# Pre-Refunding Announcement Gains in U.S. Treasurys*

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**Abstract**

Each quarter, the U.S. Department of the Treasury unveils its refunding plan, outlining the size and maturity composition of Treasury issuances for the upcoming quarters. We document substantial positive returns on long-term Treasurys on the day before these Treasury Refunding Announcements (TRAs), a pattern persisting since the 1990s and intensifying over the last two decades amidst growing Federal deficits. These pre-TRA gains are distinct from known end-of-month pricing effects, account for a sizable portion of annual yield and term premium changes, and cannot be attributed to information leakage or other simultaneous macroeconomic releases. A trading strategy focused solely on these four days per year generates a Sharpe ratio exceeding four. Additionally, pre-TRA gains are more pronounced when they occur within a week following an FOMC announcement, and when the most recent FOMC decision involves no rate change. We show that uncertainty reduction around TRAs is a key mechanism, as pre-TRA returns are directly related to both Treasury market uncertainty and fiscal uncertainty.

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*Refunding overshadows Fed rate hike: In a week in which the FOMC meeting was to be the main event for the Treasury market, the announcement of supply cuts at the refunding clearly dominated trading.*

*—Deutsche Bank, 4 February 2000*

# 1 Introduction

Once per quarter, the U.S. Department of the Treasury releases its refunding plan during the Treasury Refunding Announcements (TRAs). The TRAs contain critical information on the United States' expected borrowing needs for the current quarter and the quarter ahead, which have significant ramifications for fiscal policy, interest rates, and broader financial stability. However, this key fiscal policy event and its impacts on financial markets have been largely overlooked, especially compared to similar monetary policy events such as FOMC meetings.

The TRAs have grown in importance in recent years in light of rising debt and increased debt servicing costs. In response to the Global Financial Crisis and the COVID-19 pandemic, fiscal stimulus measures pushed the debt-to-GDP ratio from 35% in 2007 to over 100% by 2021. This trend is expected to continue, with the Congressional Budget Office projecting ongoing budget deficits. The post-COVID higher interest rate environment and increased Treasury supply have raised borrowing costs for the U.S. government, sparking concerns about fiscal sustainability and its impact on the economy.[1]

The TRAs provide essential insight into government financing strategies and their implications for the financial markets. In contrast to Federal Reserve actions which mainly adjust short-term interest rates, TRAs directly influence the supply of long-term safe assets, a key determinant of term premiums, liquidity conditions, and global capital flows. As such, the TRAs offer a unique vantage point from which to gauge the intersection of fiscal policy and market behavior, particularly with respect to how anticipated government borrowing needs and Treasury supply across maturities

[1]See Jiang et al. (2023) for a detailed discussion on fiscal capacity and its impact on the economy.

influence the pricing of Treasury securities.

This paper directly studies Treasury bond return patterns around TRAs and uncovers a striking and persistent pattern: Treasury bonds earn substantial positive returns on the day before TRAs. This effect is increasing with bond maturity and has intensified in recent decades amid growing fiscal uncertainty. A simple trading strategy consisting of going long Treasurys on the four routinely scheduled pre-TRA days per year yields a Sharpe ratio above four for each of the Treasury bonds with maturity of at least two years. In contrast, being long Treasurys on all other days has a Sharpe ratio of less than one. This is because Treasurys earn a significantly higher return on pre-TRA days, even though their standard deviation of returns on pre-TRA days is comparable to or even lower than its standard deviation on non-pre-TRA days.


**Figure 1** Cumulative Returns of 10-Year Treasurys Around Treasury Refunding Announcements

**Figure 1** offers a graphical representation of the pre-TRA gains by charting the intraday cumulative returns on 10-year Treasurys from the start of New York trading hours on the pre-TRA

day. There is a sharp increase in bond prices starting shortly after trading begins, leading to a sizable gain of over 12 basis points (bps) by the day's close. This elevated price level is then maintained throughout the announcement day and into the subsequent post-announcement day. In contrast, on non-TRA days, the price increase is near zero on average.

The magnitude of the pre-TRA return is monotonically increasing with bond maturity. At the shorter end, we find that 2-year Treasury Bill returns are about twice as high on pre-TRA days compared to the unconditional average. Moving up the maturity spectrum, 10-year Treasury Notes have a return of 12.6 basis points on pre-TRA days compared to 1.8 bp on other days, resulting in 11% of annual returns being accumulated solely on the four pre-TRA days per year. The longest maturity Treasurys, 30-year Bonds, have an average return of 24.3 bp on pre-TRA days, over 12 times as large as their unconditional average. Consequently, almost 20% of the total annual return on 30-year Treasurys is accumulated on four pre-scheduled and easily identifiable days.

We then examine subsamples during which the observed pre-TRA drift effect is stronger. We find that pre-TRA returns are especially strong after 2002, coinciding with the more recent time period when the federal government began running persistent deficits and there is greater uncertainty around U.S. government debt. In a more direct test of how fiscal capacity interacts with pre-TRA returns, we find that gains are more pronounced when total national debt approaches the debt ceiling and when the debt ceiling is close to being changed.

Next, we study daily changes in zero-coupon bond yields from Gürkaynak, Sack, and Wright (2007) in order to examine whether elevated pre-TRA returns result from price appreciation or some other factor, such as accrued interests or diminishing maturities. Consistent with the main results, we find that GSW yield changes are significantly negative on pre-TRA days, so price movements are a primary driver of positive pre-TRA returns. We further split out the term premium component of the zero-coupon yields using the method of Kim and Wright (2005). Although this measure is only available for short to medium maturity Treasurys of 1-10 years, we find that changes in the term premium drive much of the observed changes in zero-coupon bond yields. We find that the 1-year term premium drops by 0.21 bp while the 10-year term premium drops by 0.60 bp on

pre-TRA days.

Next, we examine how TRAs interact with Federal Open Market Committee (FOMC) announcements. FOMC announcements have been studied extensively, including the seminal paper by Lucca and Moench (2015) documenting a pre-FOMC announcement drift in equities and a more recent paper documenting an FOMC-window drift in Treasurys (Hillenbrand, 2021). We leverage the variable timing between TRA and FOMC announcements to examine how relative scheduling affects pre-announcement drift dynamics in both equity and bond markets. We find that pre-TRA returns are particularly high when the TRA occurs shortly after an FOMC announcement. This is consistent with uncertainty reduction as a potential mechanism, as in this case the market can process the information from both the TRA and FOMC announcements together.

We then turn to the impact of a nearby TRA on documented FOMC announcement drifts. We find that the Treasury return drift around FOMC announcements is strong when it follows a nearby TRA, but it is weak or even non-existent when it precedes a nearby TRA. This provides additional detail to the puzzle documented in Hillenbrand (2021) that the majority of the Treasury yield decline has occurred around the 3-day FOMC window. Moving to equities markets, we document that the pre-FOMC drift is strong and robust when the FOMC meeting occurs within a week of a TRA, even as the pre-FOMC announcement drift has been disappearing in recent years (Kurov, Wolfe, and Gilbert, 2021). However, the pre-FOMC drift is much weaker and reverses on the day after the announcement when there is no proximate TRA. This is consistent with TRAs revealing relevant and important information to market participants observing FOMC announcements.

In the final part of this paper, we explore potential explanations for the documented pre-TRA drift. We start by examining the relationship between pre-TRA returns and the actual refunding estimates announced at the TRAs. Information leaks could serve as an explanation for the observed pre-TRA drift if Treasury supply shocks are systematically negative (smaller than expected). However, our findings refute this possibility. Ex-post changes in marketable borrowing estimates—our proxy for Treasury supply shocks—are near zero on average with substantial symmetric variations over time. Crucially, we find no significant correlation between pre-TRA returns and the direction

or magnitude of announced refunding estimates relative to expectations. This lack of relationship strongly counters a leak-based explanation. Additionally, we also rule out the possibility that other macroeconomic announcements occurring closely in time, as well as the realizations and surprises associated with these announcements, are driving pre-TRA returns.

Instead, our findings suggest that the pre-TRA drift stems from market anticipation of the refunding decisions themselves, rather than knowledge of specific outcomes in advance. We propose that high pre-TRA returns are related to uncertainty reduction surrounding the Treasury market prior to TRAs, highlighting TRAs as crucial events for maintaining Treasury market stability. We present several pieces of evidence consistent with this hypothesis.

First, we examine the relationship between changes in Treasury market volatility and pre-TRA returns using the Treasury implied volatility (TIV) measure from Choi, Mueller, and Vedolin (2017), constructed based on options of long-term Treasurys. We find that this proxy for uncertainty in the Treasury market drops significantly on pre-TRA days, consistent with greater resolution of uncertainty on these days. Furthermore, pre-TRA days with larger drops in TIV are associated with higher returns. This finding parallels that of Hu et al. (2022) in the equity market, where higher resolution of impact uncertainty, as measured by changes in the VIX on pre-announcement days, correlates with higher stock market returns. Second, we delve deeper into the associated uncertainty, demonstrating that higher pre-TRA returns are directly related to measures of near-term fiscal uncertainty. In particular, pre-TRA returns are significantly elevated when total U.S. national debt is close to the debt ceiling, and when there is a pronounced drop in the dispersion of fiscal deficit forecasts. This dispersion is measured using Bloomberg's daily survey of professional forecasters regarding the fiscal deficit for the current fiscal year.

**Related Literature.** This paper is related to a few strands of the macro-finance literature.

First, the paper contributes to the literature on expected returns of the Treasury bond market (e.g., Cochrane and Piazzesi, 2005; Ludvigson and Ng, 2009; Cieslak and Povala, 2015). We demonstrate that Treasury returns are predictably higher—and risk premia lower—on days pre-

ceding Treasury Refunding Announcements. While prior work identifies calendar-linked patterns (e.g., end-of-month effects documented by Etula et al. (2020) and Hartley and Schwarz (2019)), our findings differ from these patterns and reveal that TRA predictability stems from fiscal policy signals rather than recurring liquidity cycles. Additionally, Hillenbrand (2021) documents systematic declines in Treasury yields around a different class of events—FOMC announcements. We show that the two sets of evidence are distinct but interact with each other in a meaningful way when they occur in close proximity.

Second, as TRAs disclose information about upcoming Treasury issuance, our findings relate to studies on Treasury supply shocks and their impact on bond risk premia (Krishnamurthy and Vissing-Jorgensen, 2012; Lou, Yan, and Zhang, 2013; Greenwood and Vayanos, 2014; He, Nagel, and Song, 2022). These studies have shown that an increase in Treasury supply raises the bond risk premium and lowers bond prices. In contrast, our findings suggest an inverse relationship: in anticipation of major announcements regarding Treasury supply (but not when the actual Treasury supply is revealed), we observe a reduction in the risk premium and an increase in bond prices. We provide multiple pieces of evidence tying pre-TRA price dynamics to a reduction in uncertainty, particularly about the Treasury market and fiscal policy. This finding connects to the broader discussion on the impact of implied volatility on bond prices (Cieslak and Povala, 2016; Choi et al., 2017).

Third, this paper contributes to the growing body of empirical studies that link government debt valuations to fiscal activities (e.g., Jiang, Lustig, Van Nieuwerburgh, and Xiaolan, 2019; Cochrane, 2022; Collin-Dufresne, Hugonnier, and Perazzi, 2023; Campbell, Gao, and Martin, 2023; Gomez Cram, Kung, and Lustig, 2023). Consistent with recent findings, we confirm the importance of fiscal activities in the pricing of Treasury bonds. Our study primarily focuses on pre-scheduled Treasury Refunding Announcements, which disclose information about the government's financing strategies under current and near-term fiscal conditions. This contrasts with other studies that focus on the dynamics of the budget surplus, often involving the empirical identification of news about the surplus. Specifically, Jiang et al. (2024a) find that the valuation of Treasurys does

not respond to news about future surpluses using aggregate quarterly data, while Gomez Cram et al. (2023) infer surplus news from high-frequency granular spending bills and document a significant response of Treasury yields to such news. Our study complements these works by demonstrating that uncertainty about the near-term budget balance is negatively associated with Treasury bond returns, at least in the context of TRAs.

Lastly, this study contributes to the literature on market responses to pre-scheduled announcements, which has primarily focused on macroeconomic and monetary policy announcements (Jones, Lamont, and Lumsdaine, 1998; Savor and Wilson, 2014; Lucca and Moench, 2015; Mueller, Tahbaz-Salehi, and Vedolin, 2017; Guo, Kontonikas, and Maio, 2020) and earnings announcements (e.g., Savor and Wilson, 2016). In the context of the bond market, a smaller but growing body of research examines how bond prices react to monetary policy announcements (e.g., Gürkaynak, Sack, and Swanson, 2005; Brooks, Katz, and Lustig, 2018; Savor and Wilson, 2013; Hillenbrand, 2021; Lou, Pinter, Üslü, and Walker, 2025). To our knowledge, this is the first study to establish TRAs as a distinct class of fiscal announcements that systematically influence bond prices. Our results broaden event studies in macro-finance, demonstrating that fiscal communications—not just monetary or macroeconomic news—drive predictable price adjustments.

**Organization.** The remainder of the paper is organized as follows. Section 2 introduces institutional details about the quarterly Treasury Refunding Announcements. Section 3 describes the data. Section 4 presents our main empirical findings. Section 5 investigates the interplay between TRA and FOMC meetings. Section 6 proposes and provides evidence on a mechanism consistent with the main findings. Section 7 concludes.

## 2 Treasury Refunding Announcements

Within the U.S. Department of the Treasury, the Office of Debt Management (ODM) is responsible for funding the government through the issuance of bills, notes, bonds, treasury inflation-protected securities, and floating rate notes. Although treasury securities are auctioned off on a scheduled

cadence, treasury supply is determined by ODM and can vary over time. ODM's goal is to fund the government at the least cost to the taxpayer through regular and predictable issuances, and it is aided in this endeavor by discussions with primary dealers and the Treasury Borrowing Advisory Committee (TBAC).[2] Once per quarter, during the TRAs, the Treasury announces its expected net borrowing needs for the current quarter and the quarter ahead.

TRAs occur four times per year on a pre-scheduled week between the first and second month of each quarter. During the TRAs, the U.S. Department of the Treasury announces its plans to issue new debt, refinance existing debt, and any changes in debt management policy. Therefore, TRAs are an important instrument that the Treasury uses to fund the government in a predictable manner and achieve Treasury market stability. **Figure 2** shows the suite of documents, along with the timing of their releases, which were posted to the Treasury website corresponding with the TRA in Q4 2023. **Table 1 Panel A** shows the full list of TRA announcement dates beginning in Q4 1991.

Each refunding cycle centers around four important events:

1. **Preliminary Distribution** of data on debt outstanding and the primary dealer meeting agenda. This occurs around two and a half weeks prior to the primary release, on a Friday at noon. The preliminary distribution includes two documents with limited new information. The first is an Excel file containing information on outstanding debt, such as maturity distributions and net marketable borrowing as of the current quarter. The second contains the agenda for the primary dealer meetings to be held in two weeks, including discussion topics and a survey on borrowing estimates for primary dealers to fill out.

2. **Primary Dealer Meetings** with ODM. During these one- or two-day meetings, which take place on Thursday and/or Friday prior to the primary release, the Treasury meets directly with primary dealers to discuss the primary dealers' estimates for the Treasury's borrowing needs. In addition, they discuss timely topics that can impact treasury markets. For example,

[2]List of primary dealers can be found on the New York Fed website and the list of current TBAC members can be found on the Treasury website.

the Q4 2023 primary dealer meetings included discussions on the newly implemented 6-week cash management bill and considerations that the Treasury should take into account during buybacks.

3. **Primary Release** of marketable borrowing estimates. Documents are typically released on a Monday between the first and second months of a quarter, at 3 PM EST. This announcement contains material information on the total size of the Treasury's borrowing needs for the current quarter and the quarter ahead (see **Figure 3 Panel A** for the Q4 2023 release). The information contained in this announcement is little changed since Q4 1991 (see **Figure 3 Panel B** for the Q4 1991 release). This announcement is our main focus, and we will take the Treasury Refunding Announcement date as the Primary Release date for the remainder of this paper.

4. **Secondary Release** of financing details and TBAC documents. On the day after the primary release, ODM conducts a meeting with TBAC, during which ODM presents its view on quarterly refunding, and TBAC presents its observations and recommendations. These presentations, along with meeting minutes, a revised auction schedule, and additional details on the maturity breakdown of planned issuances, are released to the public at 8:30 AM EST on the Wednesday following (2 days after) the primary release.

The scheduling, structure, and information content of the TRAs have remained largely consistent since Q4 1991.[3] However, financial market attention has escalated post-pandemic as a result of higher yields, tight monetary policy, an increasing budget deficit, and credit downgrades.[4]

## 2.1 Relationship with FOMC Announcements

The Federal Open Market Committee (FOMC) holds regular meetings during which they announce relevant decisions regarding monetary policy. The economic impact of FOMC announcements has

[3] Q4 1991 is the earliest Quarterly Refunding Financing Estimate maintained on the Treasury website.
[4] Bloomberg: Why Treasury's Borrowing Plan Has Market's Attention.

been studied extensively (e.g., Lucca and Moench, 2015). FOMC meetings are typically scheduled for every six weeks, resulting in two per quarter and eight per year. Oftentimes, FOMC meetings and TRA fall within a week of each other. **Table 1 Panel B** shows the relationship in the timing between TRA and FOMC announcements. Since 1991, 81 out of 129 TRAs have occurred within one week of an FOMC meeting, while 81 out of 267 FOMC announcements occur within one week of a TRA. There is also variation in the order of the announcements: within the 81 two-week windows during which there is both a TRA and a FOMC meeting, TRA preceded FOMC on 45 occasions and followed FOMC on 36 occasions.

# 3 Data

All data used in this paper are from standard sources in the academic literature or information that is publicly available on the Treasury website.

## 3.1 Treasury Refunding Announcement Dates

We hand-collect Treasury Refunding Announcement dates from the Treasury website. We extract the announcement date from the press release accompanying the announcement for each primary release dating back to Q4 1991. Quarterly releases occur on a Monday between the first and second months of the quarter at a pre-scheduled and regular cadence. See **Table 1** for the full list of dates, along with how they relate to proximate FOMC announcements.

## 3.2 Treasury Market Data

Treasury market data are from standard sources. We get data on daily returns and yields on Treasurys from the CRSP US Treasury Database. The Treasury securities we study are the standard, most liquid group with maturities of 1, 2, 5, 7, 10, 20, and 30 years. Specifically, we obtain the pricing information from the Fixed Term Indexes file and bond characteristics from the Issue Descriptions

and Daily Time Series file. The daily data begins in 1961, but we restrict the sample to Q4 1991 to Q4 2023, the time period during which we have information about TRAs.

For intraday data on Treasury securities, we turn to Datascope, specifically their Tradeweb Market Data. Tradeweb contains minute-level information on dealers' bid and ask prices, along with the number of dealers who submitted a quote for Treasurys with maturities of 2, 5, 10, and 30 years. Coverage begins in 2006, restricting our intraday analysis to the second half of the time period covered by our daily analysis. Because Tradeweb does not contain information on actual trades, we take the midpoint of the closing bid and closing ask each minute as the Treasury price.

We acquire daily constant maturity zero-coupon Treasury bond yields as constructed by Gürkaynak, Sack, and Wright (2007, hereafter GSW) from the Federal Reserve Board. These yields, unaffected by accrued interests or diminishing maturities of conventional coupon-bearing Treasurys, provide a useful measure for isolating price movement due to yield curve fluctuations. We also source term premia estimates, derived from a canonical affine term structure model by Kim and Wright (2005), from the Federal Reserve Board's website.

We supplement the treasury security data with daily data on Treasury Bond ETF, Corporate Bond ETF, and Equity ETF returns from CRSP. These ETFs originated in the early to mid-2000s and have become more prominent in recent years. Among all the available bond ETFs, we focus on those with relatively long time series and large assets under management, from short to long maturities. The ETFs we study are SHY (1-3 year Treasury Bonds), IEI (3-7 year Treasurys), IEF (7-10 year Treasurys), TLH (10-20 year Treasurys), TLT (20+ year Treasurys), and SPY (Equity Index).[5] For intraday analysis on ETFs, we construct minute-level returns using tick data from the Trade and Quotes (TAQ) database. We additionally source equity market index returns from Ken French's website.

Finally, we obtain daily option-implied volatility data for 10-year Treasury futures from October 1991 to December 2023, following the methodology outlined in Choi, Mueller, and

[5]In Appendix Tables, we also show results for TIP (Inflation Protected Treasurys), LQD (Investment-Grade Corporate Bonds), VCSH (Short-Term Corporates), VCIT (Intermediate-Term Corporates), and VCLT (Long-Term Corporates).

Vedolin (2017).[6] This measure, referred to as Treasury Implied Volatility (TIV), serves as a forward-looking indicator of uncertainty in the Treasury market, analogous to the VIX Index in the equity market. For other measures of uncertainty we use in the paper, we get the daily close price of the MOVE Index from Bloomberg, the daily close price of the VIX Index from FRED, and a daily measure of Economic Policy Uncertainty in the United States (EPU) from FRED.

## 3.3 Summary Statistics

**Table 2** presents some summary statistics for our sample, split between pre-TRA days and all other days. Over the 33-year sample starting in 1991, there have been a total of 129 Treasury Refunding Announcements.

