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

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**Abstract**

Each quarter, the Treasury Department unveils its refunding plan, detailing the following quarter's treasury issuances in terms of size and maturity composition. 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 patterns and account for a sizable fraction of annual yield and term premium changes. Implementing a trading strategy focused solely on these four days per year yields a Sharpe ratio of over 4. We provide evidence of uncertainty reduction and associated information production around TRAs as a potential mechanism. Finally, we discuss implications for some documented bond market patterns and the pre-FOMC drift in the equities market.

*The views stated herein are those of the authors alone and are not necessarily the views of the Office of Financial Research or the U.S. Department of the Treasury. We thank Francisco Ilabaca for helpful comments. All errors are our own. First version: March 18, 2024.

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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, during the Treasury Refunding Announcements (TRA, henceforth), the U.S. Department of the Treasury announces its expected borrowing needs for the current quarter and the quarter ahead. Within the refunding plan, the Treasury provides details about the next quarter's total issuances as well as a breakdown by maturity. Since Q4 1991, which is the first quarter during which TRA documents are publicly available on the Treasury website, TRAs have occurred once per quarter between the first and second months of the quarter. The primary release typically happens on a Monday at 3 PM EST, followed by a secondary release with additional information two days after on Wednesday.

The TRAs provide essential insight into government financing strategies and their implications for the financial markets. As the U.S. government grapples with expanding deficits, these announcements have taken on heightened importance. As such, the TRAs offer a unique vantage point from which to gauge the intersection of fiscal policy and market behavior, particularly in how anticipated government borrowing needs and Treasury supply across maturities influence the pricing of Treasury securities. Because the TRAs reveal both immediate fiscal needs and longer-term government financing strategies, they are a critical event for both market participants and policymakers. The Treasury uses the TRAs as an important tool to fulfill its objective of funding the government through regular and predictable issuance, and ultimately advance its mission of promoting economic growth and stability.

This paper studies Treasury bond return patterns around TRAs, and is the first to document a pre-announcement drift effect in Treasury markets. We hand collect TRA dates going back to

