending on the model. Their analysis highlights the importance of using debt (rather than deficit) measures and accounting for macroeconomic controls. Other studies, such as Ardagna et al. (2007), Kinoshita (2006), and Gruber and Kamin (2012), consider international data and find heterogeneous effects, with stronger interest rate responses to debt in countries with weaker fiscal credibility. These findings support the idea that markets respond not just to debt levels, but also to their perceived sustainability.

More recent work has used high-frequency identification methods to provide new insights into the asset pricing effects of fiscal policy. Gomez Cram et al. (2025) use high-frequency event studies around CBO cost estimate releases to show that fiscal news—particularly large projected deficit increases—raises term premia. Similarly, Phillot (2025) and Wiegand (2025) document significant effects of fiscal announcements on term premia. These findings complement earlier studies by showing that the term premium, rather than expected short-term real rates, account for much of the interest rate response to fiscal policy. Our paper contributes to this evolving literature by decomposing nominal interest rate responses to changes in forward-looking fiscal projections into term premia and expected short rate responses, while addressing concerns around nonstationarity.

2 Econometric Issues

2.1 Framework and Data Our objective is to determine the effects of federal debt on long-term interest rates. It is difficult to isolate the effects of 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 rates, creating a seemingly negative relationship. To help address this concern, Laubach (2009) uses long-horizon expectations of interest rates

Figure 2: Long-term federal debt and deficit projections



Notes: The dashed vertical line represents the last data point in the Laubach (2009) sample. The horizontal axis denotes the fiscal year in which the projection was made by the CBO. Unless specified otherwise, the projections are for 5-years-ahead.

and federal debt or deficits. The analysis is based on the following regression model:

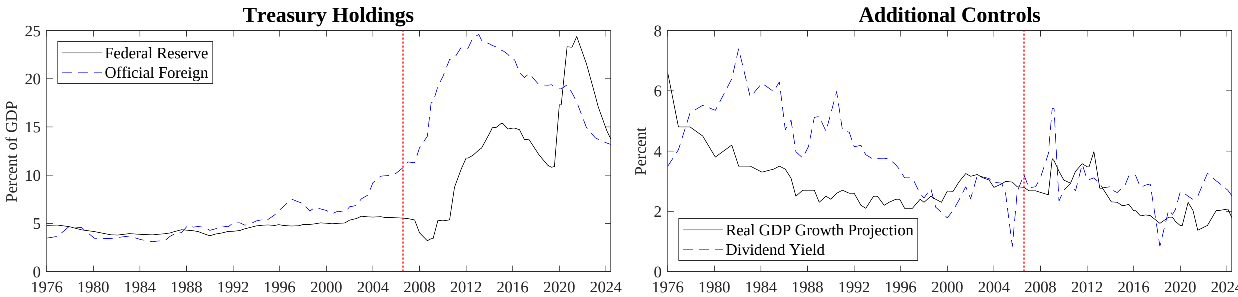
$$E_t i_{t+k} = \beta_0 + \beta_1 E_t f_{t+k} + \beta_2 E_t \pi_{t+k} + \beta_3 u_t + \varepsilon_t, \tag{1}$$

where $E_t i_{t+k}$ is the expected nominal interest rate k-years ahead, $E_t \pi_{t+k}$ is the expected inflation rate k-years ahead, $E_t f_{t+k}$ is the expected fiscal position (federal debt or deficit) k-years ahead, and u_t are additional 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.

Our baseline results use the 5-year-ahead, 5-year Treasury rate (5y5y) as the dependent variable, but we also report results for other 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). To control for the effect of inflation expectations on long-term nominal interest rates, we need a measure of inflation expectations of matching maturity. 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.[2]

[2]PTR is based on three sources. Through 1981Q1 it is constructed using the method in Kozicki and Tinsley (2001). From 1981Q2 to 1991Q1 it is based on the Hoey survey. Since 1991Q2, the source is the Survey of Professional Forecasters. Until 2007 it uses forecasts of CPI inflation with an adjustment that accounts for the average difference between CPI and PCE inflation rates. PCE inflation forecasts have been used since they became available in 2007.

Figure 3: Additional independent variables



Notes: The dashed vertical line represents the last data point in the Laubach (2009) sample. The real GDP growth projection (GNP growth before 1992) is for 5-years-ahead and the horizontal axis denotes the fiscal year in which the projection was made by the CBO. For other variables, the horizontal axis denotes the calendar year.

Our fiscal variables include the (typically) semiannual CBO projections of federal debt 5-years-ahead and 10-years-ahead, as well as projections of total and primary federal deficits 5-years-ahead. All of the projections are measured as a percent of GDP (or GNP before 1992) and plotted in Figure 2. The CBO's projections are, by law, based on fiscal policies that are in effect at the time of the forecast. We extend the sample period considered in Laubach (2009) to June 2024. The additional data captures large increases in federal debt and deficits that correspond to the fiscal actions taken during the Great Recession and Covid-19 pandemic. Appendix A provides more information about these projections, as well as the sources of the other data used in this study.

Laubach (2009) proposes using two other control variables that are shown in the right panel of Figure 3. The first is the 5-year-ahead CBO projection for real GDP growth (or GNP growth before 1992), which is as a proxy for long-run (consumption) growth expectations that affect the real interest rate via the 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.