**Table 2 Panel A** shows Treasury returns split by maturity for pre-TRA and non pre-TRA days. Comparing the two subsamples, returns on shorter-maturity Treasury securities are relatively similar. For example, 1-year Treasury Bills had a return of 0.7bp on pre-TRA days compared to a return of 1.2bp on all other days. As maturity increases, a difference between returns on pre-TRA days and all other days emerges. 10-Year Notes had a daily return of 12.6bp on pre-TRA days compared to 1.8bp on other days, resulting in 11% of annual returns being accumulated solely over the four pre-TRA days. For the longest maturity Treasurys, the difference becomes even more striking. 30-year Bonds have an average return of 24.3bp on pre-TRA days compared to 1.9bp on other days and accumulate over 19% of their total annual return over the four days. Interestingly, Treasury returns are not more volatile on pre-TRA days compared to other days. For example, 30-year Bonds have a standard deviation of 84.4bp on pre-TRA days compared to 89.4bp on other days.

**Table 2 Panel B** shows summary statistics of daily yield changes constructed by Gürkaynak, Sack, and Wright (2007) and split by pre-TRA and other days. As yields move in the opposite direction of returns, the average daily yield changes on pre-TRA days are negative, with their

[6]The implied volatilities are computed based on at-the-money options with a 40-day maturity. We are grateful to Hoyong Choi for generously providing this data.

magnitude notably increasing across all maturities. In comparison to other days, the mean yield shifts on pre-TRA days are significantly greater for maturities exceeding 2 years, though the standard deviations remain similar between the two groups. Constant maturity yields capture price variations exclusive of accrued interests and diminishing maturities, making them a more precise metric for assessing price/yield fluctuations. Remarkably, for all maturities beyond two years, yield changes accumulated on just four pre-scheduled days are comparable to those observed across all other trading days within the same year. For instance, approximately 46% (0.06/(0.06+0.07)) of the average decrease in the 30-year yield is concentrated on the four pre-TRA days.

# 4 Empirical Results

In this section, we present our main finding: Treasury returns are high on the day prior to the Treasury Quarterly Refunding Announcements. We show that a significant portion of treasury returns are accumulated on just these four days per year. Treasury returns on pre-TRA days are monotonic with respect to maturity, and a majority of the return comes from term premia rather than expected changes in the short rate.

## 4.1 Treasury Returns around TRAs

In order to test how treasury returns evolve around TRAs, we run a simple regression model:

$$ret_t = \alpha + \beta_1 \times \mathbb{1}_t(preTRA) + \beta_2 \times \mathbb{1}_t(TRA) + \beta_3 \times \mathbb{1}_t(postTRA) + \epsilon_t \tag{1}$$

where $\mathbb{1}_t(preTRA)$ is an indicator equal to 1 on the day prior to a TRA, $\mathbb{1}_t(TRA)$ is an indicator equal to 1 on a TRA day, and $\mathbb{1}_t(postTRA)$ is an indicator equal to 1 on the day after a TRA. We run the regression separately for treasury bonds of maturities of 1, 2, 5, 10, 20, and 30 years. $ret_t$ represents the daily return on those bonds in basis points.

**Table 3 Panel A** shows the results of regression specification (1) across the host of treasury

maturities we study. The coefficient on $preTRA$ is positive and significant for Treasurys of maturities between 2 years and 30 years. For 2-year Treasury Notes, the return on pre-TRA days is 1.4 basis points higher than non-pre-TRA days, a return that is around twice as high. The return earned on pre-TRA days is monotonically increasing in magnitude with maturity. For example, 10-year Treasury Notes earn a return of 10.8 basis points on the four pre-TRA days per year, six times more than the unconditional average. The longest maturity Treasurys, 30-year bonds, have a return of 22.3 basis points on pre-TRA days, over 10 times greater than the unconditional average. Importantly, the excess returns earned on pre-TRA days do not reverse during or after the TRA. The coefficients on $TRA$ and $postTRA$ are insignificant across all maturities of interest.

**Figure A.1** shows the distribution of daily returns across different Treasury maturities, split between pre-TRA days and non-pre-TRA days. The distribution of pre-TRA daily returns is shifted to the right for the majority of maturities, and the difference is the most stark for the longer maturity Treasurys. It is apparent from the figure that the high average mean return on the pre-TRA days is not driven by outliers or a highly skewed distribution. **Figure 4** shows the time series of the four quarterly pre-TRAs days for 10-year, 20-year, and 30-year maturity Treasurys. There is no obvious pattern in the return time series, though they are, on average, positive throughout and slightly stronger in the later period.

In our sample, most TRAs occur on Mondays, which means that our day of interest, $preTRA$, typically falls on a Friday. Birru (2018) finds that Treasury returns are, on average, highest on Monday and lowest on Friday, making it unlikely that our results on pre-TRA drift are driven by a day-of-week (DOW) effect. We test this formally by adding a DOW fixed effect to our baseline specification (1). The results are presented in **Table 3 Panel B**. The coefficients on $preTRA$ are barely changed with the inclusion of the DOW fixed effect, especially for the longer maturity bonds. For the shorter maturity bonds, the coefficients actually increase in magnitude. For example, the return on the 2-year Treasury bond on pre-TRA days nearly doubles to 2.7 basis points after including the DOW fixed effect. This is consistent with Birru (2018), who documented that the lower Friday returns to Treasurys are strongest for the shortest maturity bonds.

TRA dates are scheduled for the week between the first and second months of a quarter, in such a way that the pre-TRA day generally lines up with the end of a month (EOM). Etula et al. (2020) and Hartley and Schwarz (2019) find that Treasury returns are largest in the last five days of the month, and that the size of the return lines up with maturity. We want to ensure that pre-TRA returns are not driven by a pure EOM effect. We construct an EOM variable equal to 1 if the trading day falls in the last five days of a month and run a version of the specification (1) controlling for an EOM fixed effect. **Table 3 Panel C** shows results after including the EOM fixed effect. The size of the coefficient on $preTRA$ drops a bit, but remains positive and significant for all of our maturities of interest. This finding suggests that pre-TRA days earn higher bond returns even when compared to other EOM days.

#### 4.1.1 Bond ETFs

**Table A.1** repeats the same analysis but using Treasury ETFs rather than individual Treasury securities. The bond ETFs are ordered from left to right by the average maturity of the Treasurys they seek to track. The ETFs have a shorter time series relative to the underlying equities, with most bond ETFs originating in the early to mid-2000s. A similar pattern emerges, even with the shorter time sample. Treasury ETFs earn a significantly positive return on pre-TRA days, with the ETFs holding longer maturity Treasurys (TLT and TLH) having larger magnitude returns compared to the ETFs holding shorter maturity Treasurys (SHY and IEI). We also find positive and significant returns for the ETF holding inflation-protected Treasurys (TIP) and some corporate bond ETFs. As a placebo test, Column (11) shows returns around TRAs for an aggregate equity market ETF, SPY. We find insignificant coefficients on $preTRA$, $TRA$, and $postTRA$ for SPY.

#### 4.1.2 GSW Yields and Term Premium

Next, we analyze zero-coupon bond yields to determine if the higher returns observed on pre-TRA days are due to price appreciation, indicated by falling bond yields, or a result of accrued interest from diminishing maturities. Specifically, we replace the dependent variable in equation (1) with

daily changes in zero-coupon bond yields obtained from Gürkaynak, Sack, and Wright (2007):

$$y_t^{(n)} - y_{t-1}^{(n)} = \alpha + \beta_1 \times \mathbb{1}_t(preTRA) + \beta_2 \times \mathbb{1}_t(TRA) + \beta_3 \times \mathbb{1}_t(postTRA) + \epsilon_t, \tag{2}$$

The results in **Table 4 Panel A** show that zero-coupon bond yields for maturities over 2 years significantly decrease by more than 1 bp on pre-TRA days. Other days show smaller, statistically insignificant changes. These results remain robust when controlling for day-of-week and end-of-month fixed effects, although with slightly reduced magnitudes. While some maturities show small, marginally significant yield increases on TRA days, these are primarily limited to shorter-term bonds. Our analysis of GSW yield changes reveals that positive Treasury returns on pre-TRA days are mainly due to price appreciation.

To delve deeper, we examine the term premium component of zero-coupon yields using estimates from Kim and Wright (2005). Regression results in **Table 4 Panel B** show that daily changes in term premia ($tp_t^{(n)} - tp_{t-1}^{(n)}$) are significantly negative across all maturities (1–10 years) on pre-TRA days, with and without fixed effects. The impact increases with maturity; for instance, the 1-year term premium drops by 0.21 bp, while the 10-year drops by 0.60 bp. Unlike yield changes, term premia show no reversals on TRA days and are more statistically significant at shorter maturities. These findings indicate substantial downward adjustments in interest rate risk compensation before TRAs, contrasting with Greenwood and Vayanos (2014), who suggest that Treasury supply shocks increase risk premiums. Our results instead point to reduced risk premiums in anticipation of Treasury supply announcements.

## 4.2 Trading Strategy

The documented price appreciation preceding Treasury Refunding Announcements implies significant trading profits, at least before transaction costs. The simplest strategy to capitalize on this predictable price movement is to long the longer-maturity Treasurys on the pre-TRA days, executed four times each year. We calculate the trading profit from this strategy for all Treasury bonds in our

main sample, with a 1-month Treasury bill as the risk-free rate.

The mean and standard deviation of the daily excess return and the corresponding Sharpe ratios for these trading strategies are detailed in **Table 5**, in which all metrics are annualized. **Table 5 Panel A** showcases the performance of Treasury bonds. With the exception of the shortest maturity of one year, the pre-TRA trading strategy yields positive and significant excess returns for all maturities, boasting annualized Sharpe ratios exceeding 4. An equally weighted portfolio of all Treasury bonds delivers a mean annualized excess return of 27%, a 6% standard deviation, and an annualized Sharpe ratio of 4.65. To put this in perspective, we also compare the performance of strategies that long the respective Treasury bonds on all other non-pre-TRA days. Trading the Treasurys on pre-TRA days significantly outperforms the alternative strategy for all maturities other than the 1-year, with Sharpe ratios an order of magnitude higher.

It is important to note that these findings do not account for trading costs. Following Lou, Yan, and Zhang (2013), one might consider financing the long positions in Treasury bonds via overnight repos while accounting for bid-ask spreads. Factoring in transaction costs would inevitably diminish the trading profits. Nonetheless, based on the estimated daily return differential of approximately 4 bps between strategies with and without transaction costs, as reported by Lou, Yan, and Zhang (2013), our pre-TRA strategy remains highly lucrative for maturities beyond 2 years. Back of the envelope calculations indicate that, even with a 4 bps transaction cost, the equally weighted pre-TRA strategy would sustain an annualized Sharpe ratio close to 4, notably higher than that of many well-known anomalies.

To address potential concerns regarding the practicability of this strategy, we extend our analysis to a set of Treasury ETFs, applying the same pre-TRA strategy. The results, presented in **Table 5 Panel B**, show that the pre-TRA trading in the six bond ETFs yields Sharpe ratios ranging from 3.9 to 6.6, whereas the Sharpe ratios for trading on all other days all fall below one. As an additional robustness test, we assess the equity ETF SPY's performance during and outside pre-TRA days in **Table 5 Panel C**. For SPY, the pre-TRA strategy yields a negative excess return, with a Sharpe ratio of $-0.1$. This suggests that the pre-TRA trading strategy is unique to the Treasury

market and does not apply to the stock market.

## 4.3 Intraday Dynamics

In this section, we explore the intraday price dynamics of the Treasurys and Treasury ETFs surrounding Treasury Refunding Announcements. We start by depicting the Treasury bond returns around TRAs using intraday pricing information from Tradeweb. We calculate three-day cumulative intraday returns, encompassing the day before the TRA (Day $-1$), the TRA day (Day 0), and the day following the TRA (Day +1), focusing on 5, 10, and 30-year maturities.

The US Treasury securities market is an over-the-counter market with round-the-clock trading, with trading concentrated in New York, London, and Tokyo. However, the majority of the trades take place during the US trading hours. Fleming (1997) notes that "more than 94 percent of that trading occurs in New York, on average, with less than 4 percent in London and less than 2 percent in Tokyo." Accordingly, we follow the practice of Fleming (1997) and Adrian et al. (2023) by confining our analysis to New York trading hours (07:30 to 17:00 Eastern time). Tradeweb contains dealer quotes rather than actual trades, so we take the midpoint of the closing bid and closing ask each period as the Treasury price.

**Figure 5** illustrates the pronounced trend of Treasury cumulative returns around TRAs, with the shaded area indicating the 95% confidence interval for the average return. There is a significant upward price movement in Treasurys starting early in the New York trading session on the day preceding the TRA (Day $-1$). Prices surge notably in the morning, reaching over 10 bps higher for the 10-year Treasury, and then marginally increase for the remainder of the New York trading hours. During the TRA day (Day 0) and the subsequent day (Day +1), prices maintain this elevated level, displaying no significant fluctuations around the typical 15:00 announcement time on Day 0. Notably, the magnitude of this pre-TRA drift increases with maturity, with the 30-year Treasurys climbing over 20 basis points by the end of the pre-TRA day.

To contextualize the economic magnitude of this pre-TRA drift, we calculate the average cumulative returns on all other days in the sample, excluding days around TRAs. On average,

cumulative returns on these days are essentially zero in the sample period.

## 4.4 Subsample Analysis

The pre-TRA drift in Treasury markets has evolved alongside changes in U.S. fiscal activities and debt management. Unlike the declining pre-FOMC drift in equity markets documented by Kurov, Wolfe, and Gilbert (2021), the pre-TRA effect has intensified in recent years. This divergence can be attributed to the mounting uncertainty surrounding U.S. government debt, particularly after the federal government began running persistent deficits in 2002 (Section 6.2.2 contains a detailed discussion on the link between fiscal uncertainty and pre-TRA returns).[7]

Although pre-TRA returns are positive for both 1991-2001 and 2002-2023 periods, they are generally higher for the later period. In **Table 6**, we show that the average return on 30-year Treasurys on the pre-TRA day was 17.4bp before 2002, and rose to 27.6bp during 2002-2023. The difference in return by time period is also pronounced for short to medium-maturity Treasurys. For example, the return on 5-year Treasurys on pre-TRA days jumped from 4.6bp to 10.0bp in the later time period, while the 10-year Treasury return rose from 6.5bp to 15.5bp.

The rest of **Table 6** highlights additional subsamples where pre-TRA returns exhibit heterogeneity. Consistent with the observation that the TRA has taken on additional importance in more recent years, we find that pre-TRA returns are stronger when the federal government is running a deficit, when the short-term interest rate is at the zero lower bound, and when total borrowing approaches the debt ceiling. Conversely, pre-TRA returns are weaker during recession periods, when the yield curve is downward sloping, and in the second quarter of the year. Notably, the seasonal pattern in pre-TRA returns lines up with the findings in Kamstra, Kramer, and Levi (2015), suggesting that returns around TRAs may play a role in driving the observed seasonality in Treasury returns.

[7]Only twice in history has any of the three major credit rating agencies, Moody's, Standard & Poor's, and Fitch, lowered their credit rating of the U.S. Federal Government. The first time was in 2011 when S&P reduced its rating to AA+. The second time was in 2023, when Fitch reduced their long-term credit rating to AA+.

# 5 The Interaction Between TRA and FOMC Meetings

The TRA and FOMC announcements both provide critical information pertaining to interest rate risks in the market. For example, Gürkaynak, Sack, and Swanson (2005) and Hanson and Stein (2015) show that the monetary policy surprises from the FOMC meetings have a significant impact on the term structure of interest rates. Similarly, our analyses so far have shown a significant impact of the TRAs on Treasury risk compensation. Despite revealing information about different aspects of the Treasurys, both sets of announcements are likely considered to be pivotal by market participants.

We are interested in how these two events interact with each other, particularly given that the fiscal and monetary policy events are often scheduled closely. Recall from Section 2.1 that 81 out of 129 TRAs since 1991 occur within one week of an FOMC meeting, with 45 preceding an FOMC announcement and 36 following an FOMC announcement. Since Q4 2011, every TRA has occurred within 1 week of a FOMC announcement. Similarly, especially in recent decades, four out of the eight annual FOMC meetings have typically been scheduled around TRAs. In this section, we explore how the scheduling of the two events can impact the dynamics of when and how much information is revealed to market participants, and the pre-announcement drifts in their respective markets.

## 5.1 Pre-TRA drift around FOMC Announcements

Although the Federal Reserve only purchases Treasurys through the open market, the context and relevant information provided by FOMC announcements can be important for nearby TRAs. We directly assess the impact of FOMC announcements on pre-TRA returns in two ways. First, we exploit differences in the order in which the TRA and FOMC announcements happen, which often change from quarter to quarter. Second, we test whether pre-TRA Treasury returns are different depending on whether the Fed is currently cutting rates, hiking rates, or maintaining the status quo.

To directly test the impact of nearby FOMC announcements on our main finding, we first

categorize the sample of TRAs as those occurring within 5 days of an FOMC announcement ("FOMC near") and those without a proximate FOMC announcement ("FOMC far"). We further divide the "FOMC near" group into those where the FOMC announcement happens before ("FOMC earlier") or after ("FOMC later") the TRA. We regress the daily Treasury returns across maturities on the interaction between pre-TRA indicators and their timing relative to FOMC meetings.

The findings are reported in **Table 7 Panel A**, in which all non-TRA days serve as the reference category. The results indicate that the positive pre-TRA gains are predominantly significant when there is an FOMC announcement in the five days leading up to the TRA. In these cases, the pre-TRA return approximately doubles in size. For example, the 10-year and 30-year Treasurys have significantly positive returns of 23.7bp and 34.6bp, respectively, even after controlling for day-of-week and end-of-month fixed effects. Pre-TRA returns are still positive, but much smaller and statistically insignificant when there is no FOMC meeting scheduled around the TRA or if the TRA precedes the FOMC meeting. It's worth noting that every TRA since 2011 has had a proximate FOMC meeting, so the "FOMC Far" group primarily consists of earlier years where we have shown that the pre-TRA drift is not as strong.

Next, we consider how different phases of the monetary policy cycle might uniquely influence the information dynamics surrounding TRAs. We explore this by categorizing days based on the most recent FOMC rate decision—hike, cut, or no change—and interacting this variable with the pre-TRA indicator. The results, summarized in **Table 7 Panel B**, show that there is a stronger pre-TRA drift when the latest FOMC decision maintains the status quo. In this case, the 10-year Treasury has a return of 14.0bp and the 30-year Treasury has a return of 22.1bp after controlling for fixed effects. Returns are positive but statistically insignificant if the Fed hiked rates in the most recent FOMC meeting and even become negative following a recent rate cut.

The observed heterogeneity—that pre-TRA returns are more pronounced when they directly follow a FOMC announcement and when there is no rate change in the most recent FOMC announcement—is consistent with the main mechanism we propose in Section 6, uncertainty reduction. This is because both the TRA and the FOMC announcements are important in assessing

Treasury market risk, so there is greater uncertainty resolution if the market is already aware of the relevant information disseminated by the Federal Reserve. Furthermore, if the Federal Reserve is actively hiking or cutting rates, this becomes a significant source of uncertainty in Treasury markets as questions arise about how the Fed will manage its balance sheet. On the other hand, when the Fed is not in an active rate change cycle, refunding becomes a relatively large source of uncertainty in Treasury markets. The uncertainty resolved during TRAs is larger in these cases.

## 5.2 FOMC Announcement Drift around TRAs

Having investigated the impact of proximate FOMC meetings on pre-TRA returns, we next turn to the influence of TRAs on the FOMC drift observed in the stock market and bond markets. Lucca and Moench (2015) demonstrate that the S&P 500 index exhibits a notable positive drift of 50 bps on average during the 24 hours preceding FOMC announcements, although recent literature has documented that the pre-FOMC announcement drift is less prevalent after 2015 (Kurov et al., 2021). In more recent work, Hillenbrand (2021) finds evidence of high Treasury returns in the 3-day window around FOMC meetings.

Similar to the previous section, we first categorize FOMC meetings after 1991Q4 based on whether they occur within 5 days of a TRA ("TRA near") and those without a proximate TRA ("TRA far"). We further divide the "TRA near" group into those where the TRA happens before ("TRA earlier") or after ("TRA later") the FOMC announcement.

### 5.2.1 Treasury Returns

Hillenbrand (2021) found that Treasury yields fall in the 3-day window around FOMC meetings, with most of the action occurring on the pre-FOMC and FOMC announcement days. In this section, we further split the sample of FOMC meetings to test if there is heterogeneity in Treasury returns around the 3-day window based on whether or not there is a nearby TRA meeting, and the order in which the TRA and FOMC announcements occur.

The average cumulative returns over the 3-day window for the different groups are presented

in **Table 8**, while the day-by-day returns are presented in **Table A.2**. On the pre-FOMC day, long maturity Treasury returns are highest when the FOMC announcement occurs within 5 days *after* a TRA. Returns are insignificant, even negative, when the FOMC announcement occurs within 5 days *before* a TRA. Taken together with the findings in Section 5.1, this shows that when TRA and FOMC announcements occur close in time, it is at the *later* of the announcements that we observe elevated returns on Treasurys. Again, this is consistent with our preferred explanation for the pre-announcement drift, uncertainty resolution.

Aggregating returns across the 3-day window, we find a significantly positive Treasury return across all maturities, mirroring the main observation in Hillenbrand (2021). These positive returns are primarily driven by cases during which there is not a nearby TRA. 10 year maturity Treasurys earn a return of 24.9bp over the 3-day FOMC window when there is no nearby TRA, compared to just 9.9bp when there is a nearby TRA. The contrast is even more striking for 30 year Treasurys, which have a return of 45.4bp with a nearby TRA compared to 5.5bp without. Further splitting the cases where there is a proximate TRA, we find a positive return on 30 year Treasurys when the FOMC announcement occurs after the TRAs, and a similar in magnitude negative return when the FOMC announcement occurs before the TRAs. When the FOMC announcement occurs prior to the TRAs, the Treasury return is realized a few days later during the pre-TRA day, as shown in Section 5.1.