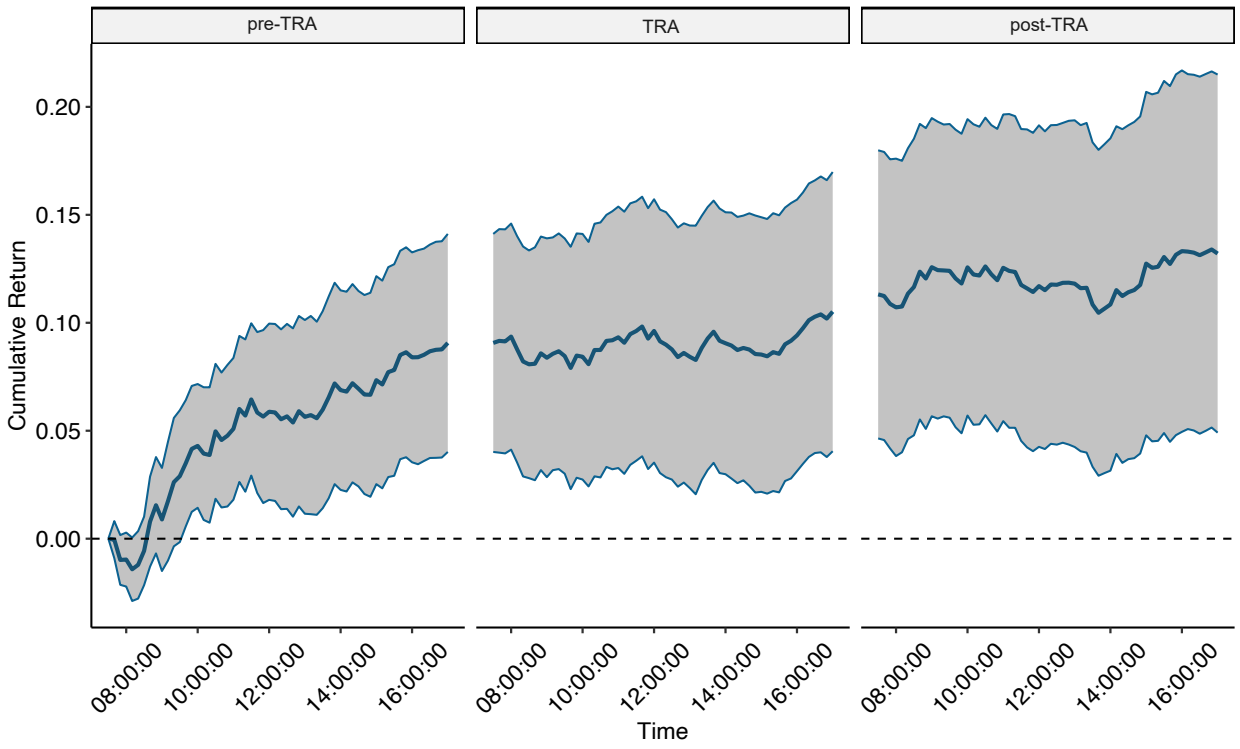



**Figure 1** Cumulative Returns of 10-Year Treasurys Around Treasury Refunding Announcements

1991, and study returns to Treasury securities around the announcement date. We find a large and positive return to Treasury securities on the day prior to the TRA. This effect is robust to the inclusion of day-of-week and end-of-month fixed effects, both of which are calendar effects that have been shown to interact with Treasury markets.

**Figure 1** offers a graphical representation of the pre-TRA gains, particularly focusing on 10-year Treasurys, by charting the intraday cumulative returns from the onset of New York trading hours on the pre-TRA day. The illustration captures a sharp increase in bond prices starting shortly after trading begins, leading to a sizable gain of 10 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.

The magnitude of the pre-TRA return is monotonically increasing with 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 Treasury 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 high 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.

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 shorter maturity Treasurys of 1-10 years, we find that changes in the term premium drive much of the observed price movements. 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.

With the main empirical finding in mind, we construct a trading strategy based around being long Treasurys on four pre-TRA days every year. This simple strategy has a Sharpe ratio of above 4 for each of the Treasurys with maturity of at least 2 years. In contrast, being long Treasurys on all other days has a Sharpe ratio of 1.5 for the 2-year Treasury Note and less than 1 for all longer maturities. This is because Treasurys earn a much higher return on pre-TRA days, even though its standard deviation of returns on pre-TRA days is comparable to or even lower than its standard deviation on non-pre-TRA days.

We split our main 1991-2023 time period into two subsamples, 1991-2002 and 2003-2023, marking the latter phase as one characterized by mounting U.S. government deficits. We find that the pre-TRA drift effect is more pronounced during this later period, coinciding with heightened uncertainty regarding government indebtedness. We further explore how pre-TRA returns interact with economic recessions as defined by the NBER. Typically, during downturns, Treasurys are

sought after for their safe-haven status, and the Treasury market's uncertainty tends to diminish. In line with this observation, we find that pre-TRA returns are pro-cyclical.

In the second 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. If the actual Treasury supply shocks are systematically negative (smaller than expected), then the pre-TRA returns could be driven by leaks of this information. However, we find no such relationship, as the returns are not significantly different when the refunding estimates are larger or smaller than previously expected. This evidence refutes the possibility of a leak-based explanation and indicates that the drift is likely driven by anticipation, rather than actual realization, of refunding decisions.

We then propose and offer some evidence that high pre-TRA returns are driven by uncertainty reduction and increased attention to the Treasury market prior to TRAs. In this sense, TRAs are an important event for maintaining the stability of the Treasury market. We isolate two mechanisms by which uncertainty reduction on the pre-TRA day might be elevated. First, we study how changes in Treasury market volatility, as measured by the MOVE index, are related to subsequent pre-TRA returns. We find that the increases in the MOVE index in the week prior to the TRA correspond to high pre-TRA returns. This finding mirrors that of Hu et al. (2022) in the equity market, who find that accumulation period increases in the VIX are correlated with high subsequent equity market returns. Second, we examine a subset of pre-TRA days that line up with the start of meetings that the Treasury Department holds with primary dealers in the days leading up to the TRA. Primary dealers are the main direct buyers of Treasury securities, and they may learn some details about future issuance during these meetings. We find that pre-TRA return is especially high when the pre-TRA day coincides with the start of the primary dealer meetings.

Next, we offer two pieces of evidence that attention to the Treasury market is increased prior to TRAs. This added attention can translate to additional information generation and reduced uncertainty in this window. First, using Google Trends data, we find a marked increase in search volume for "treasury quarterly refunding" in the days leading up to the TRA. Second, we exploit

the fact that TRAs and FOMC meetings sometimes occur within days of each other, with the TRA occurring first in some quarters and following the FOMC meeting in other quarters. We hypothesize that attention to the TRA is higher when the TRA precedes the FOMC or when there is no rate change in the most recent FOMC announcement. This is because market participants are better able to focus on the TRA without having to digest the contents of the FOMC announcement. We provide evidence that the pre-TRA return pattern is stronger when the TRA precedes the FOMC announcement, and when there was no rate adjustment at the most recent FOMC meeting.