Finally, following Gamber and Seliski (2019) and Neveu and Schafer (2024) we include Federal Reserve and foreign official holdings of US Treasuries as additional controls. Both variables are quarterly, available from the Flow of Funds, and converted to shares of GDP. As shown in the left panel of Figure 3, these variables sharply increased after the Great Recession and can help account for some of the demand-side factors that influenced interest rates independently of the level of debt. The literature finds that not including these controls leads to large, negative values of β_1, inconsistent with economic intuition about the impacts of federal debt on interest rates.

2.2 COINTEGRATION

Laubach (2009) found evidence that nominal rates and inflation expectations are cointegrated. The results from unit root tests also led him to treat his fiscal variables as stationary. We reinvestigate these conclusions and provide evidence that the statistical properties of the relevant time series have changed over the last twenty years. We first show that regressing a nominal interest rate on expected inflation, as in Equation 1, is no longer sufficient to properly deal with the stochastic trends in those variables. The nonstationary residual calls into question the regression model, which is specified in levels. Second, there is no longer evidence that the control variables (e.g., projected debt) are stationary. These two findings suggest that a regression model where the variables enter in first-differences rather than in levels is more appropriate.

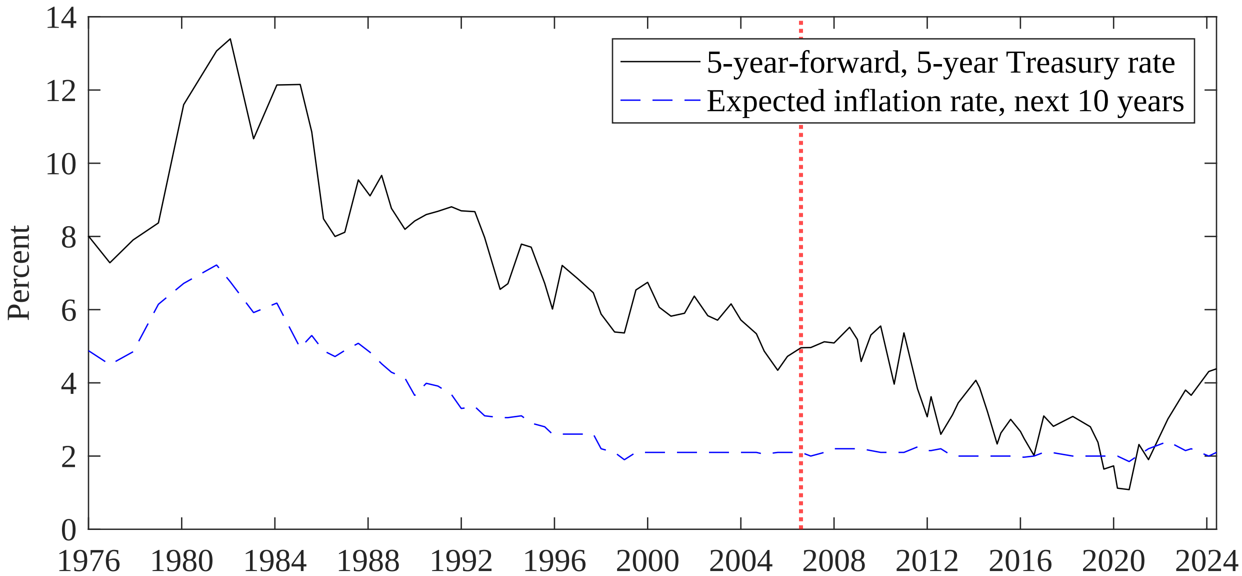
To motivate the first part of our analysis, Figure 4 plots the 5y5y rate and expected inflation. Both trended down over time, but the 5y5y rate exhibited considerable variation even after expected inflation leveled out in the late 1990s. This points to movements in expected real rates, consistent with estimates in the literature (see, e.g., D'Amico et al., 2018; Holston et al., 2017; Laubach and Williams, 2003), and raises concerns about whether regressing the 5y5y rate on expected inflation is sufficient to deal with the stochastic 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 using dynamic OLS (see Stock and Watson, 1993) to estimate

$$E_t i_{t+5}^{(5)} = \alpha_0 + \alpha_1 E_t \pi_{t+10} + \varepsilon_t, \tag{2}$$

where $E_t i_{t+5}^{(5)}$ is the 5y5y Treasury rate and $E_t \pi_{t+10}$ is the perceived target rate of inflation. The sample is from 1976Q1 to 2024Q2. We include 3 leads and lags of $\Delta E_t \pi_{t+10}$ based on the Akaike

Figure 4: Comovement between nominal interest rates and expected inflation



Notes: The dashed vertical line represents the last data point in the Laubach (2009) sample.

Information Criterion. We find that the residuals, which are plotted in Appendix B, are highly autocorrelated with a first-order autocorrelation of 0.91. An Augmented Dickey-Fuller unit root test on the residuals fails to reject the null hypothesis of a unit root.

To formally test for cointegration between the 5y5y rate and expected inflation, we apply the test developed by Phillips and Ouliaris (1990). We consider two samples: the full sample from 1976Q1 to 2024Q2 and the Laubach (2009) sample from 1976Q1 to 2006Q3. For these two samples, we either use all available quarterly data or the subset of observations that coincide with the CBO data releases. The results are shown in Table 1. Using the Laubach sample with quarterly data, we can reject the null hypothesis of no cointegration with a p-value of 0.03, and we reach a similar conclusion when using the semiannual data that coincides with the CBO releases. These findings are consistent with those reported in Laubach (2009) and support his use of the regression model in levels. However, changes in the data over the last twenty years have led to the opposite results. We can no longer reject the null hypothesis of no cointegration, with a p-value of 0.24 using quarterly data and a p-value of 0.61 using the CBO release dates.