### 5.2.2 Equity Returns

Equity returns around FOMC announcements is an area of great interest in the academic literature, sparked by Lucca and Moench (2015)'s observation of a substantial pre-FOMC announcement drift. We add to this discussion by examining whether the presence of a nearby TRA, and the order in which the two announcements occur, impacts the existence and magnitude of the pre-FOMC drift in equities markets.

The results are shown in columns (8) and (9) in **Table 8** and **Table A.2**. Column (8) shows equity market returns around the 3-day FOMC window for 1991Q4-present, while column (9)

restricts the time period to 2002-present. This later time period is of particular interest because the pre-FOMC drift has weakened in recent years (Kurov et al., 2021) and it is also when TRAs began taking on additional importance (see Section 4.4).[8] We find that 3-day cumulative returns around the FOMC window are elevated when there is a TRA nearby. When there is no proximate TRA, the pre-FOMC drift almost completely reverses on the post-FOMC day. This is especially pronounced post-2002, when 3-day FOMC window returns are 55.2bp with a TRA nearby compared to -11.5bp without a TRA nearby. Interestingly, for the sample of FOMC announcements with a proximate TRA, cumulative returns around the FOMC window are similar pre- and post-2002. This raises into question whether the noted decline of the pre-FOMC drift in recent years can be partially explained by the interaction of these two announcements.

## 5.3 Other Macroeconomic Announcements

Besides FOMC meetings, the scheduling of other macroeconomic announcements occasionally coincides with the TRAs, raising the question of whether these other announcements, along with their realizations and surprises, might be driving Treasury returns instead. To directly address this, we compile a comprehensive set of macroeconomic announcements, their announcement dates, and their surprises from Refinitiv.[9] We limit the sample period to 2004-2023 to ensure consistency, to align with the year during which data on the majority of announcements begin.

**Table 9** shows how pre-TRA returns vary when the timing lines up with other macroeconomic announcements. **Panel A** presents baseline results for the shortened 2004-2023 sample period controlling for DOW and EOM fixed effects. The results show that 10-year and 30-year Treasurys have around a 13.5bp and 16.7bp higher return on pre-TRA days, respectively, similar to our full sample results. **Panel B** adds a fixed effect for the presence of a macroeconomic announcement

[8]This is also around the year when TRA and FOMC announcement dates began to coincide more often. Up until 2002, TRA dates never had a proximate FOMC announcement outside of Q1.

[9]The macroeconomic announcements include Industrial Production, Nonfarm Payrolls, Consumer Price Index (CPI), Producer Price Index (PPI), Purchasing Manager Index (PMI), Unemployment Rate, Gross Domestic Product (GDP), University of Michigan Consumer Sentiment Final, Initial Jobless Claims, Retail Sales, Durable Goods Orders, Housing Starts, Construction Spending, Capacity Utilization, The Leading Index, Trade Balance, Factory Orders, New Home Sales, US Federal Budget Balance.

on a pre-TRA day, with an indicator variable set to 1 if at least one other macro announcement occurs on the same day. While the magnitudes decrease slightly for longer maturity Treasurys, the pre-TRA returns remain positive and significant for medium maturity such as the 10-year Treasury. **Panel C** instead controls for actual surprises associated with macro announcements. Surprises are constructed as the difference between the actual outcomes and consensus forecasts from Refinitiv, with surprises on non-announcement days set to zero.[10] Across maturities, pre-TRA returns are largely unchanged after adding these macroeconomic surprises. In summary, the presence of other macroeconomic announcements and the associated surprises are not a driving factor in the observed pre-TRA returns, underscoring the unique importance of TRAs in influencing Treasury market behavior.

# 6 Potential Mechanisms

## 6.1 Actual Refunding Announcements

We have documented significant unconditional returns of Treasurys ahead of the quarterly TRAs. A natural question arises: are these return patterns related to actual refunding estimates? If returns are driven by the actual refunding estimates, an unexpectedly high refunding estimate should result in lower, not higher, pre-TRA returns, as the market needs to absorb a greater supply shock. For the actual refunding estimates to explain the pre-TRA drift, the refunding announcements from the Treasury would need to consistently deliver smaller-than-anticipated borrowing figures—an unlikely scenario given rising federal budget deficits. Moreover, a strong correlation between actual refunding estimates and the pre-TRA drift, if it exists, could suggest the possibility of systematic information leakage. While there has been considerable discussion regarding leaks in the monetary policy context (e.g., Lucca and Moench, 2015; Vissing-Jorgensen, 2020), little research or evidence has been documented about information leakage around TRAs.

We empirically examine this relationship using Treasury refunding estimates, announced on

[10] **Appendix Table A.3** provides coefficients on surprise for each of the macro announcements separately.

TRA days, from the Sources and Uses tables. Each quarter, we calculate the dollar amount of the Marketable Borrowing estimate for the upcoming quarter ($MB_t$) and the Treasury's revision of this estimate from the previous to the current quarter ($FR_t(MB)$). To address seasonality due to fiscal cycles, we adjust estimates by subtracting the previous year's same-quarter estimate and normalize them by lagged GDP. We analyze three seasonally adjusted, GDP-normalized variables: (1) the previous quarter's refunding estimates ($\Delta MB_{t-1}/GDP_{t-2}$); (2) the forecast revision of refunding estimates ($FR_t(MB)/GDP_{t-1}$); and (3) the current quarter's refunding estimates ($\Delta MB_t/GDP_{t-1}$). The first variable represents the information available before the pre-TRA day, while the latter two, available at quarter $t$ announcements, serve as a proxy for ex-post supply shocks to the market participants. The data spans from 1997 to 2023.

**Figure 6** illustrates their time series properties. The big spikes and subsequent drops in the estimates occurred during the COVID-19 pandemic in 2020. Apart from the pandemic, the estimates are relatively stable over time. The summary statistics indicate that all three variables are close to zero on average (means of 0.15, 0.22, and 0.17% of GDP), with standard deviations of 1.18, 1.61, and 2.04%, respectively.

Two key implications emerge from these properties of the actual marketable borrowing announcements (i.e., Treasury supply). First, the zero mean across various refunding estimates implies that Treasury supply shocks are not concentrated in one direction. Notably, there is no systematic pattern of the Treasury surprising the market with lower borrowing needs, which would be necessary for the actual announcements to explain the pre-TRA drift we document. Second, the significant standard deviations of the refunding estimates suggest that, despite the Treasury Department's best efforts to manage its borrowing needs in a "regular and predictable" manner, substantial variations and unexpected supply shocks remain.

We regress the pre-TRA Treasury returns on these three variables. Note that the first variable is available before the pre-TRA day, while the latter two are available after the pre-TRA day. Results in **Table 10** show that almost all refunding estimates have positive signs (**Panels A** and **C**), while forecast revisions for maturities between 2 and 20 years are negative (**Panel B**). However,

nearly all beta coefficients lack statistical insignificance, and all constant terms remain positive and significant, indicating that the pre-TRA drift is not driven by actual refunding estimates or shocks to these estimates, ex-ante or ex-post. This finding suggests that the positive pre-TRA drift is driven by anticipation rather than actual refunding estimates, challenging a leakage-based explanation.

## 6.2 Uncertainty Reduction

In the pre-announcement drift literature, one of the main mechanisms proposed is that macroeconomic announcements reduce uncertainty, and this resolution of uncertainty translates to higher realized returns. Some of the evidence presented in previous sections is consistent with uncertainty reduction as a mechanism. For example, we found in Section 5 that pre-TRA returns are higher when they directly follow an FOMC meeting, as information from both the FOMC announcement and the TRA is critical for Treasury markets. In addition, **Table 6** shows that pre-TRA returns are higher when rates are close to the zero lower bound. Treasury market uncertainty can manifest in both rates and quantities, but because uncertainty around rates is low around the ZLB, the TRA becomes the premier source of uncertainty reduction as it provides information on issuance quantities.

In this section, we further explore uncertainty reduction as a mechanism for heightened pre-TRA returns. First, we examine how Treasury market uncertainty, namely the implied volatility of Treasury bonds, behaves on the pre-TRA day. Second, we explore how measures of fiscal uncertainty—the proximity of national debt to the debt ceiling and the dispersion of forecasts of the fiscal deficit—relate to pre-TRA returns. Third, Appendix B presents some additional evidence consistent with uncertainty reduction using intraday liquidity conditions and text-based uncertainty measures.

### 6.2.1 Treasury Market Uncertainty

In their equity market setting, Lucca and Moench (2015) explore the relationship between implied volatility and pre-FOMC returns and find that pre-FOMC returns are especially high when VIX is

elevated. Similarly, Hu et al. (2022) propose a premium for heightened uncertainty as an explanation for large equity returns prior to macroeconomic announcements. They present evidence that a higher resolution of impact uncertainty on the pre-announcement day, as measured by the change in the VIX on that day, is correlated with higher equity returns before a few major macroeconomic announcements. We extend this analysis to the Treasury market, testing whether a similar pattern exists prior to TRAs using Treasury implied volatility (TIV) calculated using options on 10-year Treasury futures (Choi, Mueller, and Vedolin, 2017). Specifically, we investigate how returns on pre-TRA days differ based on changes in TIV on that day.

Analogous to Hu et al. (2022), we define the resolution of impact uncertainty on a particular day, $\Delta TIV_t$, as the difference between the TIV on the previous day and that day: $TIV_{t-1} - TIV_t$. Thus, a higher value of $\Delta TIV_t$ corresponds to a greater resolution of uncertainty on day $t$. The mean $\Delta TIV$ on pre-TRA days is 6.8bp ($t = 3.53$), compared to 0.1bp ($t = 0.26$) on all other days, consistent with the notion that there is generally a greater resolution of uncertainty on pre-TRA days.

In order to test if pre-TRA returns are particularly elevated following days with greater resolution of uncertainty, we run the following regression:

$$ret_t = \beta_1 \times \mathbb{1}_t(preTRA) \times \Delta TIV[-1,0] + \beta_2 \times \mathbb{1}_t(preTRA) + \beta_3 \times \Delta TIV[-1,0] + FE + \epsilon_t \quad (3)$$

where $\Delta TIV_{[-1,0]}$ is the TIV on the previous day minus the TIV on the current day. The coefficient of interest, $\beta_1$, is on the interaction term between $preTRA$ and $\Delta TIV[-1,0]$.

The results are shown in **Table 11 Panel A**. We find that, across the board, the coefficient on the interaction term is positive and significant. This even holds for shorter maturity Treasurys, such as the 1-year bond where we did not document a positive unconditional pre-TRA return. Controlling for day-of-week and end-of-month fixed effects, the return on 1-year Treasury bonds is 0.1bps higher on pre-TRA days when $\Delta TIV[-1,0]$ is 0, but this increases to 1.5bps higher if $\Delta TIV[-1,0]$ is one standard deviation higher. The magnitude increases drastically with maturity.

If $\Delta TIV[-1,0]$ is one standard deviation higher, 10-year and 30-year Treasury returns on pre-TRA days are 12.7bps and 24.8bps higher, respectively. We do not observe a similar pattern when examining equity market returns. Overall, this suggests that TRAs can be an important event that the Treasury uses to reduce uncertainty and maintain stability in Treasury markets.

We also run an alternate specification that only looks within pre-TRA dates, allowing for additional controls for other uncertainty variables. Specifically, we control for accumulation period changes in VIX (equity market uncertainty) and Economic Policy Uncertainty in the United States (EPU; policy uncertainty derived from newspaper articles) from Baker, Bloom, and Davis (2016):

$$ret_t = \beta_1 \times \Delta TIV[-1,0] + \beta_2 \times \Delta VIX[-1,0] + \beta_3 \times \Delta EPU[-1,0] + \epsilon_t \tag{4}$$

The results in **Table 11 Panel B** show that pre-TRA returns remain positively related to resolution of uncertainty, as measured by $\Delta TIV[-1,0]$. This holds after controlling for $\Delta VIX[-1,0]$ and $\Delta EPU[-1,0]$, our measures of uncertainty in other settings. We also note that the reduction of uncertainty in the equity market, as proxied by $\Delta VIX[-1,0]$, is negatively related to Treasury market returns on pre-TRA days. Taken together, this suggests that the resolution of uncertainty associated with TRAs, and the associated pre-TRA return, are likely Treasury market specific phenomena.

### 6.2.2 Fiscal Uncertainty

During TRAs, the Treasury Department outlines its detailed plans to finance the federal government's debt and provides an economic and market outlook, particularly, particularly for the upcoming two quarters. These announcements can inform markets about the federal government's near-term fiscal conditions, making it natural to investigate whether pre-TRA gains are associated with fiscal uncertainty. We consider two proxies for fiscal uncertainty: the proximity of total national debt to the debt ceiling and the dispersion in forecasts of the fiscal budget balance.

**Debt Ceiling.** The relationship between fiscal uncertainty and pre-TRA returns is illuminated when we consider the national debt ceiling.[11] Just as persistent deficits in later years have amplified the importance of TRAs, we find that the debt ceiling—another critical aspect of fiscal policy—also influences the magnitude of pre-TRA returns. Specifically, we find that pre-TRA returns vary significantly based on two factors: the proximity of the national debt to the current ceiling and the imminence of future changes to the ceiling. These factors serve as important proxies for periods during which fiscal uncertainty in the United States is elevated.

We obtain the entire history of statutory limits on federal debt from the White House website and the daily total debt outstanding from the Treasury website. Over the period of our main analysis, beginning in Q4 1991, there have been a total of 34 changes to the debt ceiling, including 26 limit increases and 8 suspensions. We categorize TRAs into four groups based on their relationship to the debt ceiling: (1) "Close to ceiling": when the total national debt is within 1% of the debt ceiling or the ceiling is suspended (55 occurrences); (2) "Close to change": when a debt ceiling change occurs within 30 trading days after the TRA (19 occurrences); (3) "Both": satisfying both conditions above (16 occurrences); and (4) "Neither": satisfying neither condition (64 occurrences).[12]

**Figure 7** illustrates the pre-TRA day returns across these categories. While pre-TRA returns for longer-maturity Treasurys are positive across all groups, there is substantial variation in magnitude. For 30-year Treasurys, the average pre-TRA return in the "Both" category (59.9 bps) is nearly triple that of the "Neither" category (22.1 bps). Interestingly, pre-TRA days close to future debt ceiling changes exhibit higher returns (42.8 bps) compared to those when the national debt is approaching the current limit (30.4 bps). This heterogeneity in pre-TRA returns suggests that market participants are particularly sensitive to TRAs during periods of heightened fiscal uncertainty, such as when the government is operating near its borrowing limit or when changes to that limit are imminent. In these scenarios, TRAs likely command greater attention and play a more critical role in disseminating market-relevant information about the government's debt management strategies.

[11] For the history of debt ceiling changes, see Table 7.3—Statutory Limits on Federal Debt. For daily data on total US debt outstanding, see Debt to the Penny.

[12] Although the information on change may not be available on the TRA or pre-TRA day, it serves as an important proxy for periods when TRAs are especially important as a way to disseminate information to market participants.

The observed relationship between pre-TRA returns and debt ceiling dynamics underscores the intricate relationship between fiscal policy, market attention, and Treasury market behavior. As U.S. fiscal challenges have intensified, TRAs have gained greater significance, leading to more pronounced pre-announcement drifts in Treasury markets.

**Fiscal Condition Forecast Dispersion.** To further quantify fiscal-related uncertainty, we utilize professional forecasts of the fiscal budget balance (i.e., fiscal deficit or surplus) from the Bloomberg ECFC survey. This survey, covering economists from banks and research institutions, spans the period from 2007 to 2023. Importantly, economists in the Bloomberg survey can update their forecasts daily, unlike many surveys tied to fixed schedules. We measure fiscal uncertainty as the interquartile range of individual forecasts for the current fiscal year's budget balance, reflecting cross-economist disagreement.[13]

We define the *reduction* in fiscal uncertainty around the pre-TRA day as the change in forecast dispersion from the day before to the day of the pre-TRA day:

$$\Delta\text{ForecastDisp}[-1,0] \equiv \text{ForecastDisp}[\tau-1] - \text{ForecastDisp}[\tau], \tag{5}$$

where $\tau$ refers to the pre-TRA day. We hypothesize that larger reductions in fiscal uncertainty on the pre-TRA day ($\Delta\text{ForecastDisp}[-1,0] > 0$) should be associated with greater pre-TRA gains in Treasury bonds.

The results are reported in **Panel A** of **Table 12**, where we interact the indicator variable for the pre-TRA day with the fiscal uncertainty reduction variable ($\Delta\text{ForecastDisp}[-1,0]$). For longer-term Treasury bonds (7 years and above), the coefficients of the interaction term are positive and statistically significant. This evidence suggests that pre-TRA gains are more pronounced when fiscal uncertainty decreases, as indicated by reduced forecast dispersion on the pre-TRA day, consistent with uncertainty reduction being the key driver of pre-TRA gains in Treasurys.

One potential concern is that economists may not immediately update their forecasts when

[13]The forecast dispersion changes as economists incorporate new information into their projections

receiving new information, leading to delayed forecast updates. To address this potential, we analyze the forecast dispersion reduction over extended windows—from one day before to one day after the pre-TRA day, $\Delta\text{ForecastDisp}[-1,1]$, and from one day before to five days after the pre-TRA day, $\Delta\text{ForecastDisp}[-1,5]$. **Panels B** and **C** of **Table 12** report these results. The interaction coefficients are positive and significant across all maturities, reinforcing the findings in Panel A. However, we caution that extended windows may capture reactions to the actual TRA announcements, potentially confounding these results.

In sum, the relationship between fiscal uncertainty and pre-TRA returns highlights the crucial role of TRAs in resolving fiscal ambiguities. Both proximity to the debt ceiling and reductions in forecast dispersion are associated with heightened pre-TRA gains, supporting the notion that uncertainty reduction is a key driver of these returns.

# 7 Conclusion

In this paper, we uncover a novel pattern of significant price appreciation in long-term Treasurys preceding the quarterly Treasury Refunding Announcements, a phenomenon observable since the 1990s and notably more pronounced in recent decades coinciding with escalating Federal deficits. These pre-TRA movements account for a substantial fraction of the annual fluctuations in yields and term premia. We build a simple trading strategy that exploits this predictable pattern on just four days per year and achieves a Sharpe ratio of over 4. Additionally, we find evidence that uncertainty reduction contributes to the pre-TRA price movement. This highlights the importance of the TRAs as a key policy event in the bond market and as an essential tool for the Treasury Department to maintain market stability.

Recent literature on the bond market has emphasized the impact of fiscal policy-related events and budgetary conditions on government bond pricing and risk premia (e.g., Jiang, Lustig, Van Nieuwerburgh, and Xiaolan, 2024b; Gomez Cram, Kung, and Lustig, 2023). Our paper finds evidence of heightened sensitivity of the Treasury market to the Quarterly Treasury Refunding

Announcements, elevating the status of TRAs within the bond market context to a level of importance comparable to FOMC meetings within equity markets. This novel insight invites further exploration into the interplay between fiscal and monetary events and their impact on various asset prices.

# Tables and Figures

## Most Recent Quarterly Refunding Documents

### DOCUMENTS RELEASED AT 3:00 PM MONDAY, OCTOBER 30, 2023

Financing Estimates: 2023 - 4th Quarter

Economic Policy Statements to TBAC: 2023 - 4th Quarter

(The next release is scheduled for January 29, 2024)

### DOCUMENTS RELEASED AT 8:30 AM WEDNESDAY, NOVEMBER 1, 2023

Policy Statement: 2023 - 4th Quarter
TBAC Report to Secretary: 2023 - 4th Quarter
TBAC Minutes: 2023 - 4th Quarter

TBAC Recommended Financing Table Q4 2023
TBAC Recommended Financing Table Q1 2024
TBAC Recommended Financing Table By Refunding Quarter

**TBAC Discussion Charts:**

Treasury Presentation to TBAC (Final): 2023 - 4th Quarter
TBAC Presentation to Treasury: (Charge 1, Charge 2, Archives)

Auction Schedule: XML Format | PDF Format

(The next release is scheduled for January 31, 2024)

### DOCUMENTS RELEASED AT 12:00 PM FRIDAY, OCTOBER 13, 2023

Primary Dealer Meeting Agenda: 2023 - 4th Quarter

Quarterly Release Data: 2023 - 4th Quarter

(The next release is scheduled for January 12, 2024)

**Figure 2** Treasury Refunding Documents from Q4 2023

PRESS RELEASES

# Treasury Announces Marketable Borrowing Estimates

October 30, 2023

Sources and Uses Table

**WASHINGTON --** The U.S. Department of the Treasury today announced its current estimates of private held net marketable borrowing[1] for the October – December 2023 and January – March 2024 quarters.