In the final part of the paper, we explore how Treasury Refunding Announcements and pre-TRA price appreciation interact with some previously documented patterns in the stock and bond markets. First, we study how the pre-FOMC announcement drift (Lucca and Moench, 2015) interacts with TRAs. There are roughly eight FOMC announcements per year, with roughly half of them having a proximate TRA since 2002. We find that since 2002, the pre-FOMC announcement 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 et al., 2021). However, the pre-FOMC drift is much weaker and reverses on the day after the announcement when there is no proximate TRA.

Finally, we discuss the relationship between pre-TRA returns and seasonal Treasury returns as documented in Kamstra et al. (2015), who find that Treasury returns are highest in October and lowest in April. We split our sample into four quarters, and find that pre-TRA returns are large and positive across maturities for Q1, Q3, and Q4, but negative in Q2. The difference in pre-TRA returns on a single day in Q2 and a single day in Q4 can explain almost 40% of the difference in the peak-to-trough seasonal Treasury returns.

**Related Literature.** This paper contributes to three key areas of the bond and asset pricing literature.

First, the paper contributes to the literature on the expected returns of the treasury market (e.g, Cochrane and Piazzesi, 2005; Cieslak and Povala, 2015). We demonstrate that Treasury returns are

predictably higher and risk premia lower on specific days. This is tangentially related to the recent findings from Etula et al. (2020) and Hartley and Schwarz (2019) on the end-of-month effects in the US Treasury prices. Crucially, we show that such predictability is not merely an extension of end-of-month phenomena but instead directly linked to Treasury Refunding Announcements

As TRAs reveal information about forthcoming Treasury issuance, our findings are also related to studies on the supply of Treasurys and its impact on the bond risk premia, such as those from Krishnamurthy and Vissing-Jorgensen (2012), Lou et al. (2013) and Greenwood and Vayanos (2014). These studies have documented in various settings that an (expected) increase in the supply of Treasurys elevates the bond risk premium and lowers the bond prices. Conversely, our findings, though related to Treasury supply, suggest an inverse relationship—in anticipation of major announcements regarding supply, a reduction in the risk premium and an uptick in bond prices are observed. This is attributable to the market's anticipatory uncertainty reduction through heightened attention and information production. This finding also links to the broader discussion on how implied volatility impacts bond prices (Cieslak and Povala, 2016; Choi et al., 2017).

Second, this study contributes to the literature analyzing market responses to scheduled announcements, which has predominantly centered around 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). Specific to the bond market, a smaller but growing set of papers examine how bond prices respond to monetary policy announcements (e.g., Gürkaynak, Sack, and Swanson, 2005; Brooks, Katz, and Lustig, 2018; Savor and Wilson, 2013; Hillenbrand, 2021; Lou, Pinter, and Uslu, 2022). We are the first to formally introduce the Treasury Refunding Announcements to the literature and study the impact of this *fiscal* event on bond prices, thereby broadening the focus beyond monetary policy influences.

Lastly, this paper focuses on investor attention to TRAs as a pivotal factor underpinning the observed pricing drift. This notion resonates with the body of research concerning investor attention to macroeconomic events and its typically positive price impacts (Da, Engelberg, and Gao, 2011;

Boguth, Grégoire, and Martineau, 2019; Ben-Rephael, Carlin, Da, and Israelsen, 2021). Unlike prevailing literature that often attributes price appreciations to temporary price pressures, we emphasize the role of attention coordination and information production (Kacperczyk et al., 2016), and the resultant uncertainty reduction (Ai and Bansal, 2018; Hu et al., 2022), as key drivers of the price run-up preceding TRAs, providing new insights into mechanisms at play within Treasury markets.

**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 proposes and provides evidence on a mechanism that explains our findings. Section 6 discusses a few implications of our findings for the bond and stock markets. The final section 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 is aided in this endeavor by discussions with primary dealers and the Treasury Borrowing Advisory Committee (TBAC).[1] 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,

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

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 with respect to 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, 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 information on the total size of the Treasury's borrowing needs for the current quarter and the quarter ahead (see **Figure 3** for the Q4 2023 release). The information contained in this announcement is little changed since Q4 1991 (see **Figure 4** 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 their 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.[2] However, financial market attention has escalated post-pandemic as a result of higher yields, tight monetary policy, an increasing budget deficit, and credit downgrades.[3]

## 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 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 occur within one week of a 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.