Table 1: Phillips-Ouliaris cointegration test

	Full Sample (1976-2024)			Laubach Sample (1976-2006)		
Frequency	t-stat	5% cv	p-value	t-stat	5% cv	p-value
Quarterly Data	−2.62	−3.37	0.24	−3.65	−3.39	0.03
CBO Releases	−1.81	−3.40	0.61	−3.40	−3.46	0.06

Notes: Test based on a regression of the 5-year-ahead, 5-year Treasury rate on expected inflation.

Table 2: Augmented Dickey-Fuller unit root test

	Full Sample (1976-2024)			Laubach Sample (1976-2006)		
Variable	t-stat	5% cv	p-value	t-stat	5% cv	p-value
Federal Debt	−0.51	−2.89	0.88	−2.15	−2.92	0.23
Total Deficit	−2.56	−2.89	0.11	−2.46	−2.92	0.13
Primary Deficit	−2.45	−2.89	0.13	−2.77	−2.92	0.07
Fed Holdings	−1.22	−2.89	0.64	−0.97	−2.92	0.74
Foreign Holdings	−1.10	−2.89	0.69	0.75	−2.92	0.99

Notes: The debt and deficit are 5-year-ahead projections by the CBO and expressed as a percent of GDP (or GNP before 1992). Fed and foreign holdings of Treasury securities are realized values expressed as a percent of GDP.

2.3 STATIONARITY Next we examine the stationarity of key independent variables, including the CBO's 5-year-ahead federal debt, total deficit, and primary deficit projections, Federal Reserve holdings of US Treasuries as a percent of GDP, and foreign official holdings of US Treasuries as a percent of GDP. For each variable, we run an Augmented Dickey-Fuller test using the full sample and the Laubach sample, both with the observations that coincide with the CBO data releases. We specify one lag given the irregular spacing of the data, but the results are robust to longer lags.

Table 2 reports the results. The test fails to reject the null hypothesis of a unit root in the debt projection for both samples, although the p-value is larger over the full sample. The test is also unable to reject the null hypothesis of a unit root for both Federal Reserve and foreign official holdings of US Treasuries. There is only weak evidence that the deficit projections are stationary, as we can reject the null of a unit root at a 10% level only for the primary deficit during the Laubach sample.

2.4 DISCUSSION The cointegration and unit root test results raise concerns about bias in the coefficient estimates and faulty inference about their statistical significance when the regression model is specified in levels. These concerns could be addressed if one had the necessary set of control variables to explain movements in the expected real interest rate. However, that task is exceedingly difficult given the wide-range of hypotheses put forward to explain movements in the expected real rate, 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 considering a regression model where the variables enter in first-differences rather than in levels.

3 INTEREST RATE RESPONSE TO CHANGES IN THE FEDERAL BUDGET

Our baseline regression model is given by

$$\Delta E_t i^{(5)}_{t+5} = \beta_0 + \beta_1 \Delta E_t f_{t+5} + \beta_2 \Delta E_t \pi_{t+10} + \beta_3 \Delta \text{Fed}_t + \beta_4 \Delta \text{Foreign}_t + \varepsilon_t,$$

where $\Delta E_t i^{(5)}_{t+5}$ is the change in the 5y5y Treasury rate, $\Delta E_t f_{t+5}$ is the change in the 5-year ahead fiscal projection (debt, total deficit, or primary deficit), $\Delta E_t \pi_{t+10}$ is the change in the perceived target rate of inflation, ΔFed_t is the change in Federal Reserve Treasury holdings, and $\Delta\text{Foreign}_t$ is the change in foreign official Treasury holdings. All regressors except inflation enter as a percent of GDP. We also consider a model that includes the change in the 5-year-ahead projection for real GDP growth (real GNP growth before 1992) and the change in the dividend yield.

3.1 BASELINE ESTIMATES Table 3 presents the results. The rows show the coefficients and robust standard errors for each variable. Our primary interest is the interest rate response to a change in the federal budget (β_1). We report results for federal debt in columns 2 and 3, the total deficit in columns 4 and 5, and the primary deficit in columns 6 and 7. A 1 percentage point increase in the debt-to-GDP ratio generates a 3-3.2 basis point increase in the 5y5y rate. The coefficients are statistically significant with p-values below 0.02 and more precisely estimated than recent estimates.