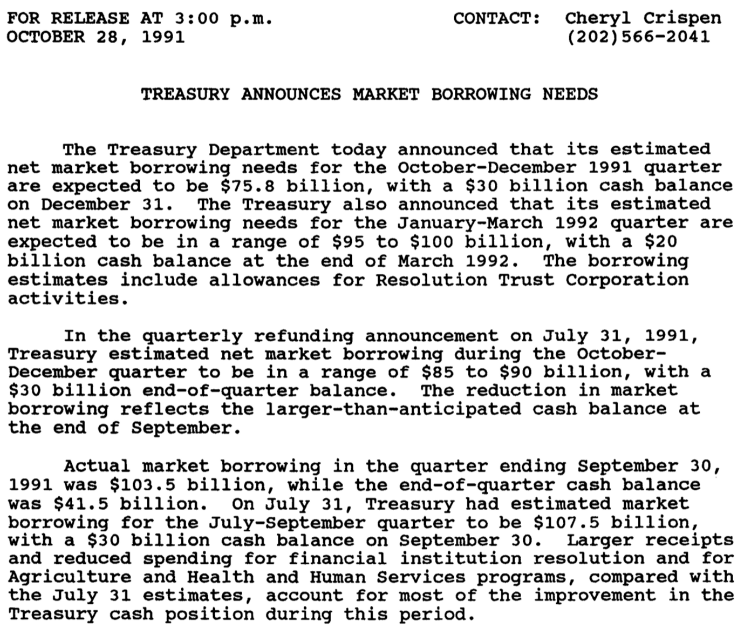
- During the October – December 2023 quarter, Treasury expects to borrow $776 billion in privately-held net marketable debt, assuming an end-of-December cash balance of $750 billion.[2] The borro estimate is $76 billion lower than announced in July 2023, largely due to projections of higher recei somewhat offset by higher outlays.[3]
- During the January – March 2024 quarter, Treasury expects to borrow $816 billion in privately-held marketable debt, assuming an end-of-March cash balance of $750 billion.[4]

During the July – September 2023 quarter, Treasury borrowed $1.010 trillion in privately-held net marketable debt and ended the quarter with a cash balance of $657 billion. In July 2023, Treasury estimated borrowing of $1.007 trillion and assumed an end-of-September cash balance of $650 billion. increase in privately-held net market borrowing was $3 billion: changes across all major components w small.

Additional financing details relating to Treasury's Quarterly Refunding will be released at 8:30 a.m. on Wednesday, November 1, 2023.

###

**A.** Q4 2023 Release



FOR RELEASE AT 3:00 p.m.
OCTOBER 28, 1991

CONTACT: Cheryl Crispen
(202)566-2041

TREASURY ANNOUNCES MARKET BORROWING NEEDS

The Treasury Department today announced that its estimated net market borrowing needs for the October-December 1991 quarter are expected to be $75.8 billion, with a $30 billion cash balance on December 31. The Treasury also announced that its estimated net market borrowing needs for the January-March 1992 quarter are expected to be in a range of $95 to $100 billion, with a $20 billion cash balance at the end of March 1992. The borrowing estimates include allowances for Resolution Trust Corporation activities.

In the quarterly refunding announcement on July 31, 1991, Treasury estimated net market borrowing during the October-December quarter to be in a range of $85 to $90 billion, with a $30 billion end-of-quarter balance. The reduction in market borrowing reflects the larger-than-anticipated cash balance at the end of September.

Actual market borrowing in the quarter ending September 30, 1991 was $103.5 billion, while the end-of-quarter cash balance was $41.5 billion. On July 31, Treasury had estimated market borrowing for the July-September quarter to be $107.5 billion, with a $30 billion cash balance on September 30. Larger receipts and reduced spending for financial institution resolution and for Agriculture and Health and Human Services programs, compared with the July 31 estimates, account for most of the improvement in the Treasury cash position during this period.

**B.** Q4 1991 Release

**Figure 3** Primary Release of Marketable Borrowing Estimates from Treasury Refunding Announcements

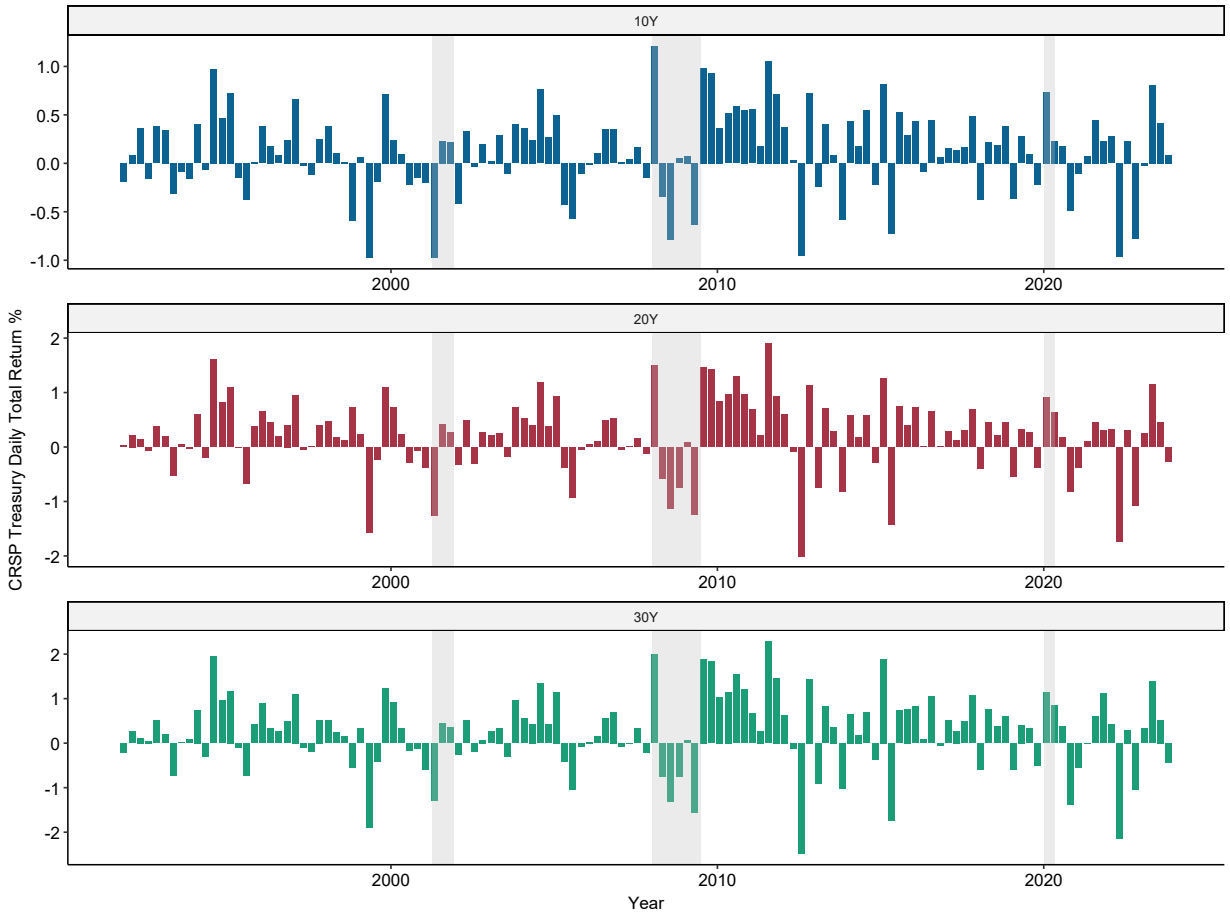



**Figure 4** 10, 20, and 30-Year Treasury Returns on Pre-TRA Days Over Time

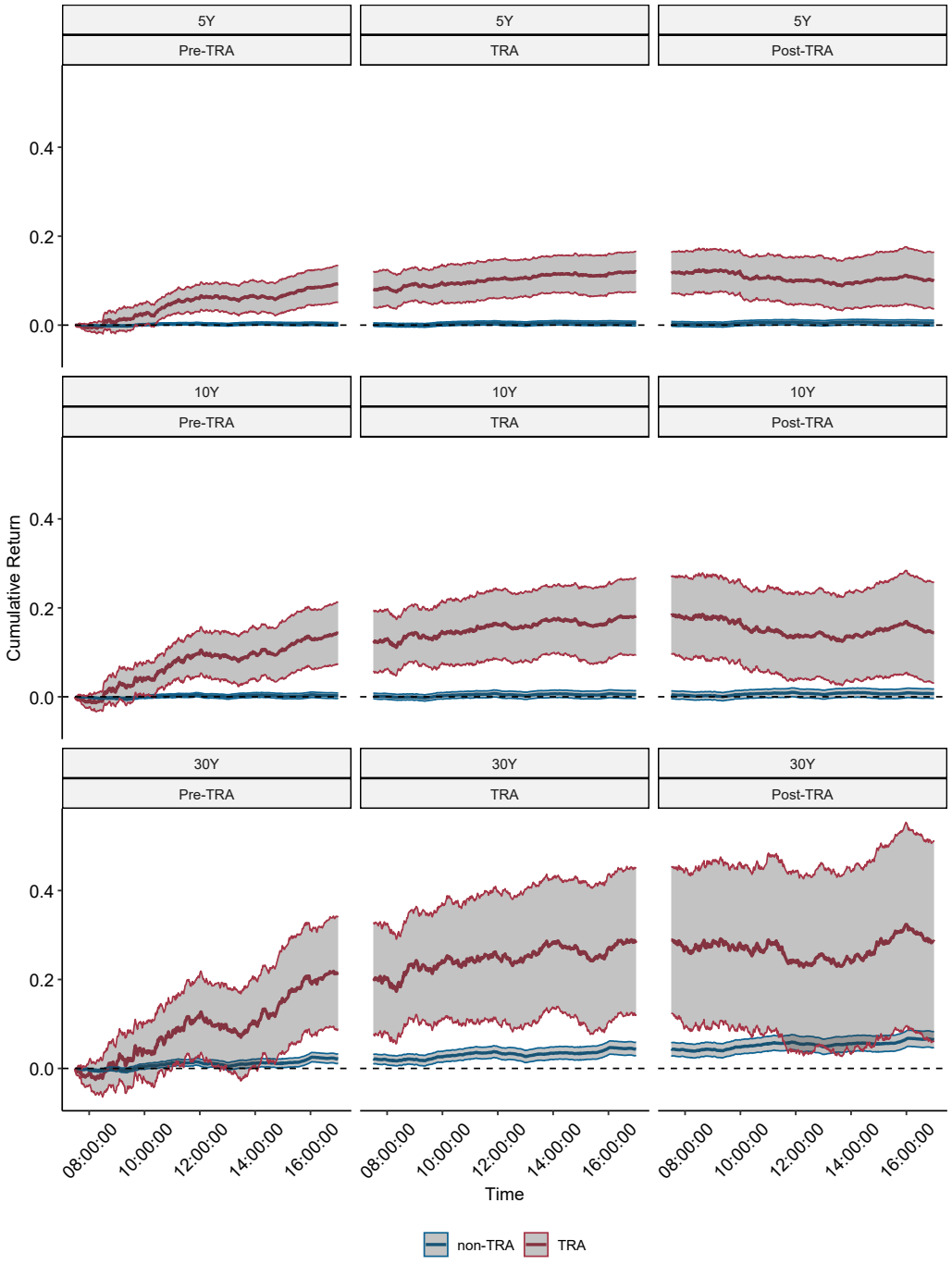



**Figure 5** Cumulative Intraday Returns of 5, 10, and 30-Year Treasurys around TRAs


| | n | mean | sd | p5 | p25 | median | p75 | p95 |
|---|---|---|---|---|---|---|---|---|
| $\Delta MB_{t-1}/GDP_{t-2}$ (%) | 102 | 0.15 | 1.18 | -1.40 | -0.49 | -0.05 | 0.68 | 2.38 |
| $FR_t(MB)/GDP_{t-1}$ (%) | 106 | 0.22 | 1.61 | -1.12 | -0.25 | 0.04 | 0.45 | 1.56 |
| $\Delta MB_t/GDP_{t-1}$ (%) | 102 | 0.17 | 2.04 | -1.32 | -0.47 | 0.02 | 0.68 | 2.41 |

**Figure 6** Time Series of Refunding Estimates Announced by the Treasury Department

This figure plots the time series of three measures of marketable borrowing estimates announced by the Treasury Department: The seasonally-adjusted change in Marketable Borrowing estimate in quarter $t$ ($FR_t(MB)/GDP_{t-1}$), the seasonally-adjusted change in Marketable Borrowing estimate in quarter $t-1$ ($\Delta MB_{t-1}/GDP_{t-2}$), and the forecast revision of Marketable Borrowing in quarter $t$ ($\Delta MB_{t-2}/GDP_{t-1}$). Shaded areas represent NBER recession periods.

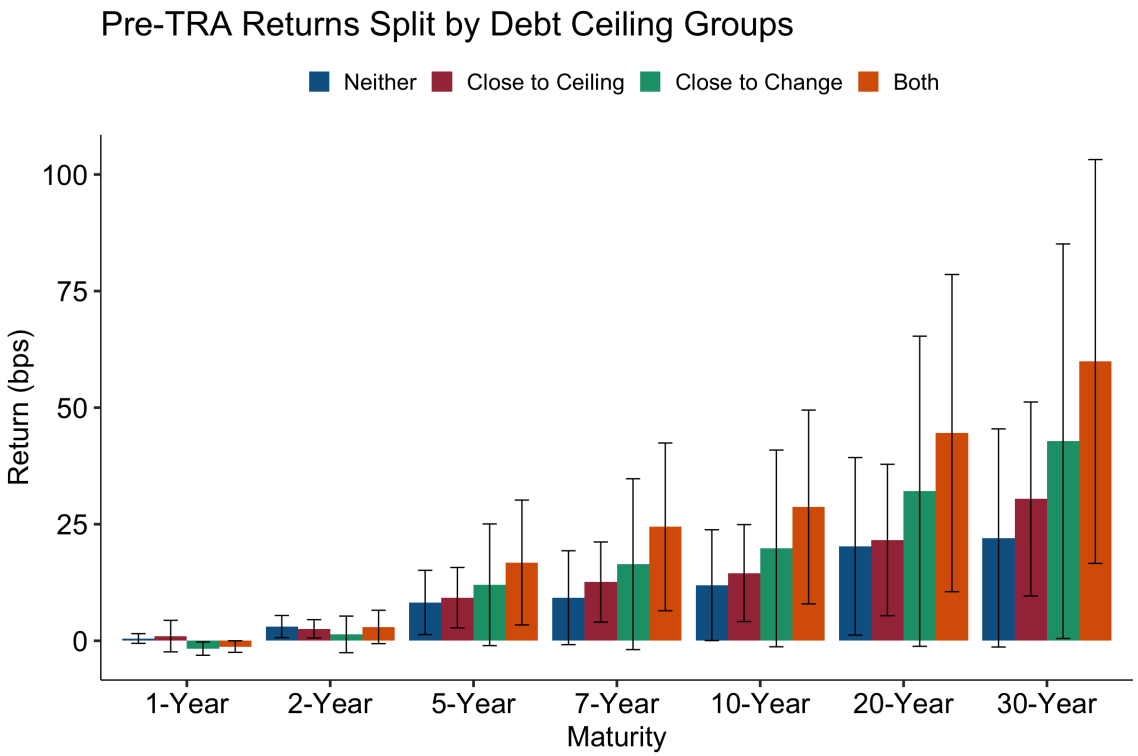



**Figure 7** Average Returns on Pre-TRA Days Split by Debt Ceiling Groups

This figure plots the average return on pre-TRA days for Treasurys with maturities of 1, 2, 5, 7, 10, 20, and 30 years, split by debt ceiling groups. Red bars show the average return on days when the total national debt is within 1% of the debt ceiling or the debt ceiling is suspended. Green bars show the average return on days when a change in the debt ceiling occurs within the 30 trading days following the associated TRA day. Orange bars show the average return on days when both are true, while blue bars show the average return on days when both are false. Standard error bars depict 95% confidence intervals.

**Table 1** Treasury Refunding Announcement Dates

This table lists all primary Treasury Refunding Announcement dates between Q4 1991 and Q4 2023. * indicates that TRA directly preceding FOMC Announcement (within 1 week); † indicates that TRA directly following FOMC Announcement (within 1 week)

**Panel A: Complete List of TRA Dates by Year**

| Year | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| **1991** | | | | 10/28/1991 |
| **1992** | 02/03/1992* | 04/27/1992 | 08/03/1992 | 10/30/1992 |
| **1993** | 02/01/1993* | 05/03/1993 | 08/02/1993 | 11/01/1993 |
| **1994** | 01/31/1994* | 05/02/1994 | 08/01/1994 | 10/31/1994 |
| **1995** | 01/30/1995* | 05/01/1995 | 07/31/1995 | 10/30/1995 |
| **1996** | 01/29/1996* | 04/29/1996 | 07/29/1996 | 10/28/1996 |
| **1997** | 02/03/1997* | 04/28/1997 | 07/28/1997 | 10/27/1997 |
| **1998** | 02/02/1998* | 05/04/1998 | 08/03/1998 | 10/26/1998 |
| **1999** | 02/01/1999* | 05/03/1999 | 08/02/1999 | 11/01/1999 |
| **2000** | 01/31/2000* | 05/01/2000 | 07/31/2000 | 10/30/2000 |
| **2001** | 01/29/2001* | 04/30/2001 | 07/30/2001 | 10/29/2001 |
| **2002** | 01/28/2002* | 04/29/2002 | 07/29/2002 | 10/28/2002 |
| **2003** | 02/03/2003† | 04/28/2003 | 07/28/2003 | 11/03/2003† |
| **2004** | 02/02/2004† | 05/03/2004* | 08/02/2004 | 11/01/2004 |
| **2005** | 01/31/2005* | 05/02/2005* | 08/01/2005 | 10/31/2005* |
| **2006** | 01/30/2006* | 05/01/2006 | 07/31/2006 | 10/30/2006† |
| **2007** | 01/29/2007* | 04/30/2007 | 07/30/2007 | 10/29/2007* |
| **2008** | 01/28/2008† | 04/28/2008* | 07/28/2008 | 11/03/2008† |
| **2009** | 02/02/2009† | 04/27/2009* | 08/03/2009 | 11/02/2009* |
| **2010** | 02/01/2010† | 05/03/2010† | 08/02/2010 | 11/01/2010* |
| **2011** | 01/31/2011† | 05/02/2011† | 08/01/2011 | 10/31/2011* |
| **2012** | 01/30/2012† | 04/30/2012† | 07/30/2012* | 10/29/2012† |
| **2013** | 02/04/2013† | 04/29/2013* | 07/29/2013* | 11/04/2013† |
| **2014** | 02/03/2014† | 04/28/2014* | 08/04/2014† | 11/03/2014† |
| **2015** | 02/02/2015† | 05/04/2015† | 08/03/2015† | 11/02/2015† |
| **2016** | 02/01/2016† | 05/02/2016† | 08/01/2016† | 10/31/2016* |
| **2017** | 01/30/2017* | 05/01/2017* | 07/31/2017† | 10/30/2017* |
| **2018** | 01/29/2018* | 04/30/2018* | 07/30/2018* | 10/29/2018 |
| **2019** | 01/28/2019* | 04/29/2019* | 07/29/2019* | 10/28/2019* |
| **2020** | 02/03/2020† | 05/04/2020† | 08/03/2020† | 11/02/2020* |
| **2021** | 02/01/2021† | 05/03/2021† | 08/02/2021† | 11/01/2021* |
| **2022** | 01/31/2022† | 05/02/2022* | 08/01/2022† | 10/31/2022* |
| **2023** | 01/30/2023* | 05/01/2023* | 07/31/2023† | 10/30/2023* |

**Panel B: Count by TRA and FOMC Proximity**

| Announcement Type | Count |
|---|---|
| Total TRA (Since Q4 1991) | **129** |
| TRA directly preceding FOMC Announcement (within 1 week) | 45 |
| TRA directly following FOMC Announcement (within 1 week) | 36 |
| TRA without proximate FOMC announcement | 48 |
| Total FOMC Announcements (Since Q4 1991) | **267** |
| FOMC announcement without proximate TRA | 186 |

**Table 2** Summary Statistics of Returns and Yields on Pre-TRA Days and All Other Days

This table reports summary statistics on daily returns and yields on pre-Treasury Refunding Announcement (pre-TRA) Days and all other days. The sample period is from 1991Q4 to 2023Q4. Panel A presents CRSP Treasury bond returns and Panel B presents GSW Treasury bond yields.