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

## 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 Treasuries 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 GovPX, which has coverage beginning in 1991. Adrian et al. (2023) contains a detailed discussion on the scope of GovPX coverage. They report that the GovPX coverage is relatively comprehensive between 1991 and 2004 during the era of voice-assisted trading, but worsens in the later time period after fully electronic trading was introduced. For the purposes of this project, we are mainly interested in using tick data on Treasury security prices to construct minute-level returns. Therefore, GovPX's dwindling coverage of more microstructure-related metrics, such as bid prices and market depth, is not an issue.

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 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 Treasury ETFs 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), IEF (7-10 year), TLH (10-20 year), TLT (20+ year), and SPY (Equity Index). For intraday analysis on ETFs, we construct minute-level returns using tick data from the Trade and Quotes (TAQ) database.

Finally, we get data on the daily closing price of the MOVE Index from November 2002 to December 2023 from the FRED database at the St. Louis Fed. The MOVE Index is the Treasury market equivalent of the VIX Index for the Equity market. It represents the option implied volatility on U.S. Treasury futures and is calculated using a weighted average across maturities of 2, 5, 10, and 30 years.

## 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. Consequently, there are 129 pre-TRA days of interest and a total of 8,080 non pre-TRA days.

**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 Treasuries, 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 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. The cumulative yield changes per year reveal the significance of the pre-TRA days in bond price variation. Remarkably, yield changes accumulated on only four days are tantamount to those observed across all other trading days within the same year for maturities beyond two years. 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.

**Table 2 Panel C** shows a similar breakdown for Treasury and Equity ETFs. Although the time period is shorter due to ETFs not being introduced until the 2000s, a similar pattern emerges. As we move from ETFs holding short-maturity Treasuries (SHY and IEI) to those holding long-maturity Treasuries (TLH and TLT), the difference in returns between pre-TRA days and other days grows. Notably, we do not observe a difference in equity returns (SPY) between these two types of 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.

**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 Bills, the return on $preTRA$ days is 1.32 basis points higher than non-$preTRA$ 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 bonds earn a return of 10.8 basis points on the four pre-TRA days per year, over six times more than the unconditional average. The longest maturity treasurys, 30-year bonds, have a return of 22.4 basis points on pre-TRA days, over 10 times greater than the unconditional average. Importantly, the excess returns earned on $preTRA$ days do not reverse during or after the TRA. The coefficients on $TRA$ and $postTRA$ are insignificant across all maturities of interest.

**Figure 5** 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 6** 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 (see **Section 4.4**). NBER Recession periods are shaded gray (see **Section 4.5** for a more in-depth exploration of Recession periods).

In our sample, most TRAs occur on Mondays, which means that our day of interest, $preTRA$, normally 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 doubles to 2.66 basis points after including the DOW fixed effect. This is consistent with Birru (2018), who documented that the lower Friday returns to Treasuries are strongest for the shortest maturity bonds.

$TRA$ dates are scheduled for the week between the second and third months of a quarter, in such a way that $preTRA$ 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 $preTRA$ returns are not driven by a pure EOM effect. We construct an EOM variable that is 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 suggests that pre-TRA days earn higher bond returns even when compared to other EOM days.

#### 4.1.1 Bond ETFs

**Table 4** 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). As a placebo test, Column (6) 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

In addition to analyzing the returns of actual coupon-bearing Treasurys, we extend our investigation to zero-coupon bond yields, following the precedent set by the term structure literature, to discern if a similar pattern exists. This exercise enables us to further distinguish whether the higher returns noted on pre-TRA days stem from price appreciation, evidenced by declining zero-coupon bond yields, or are a result of accrued interests or diminishing maturities.

We replace the dependent variable in equation (1) with daily changes in zero-coupon bond yields obtained from Gürkaynak, Sack, and Wright (2007):

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

We focus on the same set of maturities as in the previous regressions. The results summarized in **Table 5** are consistent with those from bond returns. Specifically, on the trading day before the TRA, zero-coupon bond yields experience a decline exceeding 1 bp for maturities over 2 years, a result that is statistically significant. Conversely, the average daily changes in yield on all other days are lesser in scale and statistically indistinct from zero.

The robustness of these results is further enhanced in **Table 5 Panel B**, following the inclusion of day of the week (DOW) fixed effects. Moreover, in **Table 5 Panel C**, where both day of the week (DOW) and end of the month (EOM) fixed effects are accounted for, the point estimates exhibit a slight decrease in absolute value but maintain their statistical significance. It's noteworthy that for some maturities, yields increase on TRA days across certain specifications; however, these increments are modest in magnitude and only marginally significant for shorter maturities.