Table 3: Baseline estimates of the interest rate effects of changes in the federal budget

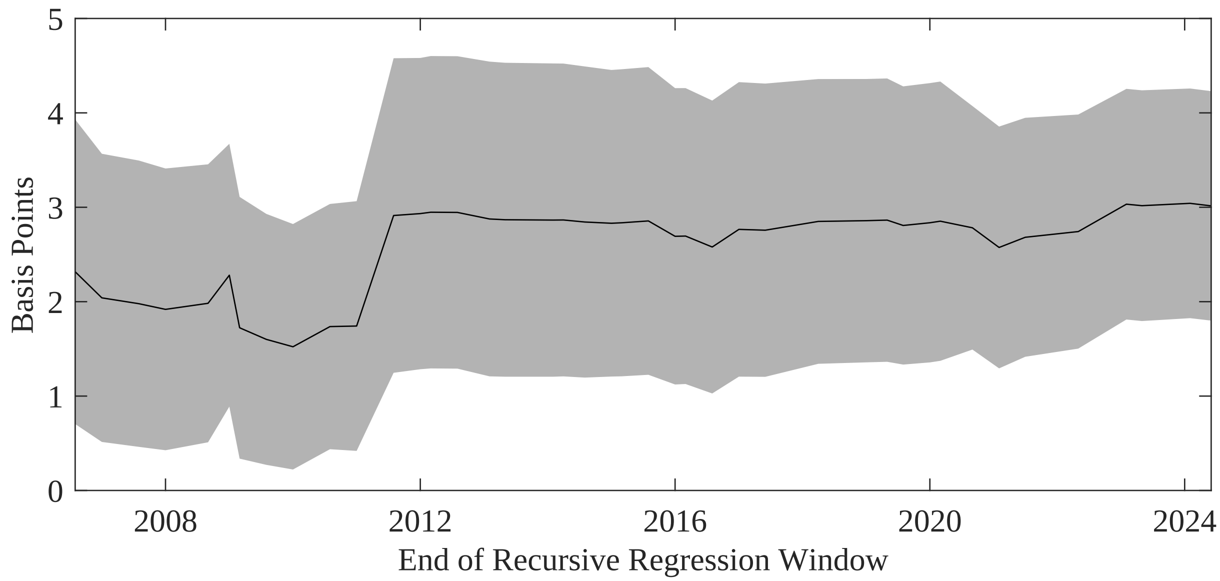
	5-Year-Ahead Budget Projection (Percent of GDP)					
	Federal Debt		Total Deficit		Primary Deficit	
Fiscal Variable (β_1)	3.20 (1.22)	3.01 (1.22)	16.82 (5.91)	16.76 (7.18)	13.98 (6.37)	13.01 (7.32)
Expected Inflation (β_2)	131.95 (53.23)	125.98 (45.70)	128.90 (42.28)	123.61 (43.09)	125.67 (50.01)	119.41 (50.51)
Fed Holdings (β_3)	−4.31 (4.97)	−3.80 (4.58)	−1.81 (4.72)	−1.46 (4.60)	−2.90 (4.91)	−2.44 (5.15)
Foreign Holdings (β_4)	−26.74 (10.11)	−26.51 (11.68)	−24.68 (10.44)	−25.79 (11.15)	−25.26 (10.82)	−25.61 (11.84)
Expected Real GDP (β_5)	–	−14.00 (22.28)	–	0.49 (20.38)	–	−9.24 (22.17)
Dividend Yield (β_6)	–	10.05 (14.64)	–	9.29 (13.77)	–	10.56 (14.93)

Notes: The estimates are based on a regression of the 5-year-ahead, 5-year Treasury rate on projections of the federal budget 5-years-ahead. The sample is from January 1976 to June 2024. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.

We also consider the 5-year-ahead, 10-year Treasury rate (5y10y), which is also commonly used in the literature. As shown in Appendix B, the results are similar to those from our baseline model: a 1 percentage point increase in the debt-to-GDP ratio generates a 3.3-3.5 basis point increase in the 5y10y rate. These estimates are over 50% larger than the 2 basis point estimate in Neveu and Schafer (2024). The coefficients are statistically significant with p-values below 0.01.

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 16.8 basis point increase in the 5y5y rate. One potential concern is that the total deficit is a function of interest rates, since it includes (net) interest spending on the debt. Our results for the primary deficit-to-GDP ratio, consistent with those in Laubach (2009), show that excluding interest spending has little effect on the estimates. A 1 percentage point increase in the primary deficit-to-GDP ratio is associated with a 13-14 basis point increase in 5y5y rate. In all cases, the coefficients are significant at the 10% level or higher.

Figure 5: Recursive estimates of the interest rate effects of changes in the federal budget



Notes: Data points are based on a regression of the 5-year-ahead, 5-year Treasury rate on the 5-year-ahead projection for federal debt and all controls. Observations are recursively added to the sample period. The horizonal axis shows the end point of the sample. The starting point is January 1976 for all regressions. The shaded region shows 95% confidence intervals.

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 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 deficit was 0.73. This value would suggest that a 1 percentage point increase in the primary deficit-to-GDP ratio leads to a $1/(1-0.73) = 3.7$ basis point increase in the debt-to-GDP ratio, in line with our estimates.[3]

One may be interested in knowing whether the effect of federal debt on long-term interest

[3] Laubach (2009) estimates that the coefficient on the deficit is about 6 times larger than the coefficient on debt. For his sample (1976-2006), the autocorrelation of the deficit is 0.83, consistent with his results. The decline in the persistence of the deficit over the last twenty years explains why we find a smaller coefficient ratio.

rates is stable over time. To answer this question, we estimate the model with all controls using a recursive window. We begin with the Laubach sample from January 1976 to August 2006 and then recursively add one observation at a time until the full sample is estimated, providing a clear view of the marginal impact of recent data. Figure 5 shows the estimated coefficient for each sample with 95% confidence intervals. We find that the coefficient is remarkably stable, hovering around 3 basis points and never falling much below 2 basis points. One might be concerned that the projections at the beginning of the sample are less reliable, so we also considered a backward-looking recursive window in Appendix B. We started with a sample from January 1996 to June 2024 and then added observations at the beginning of the sample until the full sample was estimated. Once again, we find stable estimates that are statistically significant at a 5% level or higher in all samples.