**Panel A: CRSP Treasury Returns**

| | Pre-TRA Days | | | | | Other Days | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Maturity | N | Mean | SD | Min | Max | N | Mean | SD | Min | Max |
| **Daily Return (bps)** | | | | | | | | | | |
| 1y | 129 | 0.66 | 8.77 | -10.12 | 90.59 | 7,933 | 1.18 | 4.92 | -90.75 | 98.17 |
| 2y | 129 | 2.66 | 8.78 | -21.33 | 34.15 | 7,933 | 1.31 | 10.48 | -91.66 | 118.14 |
| 5y | 129 | 8.25 | 25.88 | -57.33 | 91.08 | 7,933 | 1.73 | 27.52 | -182.72 | 189.87 |
| 7y | 129 | 10.27 | 36.36 | -90.97 | 115.28 | 7,933 | 1.93 | 37.36 | -234.92 | 314.23 |
| 10y | 129 | 12.62 | 43.15 | -97.92 | 121.41 | 7,933 | 1.82 | 45.59 | -291.93 | 355.48 |
| 20y | 129 | 19.88 | 67.68 | -200.41 | 189.87 | 7,933 | 2.33 | 69.60 | -615.60 | 519.17 |
| 30y | 129 | 24.33 | 84.44 | -249.16 | 228.21 | 7,933 | 2.07 | 90.28 | -855.62 | 839.07 |
| **Return Accumulated Per Year (%)** | | | | | | | | | | |
| 1y | 33 | 0.03 | 0.18 | -0.17 | 0.92 | 33 | 2.90 | 2.49 | -0.68 | 8.14 |
| 2y | 33 | 0.10 | 0.19 | -0.38 | 0.53 | 33 | 3.25 | 3.30 | -3.60 | 11.24 |
| 5y | 33 | 0.32 | 0.54 | -0.81 | 1.53 | 33 | 4.30 | 5.88 | -8.90 | 17.92 |
| 7y | 33 | 0.40 | 0.74 | -1.17 | 2.21 | 33 | 4.82 | 7.44 | -11.68 | 20.65 |
| 10y | 33 | 0.49 | 0.83 | -1.24 | 2.53 | 33 | 4.52 | 8.22 | -15.43 | 23.34 |
| 20y | 33 | 0.78 | 1.34 | -2.18 | 4.12 | 33 | 5.85 | 12.26 | -24.77 | 29.45 |
| 30y | 33 | 0.95 | 1.62 | -2.47 | 5.03 | 33 | 5.33 | 16.17 | -31.65 | 43.35 |

**Panel B: GSW Yields**

| | Pre-TRA Days | | | | | Other Days | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ticker | N | Mean | SD | Min | Max | N | Mean | SD | Min | Max |
| **Daily Yield Changes (bps)** | | | | | | | | | | |
| 1Y | 129 | -0.07 | 3.32 | -13.12 | 9.85 | 7,919 | -0.01 | 4.42 | -59.54 | 40.47 |
| 2Y | 129 | -0.93 | 4.64 | -19.97 | 13.73 | 7,919 | -0.01 | 5.42 | -51.58 | 37.47 |
| 5Y | 129 | -1.58 | 5.71 | -23.89 | 15.38 | 7,919 | -0.01 | 6.04 | -47.08 | 39.29 |
| 10Y | 129 | -1.54 | 5.75 | -20.48 | 17.15 | 7,919 | -0.02 | 5.90 | -51.89 | 38.24 |
| 20Y | 129 | -1.73 | 5.50 | -20.90 | 15.14 | 7,919 | -0.02 | 5.44 | -33.22 | 36.10 |
| 30Y | 129 | -1.71 | 5.88 | -26.21 | 16.72 | 7,919 | -0.02 | 5.61 | -33.14 | 34.21 |
| **Yield Changes Accumulated Per Year (%)** | | | | | | | | | | |
| 1Y | 33 | 0.00 | 0.07 | -0.18 | 0.18 | 33 | -0.02 | 1.53 | -3.38 | 4.10 |
| 2Y | 33 | -0.04 | 0.10 | -0.27 | 0.21 | 33 | -0.02 | 1.40 | -2.53 | 3.63 |
| 5Y | 33 | -0.06 | 0.12 | -0.35 | 0.10 | 33 | -0.03 | 1.19 | -2.39 | 2.88 |
| 10Y | 33 | -0.06 | 0.12 | -0.37 | 0.14 | 33 | -0.06 | 1.03 | -2.07 | 2.20 |
| 20Y | 33 | -0.07 | 0.11 | -0.33 | 0.15 | 33 | -0.05 | 0.92 | -1.67 | 2.17 |
| 30Y | 33 | -0.07 | 0.12 | -0.49 | 0.14 | 33 | -0.04 | 0.92 | -2.02 | 2.36 |

**Table 3** Treasury Returns around Treasury Refunding Announcements

This table reports estimation results of Regression (1) using the CRSP Treasury bond returns with maturities ranging from 1 to 30 years. Day-of-week (DOW) and end-of-month (EOM) fixed effects are included in certain specifications. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 1991Q4 to 2023Q4.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A** | | | | | | | |
| pre-TRA | -0.50 | 1.36* | 6.52*** | 8.35*** | 10.80*** | 17.60*** | 22.25*** |
| | (0.77) | (0.78) | (2.29) | (3.21) | (3.81) | (5.97) | (7.45) |
| TRA | 0.80 | 0.41 | -1.70 | -1.91 | -3.00 | -3.03 | -5.80 |
| | (0.79) | (0.76) | (2.16) | (2.83) | (3.58) | (5.74) | (7.57) |
| post-TRA | -0.09 | 0.42 | 1.76 | 2.07 | 2.46 | 5.67 | 4.88 |
| | (0.40) | (0.92) | (2.63) | (3.56) | (4.36) | (6.65) | (8.74) |
| Constant | 1.17*** | 1.30*** | 1.72*** | 1.92*** | 1.82*** | 2.28*** | 2.08** |
| | (0.06) | (0.12) | (0.30) | (0.40) | (0.49) | (0.74) | (0.94) |
| DOW FE | | | | | | | |
| EOM FE | | | | | | | |
| $R^2$ | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $N$ | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 |
| **Panel B** | | | | | | | |
| pre-TRA | 0.44 | 2.67*** | 8.04*** | 10.03*** | 12.63*** | 17.74*** | 21.21*** |
| | (0.78) | (0.83) | (2.40) | (3.33) | (3.95) | (6.18) | (7.73) |
| TRA | -0.72 | -1.10 | -3.12 | -3.66 | -4.56 | -4.38 | -6.59 |
| | (0.80) | (0.80) | (2.24) | (2.94) | (3.70) | (5.89) | (7.77) |
| post-TRA | -0.14 | 0.23 | 0.92 | 0.97 | 0.86 | 4.61 | 3.97 |
| | (0.42) | (0.95) | (2.71) | (3.70) | (4.51) | (6.90) | (9.06) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | | | |
| $R^2$ | 0.024 | 0.007 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 |
| $N$ | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 |
| **Panel C** | | | | | | | |
| pre-TRA | 0.54 | 1.86** | 6.01** | 7.46** | 9.40** | 13.20** | 14.78* |
| | (0.79) | (0.83) | (2.43) | (3.38) | (4.03) | (6.30) | (7.86) |
| | (0.79) | (0.83) | (2.43) | (3.38) | (4.02) | (6.29) | (7.85) |
| TRA | -0.68 | -1.44* | -3.97* | -4.73 | -5.92 | -6.29 | -9.28 |
| | (0.80) | (0.80) | (2.24) | (2.94) | (3.71) | (5.94) | (7.84) |
| post-TRA | -0.12 | 0.08 | 0.53 | 0.47 | 0.24 | 3.73 | 2.72 |
| | (0.42) | (0.94) | (2.70) | (3.68) | (4.49) | (6.87) | (9.02) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.024 | 0.009 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| $N$ | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 |

**Table 4** Yield and Term Premium Changes Around Treasury Refunding Announcements

This table reports regression results of daily changes in various yield and term premium measures around TRAs. The dependent variables include daily changes in constant maturity Treasury yields estimated by Gürkaynak et al. (2007) (Panel A), term premia estimated by Kim and Wright (2005) (Panel B), and TIPS yields estimated by Gürkaynak et al. (2007) (Panel C). The maturities range from 1 to 10 years. Day-of-week (DOW) and end-of-month (EOM) fixed effects are included in all specifications. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 1991Q4 to 2023Q4.

| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: GSW Daily Yield Changes** | | | | | | | |
| pre-TRA | -0.12 | -0.80* | -1.39*** | -1.38** | -1.32** | -1.32*** | -1.26** |
| | (0.32) | (0.44) | (0.54) | (0.54) | (0.54) | (0.51) | (0.55) |
| TRA | 0.21 | 0.61 | 0.77 | 0.78* | 0.76* | 0.64 | 0.76 |
| | (0.32) | (0.41) | (0.47) | (0.47) | (0.46) | (0.45) | (0.48) |
| post-TRA | -0.30 | -0.34 | -0.36 | -0.46 | -0.58 | -0.59 | -0.69 |
| | (0.36) | (0.46) | (0.55) | (0.55) | (0.55) | (0.53) | (0.56) |
| $R^2$ | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 | 0.003 |
| $N$ | 8,048 | 8,048 | 8,048 | 8,048 | 8,048 | 8,048 | 8,048 |
| **Panel B: KW Daily Term Premium Changes** | | | | | | | |
| pre-TRA | -0.21*** | -0.33*** | -0.46*** | -0.48** | -0.50** | | |
| | (0.08) | (0.13) | (0.18) | (0.19) | (0.21) | | |
| TRA | 0.02 | 0.03 | 0.06 | 0.09 | 0.12 | | |
| | (0.07) | (0.11) | (0.16) | (0.17) | (0.18) | | |
| post-TRA | -0.10 | -0.16 | -0.21 | -0.21 | -0.21 | | |
| | (0.08) | (0.13) | (0.18) | (0.20) | (0.21) | | |
| $R^2$ | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 | | |
| $N$ | 8,048 | 8,048 | 8,048 | 8,048 | 8,048 | | |
| **Panel C: GSW TIPS Daily Yield Changes (1999-2023)** | | | | | | | |
| pre-TRA | | -1.00 | -1.60*** | -1.34*** | -1.09** | -0.40 | |
| | | (1.34) | (0.54) | (0.49) | (0.47) | (0.51) | |
| TRA | | -1.59 | 0.64 | 0.43 | 0.35 | 0.33 | |
| | | (1.37) | (0.50) | (0.45) | (0.43) | (0.45) | |
| post-TRA | | 1.84 | -0.56 | -0.24 | 0.00 | -0.39 | |
| | | (1.38) | (0.57) | (0.53) | (0.50) | (0.50) | |
| $R^2$ | | 0.002 | 0.005 | 0.004 | 0.003 | 0.002 | |
| $N$ | | 6,238 | 6,238 | 6,238 | 6,238 | 6,238 | |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 5** Treasury Returns around Quarterly Refunding Announcements: Trading Strategies

This table compares the performance of trading strategies that long respective securities on the pre-TRA days ("Pre-TRA Days") against strategies that invest on all other days ("Other Days"). For each strategy, we report annualized returns (%), standard deviations (%), and Sharpe ratios. The 1-month Treasury bill rate is used as the risk-free rate. Additionally, we provide the starting year of each strategy based on the sample length. Panel A presents strategies investing in Treasury bonds with maturities ranging from 1 to 30 years, as well as an equally weighted strategy investing equally across all these maturities. Panel B presents strategies investing in nominal Treasury bond ETFs (SHY, IEI, IEF, TLH, TLT) and TIPS ETFs (TIP). Panel C presents strategies investing in corporate bond ETFs (LQD, VCSH, VCIT, VCLT). Panel D presents the strategy investing in the equity ETF (SPY). The sample period is from 1991Q4 to 2023Q4.

| | Pre-TRA Days | | | Other Days | | | |
|---|---|---|---|---|---|---|---|
| Maturity | Return | Std | Sharpe Ratio | Return | Std | Sharpe Ratio | Start Year |
| **Panel A: Treasury bonds** | | | | | | | |
| 1Y | 0.74 | 1.39 | 0.54 | 2.06 | 0.77 | 2.67 | 1991 |
| 2Y | 5.78 | 1.39 | 4.15 | 2.42 | 1.66 | 1.46 | 1991 |
| 5Y | 19.86 | 4.12 | 4.82 | 3.47 | 4.36 | 0.80 | 1991 |
| 7Y | 24.95 | 5.78 | 4.32 | 3.98 | 5.92 | 0.67 | 1991 |
| 10Y | 30.87 | 6.86 | 4.50 | 3.70 | 7.23 | 0.51 | 1991 |
| 20Y | 49.18 | 10.75 | 4.58 | 4.97 | 11.04 | 0.45 | 1991 |
| 30Y | 60.39 | 13.41 | 4.50 | 4.33 | 14.33 | 0.30 | 1991 |
| EW | 27.40 | 5.90 | 4.65 | 3.56 | 6.16 | 0.58 | 1991 |
| **Panel B: Treasury ETFs** | | | | | | | |
| SHY | 7.85 | 1.21 | 6.46 | 1.10 | 1.52 | 0.73 | 2002 |
| IEI | 24.70 | 3.72 | 6.64 | 2.06 | 4.16 | 0.50 | 2007 |
| IEF | 37.54 | 6.18 | 6.08 | 2.59 | 6.90 | 0.38 | 2002 |
| TLH | 36.36 | 9.34 | 3.89 | 2.80 | 10.57 | 0.26 | 2007 |
| TLT | 59.62 | 12.67 | 4.71 | 3.85 | 14.51 | 0.27 | 2002 |
| TIP | 33.82 | 5.42 | 6.24 | 2.57 | 6.35 | 0.41 | 2003 |
| **Panel C: Corporate Bond ETFs** | | | | | | | |
| LQD | 38.89 | 6.28 | 6.19 | 3.76 | 8.54 | 0.44 | 2002 |
| VCSH | 12.63 | 1.91 | 6.61 | 2.06 | 2.97 | 0.69 | 2009 |
| VCIT | 34.45 | 4.58 | 7.52 | 3.41 | 5.86 | 0.58 | 2009 |
| VCLT | 35.20 | 9.61 | 3.66 | 4.74 | 11.96 | 0.40 | 2009 |
| **Panel D: Stock ETFs** | | | | | | | |
| SPY | -2.07 | 19.03 | -0.11 | 10.53 | 18.75 | 0.56 | 1993 |

**Table 6** Pre-Refunding Announcements Return across Subsamples

This table reports the average returns of Treasurys of various maturities on pre-TRA days across several subsamples. Panel A presents the baseline results for the full sample. Panel B splits the sample into pre-2002 and post-2002 periods. Panel C splits the sample based on the federal budget balance (Surplus or Deficit). Panel D splits the sample by the proximity to the debt ceiling and subsequent changes of the debt ceiling (Close to debt ceiling, Close to change, Both, and Neither). Panel E splits the sample by whether the federal funds rate is at the zero lower bound (ZLB). Panel F splits the sample based on whether the economy is in a recession, as determined by the NBER recession dating committee. Panel G splits the sample by the slope of the Treasury yield curve, defined as the difference between the 10-year and 2-year constant maturity Treasury yields from Gürkaynak et al. (2007) (Upward or Downward sloping). Panel H splits the sample by calendar quarter. $t$-statistics are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | | 1Y | | 5Y | | 10Y | | 30Y | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | $t$-stat | Mean | $t$-stat | Mean | $t$-stat | Mean | $t$-stat |
| **A. Full sample** | | | | | | | | | |
| Full | 129 | 0.66 | [0.86] | 8.25*** | [3.62] | 12.62*** | [3.32] | 24.33*** | [3.27] |
| **B. Pre and post 2002** | | | | | | | | | |
| Pre-2002 | 41 | 0.86 | [1.27] | 4.55 | [1.10] | 6.48 | [1.03] | 17.44 | [1.61] |
| Post-2002 | 88 | 0.57 | [0.53] | 9.97*** | [3.66] | 15.48*** | [3.27] | 27.55*** | [2.85] |
| **C. Federal budget balance** | | | | | | | | | |
| Surplus | 16 | -0.42 | [-0.37] | -4.47 | [-0.68] | -7.81 | [-0.68] | -3.40 | [-0.17] |
| Deficit | 113 | 0.82 | [0.94] | 10.05*** | [4.20] | 15.51*** | [3.91] | 28.26*** | [3.54] |
| **D. Debt ceiling** | | | | | | | | | |
| Close to debt ceiling | 55 | 1.01 | [0.60] | 9.25*** | [2.86] | 14.51*** | [2.79] | 30.41*** | [2.92] |
| Close to change | 19 | -1.68** | [-2.37] | 12.01* | [1.84] | 19.81* | [1.88] | 42.80** | [2.02] |
| Both | 16 | -1.24** | [-1.99] | 16.79** | [2.51] | 28.69*** | [2.76] | 59.90*** | [2.77] |
| Neither | 64 | 0.49 | [0.94] | 8.22** | [2.39] | 11.92** | [2.01] | 22.06* | [1.89] |
| **E. Zero lower bound** | | | | | | | | | |
| ZLB | 28 | -1.94*** | [-5.07] | 17.47*** | [3.34] | 27.06*** | [2.72] | 47.77** | [2.15] |
| Non-ZLB | 101 | 1.39 | [1.43] | 5.69** | [2.30] | 8.62** | [2.19] | 17.84** | [2.49] |
| **F. Recession** | | | | | | | | | |
| Recession | 10 | -0.94 | [-0.51] | 2.12 | [0.18] | -2.18 | [-0.10] | -16.67 | [-0.45] |
| Non-recession | 119 | 0.80 | [0.97] | 8.76*** | [3.86] | 13.86*** | [3.73] | 27.78*** | [3.75] |
| **G. Slope of the yield curve** | | | | | | | | | |
| Upward-sloping | 118 | 0.78 | [0.92] | 8.94*** | [3.78] | 13.66*** | [3.42] | 26.36*** | [3.33] |
| Downward-sloping | 10 | -0.43 | [-0.38] | 2.04 | [0.22] | 4.71 | [0.36] | 10.12 | [0.50] |
| **H. By quarter** | | | | | | | | | |
| Q1 | 32 | 0.51 | [0.93] | 14.51*** | [3.61] | 24.55*** | [3.70] | 45.93*** | [3.74] |
| Q2 | 32 | 1.30 | [0.44] | -1.60 | [-0.36] | -2.81 | [-0.36] | -7.83 | [-0.51] |
| Q3 | 32 | 0.18 | [0.24] | 11.52** | [2.16] | 15.49* | [1.86] | 30.42* | [1.81] |
| Q4 | 33 | 0.67 | [1.10] | 8.55** | [2.11] | 13.23* | [1.86] | 28.68** | [2.07] |

**Table 7** Pre-TRA Returns and FOMC Announcements

This table reports regression results using the CRSP Treasury bond returns with maturities ranging from 1 to 30 years as dependent variables. Panel A examines differences in returns on pre-TRA days conditional on the relative timing between TRA and FOMC announcements. "FOMC Far" is an indicator that equals 1 if there is no FOMC announcement within 5 days of the TRA. "FOMC Later (Earlier)" is an indicator that equals 1 if the FOMC occurs after (before) the TRA announcement within 5 days, and 0 otherwise. Panel B examines differences in returns on pre-TRA days conditional on the current FOMC rate announcement. "Cut (Hike)" is an indicator for each day that equals 1 if the most recent FOMC meeting announces a rate cut (hike). Day-of-week (DOW) and end-of-month (EOM) fixed effects are included in all specifications. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Relationship with Proximate FOMC Meeting** | | | | | | | |
| pre-TRA × FOMC Far | 2.42 | 2.31 | 4.01 | 3.24 | 4.40 | 11.78 | 8.89 |
| | (1.99) | (1.48) | (4.18) | (5.81) | (6.50) | (9.96) | (11.87) |
| pre-TRA × FOMC Later | -0.49 | -0.14 | 1.77 | 2.23 | 3.60 | 3.42 | 5.53 |
| | (0.44) | (1.31) | (3.90) | (5.43) | (6.74) | (10.90) | (13.96) |
| pre-TRA × FOMC Earlier | -0.62 | 3.85*** | 14.19*** | 19.87*** | 23.65*** | 27.51*** | 34.63*** |
| | (0.54) | (1.12) | (3.45) | (4.91) | (6.15) | (10.02) | (12.75) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.025 | 0.009 | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 |
| **Panel B: Conditional on Most Recent FOMC Rate Announcement** | | | | | | | |
| pre-TRA | 0.97 | 2.77*** | 9.33*** | 11.77*** | 13.95*** | 18.50** | 22.13** |
| | (1.09) | (0.92) | (2.73) | (3.95) | (4.64) | (7.56) | (9.56) |
| pre-TRA × Hike | -1.16 | -3.03 | -8.33 | -9.02 | -9.68 | -11.61 | -14.30 |
| | (1.34) | (2.28) | (6.28) | (8.30) | (9.69) | (14.67) | (17.45) |
| pre-TRA × Cut | -1.80 | -3.14 | -14.33** | -20.63** | -21.34* | -24.87 | -36.18* |
| | (1.48) | (2.53) | (7.16) | (9.31) | (11.87) | (17.18) | (20.60) |
| Hike | 0.14 | -0.29 | -0.81 | -1.19 | -1.28 | -2.25 | -2.51 |
| | (0.14) | (0.30) | (0.75) | (0.99) | (1.19) | (1.77) | (2.19) |
| Cut | 1.09*** | 1.19** | 1.15 | 0.87 | -0.07 | -1.41 | -1.00 |
| | (0.24) | (0.48) | (1.14) | (1.56) | (1.84) | (2.67) | (3.43) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.029 | 0.011 | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 | 8,062 |

**Table 8** Treasury Returns Around FOMC Announcements

This table reports the average cumulative return over the 3-day FOMC window for Treasury Bonds of maturities ranging from 1-30 years in columns (1)-(7), cumulative returns for the equity market index in column (8), and cumulative returns for the equity market index from 2002-2023 in column (9). "All FOMC" represents all FOMC announcements between 1991Q4 and 2023. "TRA Near (Far)" is the subset of FOMC announcements where there is (is not) a TRA announcement within 5 days of the FOMC announcement. "TRA Later (Earlier)" is the subset of FOMC announcements where the TRA occurs after (before) the FOMC announcement within 5 days. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. See Table A.2 for a further breakdown between the 3 days around the FOMC window.

| | **1Y** (1) | **2Y** (2) | **5Y** (3) | **7Y** (4) | **10Y** (5) | **20Y** (6) | **30Y** (7) | **MKT** (8) | **MKT†** (9) |
|---|---|---|---|---|---|---|---|---|---|
| | 3-Day Cumulative Return (bps) | | | | | | | | |
| All FOMC | 5.40*** | 7.83*** | 14.83*** | 18.10*** | 20.46*** | 28.07*** | 33.56*** | 33.51** | 14.67 |
| | (0.62) | (1.28) | (3.26) | (4.60) | (5.63) | (8.21) | (10.59) | (13.86) | (18.43) |
| TRA Far | 6.54*** | 8.87*** | 16.59*** | 21.18*** | 24.91*** | 36.57*** | 45.40*** | 25.50 | -11.49 |
| | (0.78) | (1.62) | (4.09) | (5.85) | (7.10) | (10.28) | (13.05) | (16.95) | (24.95) |
| TRA Near | 2.71*** | 5.37*** | 10.65** | 10.81 | 9.92 | 7.93 | 5.49 | 52.57** | 55.19** |
| | (0.91) | (1.91) | (5.13) | (6.89) | (8.62) | (12.79) | (17.30) | (23.67) | (26.05) |
| TRA Later | 2.17* | 3.90 | 3.40 | -0.28 | -6.25 | -20.79 | -31.64 | 53.49 | 53.49 |
| | (1.31) | (2.38) | (6.78) | (9.16) | (11.66) | (17.44) | (22.96) | (40.49) | (40.49) |
| TRA Earlier | 3.14** | 6.55** | 16.46** | 19.69** | 22.85* | 30.90* | 35.20 | 51.83* | 56.94* |
| | (1.26) | (2.84) | (7.36) | (9.80) | (12.06) | (17.59) | (24.25) | (27.68) | (32.52) |