The analysis of GSW yield changes underscores that the positive Treasury returns on pre-TRA days are predominantly driven by price movements. To further refine our understanding, we isolate the term premium component of the zero-coupon yields. We use term premium estimates derived from a standard affine term structure model by Kim and Wright (2005), employing the same GSW yields. The term premium represents the risk compensation demanded by investors for holding a specific Treasury bond, spanning maturities from 1 to 10 years. Substituting the dependent variable in our prior regression with daily changes in term premium ($tp_t^{(n)} - tp_{t-1}^{(n)}$), the findings, detailed in **Table 6**, reveal that the coefficients for pre-TRA dummies are negatively significant across all maturities. This holds both with and without various fixed effects, and the impact intensifies over longer maturities. For example, the 1-year term premium drops by 0.21 bp while the 10-year term premium drops by 0.60 bp.

Compared with those in **Table 5**, the coefficients on pre-TRA are more statistically significant at the shorter maturities, and notably, there are no reversals in term premia on the TRA days. These insights into term premia clarify the significant downward adjustments in interest rate risk compensation on pre-TRA days. This contrasts with Greenwood and Vayanos (2014), who suggest that Treasury supply shocks elevate the risk premium as marginal investors seek greater compensation for the additional interest rate risk. Our results indicate a reduction in risk premium in anticipation of key announcements pertaining to the Treasury supply.

## 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 7**, in which all metrics are annualized. **Table 7 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 maturity Treasury bonds on all other non-pre-TRA days. This comparison reveals that, save for the 1-year maturity, trading the Treasurys on pre-TRA days significantly outperforms the alternative strategy for all maturities, 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 7 Panel B**, show that the pre-TRA trading in five bond ETFs yields Sharpe ratios ranging from 2.6 to 6.5, 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 7 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 GovPX. 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 the 10, 20, 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) and weighting all ticks equally. As trading in the earlier part of the sample does not happen continuously, we resample the data at 10-minute intervals and use the last price in each interval to compute cumulative returns.

**Figure 7** 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 approximately 10 bps higher, 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 uptrend increases with maturity, with the 30-year Treasuries climbing about 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 (not shown in the figure).

We also explore the intraday price dynamics of the Treasury ETFs around the TRAs. We pick IEF (iShares 7-10 Year Treasury Bond ETF) as a proxy for long-term Treasurys and obtain its intraday pricing information from the TAQ database. Given that ETFs are traded on stock exchanges, a considerable portion of the observed pre-TRA uptrend occurs before the market opens on Day $-1$. Therefore, we commence our cumulative return calculations from the market opening at 9:30 on Day $-2$. **Figure 8** presents the findings, highlighting a noticeable jump in ETF prices at the market open on Day $-1$, followed by a consistent rise throughout the day, culminating in a level of about 10 bps higher by the day's end. This magnitude mirrors the pre-TRA drift in the 10-year Treasury. The ETF price stays elevated through the TRA day and the day after.

## 4.4 Subsample Splits

Kurov et al. (2021) find that the FOMC drift in equity markets has been declining, and is essentially non-existent after 2015. They attribute this to reduced uncertainty in the more recent time period. In contrast to FOMC announcements, uncertainty about U.S. Government debt and around TRAs has been elevated in later years, especially after the US government began running a deficit in 2002 which has increased in magnitude since then. 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 their rating to AA+.[4]

[4]See WSJ Press Release here

The second time was in 2023, when Fitch reduced their long-term credit rating to AA+.[5]

We split the sample into two periods, 1991-2002 and 2003-2023.[6] Returns around TRA controlling for the day of the week and the end of the month fixed effects are shown in **Table 8**. Although pre-TRA returns are positive for both subsamples, they are generally higher for the later time period. This is especially the case for short to medium-maturity Treasurys. For example, the return on 5-year Treasurys on pre-TRA days is around 8 basis points in the later period compared to 2 basis points in the earlier period. For 10-year Treasurys, the difference is even more stark at 13 basis points post-2003 compared to 2 basis points pre-2003.

## 4.5 Recessions

Recessions are periods of financial stress when equity valuations become depressed and there is a flight to quality and safety. During these times, there is often a low equity return and high bond return, as Treasury bonds are one of the main asset classes that investors value during a flight to safety (Baele et al. (2020)). During recessions, uncertainty around equity markets is also heightened, so macroeconomic announcements such as FOMC announcements are especially crucial in resolving that uncertainty. Lucca and Moench (2015) find some evidence along that line, showing that pre-FOMC returns are counter-cyclical.