3.2 CONSIDERING LONGER HORIZON PROJECTIONS To further reduce the potential influence of short-run cyclical factors, we collect 10-year-ahead CBO projections for federal debt and deficits, which have not been previously used in the literature. These projections are only available starting in August 1995 but still leave a decent sample size for our analysis.[4] To align with the 10-year projections, we also construct a 10-year-ahead, 5-year Treasury rate (10y5y).

Using these new series, we regress the 10-year-ahead, 5-year Treasury rate on 10-year-ahead projections of the federal budget (debt, deficit, and primary deficit). As a benchmark, we also rerun our baseline regression of the 5-year-ahead, 5-year Treasury rate on 5-year-ahead projections using the same sample. Table 4 presents the results. The estimates using our baseline 5-year horizon mirror the results in Table 3. When extending the horizon to 10 years, the estimated effects of the federal budget on interest rates is little changed, but the coefficients 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 10-year-ahead, 5-year Treasury rate with a 95% confidence interval that ranges from 2.0 to 3.7 basis points. These tighter estimates are in line with intuition that longer horizons remove some of the noise present in the shorter-run projections.

[4] Our full sample from January 1976 to June 2024 based on a 5-year horizon has 94 observations. The sample based on the 10-year horizon has 63 observations. For comparison, the sample in Laubach (2009) had 53 observations.

Table 4: Interest rate effects of changes in the federal budget using longer horizons

	Federal Debt		Total Deficit		Primary Deficit	
	5y5y	10y5y	5y5y	10y5y	5y5y	10y5y
Fiscal Variable (β_1)	3.52 (1.61)	2.84 (0.89)	23.49 (9.47)	21.78 (6.56)	21.69 (12.66)	23.40 (9.90)
Expected Inflation (β_2)	81.16 (64.91)	48.27 (58.78)	62.52 (69.53)	39.96 (50.58)	71.14 (73.19)	52.50 (57.09)
Fed Holdings (β_3)	−4.89 (5.25)	−3.02 (4.58)	−2.03 (4.71)	−2.31 (4.83)	−3.77 (5.13)	−3.55 (5.02)
Foreign Holdings (β_4)	−17.56 (10.46)	−13.93 (7.91)	−17.56 (9.97)	−14.16 (7.93)	−17.19 (11.04)	−12.72 (8.34)
Expected Real GDP (β_5)	−18.93 (25.93)	2.47 (22.48)	1.04 (26.30)	13.15 (25.80)	−5.49 (27.80)	6.00 (26.93)
Dividend Yield (β_6)	−8.28 (13.72)	3.54 (9.41)	−6.86 (14.65)	1.24 (10.67)	−8.37 (14.78)	0.29 (10.67)

Notes: The estimates in the 5y5y columns are based on a regression of the 5-year-ahead, 5-year Treasury rate on projections of the federal budget 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 the federal budget 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 June 2024. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.

3.3 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 nominal rates is due to term premia vs. shifts in expected short rates. To determine this decomposition, we rely on estimates from publicly available term structure models.

Our main set of results is based on the model in 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, the real term premium, expected inflation, and the inflation risk premium. We refer to the sum of the latter three components as the term premium component of the model. We focus on the DKW model for two reasons. First, it provides estimates for short rates and the term premium 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.

Table 5: Decomposition of the estimates of the federal budget on long-term interest rates

	5y5y	DKW r*	DKW tp	10y	ACM tp
Federal Debt	3.52	1.01	2.43	3.04	2.50
	(1.61)	(0.49)	(1.18)	(1.37)	(1.39)
Total Deficit	23.49	6.52	16.04	19.48	17.62
	(9.47)	(3.04)	(6.89)	(8.69)	(7.60)
Primary Deficit	21.69	5.68	15.08	16.66	17.66
	(12.66)	(3.77)	(9.36)	(11.02)	(10.45)

Notes: The rows are projections of the federal budget 5-years-ahead as a percent of GDP (or GNP before 1992). The columns are the 5-year-ahead, 5-year Treasury rate (5y5y), the expected real short rate (DKW r*) and term premium (DKW tp) from the D'Amico et al. (2018) model, the 10-year Treasury yield (10y), and the term premium (ACM tp) from the Adrian et al. (2013) model. The estimates are based on a regression of the interest rate or term premium on the projections of the federal budget. The sample is from August 1995 to June 2024. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.

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 (DKW r*) and the term premium (tp). The DKW estimates become available in 1983, so we estimate our models on data from August 1995 to June 2024 to align with the sample used in Table 4. Using additional data does not significantly affect the point estimates but produces tighter confidence intervals.

Table 5 shows the estimated coefficients and robust standard errors on projections of the federal budget (debt, deficit, and primary deficit) 5-years-ahead. The responses of the expected short rate and term premium roughly sum to the response of the 5y5y rate. We find that about 70% of the change in the 5y5y rate comes through the term premium. In particular, a 1 percentage point increase in the debt-to-GDP ratio raises the term premium by 2.4 basis, compared to a 1 basis point increase in the expected real short rate. The results for the total and primary deficit are similar.