†2002-2023

**Table 9** Pre-Announcement Returns and Other Macroeconomic Announcements

This table presents OLS regression results of daily Treasury returns on pre-TRA day dummies, controlling for other macroeconomic announcements and their surprises. The dependent variables are daily CRSP Treasury bond returns with maturities ranging from 1 to 30 years. Panel A presents the baseline results, controlling for day-of-week and end-of-month fixed effects, Panel B additionally includes macroeconomic announcement day fixed effects, and Panel C additionally includes a full set of macroeconomic announcement surprises (the coefficients are available in Table A.3 in the Appendix). The macroeconomic announcements include Industrial Production, Nonfarm Payrolls, Consumer Price Index (CPI), Producer Price Index (PPI), Purchasing Manager Index (PMI), Unemployment Rate, Gross Domestic Product (GDP), University of Michigan Consumer Sentiment Final, Initial Jobless Claims, Retail Sales, Durable Goods Orders, Housing Starts, Construction Spending, Capacity Utilization, The Leading Index, Trade Balance, Factory Orders, New Home Sales, US Federal Budget Balance. The surprises are calculated as the difference between the actual and the consensus forecast from Refinitiv (formerly Reuters). Surprises of non-announcement days are set to zero. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2004 to 2023.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Baseline Results** | | | | | | | |
| pre-TRA | -0.14 | 2.33** | 8.41*** | 10.97** | 13.58** | 13.67 | 16.73 |
| | (0.38) | (1.00) | (3.13) | (4.40) | (5.41) | (8.79) | (11.12) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.028 | 0.009 | 0.005 | 0.004 | 0.004 | 0.002 | 0.003 |
| $N$ | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 |
| **Panel B: Including Macro Announcement Day FEs** | | | | | | | |
| pre-TRA | -0.50 | 2.16** | 8.25** | 10.89** | 12.93** | 11.35 | 12.72 |
| | (0.45) | (1.10) | (3.33) | (4.60) | (5.67) | (9.21) | (11.72) |
| Macro Announcement Day FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.26985 | 0.24948 | 0.24354 | 0.23437 | 0.22966 | 0.21807 | 0.22092 |
| $N$ | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 |
| **Panel C: Including Macro Announcement Surprises** | | | | | | | |
| pre-TRA | -0.10 | 2.51** | 9.02*** | 11.79*** | 14.53*** | 15.22* | 18.53 |
| | (0.39) | (1.01) | (3.16) | (4.46) | (5.49) | (8.95) | (11.34) |
| Macro Announcement Surprises | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.040 | 0.023 | 0.019 | 0.017 | 0.016 | 0.014 | 0.013 |
| $N$ | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 |

**Table 10** Pre-Announcement Returns and Actual Treasury Refunding Estimates

This table reports results from an OLS regression that regresses pre-TRA Treasury returns on realized Treasury refunding estimates. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years on the day before the TRA. The independent variables are three measures of marketable borrowing estimates announced by the Treasury Department on the TRA day: The seasonally-adjusted change in Marketable Borrowing estimate in quarter $t-1$ ($\Delta MB_{t-1}/GDP_{t-2}$, available before pre-TRA), the forecast revision of Marketable Borrowing in quarter $t$ ($\Delta MB_{t-2}/GDP_{t-1}$, available after pre-TRA), and the seasonally-adjusted change in Marketable Borrowing estimate in quarter $t$ ($FR_t(MB)/GDP_{t-1}$, available after pre-TRA). All measures are scaled by GDP from the previous quarter. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 1997:Q1 to 2023:Q4.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Marketable Borrowing Estimates in Quarter $t-1$** | | | | | | | |
| Constant | 0.00 | 0.02* | 0.07** | 0.09** | 0.11** | 0.17** | 0.22** |
| | (0.01) | (0.01) | (0.03) | (0.04) | (0.05) | (0.08) | (0.10) |
| $\Delta MB_{t-1}/GDP_{t-2}$ | 2.04 | 1.51* | 2.85 | 3.16 | 1.88 | 1.32 | 0.76 |
| | (1.47) | (0.77) | (2.07) | (2.94) | (3.40) | (5.74) | (7.41) |
| $R^2$ | 0.063 | 0.045 | 0.016 | 0.010 | 0.002 | 0.000 | 0.000 |
| $N$ | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| **Panel B: Forecast Revision of the Marketable Borrowing Estimates in Quarter $t$** | | | | | | | |
| Constant | 0.00 | 0.02** | 0.08*** | 0.09** | 0.12** | 0.18** | 0.22** |
| | (0.01) | (0.01) | (0.03) | (0.04) | (0.05) | (0.08) | (0.09) |
| $FR_t(MB)/GDP_{t-1}$ | 0.28 | -0.16 | -0.59 | -0.56 | -0.67 | -0.71 | 0.46 |
| | (0.35) | (0.26) | (0.92) | (1.63) | (2.19) | (4.67) | (5.66) |
| $R^2$ | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| $N$ | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| **Panel C: Marketable Borrowing Estimates in Quarter $t$** | | | | | | | |
| Constant | 0.00 | 0.02* | 0.07** | 0.09** | 0.11** | 0.17** | 0.22** |
| | (0.01) | (0.01) | (0.03) | (0.04) | (0.05) | (0.08) | (0.10) |
| $\Delta MB_t/GDP_{t-1}$ | -0.12 | 0.17 | 0.02 | 0.22 | 0.20 | 0.16 | 1.03 |
| | (0.16) | (0.32) | (0.88) | (1.20) | (1.40) | (2.78) | (3.36) |
| $R^2$ | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| $N$ | 101 | 101 | 101 | 101 | 101 | 101 | 101 |

**Table 11** Pre-Announcement Returns and Changes in Treasury Implied Volatility

This table reports estimation results of Regressions (3) in Panel A and (4) in Panel B. The dependent variables in columns (1)-(7) are CRSP Treasury bond returns with maturities ranging from 1 to 30 years and the equity market return in column (8). $\Delta TIV[-1,0]$ is the 1-day change in the Treasury Implied Volatility on the 10-year Treasury from Choi, Mueller, and Vedolin (2017), in basis points. $\Delta TIV$ is measured as $TIV_{t-1} - TIV_t$ so a higher value corresponds to greater resolution of uncertainty. Day-of-week (DOW) and end-of-month (EOM) fixed effects are included in all specifications in Panel A. In Panel B, $\Delta VIX[-1,0]$ is the 1-day change in the VIX index and $\Delta EPU[-1,0]$ is the 1-day change in Economic Policy Uncertainty from Baker et al. (2016), both calculated similarly to $\Delta TIV[-1,0]$. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 1991:10 to 2023:12.

| | Daily Return (bps) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** | **MKT** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A: All Days** | | | | | | | | |
| pre-TRA | 0.09 | 1.20 | 4.28* | 5.07 | 6.69 | 8.54 | 8.74 | -1.62 |
| | (0.74) | (0.87) | (2.59) | (3.63) | (4.41) | (6.94) | (8.65) | (11.09) |
| $\Delta TIV[-1,0]$ | 0.00 | 0.02* | 0.09*** | 0.15*** | 0.19*** | 0.25*** | 0.26*** | 0.73*** |
| | (0.00) | (0.01) | (0.02) | (0.03) | (0.05) | (0.07) | (0.10) | (0.12) |
| pre-TRA $\times$ $\Delta TIV[-1,0]$ | 0.07*** | 0.10** | 0.25** | 0.34** | 0.39** | 0.66** | 0.87** | -0.05 |
| | (0.02) | (0.04) | (0.11) | (0.16) | (0.19) | (0.32) | (0.39) | (0.51) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.025 | 0.012 | 0.018 | 0.021 | 0.023 | 0.018 | 0.013 | 0.045 |
| $N$ | 8,016 | 8,016 | 8,016 | 8,016 | 8,016 | 8,016 | 8,016 | 8,053 |
| **Panel B: pre-TRA Only** | | | | | | | | |
| Constant | 0.15 | 1.80** | 5.66** | 6.42* | 8.03** | 12.70** | 15.41** | -0.50 |
| | (0.68) | (0.83) | (2.41) | (3.45) | (3.88) | (6.02) | (7.62) | (5.39) |
| $\Delta TIV[-1,0]$ | 0.08*** | 0.12*** | 0.39*** | 0.56*** | 0.68*** | 1.08*** | 1.34*** | -0.11 |
| | (0.02) | (0.04) | (0.12) | (0.17) | (0.20) | (0.33) | (0.40) | (0.30) |
| $\Delta VIX[-1,-0]$ | -0.52 | -1.18** | -3.86** | -6.08** | -8.14*** | -13.62*** | -15.83** | 65.74*** |
| | (0.50) | (0.57) | (1.77) | (2.66) | (3.03) | (5.17) | (6.54) | (5.51) |
| $\Delta EPU[-1,-0]$ | 0.00 | 0.01 | -0.01 | -0.04 | -0.05 | -0.06 | -0.11 | 0.00 |
| | (0.01) | (0.01) | (0.04) | (0.05) | (0.07) | (0.11) | (0.13) | (0.08) |
| $R^2$ | 0.037 | 0.114 | 0.128 | 0.145 | 0.162 | 0.172 | 0.163 | 0.713 |
| $N$ | 128 | 128 | 128 | 128 | 128 | 128 | 128 | 128 |

**Table 12** Pre-Announcement Returns and Dispersion in Forecasts of Fiscal Deficit

This table reports the relationship between Treasury returns and dispersion in fiscal balance forecasts around pre-TRA days. The forecast dispersion is a daily measure of the interquartile range of individual fiscal balance forecasts for the current fiscal year from the Bloomberg ECFC survey. We compute the changes in forecast dispersion between (a) the day before and the pre-TRA day, $\Delta\text{ForecastDisp}[-1,0]$; (b) the day before and the day after the pre-TRA day, $\text{ForecastDisp}[-1,1]$; (c) the day before and 5 days after the pre-TRA day and $\Delta\text{ForecastDisp}[-1,5]$. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years. All regressions include day-of-week and end-of-month fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Changes in forecast dispersion between [-1,0]** | | | | | | | |
| pre-TRA | -0.39 | 2.16** | 8.80** | 11.51** | 14.14** | 13.73 | 17.45 |
| | (0.39) | (1.10) | (3.56) | (5.01) | (6.22) | (10.18) | (12.96) |
| $\Delta\text{ForecastDisp}[-1,0]$ | 0.59 | 0.17 | -2.83 | -2.76 | -5.40 | -12.45 | -18.75 |
| | (0.38) | (1.01) | (3.00) | (3.98) | (5.39) | (10.58) | (14.84) |
| pre-TRA $\times$ $\Delta\text{ForecastDisp}[-1,0]$ | 3.32 | 10.12 | 42.27 | 78.14* | 98.77** | 177.95** | 251.76*** |
| | (3.82) | (8.44) | (26.30) | (43.89) | (48.03) | (76.44) | (94.88) |
| $R^2$ | 0.035 | 0.010 | 0.005 | 0.005 | 0.004 | 0.003 | 0.004 |
| $N$ | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 |
| **Panel B: Changes in forecast dispersion between [-1,1]** | | | | | | | |
| pre-TRA | -0.40 | 2.14* | 8.79** | 11.56** | 14.22** | 14.01 | 17.89 |
| | (0.39) | (1.10) | (3.56) | (5.02) | (6.23) | (10.19) | (12.98) |
| $\Delta\text{ForecastDisp}[-1,1]$ | 0.60** | 0.27 | 1.80 | 5.47 | 5.22 | 11.73 | 14.73 |
| | (0.30) | (0.60) | (2.02) | (3.76) | (3.82) | (8.04) | (9.68) |
| pre-TRA $\times$ $\Delta\text{ForecastDisp}[-1,1]$ | 0.25 | 4.39 | 23.70 | 53.96 | 70.69* | 135.31** | 199.53** |
| | (3.48) | (7.53) | (22.93) | (36.52) | (40.44) | (66.93) | (83.70) |
| $R^2$ | 0.035 | 0.010 | 0.005 | 0.005 | 0.005 | 0.003 | 0.004 |
| $N$ | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 |
| **Panel C: Changes in forecast dispersion between [-1,5]** | | | | | | | |
| pre-TRA | -0.41 | 2.14* | 8.79** | 11.55** | 14.26** | 14.17 | 18.13 |
| | (0.39) | (1.10) | (3.58) | (5.05) | (6.27) | (10.25) | (13.06) |
| $\Delta\text{ForecastDisp}[-1,5]$ | -0.01 | -0.40 | -0.72 | -0.68 | -1.20 | -0.60 | -1.87 |
| | (0.12) | (0.35) | (1.07) | (1.62) | (2.15) | (3.92) | (5.05) |
| pre-TRA $\times$ $\Delta\text{ForecastDisp}[-1,5]$ | 0.36 | 2.51 | 15.00 | 34.34* | 47.94** | 101.41*** | 147.51*** |
| | (1.83) | (4.52) | (13.45) | (20.48) | (22.99) | (38.56) | (48.94) |
| $R^2$ | 0.035 | 0.010 | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 | 4,067 |

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Internet Appendix for

# Pre-Refunding Announcement Gains in U.S. Treasurys

## Appendix A: Additional Tables and Figures

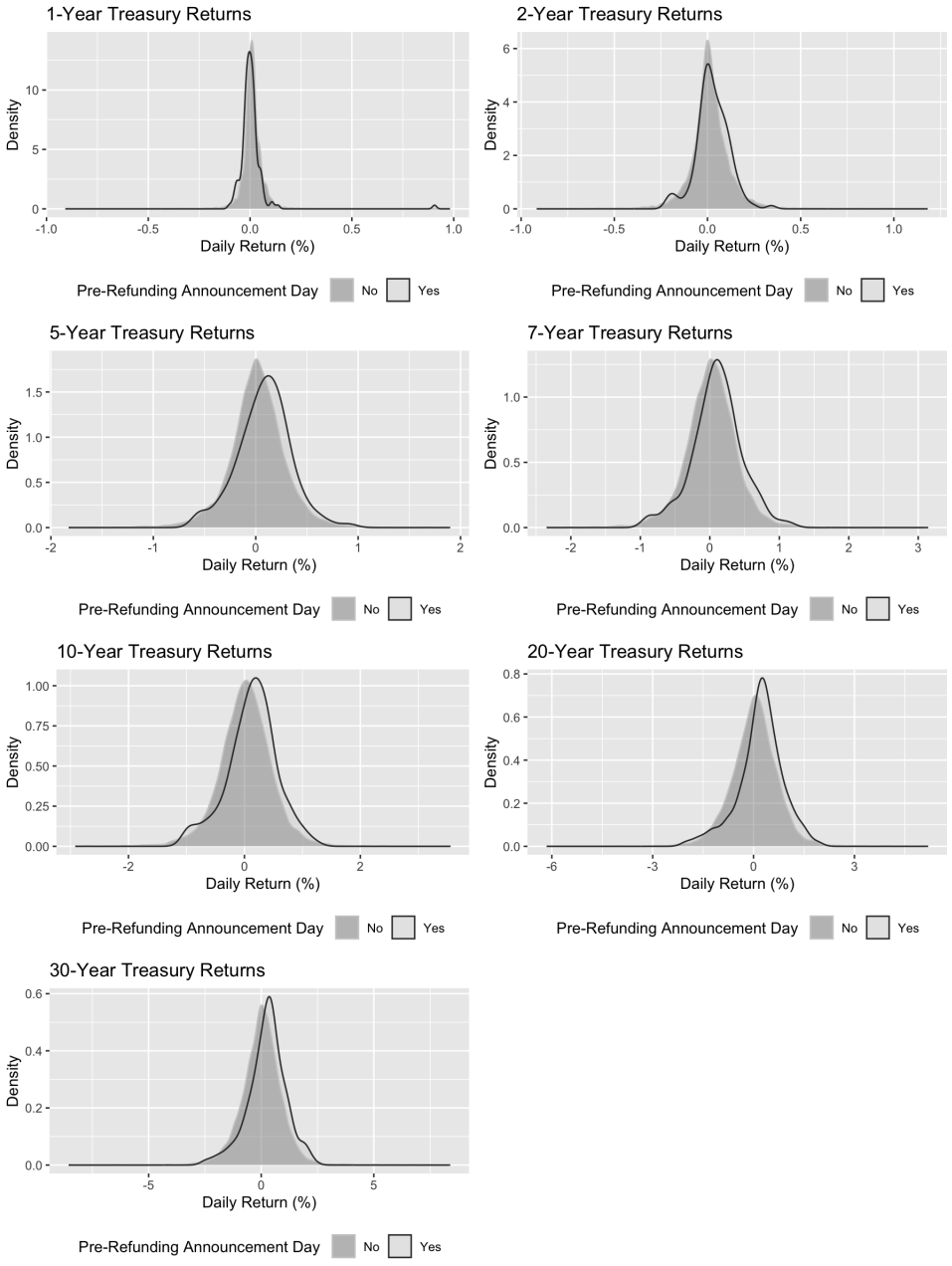



**Figure A.1** Distribution of Daily Returns for Treasurys of Various Maturities, Split by Pre-TRA and Non-Pre-TRA Days

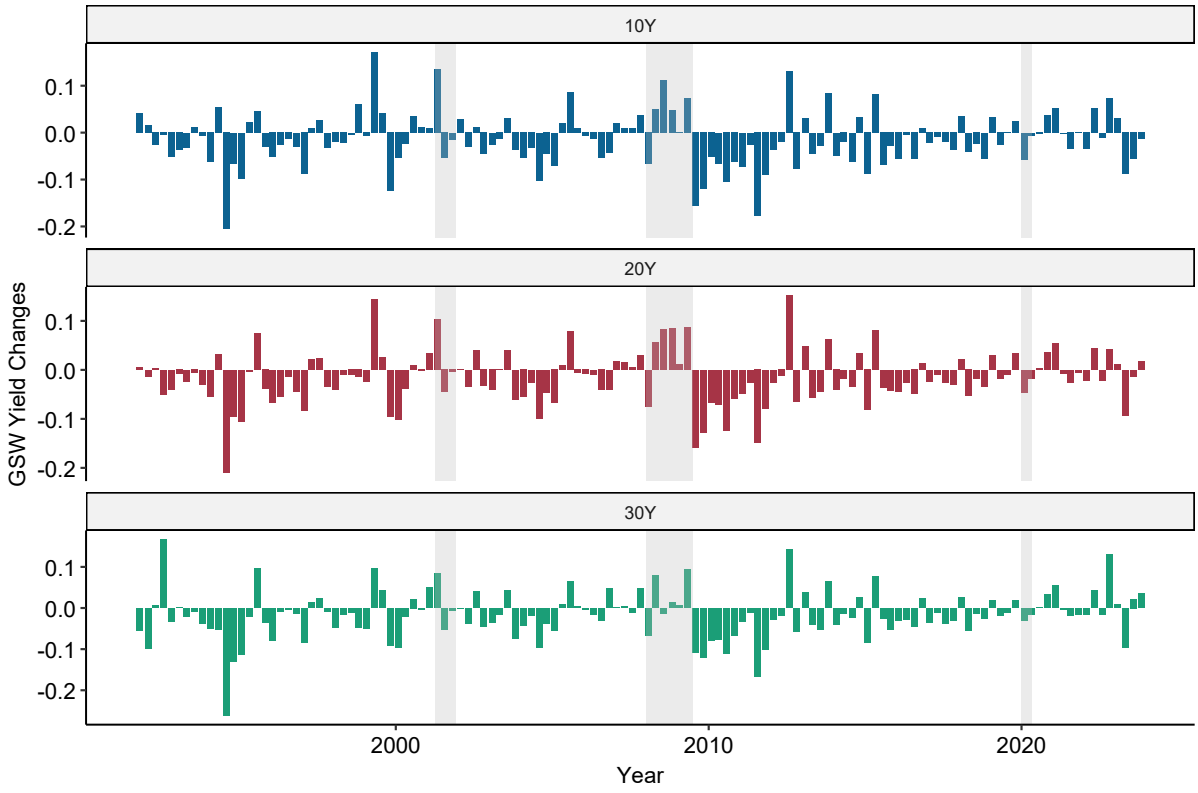
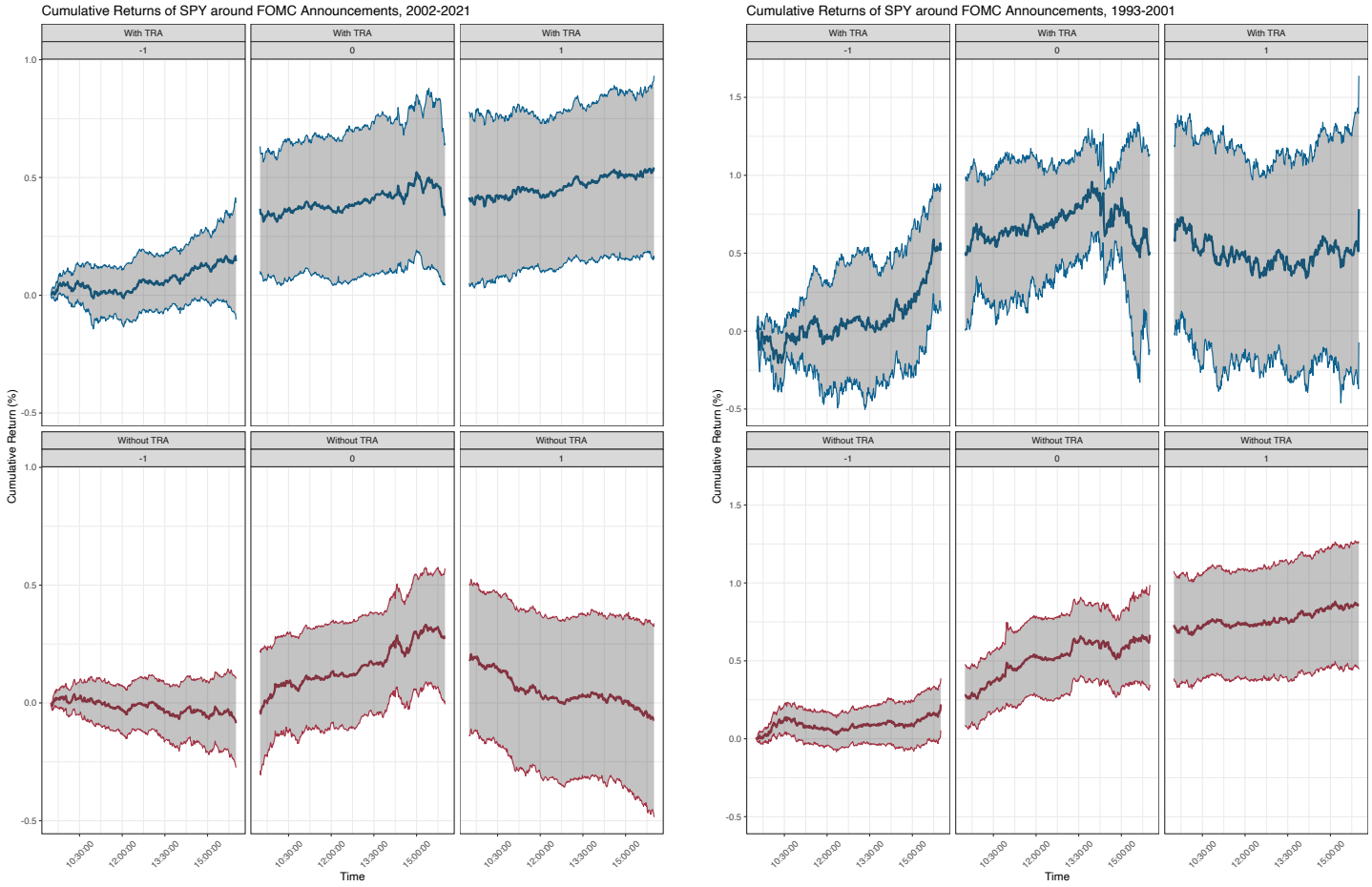