In contrast to equities, Treasurys are viewed as a safe, desirable asset during recessions. Their prices are elevated due to excess demand from flight to quality, and uncertainty around Treasury markets is relatively low. Therefore, we hypothesize that pre-TRA returns are cyclical: they are relatively low in recessions compared to normal times. **Figure 6** shows the time series of returns on pre-TRA days for Treasury bonds with 10-, 20-, and 30-year maturities. Grayed-out areas indicate NBER recession periods. Returns during recession periods are generally lower, though a big portion of this is driven by the Great Recession. This is unavoidable in our 1991Q4-2023Q4 time period that only spans three NBER recessions.

[5] See Fitch Press Release here

[6] The later time period roughly lines up with the entire time period that is available for ETF returns.

We formally test the relationship between recessions and pre-TRA treasury returns in a regression framework. Specifically, we run the following specification:

$$ret_t = \beta_1 \times \mathbb{1}_t(preTRA) \times \mathbb{1}_t(Recession) + \beta_2 \times \mathbb{1}_t(preTRA) + \beta_3 \times \mathbb{1}_t(Recession) + FE + \epsilon_t \quad (3)$$

where $\mathbb{1}_t(Recession)$ is equal to 1 during months marked as during a recession by NBER.

We also run an alternative specification looking specifically within pre-TRA dates that directly tests for the relationship between $ret_t$ and $\mathbb{1}_t(Recession)$ on these days:

$$ret_t = \beta_1 \times \mathbb{1}_t(Recession) + \epsilon_t \quad (4)$$

The results are shown in **Table 9**. Pre-TRA Treasury returns are significantly lower, even negative, during recessions. The coefficients on $\mathbb{1}_t(Recession)$ are negative and economically meaningful for every Treasury maturity, but only statistically significant for the longer maturity bonds due to limited observations. We find that 7-year Treasurys have an average return of 12 basis points on pre-TRA days in normal times, but this drops to around $-10$ basis points during NBER recessions. The magnitude of longer maturity bonds is even more striking. The average return of a 30-year Treasury on pre-TRA days is 29 bps in normal times, and $-30$ bps during recessions.

# 5 Potential Mechanisms

## 5.1 Actual Refunding Announcements

So far, we have documented unconditional excess returns of Treasurys ahead of the quarterly TRAs. An immediate question arises: are these return patterns related to actual policy realizations? If returns are driven by the actual refunding estimates, an unexpectedly high refunding estimate should lead to lower pre-TRA returns, as the market would need to absorb a greater supply shock. For the actual refunding estimates to explain the pre-TRA drift, the refunding news from the Treasury

would need to be systematically smaller than anticipated, which seems at odds with the increasing 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 arena (e.g., Lucca and Moench, 2015; Vissing-Jorgensen, 2020), little research or evidence has been documented about information leakage around TRAs.

Nonetheless, we explore this relationship empirically. We collect the actual refunding estimates from the Sources and Uses tables on the Treasury's website, announced on TRA days. 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 ($FR_t(MB)$), the latter representing a potential supply shock. Since there is strong seasonality in the refunding estimates due to the fiscal cycle, we seasonally adjust refunding estimates by subtracting the estimate from the same quarter of the previous year. We normalize both variables by the lagged GDP to account for the time trend. The data is available from 1997 to 2023. Figure 9 plots the time series of the seasonally adjusted refunding estimates and the forecast revisions. The big spikes in the estimates are due to the COVID-19 pandemic in 2020Q1.

We then regress the Treasury returns on the pre-TRA day on three variables: the previous quarter's refunding estimates ($\Delta MB_{t-1}/GDP_{t-2}$), the forecast revision of the refunding estimates ($FR_t(MB)/GDP_{t-1}$), and the current quarter's refunding estimates ($\Delta MB_t/GDP_{t-1}$). 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). Despite these observations, all but one beta coefficient is statistically insignificant, with all constant terms remaining positive and significant. This indicates that the pre-TRA drift is not driven by actual refunding estimates or shocks to these estimates, either ex-ante or ex-post. Therefore, the pre-TRA excess returns seem to be driven more by anticipation than the actual realization of refunding

decisions, contrasting a leak-based explanation.

## 5.2 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. We hypothesize a similar mechanism around TRAs, and explore uncertainty reduction in two ways. First, we examine how changes in the MOVE index, a proxy for Treasury market volatility, are related to subsequent pre-TRA returns. Second, we isolate a group of pre-TRA days that coincided with the start of primary dealer meetings with the Office of Debt Management.