We also produce results using the model in Adrian et al. (2013), which we will refer to as ACM. This model decomposes the 10-year Treasury rate into expected average *nominal* short rates and a term premium component. Since we do not have a direct estimate of the expected real short rate, we estimate our regression model using the 10-year Treasury and the term premium, and infer the effects of the real rate based on the difference between the two coefficient estimates. These results imply that over 80% of the estimated effect of federal debt on interest rates are driven by the term premium, in line with our findings based on the DKW model.[5]

Our findings are consistent with recent studies that use alternative methodologies to identify the effects of fiscal policy on yields and term premia. Gomez Cram et al. (2025) show that CBO cost estimate releases have a significant impact on Treasury term premia, particularly when the estimates signal large increases in future deficits. Employing a high-frequency event study approach, they find that markets respond to such fiscal news by repricing long-term debt. Following large negative budget proposals, approximately 60% of the rise in long-term nominal yields is attributable to increases in the nominal term premium, rather than changes in expected future short rates. Their results suggest that investors perceive a substantial portion of projected fiscal expansions is unbacked, thereby demanding greater compensation for duration and inflation risk. In our baseline analysis using the DKW term premium, we find that roughly three-quarters of the long-term interest rate response is accounted for by movements in term premia. Other high-frequency approaches, including Wiegand (2025) and Phillot (2025), corroborate these findings by documenting sizable and immediate effects of fiscal news on Treasury term premia, underscoring the bond market's sensitivity to perceived fiscal sustainability.

3.4 DISCUSSION Our estimates indicate that a 1 percentage point increase in the debt-to-GDP ratio raises nominal interest rates by approximately 3 basis points, with about three-quarters of that increase attributable to higher term premia. An important question is what these estimates imply for future interest rates. According to the most recent CBO projections, the US debt-to-GDP ratio is expected to 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 projected rate of around 6% in 2055. Of this increase, approximately

[5] We also investigated the term structure model of Christensen and Rudebusch (2012), but their estimates are not available until 1998. Using the available data, the results were similar to those implied by the DKW and ACM models.

120 basis points would stem from higher term premia, with the other 50 basis points reflecting an increase in expected short-term real rates.

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

4 CONCLUSION

This paper revisits the relationship between federal debt and interest rates. A common approach in the literature is to regress an expected interest rate on a 5-year-ahead projection of federal debt. We revisit and extend this influential approach along several dimensions. First, we demonstrate that econometric issues related to nonstationarity have become more pronounced over the past twenty years. We propose using a model in first differences instead of levels. Second, we re-estimate the relationship between federal debt and expected interest rates, expanding the sample to include the most recent CBO projections of the debt-to-GDP ratio. Our preferred specification indicates that a 1 percentage point increase in the debt-to-GDP ratio raises the 5-year-ahead, 5-year Treasury rate by 3 basis points. Third, we introduce a new dataset of 10-year-ahead fiscal projections and find similar point estimates but much tighter confidence intervals. Finally, we decompose the effects of projected debt on nominal interest rates into movements in expected short-term real interest rates and term premia. About three-quarters of the increase in interest rates is driven by term premium rather than expected short-term real rates. Overall, our findings highlight a robust and economically significant response of long-term interest rates to expected future fiscal imbalances.

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A DATA SOURCES

We use the following time-series provided by Haver Analytics:

1. **US Treasury 15-Year zero-coupon yield**
   End of period, monthly, percent (FYCCZFE@USECON)
2. **US Treasury 10-Year zero-coupon yield**
   End of period, monthly, percent (FYCCZAE@USECON)
3. **US Treasury 5-Year zero-coupon yield**
   End of period, monthly, percent (FYCCZ5E@USECON)
4. **Monetary authority Treasury securities**
   Not seasonally adjusted, end of period, quarterly, billions (OA71TRE3@FFUNDS)
5. **Treasury Securities held by foreign official institutions**
   Not seasonally adjusted, end of period, quarterly, millions (FLPAD@FFUNDS)
6. **Gross Domestic Product**
   Seasonally adjusted annual rate, quarterly, billions (GDP@USECON)
7. **Domestic nonfinancial corporate dividends**
   Seasonally adjusted annual rate, quarterly, billions (FR10ACO5@FFUNDS)
8. **Market value of equity shares held by households and nonprofit organizations**
   Not seasonally adjusted, end of period, quarterly, billions (PA15SMV5@FFUNDS)
9. **DKW expected average real short rate, 5-10 years ahead**
   End of period, monthly, percent (DKW5RSRE@USECON)

10. **DKW real term premium, 5-10 years ahead**
    End of period, monthly, percent (DKW5RTPE@USECON)
11. **DKW expected inflation, 5-10 years ahead**
    End of period, monthly, percent (DKW5EIE@USECON)
12. **DKW inflation risk premium, 5-10 years ahead**
    End of period, monthly, percent (DKW5IRPE@USECON)
13. **ACM 10-year term premium**
    End of period, monthly, percent (FACM10T@USECON)

We also use the following data sources:

1. **FRB/US 10-year expected inflation**, quarterly, percent. Variable `PTR` in `histdata.txt` from the FRB/US data package.
2. **CBO Budget and Economic Outlooks**
   January 1976, December 1976, December 1977, January 1979, February 1980, July 1981, February 1982, February 1983, February 1984, February 1985, August 1985, February 1986, August 1986, January 1987, August 1987, February 1988, August 1988, January 1989, August 1989, January 1990, July 1990, January 1991, August 1991, January 1992, August 1992, January 1993, September 1993, January 1994, August 1994, January 1995, August 1995, December 1995, May 1996, January 1997, September 1997, January 1998, August 1998, January 1999, July 1999, January 2000, July 2000, January 2001, August 2001, January 2002, August 2002, January 2003, August 2003, January 2004, September 2004, January 2005, August 2005, January 2006, August 2006, January 2007, August 2007, January 2008, September 2008, January 2009, March 2009, August 2009, January 2010, August 2010, January 2011, August 2011, January 2012, March 2012, August 2012, February 2013, May 2013, February 2014, April 2014, August 2014, January 2015, March 2015, August 2015, January 2016, March 2016, August 2016, January 2017, June 2017, April 2018, January 2019, May 2019, August 2019, January 2020, March 2020, September 2020, February 2021, July 2021, May 2022, February 2023, May 2023, February 2024, June 2024

For each report, we collect the following 5-year-ahead projections:

- Debt held by the public
- Total deficit (−)
- Net interest spending
- Fiscal year GDP (or GNP before 1992)

We also collect 10-year-ahead projections from each report after they became available in August 1995. The primary deficit is computed by adding net interest spending to the total deficit. The debt, total deficit, and primary deficit are divided by fiscal year GDP (or GNP before 1992). We manually compute the shares rather than using their projections, so the ratios are more precise.

Prior to the February 1984 report, some of the data is not provided and must be inferred. When fiscal year GNP is unavailable, we use the projection for the total deficit as a share of GNP. We then compute fiscal year GNP from that share in order to determine the debt and primary deficit as a share of GNP. When the debt projection is unavailable, it is computed by adding the cumulative total deficit over a 5-year horizon to the actual level of debt in the preceding fiscal year. When the total deficit is unavailable, it is computed as the difference between total revenues and total outlays. In January 1976, neither fiscal year GNP nor the fiscal shares are provided, so we use the projection for calendar-year GNP, which tends to equal fiscal year GNP over a 5-year horizon.

Finally, we collect CBO projections for real GDP growth, 5-years-ahead and 10-years-ahead when available. Many of the recent reports do not include fiscal year real GDP. However, the CBO maintains an achieve for all the projections since January 2000, available at https://www.cbo.gov/data/budget-economic-data under the header "Historical Data and Economic Projections". For each of these projections, we compute growth rates using the level of fiscal year GDP. In situations when the economic projection is not updated when a new Budget and Economic Outlook is released, we assume the economic projection has not changed from the latest forecast. For example, an update to the Budget and Economic Outlook was released in May 2023, but economic projections were not updated until July 2023. In this case, we assume the May 2023 real GDP projection is the same as it was in the most recent projection provided in February 2023. Prior to January 2000, projections of fiscal year real GDP growth (GNP growth before 1992) are taken directly from each Budget and Economic Outlook report. We use the projections of calendar year GNP growth in the few instances before 1985 when fiscal year GNP growth was not provided.

Data Transformations

1. **5-year-ahead, 5-year Treasury rate ($5y5y$)**

$$5y5y_t = 100 \times \left(\left(\frac{(1 + FYCCZAE_t/100)^{10}}{(1 + FYCCZ5E_t/100)^5} \right)^{1/5} - 1 \right)$$

2. **10-year-ahead, 5-year Treasury rate ($10y5y$)**

$$10y5y_t = 100 \times \left(\left(\frac{(1 + FYCCZFE_t/100)^{15}}{(1 + FYCCZAE_t/100)^{10}} \right)^{1/5} - 1 \right)$$

3. **5-year-ahead, 10-year Treasury rate ($5y10y$)**

$$5y10y_t = 100 \times \left(\left(\frac{(1 + FYCCZFE_t/100)^{15}}{(1 + FYCCZ5E_t/100)^5} \right)^{1/10} - 1 \right)$$

4. **Dividend yield**

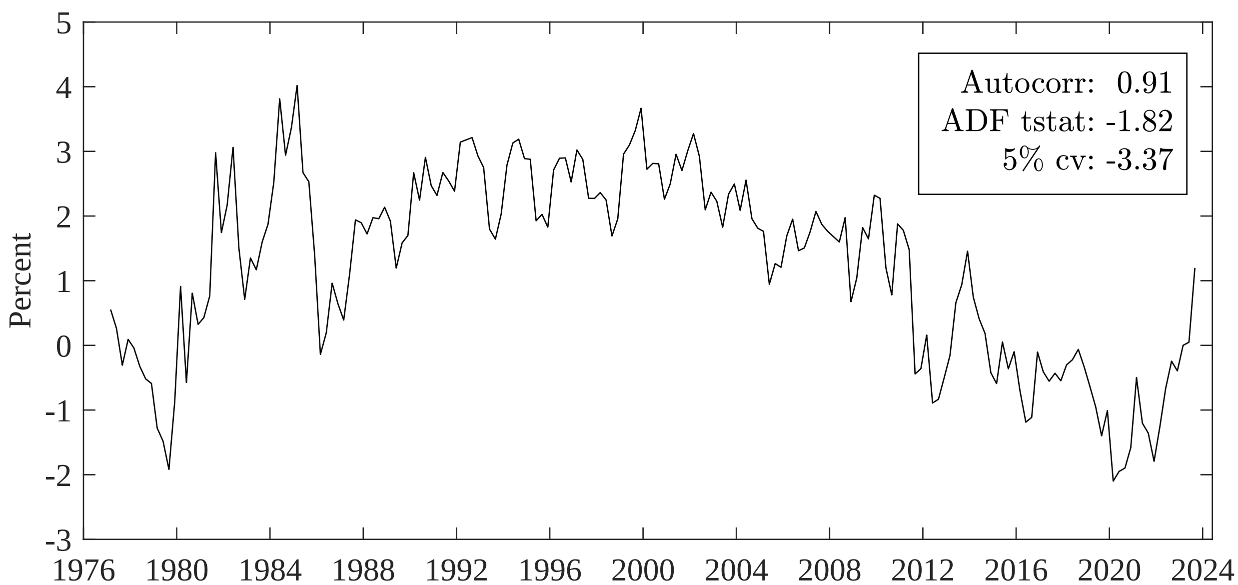
$$divyld_t = 100 \times \frac{FR10ACO5_t}{PA15SMV5_t}$$