**Figure A.2** Daily Changes of 10-Year GSW Yields on the Day Prior to Quarterly Refunding Announcements




**A.** 2002-2021 **B.** 1993-2001

**Figure A.3** Pre-FOMC Drift, Split by Time Period and FOMC Announcements With and Without a Proximate TRA

**Table A.1** Treasury Returns around Quarterly Refunding Announcements: ETFs

This table reports estimation results of Regression (1) using bond and equity ETF returns. The ETFs include SHY (1-3 year Treasury Bonds), IEI (3-7 year), IEF (7-10 year), TLH (10-20 year), TLT (20+ year), TIP (Inflation Protected Treasurys), LQD (Investment-Grade Corporate Bonds), VCSH (Short-Term Corporate Bonds), VCIT (Intermediate-Term Corporate Bonds), VCLT (Long-Term Corporate Bonds), and SPY (S&P 500 Equity Index). Day-of-week (DOW) and end-of-month (EOM) fixed effects are included in certain specifications. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Daily Return (bps) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Treasury ETFs | | | | | | Corporate Bond ETFs | | | | Stock ETF |
| Ticker | **SHY** | **IEI** | **IEF** | **TLH** | **TLT** | **TIP** | **LQD** | **VCSH** | **VCIT** | **VCLT** | **SPY** |
| Start Year | 2002 | 2007 | 2002 | 2007 | 2002 | 2003 | 2002 | 2009 | 2009 | 2009 | 1993 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| **Panel A** | | | | | | | | | | | |
| pre-TRA | 2.65*** | 8.98*** | 13.81*** | 13.34* | 22.06** | 12.39*** | 13.78*** | 4.20** | 12.29*** | 12.03 | -4.77 |
| | (0.84) | (2.86) | (4.25) | (7.19) | (8.72) | (3.84) | (4.35) | (1.66) | (3.91) | (8.19) | (10.87) |
| TRA | -1.59* | -0.28 | -6.22 | -1.34 | -9.79 | -2.09 | -8.45** | -1.22 | -5.42 | -9.74 | 10.33 |
| | (0.83) | (2.78) | (4.25) | (7.70) | (9.90) | (4.04) | (4.01) | (1.42) | (3.63) | (8.44) | (10.72) |
| post-TRA | -0.26 | -0.33 | 2.67 | 3.44 | 6.35 | 1.83 | -1.01 | 1.12 | 3.79 | 7.19 | 3.89 |
| | (0.94) | (3.44) | (4.87) | (8.43) | (10.99) | (4.53) | (4.38) | (1.74) | (4.56) | (9.93) | (10.74) |
| Constant | 0.68*** | 1.00*** | 1.30** | 1.26 | 1.81 | 1.24** | 1.86*** | 0.95** | 1.52** | 2.07 | 4.31*** |
| | (0.12) | (0.38) | (0.57) | (0.95) | (1.16) | (0.55) | (0.71) | (0.38) | (0.68) | (1.29) | (1.19) |
| $R^2$ | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.000 |
| $N$ | 5,393 | 4,270 | 5,393 | 4,270 | 5,393 | 5,049 | 5,393 | 3,547 | 3,547 | 3,547 | 7,784 |
| **Panel B** | | | | | | | | | | | |
| pre-TRA | 1.93** | 7.05** | 10.37** | 9.03 | 12.83 | 7.15* | 8.98* | 1.75 | 7.69* | 0.82 | -4.98 |
| | (0.91) | (3.08) | (4.52) | (7.58) | (9.25) | (4.11) | (4.61) | (1.79) | (4.08) | (8.72) | (11.32) |
| TRA | -1.28 | -1.24 | -6.47 | -2.62 | -10.16 | -0.74 | -7.60* | -0.58 | -3.79 | -6.99 | 10.53 |
| | (0.87) | (2.89) | (4.41) | (7.99) | (10.17) | (4.14) | (4.51) | (1.62) | (4.00) | (8.89) | (11.36) |
| post-TRA | -0.16 | -0.84 | 1.80 | 2.57 | 5.33 | 2.50 | -2.16 | 0.76 | 3.40 | 8.63 | 0.75 |
| | (0.96) | (3.55) | (5.05) | (8.73) | (11.35) | (4.66) | (4.70) | (1.73) | (4.63) | (10.14) | (10.99) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.006 | 0.005 | 0.004 | 0.002 | 0.003 | 0.005 | 0.004 | 0.006 | 0.007 | 0.005 | 0.000 |
| $N$ | 5,393 | 4,270 | 5,393 | 4,270 | 5,393 | 5,049 | 5,393 | 3,547 | 3,547 | 3,547 | 7,784 |

**Table A.2** Treasury Returns Around FOMC Announcements: Day by Day

This table reports regression results where the dependent variable is returns of Treasury Bonds with maturities ranging from 1 to 30 years in columns (1)-(7), the equity market return in column (8), and the equity market return between 2002-2023 in column (9). "FOMC" is the day of an FOMC announcement. "Pre- (Post-) FOMC" is the day before (after) an FOMC announcement. "TRA Far" is an indicator that equals 1 if there is not a TRA announcement within 5 days of the FOMC announcement. "TRA Later (Earlier)" is an indicator that equals 1 if the TRA occurs after (before) the FOMC announcement within 5 days, and 0 otherwise. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | **1Y** (1) | **2Y** (2) | **5Y** (3) | **7Y** (4) | **10Y** (5) | **20Y** (6) | **30Y** (7) | **MKT** (8) | **MKT†** (9) |
|---|---|---|---|---|---|---|---|---|---|
| | Daily Return (bps) | | | | | | | | |
| pre-FOMC × ... | | | | | | | | | |
| ... TRA Far | 0.66 | 1.77** | 4.33** | 5.51** | 5.49* | 10.09** | 13.16** | -0.48 | -13.58 |
| | (0.44) | (0.82) | (2.05) | (2.69) | (3.17) | (4.65) | (5.85) | (8.79) | (13.03) |
| ... TRA Later | -0.80*** | -0.76 | -1.59 | -1.46 | -4.36 | -5.64 | -8.50 | 21.39 | 19.47 |
| | (0.31) | (1.00) | (3.61) | (5.46) | (6.91) | (12.14) | (16.30) | (30.63) | (30.70) |
| ... TRA Earlier | 0.09 | 0.68 | 4.93 | 8.18* | 12.22** | 22.23** | 28.99** | 7.89 | -2.03 |
| | (0.63) | (1.29) | (3.35) | (4.59) | (6.01) | (9.90) | (13.55) | (13.54) | (16.40) |
| FOMC × ... | | | | | | | | | |
| ... TRA Far | 1.38*** | 2.77** | 6.88** | 8.53** | 11.24** | 16.31*** | 21.90*** | 33.11*** | 32.70** |
| | (0.50) | (1.20) | (3.05) | (4.12) | (4.70) | (6.06) | (7.32) | (9.81) | (13.57) |
| ... TRA Later | 1.21 | -0.05 | -0.54 | -2.29 | -4.53 | -15.22 | -22.35 | 20.90 | 20.40 |
| | (1.24) | (2.51) | (6.23) | (7.70) | (9.53) | (13.05) | (17.69) | (20.03) | (20.14) |
| ... TRA Earlier | -0.41 | 1.70 | 5.36 | 5.72 | 5.33 | 9.09 | 11.67 | 13.89 | 22.05 |
| | (0.77) | (1.72) | (4.38) | (5.93) | (7.08) | (10.46) | (13.95) | (16.11) | (18.50) |
| post-FOMC × ... | | | | | | | | | |
| ... TRA Far | 0.94** | 0.79 | 1.65 | 3.36 | 5.34 | 8.47 | 11.70 | -19.25* | -42.53*** |
| | (0.42) | (0.84) | (2.35) | (3.31) | (4.05) | (6.26) | (8.03) | (10.43) | (15.90) |
| ... TRA Later | -0.95* | -1.32 | -5.53 | -9.64 | -12.43 | -19.33 | -23.89 | -1.49 | -2.40 |
| | (0.54) | (1.42) | (4.67) | (6.44) | (8.56) | (12.70) | (15.96) | (19.49) | (19.66) |
| ... TRA Earlier | 0.55 | 0.47 | 1.21 | 0.45 | 0.17 | -5.58 | -9.12 | 17.30 | 21.10 |
| | (0.80) | (1.61) | (4.07) | (5.42) | (6.92) | (11.02) | (15.24) | (17.56) | (21.21) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.027 | 0.011 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.003 | 0.005 |
| $N$ | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,061 | 8,121 | 5,535 |

†2002-2023

**Table A.3** Pre-Announcement Returns and Other Macroeconomic Announcement Surprises

This table presents OLS regression results of daily Treasury returns on pre-TRA day dummies, controlling for macroeconomic announcements surprises. The dependent variables are daily CRSP Treasury bond returns with maturities ranging from 1 to 30 years. The independent variables include includes the full set of macroeconomic announcement surprises. All regressions include day-of-week and end-of-month fixed effects. The macroeconomic announcements include Industrial Production, Nonfarm Payrolls, Consumer Price Index (CPI), Producer Price Index (PPI), Purchasing Manager Index (PMI), Unemployment Rate, Gross Domestic Product (GDP), University of Michigan Consumer Sentiment Final, Initial Jobless Claims, Retail Sales, Durable Goods Orders, Housing Starts, Construction Spending, Capacity Utilization, The Leading Index, Trade Balance, Factory Orders, New Home Sales, US Federal Budget Balance. The surprises are calculated as the difference between the actual and the consensus forecast from Refinitiv (formerly Reuters). Surprises of non-announcement days are set to zero. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2004 to 2023.

| Maturity | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| pre-TRA | -0.10 | 2.51** | 9.02*** | 11.79*** | 14.53*** | 15.22* | 18.53 |
| | (0.39) | (1.01) | (3.16) | (4.46) | (5.49) | (8.95) | (11.34) |
| **Macro Announcement Surprises:** | | | | | | | |
| PMI | -3.67** | -8.16** | -19.40** | -20.50 | -23.11 | -29.23 | -28.87 |
| | (1.44) | (3.45) | (8.96) | (12.54) | (15.83) | (25.82) | (34.75) |
| Consumer Sentiment Final | -7.36*** | -18.65*** | -51.16*** | -63.53** | -69.52** | -96.60* | -125.13* |
| | (2.72) | (6.45) | (17.81) | (26.09) | (31.88) | (52.15) | (66.12) |
| Initial Jobless Claims | -0.19** | -0.33 | -0.78 | -1.19 | -1.21 | -1.72 | -2.43 |
| | (0.09) | (0.22) | (0.62) | (0.86) | (1.04) | (1.77) | (2.40) |
| The Leading Index | -0.50 | -2.11* | -5.10 | -5.95 | -5.15 | -6.97 | -6.52 |
| | (0.49) | (1.15) | (3.43) | (4.70) | (5.37) | (9.12) | (12.03) |
| Unemployment Rate | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Factory Orders | -1.40 | -4.93 | -17.25 | -20.83 | -27.16 | -45.71 | -58.51 |
| | (1.00) | (3.67) | (11.69) | (16.67) | (19.48) | (34.65) | (42.76) |
| Trade Balance | 0.00 | 0.00 | 0.00** | 0.00** | 0.00*** | 0.00*** | 0.00*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| New Home Sales | 0.00 | 0.00** | 0.00** | 0.00** | 0.00** | 0.00* | 0.00* |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Capacity Utilization | 2.65** | 3.00 | 4.99 | 4.58 | 5.30 | 6.90 | -0.90 |
| | (1.28) | (2.22) | (6.74) | (9.96) | (13.22) | (21.90) | (29.44) |
| Housing Starts | 0.00** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| PPI | -2.30*** | -1.82 | -5.08 | -5.42 | -0.83 | -3.20 | -8.65 |
| | (0.83) | (2.16) | (7.10) | (11.35) | (13.11) | (23.29) | (31.58) |
| Construction Spending | 0.00 | 0.00 | 0.00 | 0.00** | 0.00** | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| CPI | -0.55*** | -1.44*** | -4.55*** | -6.23*** | -7.30*** | -11.35*** | -13.17*** |
| | (0.13) | (0.32) | (0.93) | (1.35) | (1.68) | (2.86) | (3.73) |
| Consumer Sentiment Preliminary | -0.26 | -1.18 | -3.71 | -4.03 | 1.29 | 11.02 | 23.52 |
| | (1.26) | (3.15) | (9.62) | (13.70) | (16.61) | (27.01) | (38.55) |
| Industrial Production | -0.42** | -1.69*** | -4.54** | -5.38** | -6.64** | -10.93* | -14.45 |
| | (0.19) | (0.59) | (1.77) | (2.57) | (3.19) | (5.99) | (9.26) |
| Retail Sales | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Nonfarm Payrolls | 0.04 | -0.86 | -3.51 | -4.89 | -5.94 | -9.56 | -12.84 |
| | (0.21) | (0.64) | (2.19) | (3.37) | (3.90) | (6.36) | (8.48) |
| Federal Budget | -0.18 | -0.92 | -3.82** | -5.60** | -6.39* | -8.94 | -11.96 |
| | (0.22) | (0.57) | (1.82) | (2.60) | (3.33) | (6.06) | (8.45) |
| Durable Goods Orders | 0.83** | 0.92 | 3.06* | 4.79** | 8.29*** | 12.89*** | 19.50*** |
| | (0.35) | (0.67) | (1.56) | (1.95) | (2.49) | (4.29) | (6.74) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.040 | 0.023 | 0.019 | 0.017 | 0.016 | 0.014 | 0.013 |
| $N$ | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 | 5,005 |

# Appendix B: Additional Evidence for Uncertainty Reduction

**Intraday Liquidity**

Our intraday data allows for direct visibility into the number of dealers submitting a bid or ask on each Treasury security on the Tradeweb platform, along with the maximum bid and minimum ask price. Dealers account for a sizable portion of the volume in the Treasury market (Fleming, Keane, and Schaumburg, 2016) and may be responsible for much of the information production and uncertainty reduction around TRAs. Thus, we expect Treasury market liquidity to improve around TRAs, specifically beginning on the pre-TRA day.

We aggregate our minute-level data to 10-minute intervals, and consider two measures of liquidity: (1) the bid-ask spread and (2) the total number of bids and asks made by dealers. **Figure A.4** plots the bid-ask for the 5-year, 10-year, and 30-year Treasurys on pre-TRA, TRA, and post-TRA days, overlaid on the average bid-ask spread on non-TRA days. Bid-ask spreads are systematically lower across the three-day TRA window compared to other non-TRA days. **Figure A.5** plots the number of bids and asks across dealers. For all three maturities, the total number of bids and asks among dealers is higher on days in the three-day TRA window compared to non-TRA days. The biggest difference in liquidity occurs on the pre-TRA day.

Motivated by the graphical evidence, we conduct a formal test to determine if Treasury liquidity increases around TRAs. **Table A.4** presents results from a regression of liquidity measures on dummies for pre-TRA, TRA, and post-TRA days, with other non-TRA days serving as the comparison group. **Panel A** uses the bid-ask spread as the liquidity measure, while **Panel B** uses the total number of bids and asks. The results indicate improved Treasury market liquidity around TRAs, particularly for 30-year maturity Treasurys on pre-TRA and TRA days. Compared to non-TRA days, 30-year maturity Treasurys on pre-TRA days have an on average approximately 0.5bp lower bid-ask spread and approximately 50 more dealer quotes per 10-minute interval on the Tradeweb platform. These results remain largely significant, although slightly muted, after including day-of-week, end-of-month, and time-of-day fixed effects: the 30-year Treasury has an approximately 0.3 bps lower bid-ask spread and around 14 more dealer quotes on pre-TRA days compared to non-TRA days.

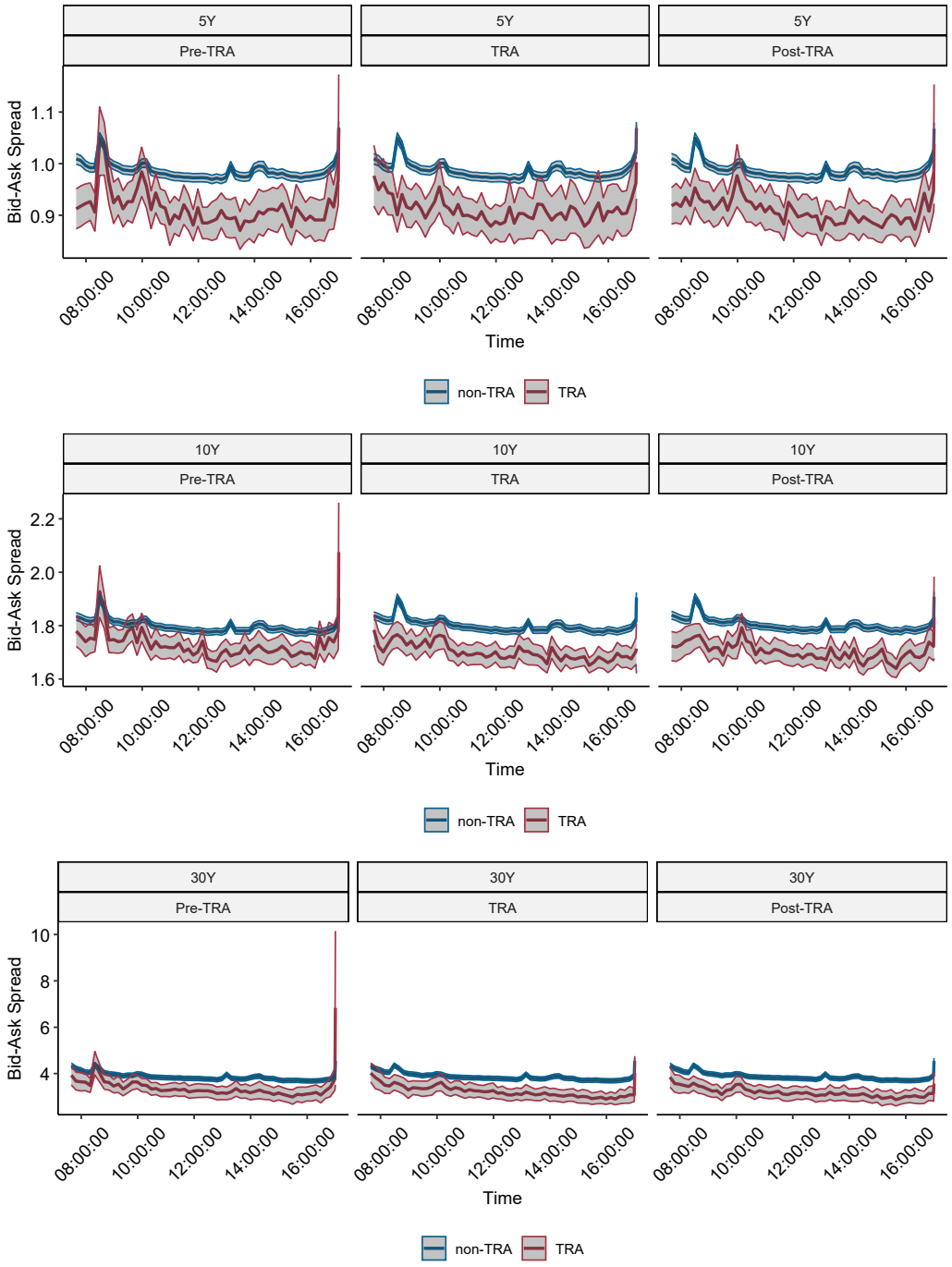



**Figure A.4** Bid-Ask Spread around Treasury Refunding Announcements

This figure plots the average bid-ask spread in 10-minute intervals for Treasurys with maturities of 5, 10, and 30 years. The red lines depict this liquidity measure on TRA days, while the blue lines represent it during any three-day period that does not overlap with TRAs. The shaded areas represent 90% confidence intervals.