### 5.2.1 MOVE Index

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 high. Hu et al. (2022) propose premium for heightened uncertainty as an explanation for large equity returns prior to macroeconomic announcements, and show evidence that accumulation of uncertainty prior to an announcement is correlated with higher pre-announcement returns. We test if a similar pattern holds in Treasury markets prior to TRAs using the MOVE index, the Treasury market equivalent of the VIX. In particular, we study how changes in MOVE during the accumulation period are related to subsequent pre-TRA returns.

Following Hu et al. (2022), we define the accumulation period MOVE as the change in the MOVE index in the five trading days leading up to the pre-TRA date. The mean accumulation period change in the MOVE index on pre-TRA days is 0.61 (standard deviation of 8.71) compared to -0.01 (standard deviation of 9.01) on non pre-TRA days, indicating that there is a slightly higher buildup of uncertainty prior to TRAs.

In order to test if pre-TRA returns are particularly elevated following large accumulations in

MOVE, we run the following regression:

$$ret_t = \beta_1 \times \mathbb{1}_t(preTRA) \times \Delta MOVE_{[-7,-2]} + \beta_2 \times \mathbb{1}_t(preTRA) + \beta_3 \times \Delta MOVE_{[-7,-2]} + FE + \epsilon_t \quad (5)$$

where $\Delta MOVE_{[-7,-2]}$ is the change in MOVE between 7 trading days prior to the TRA and 2 trading days prior to the TRA. Because this specification is run over the entire time series of returns for a particular security, the coefficient of interest, $\beta_1$, is on the interaction term between $preTRA$ and $\Delta MOVE_{[-7,-2]}$.

We also run an alternate specification that only looks within pre-TRA dates:

$$ret_t = \beta_1 \times \Delta MOVE_{[-7,-2]} + \epsilon_t \quad (6)$$

The results are shown in **Table 11** separately for each Treasury security and ETF. 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. Our results show that pre-TRA returns on 1-year Treasurys are $-0.58$ bps when there is 0 accumulation-period $\Delta MOVE$, but this increases to 0.64 bps if the $\Delta MOVE_{[-7,-2]}$ is 1 standard deviation higher. The magnitude increases drastically with maturity. 10-year Treasurys have an average return of 14.57 bps on pre-TRA days with 0 accumulation-period $\Delta MOVE$, and 26.33 bps with a 1 standard deviation increase in $\Delta MOVE$. For the longest maturity 30-year Treasurys, the pre-TRA return increases from 26.32 bps to 45.97 bps. This suggests that TRAs can be an important event that the Treasury uses to reduce uncertainty and maintain stability in Treasury markets.

### 5.2.2 Primary Dealer Meetings

A unique quirk of TRAs is that the Office of Debt Management holds meetings with primary dealers (PDs) in the days leading up to the TRA, and this often lines up with our pre-TRA window. We

collect PD meeting dates from the meeting agendas that are posted on the Treasury website.[7] The meetings are normally scheduled for the end of the week prior to the Monday TRA. Depending on the exact meeting, these can be either a 1-day meeting on Thursday (15 occurrences), a 1-day meeting on Friday (11 occurrences), or a 2-day meeting spanning Thursday and Friday (58 occurrences). Although we believe that PD meetings occurred before 2003, the agendas posted on the website only go back to Q1 2003. Therefore, we restrict our analysis in this section to this later time period of 2003–2023, where data is publicly available.

The PD meetings are meant to be a two-way conversation between ODM and primary dealers to discuss primary dealers' estimates for the Treasury borrowing needs and other timely and important topics regarding the Treasury market. This makes the quarterly PD meetings an important event that can reduce Treasury market uncertainty among some of the largest and most active traders. We formally test if the pre-TRA drift in Treasury returns is related to PD meetings using the following regression:

$$ret_t = \beta_1 \times \mathbb{1}_t(preTRA) \times \mathbb{1}_t(PD\_Start) + \beta_2 \times \mathbb{1}_t(preTRA) + \beta_3 \times \mathbb{1}_t(PD\_Start) + FE + \epsilon_t \quad (7)$$

where $\mathbb{1}_t(PD\_Start)$ is an indicator equal to 1 on days that coincide with the start of a PD meeting with ODM.