5. **DKW total term premium**

$$dkw_t^{tp} = DKW5RTPE_t + DKW5EIE_t + DKW5IRPE_t$$

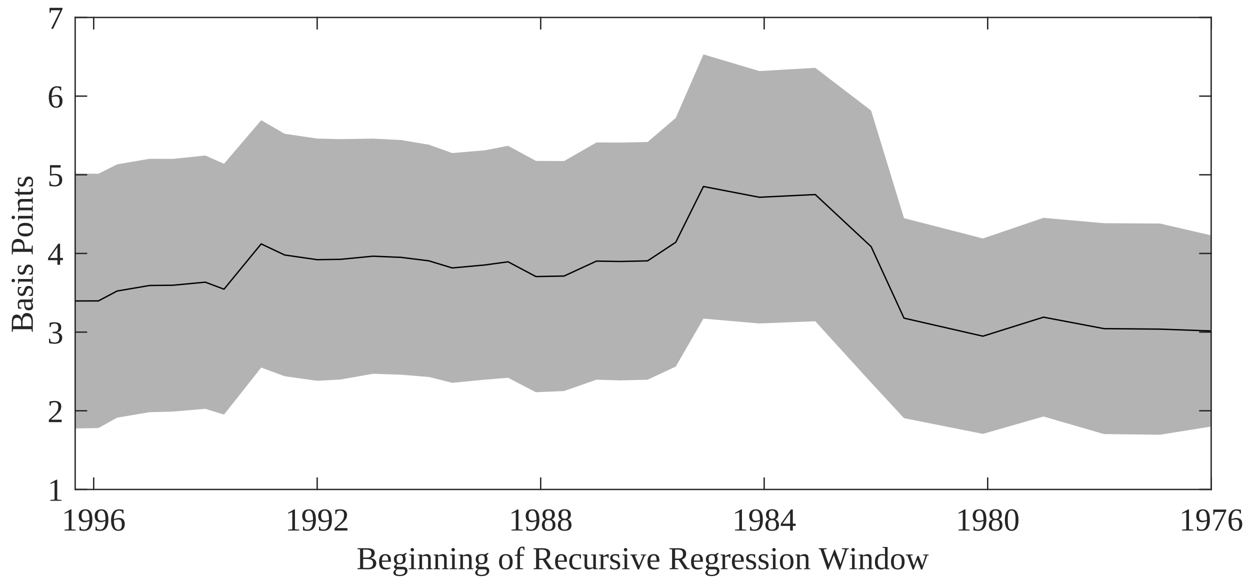
B Additional Econometric Results

Figure 6: Dynamic OLS residuals



Notes: The residual is from a cointegration regression of the 5-year-ahead, 5-year Treasury rate on expected inflation. The critical values are from Table IIa in Phillips and Ouliaris (1990).

Figure 7: Backward recursive effects of federal debt on interest rates



Notes: Data points are based on a regression of the 5-year-ahead, 5-year Treasury rate on the 5-year-ahead CBO projection for federal debt and all controls. Observations are recursively added to the sample period. The horizonal axis shows the end point of the sample. The starting point is January 1976 for all regressions. The shaded region shows 95% confidence intervals.

Table 6: Alternative estimates of the federal budget on long-term interest rates

	5y5y	5y5y	5y10y	5y10y
Federal Debt	3.20 (1.22)	3.01 (1.22)	3.50 (0.94)	3.29 (1.05)
Total Deficit	16.82 (5.91)	16.76 (7.18)	17.92 (4.47)	17.84 (5.57)
Primary Deficit	13.98 (6.37)	13.01 (7.32)	16.15 (5.15)	15.30 (6.21)
Extra Controls	No	Yes	No	Yes

Notes: The rows are projections of the federal budget 5-years-ahead as a percent of GDP (or GNP before 1992). The 5y5y columns use the 5-year-ahead, 5-year Treasury rate and the 5y10y columns use the 5-year-ahead, 10-year Treasury rate. The estimates are based on a regression of the interest rate on the projections of the federal budget. The baseline model includes expected inflation as well as Federal Reserve and foreign holdings of Treasury securities as a share of GDP. The additional 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 June 2024. The estimated coefficients are in basis points. The values in parentheses are robust standard errors.