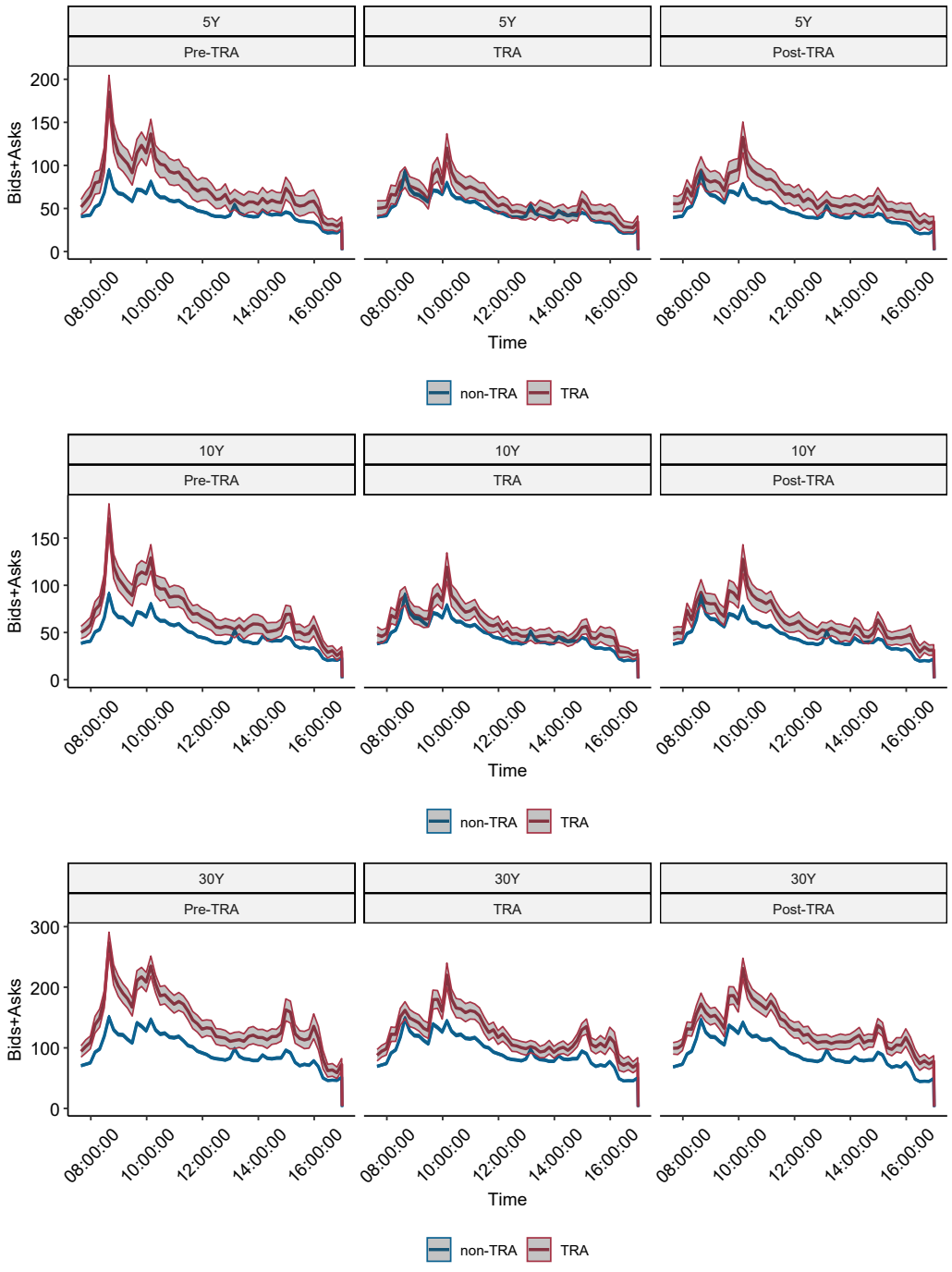



**Figure A.5** Total Bids and Asks around Treasury Refunding Announcements

This figure plots the total number of bids and asks, aggregated in 10-minute intervals, for Treasurys with maturities of 5, 10, and 30 years. The red lines depict this liquidity measure on TRA days, while the blue lines represent it during any three-day period that does not overlap with TRAs. The shaded areas represent 90% confidence intervals.

**Table A.4** Intraday Liquidity around TRAs

This table reports various intraday liquidity measures across the Treasury Refunding Announcement dates. The dependent variables are the intraday liquidity measures: average bid-ask spreads (Panel A) and total number of bids and asks (Panel B) in 10-minute intervals. We use the Tradeweb data for the 2, 5, 10, and 30-year Treasury bonds from 2006 to 2023. Day-of-week (DOW), end-of-month (EOM), and time of day (TOD) fixed effects are included in certain specifications. The comparison group is all days that are not in the 3-day window around TRAs. Standard errors based on Newey-West $t$-statistics with optimal length are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | **2Y** | **5Y** | **10Y** | **30Y** | **2Y** | **5Y** | **10Y** | **30Y** |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A: Bid-ask spread** | | | | | | | | |
| Constant | 0.77*** | 0.99*** | 1.80*** | 3.88*** | | | | |
| | (0.00) | (0.00) | (0.00) | (0.03) | | | | |
| Pre-TRA | -0.04*** | -0.07*** | -0.07*** | -0.47*** | -0.01 | -0.05*** | -0.06*** | -0.31** |
| | (0.01) | (0.01) | (0.01) | (0.12) | (0.02) | (0.02) | (0.02) | (0.14) |
| TRA | -0.04** | -0.08*** | -0.10*** | -0.64*** | -0.02 | -0.04*** | -0.08*** | -0.43*** |
| | (0.02) | (0.01) | (0.01) | (0.11) | (0.02) | (0.02) | (0.02) | (0.12) |
| Post-TRA | -0.04** | -0.08*** | -0.10*** | -0.68*** | 0.01 | -0.02 | -0.04*** | -0.27** |
| | (0.02) | (0.01) | (0.01) | (0.11) | (0.02) | (0.01) | (0.01) | (0.11) |
| DOW FE | | | | | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | ✓ | ✓ | ✓ | ✓ |
| TOD FE | | | | | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.031 | 0.025 | 0.015 | 0.014 |
| $N$ | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 |
| **Panel B: Number of bids and asks** | | | | | | | | |
| Constant | 21.31*** | 46.46*** | 45.28*** | 89.33*** | | | | |
| | (0.32) | (0.44) | (0.39) | (0.66) | | | | |
| Pre-TRA | 11.81*** | 27.36*** | 24.19*** | 50.86*** | 0.02 | 5.17 | 3.90 | 13.93*** |
| | (3.34) | (4.47) | (3.32) | (4.90) | (3.44) | (4.46) | (3.22) | (4.68) |
| TRA | 1.91 | 10.39*** | 10.97*** | 30.33*** | 0.09 | 5.93* | 5.88** | 18.38*** |
| | (2.23) | (3.32) | (2.60) | (4.01) | (2.32) | (3.31) | (2.54) | (3.88) |
| Post-TRA | 5.11* | 17.44*** | 15.32*** | 38.57*** | -3.16 | -0.53 | -2.62 | 0.38 |
| | (2.87) | (3.69) | (2.91) | (4.21) | (2.96) | (3.66) | (2.83) | (3.98) |
| DOW FE | | | | | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | ✓ | ✓ | ✓ | ✓ |
| TOD FE | | | | | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.001 | 0.003 | 0.003 | 0.006 | 0.124 | 0.305 | 0.363 | 0.500 |
| $N$ | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 | 368,242 |

**Text-Based Uncertainty**

Every quarter, on the day following the primary announcement, the Treasury Department meets with the Treasury Borrowing Advisory Committee (TBAC). The TBAC is comprised of members from large financial institutions such as banks, broker dealers, hedge funds, and asset managers.[14] During this meeting, the TBAC presents their assessment of the current state of the Treasury market and makes recommendations on timely debt management issues. In addition, the Treasury assigns "charges" to the TBAC, which involve questions and issues they seek guidance on for the quarter ahead. The minutes for the TBAC meeting are released as part of the secondary release, which occurs one day after the meeting itself and two days after the primary release.

We employ a large language model, GPT-4o, to extract uncertainty levels from the text of the TBAC minutes, following a methodology similar to Bybee (2023). For each quarter, we feed in the full text of the TBAC minutes and prompt GPT to return its assessment of the level of uncertainty embedded in the meeting minutes.[15] The time series of this measure, which we call "TBAC Uncertainty" is shown in **Figure A.7**. The series exhibits somewhat expected patterns, with noticeable spikes around the Great Recession and the beginning of the COVID-19 pandemic sandwiched around a relatively low uncertainty period in the 2010s. TBAC uncertainty is elevated during times when the MOVE index is higher, with a correlation of 0.25.

Because the TBAC meeting occurs after the primary release and discussion topics span beyond the refunding numbers themselves, the uncertainty extracted from the meeting minutes can be understood as the *leftover uncertainty* following the TRAs. Therefore, we may expect higher TBAC uncertainty to be related to lower pre-TRA returns, as higher leftover uncertainty is related to lower uncertainty reduction in the days prior. **Table A.5** documents this relationship. We find that pre-TRA returns are higher when TBAC uncertainty is low. This pattern is strongest for the longest maturity bonds, and holds after controlling for MOVE index levels. A one standard deviation increase in leftover uncertainty is associated with a 7 basis point lower pre-TRA return on the 10-year Treasury and a 16 basis point lower pre-TRA return on the 30-year Treasury, accounting for a large portion of the pre-TRA returns.

[14] List of current TBAC members can be found on the Treasury website.

[15] See **Figure A.6** for the full prompt.

```
Here is the Minutes of the Meeting of the Treasury Borrowing
    Advisory Committee of the Securities Industry and Financial
    Markets Association:

‘‘{minutes}’’

How much uncertainty do you think these minutes indicate in the
    Treasury’s financing strategy and market conditions?

Write your answer as:

{{magnitude of uncertainty (0-100, 0 is the lowest uncertainty, 100
    is highest uncertainty)}}:
{{confidence (0-1)}}:
{{explanation (less than 25 words)}}:
```

**Figure A.6** Full Prompt for Extracting Uncertainty from TBAC Meeting Minutes using GPT-4o

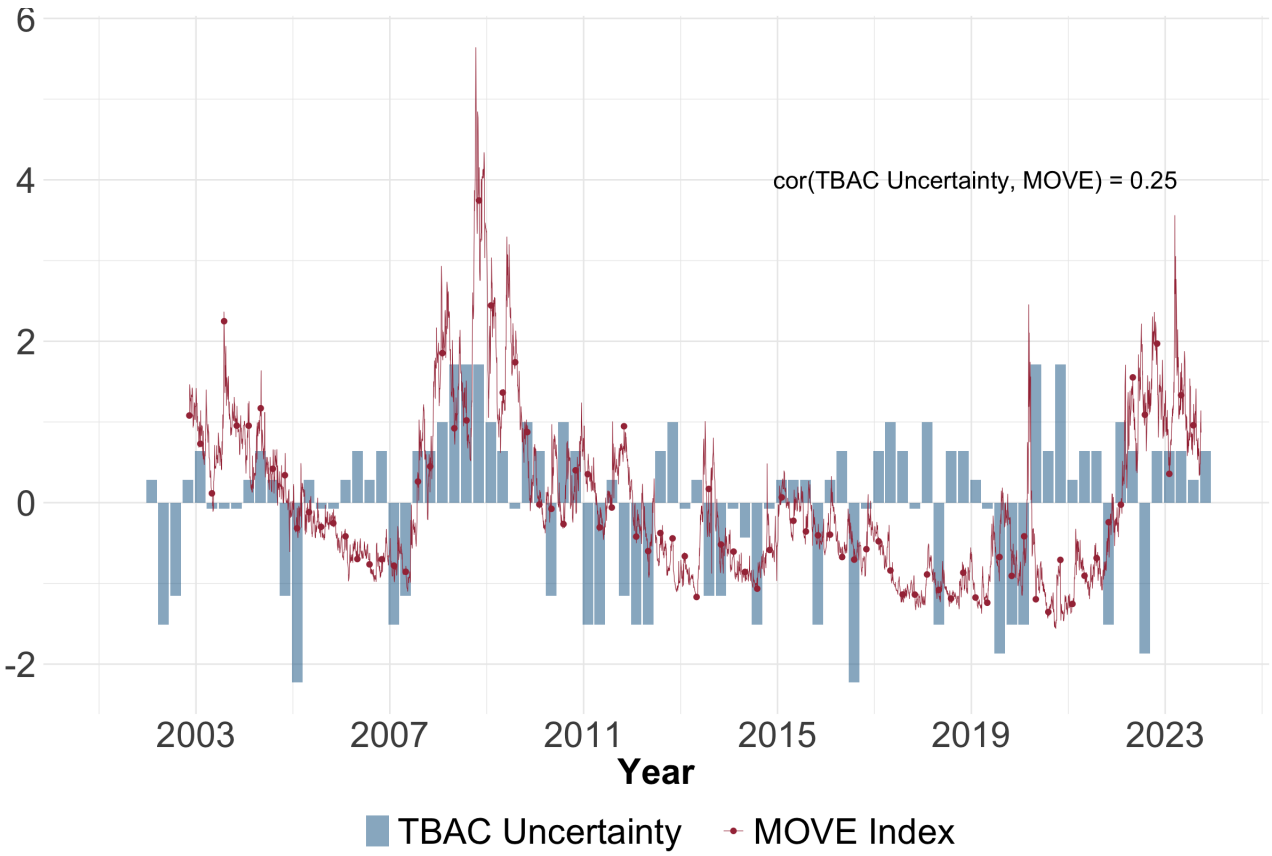



**Figure A.7** Time Series of Uncertainty in TBAC Minutes Extracted from GPT-4o

TBAC Uncertainty and MOVE time series are normalized to have mean 0 and variance 1.

**Table A.5** TBAC Meeting Minutes Uncertainty

This table reports the relationship between pre-TRA returns and uncertainty levels in TBAC Meetings Minutes as extracted from GPT-4o. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years on pre-TRA days. Panel B includes a control for the level of the MOVE index. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Pre-TRA Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A** | | | | | | | |
| Constant | 6.44 | 7.30** | 23.69*** | 35.41*** | 47.76*** | 71.87*** | 98.57*** |
| | (8.06) | (2.95) | (7.45) | (11.48) | (13.79) | (23.96) | (31.57) |
| TBAC Uncertainty | -0.10 | -0.07 | -0.22* | -0.37* | -0.53** | -0.84* | -1.16** |
| | (0.11) | (0.05) | (0.13) | (0.20) | (0.24) | (0.44) | (0.57) |
| $R^2$ | 0.017 | 0.015 | 0.015 | 0.020 | 0.028 | 0.027 | 0.032 |
| $N$ | 88 | 88 | 88 | 88 | 88 | 88 | 88 |
| **Panel B** | | | | | | | |
| Constant | -1.55 | 6.11* | 19.18** | 32.46** | 42.30** | 71.84** | 96.67** |
| | (1.64) | (3.45) | (9.52) | (14.53) | (18.27) | (32.87) | (41.86) |
| TBAC Uncertainty | 0.02 | -0.07 | -0.27* | -0.43** | -0.64** | -0.93** | -1.31** |
| | (0.03) | (0.05) | (0.14) | (0.21) | (0.26) | (0.42) | (0.57) |
| $MOVE_t$ | 0.00 | 0.01 | 0.08 | 0.07 | 0.15 | 0.07 | 0.14 |
| | (0.02) | (0.04) | (0.10) | (0.14) | (0.18) | (0.29) | (0.36) |
| $R^2$ | 0.005 | 0.013 | 0.028 | 0.026 | 0.040 | 0.031 | 0.038 |
| $N$ | 81 | 81 | 81 | 81 | 81 | 81 | 81 |

# Appendix C: Investor Attention and Information Production

One possible mechanism leading to reduced uncertainty prior to Treasury Refunding Announcements is through elevated investor attention. Traders likely generate additional information about Treasury supply through diligent research and analysis as announcements approach. The influx of information typically serves to reduce uncertainty, leading to an average increase in Treasury prices.

The underlying premise is that on non-TRA days, the market is generally less informed about the Federal government's forthcoming borrowing plans, making the quarterly TRA events key for synchronizing information dissemination and acquisition. This lack of constant awareness is highlighted by the little attention TRAs receive in the financial media. For instance, a search for TRA-related terms in Factiva, which indexes major news outlets, including the Wall Street Journal, yields only a handful of sporadic mentions.

To quantitatively assess shifts in investor attention around TRA periods, we analyze Google search volume trends. Following the methodology of Da, Engelberg, and Gao (2011), we extract the daily Google search volume index (SVI) for "treasury quarterly refunding" from Google Trends, a metric normalized relative to total Google search volumes. We regress the daily search volume index on a series of indicator variables for days surrounding TRAs, controlling for the day of the week and the end of the month fixed effects:

$$SVI_t = \sum_{i=-10}^{10} \beta_i \cdot \mathbb{1}\{t = t_{\text{TRA}} + i\} + FE + \varepsilon_t, \tag{6}$$

where days outside of the 10-day window around the TRAs are the reference category. The regression outcomes, depicted in **Figure A.8**, illustrate a marked increase in TRA-related searches leading up to and peaking on TRA days, followed by a post-announcement decline. This surge in pre-TRA searches aligns with the hypothesis of elevated market attention to Treasury supply information as TRA dates approach, mirroring similar attention dynamics observed around scheduled FOMC announcements with press conferences documented by Boguth et al. (2019).

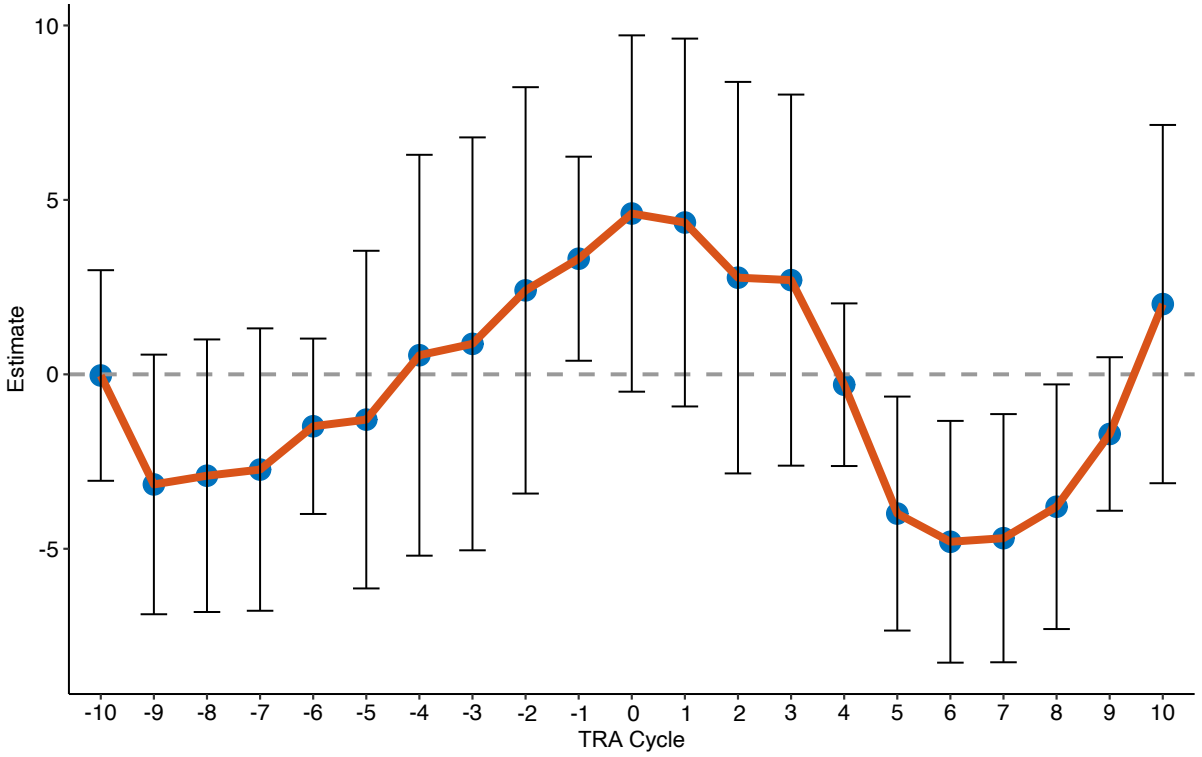



**Figure A.8** Google Search Volume for "Treasury Refunding Announcements" around TRAs