We also run an alternative specification looking specifically within pre-TRA days:

$$ret_t = \beta_1 \times \mathbb{1}_t(PD\_Start) + \epsilon_t \quad (8)$$

The results are shown in **Table 12**. Across maturities, we find a positive and significant coefficient on the interaction term between $preTRA$ and $PD\_Start$, indicating that returns are elevated when the pre-TRA day coincides with the start of the PD meetings. The magnitude also increases with the maturity of the Treasury. The start of the PD meetings is the day during which much information about the next quarter's Treasury issuances is revealed to the PDs, meaning a

[7] PD Meeting Agendas are on the Treasury Website.

significant reduction in uncertainty. This information is especially important to PDs as Treasury issuance is the main driver of PD's inventory changes (Fleming et al., 2008).

## 5.3 Attention-Induced Uncertainty Reduction

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.

### 5.3.1 Google Trends

To quantitatively assess shifts in investor attention around TRA periods, we analyze Google search volume trends. Following the methodology of Da et al. (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:

$$SVI_t = \sum_{i=-10}^{10} \beta_i \cdot \mathbb{1}\{t = t_{\text{TRA}} + i\} + FE + \varepsilon_t, \tag{9}$$

where days outside of the 10-day window around the TRAs are the reference category. The regression outcomes, depicted in **Figure 10**, 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).

### 5.3.2 The Interaction Between TRA and FOMC Meetings

To further examine the attention-driven uncertainty reduction hypothesis, we investigate the interaction between the Treasury Refunding Announcements and the FOMC meetings, particularly given that the fiscal and monetary policy events are often scheduled closely.[8]

Both the FOMC and TRA announcements provide critical information pertaining to the interest rate risks to 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 the interest rates. Similarly, our analyses so far have shown a significant impact of the TRAs on the Treasury risk compensation. Despite revealing information about different aspects of the Treasurys, both sets of announcements are likely considered pivotal by market participants. The interactions between the two events are of great interest, particularly as four of the eight annual FOMC meetings have been scheduled around TRAs in recent decades.

Given the broader market anticipation surrounding FOMC meetings compared to TRAs, the attention dynamics and corresponding uncertainty reduction mechanism around the TRAs can be influenced by the FOMC meetings. We postulate that FOMC may dilute the attention on subsequent TRAs, diminishing the uncertainty reduction effect and the associated pre-TRA price run-up. This attenuation might stem from the market's preoccupation with interest rate information from FOMC meetings, reducing the incentive to engage with TRA details, or the reallocation of traders' attention post-FOMC to recalibrate positions based on monetary policy news, thus constraining their capacity

[8]Recall from Section 2 that 81 out of 129 TRAs occur within one week of a FOMC meeting since 1991

to assimilate TRA information.

We test this hypothesis by examining TRAs in relation to the timing of FOMC meetings, categorizing them as occurring before ("TRA Earlier") or after ("FOMC Earlier") FOMC meetings within a 5-day window, and TRAs that did not happen within a 5-day window of an FOMC meeting. We regress the daily CRSP Treasury returns across maturities on the interaction between pre-TRA indicators and the timing relative to FOMC meetings, controlling for the day of the week and the end of the month fixed effects. The findings are reported in **Table 13**, in which all non-TRA days serve as the reference category. The results indicate that the notable pre-TRA uplift is predominantly significant when TRAs precede FOMC meetings by up to 5 days, with substantially larger effect sizes than our baseline analysis. Conversely, the pre-TRA drift becomes statistically indistinct when TRAs follow FOMC meetings or when the two are distantly scheduled, validating our hypothesis of intensified pre-TRA attention and price appreciation when TRAs occur earlier and are likely to command greater investor attention.

Lastly, we consider how different phases of the monetary policy cycle might uniquely influence the attention dynamics surrounding TRAs. With the Federal Reserve's rate decisions typically unfolding in cycles, FOMC announcements draw heightened attention during active rate hike or cut phases. Conversely, during periods without FOMC rate adjustments, there may be less distraction from TRA-related information, potentially leading to a more pronounced pre-TRA drift in Treasurys due to increased uncertainty reduction from intensified investor attention to 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 14**, align with our premise. There is a stronger pre-TRA positive drift when the latest FOMC decision maintains the status quo, suggesting more focused attention on TRAs during these periods. Notably, the pre-TRA drift becomes subdued or non-existent following recent FOMC rate adjustments. Specifically, a negative pre-TRA drift emerges after a rate cut, likely because rate cuts typically occur in response to economic downturns, a time when investors may demand higher risk compensation for Treasurys. These are periods when uncertainty reduction associated with TRAs

might be limited (similar to recession periods, as seen in **Section 4.5**)

# 6 Implications of the Pre-TRA Drift

Having established a pronounced pre-TRA price appreciation in Treasurys, this section delves into some direct implications of this price pattern on a couple of well-documented asset pricing puzzles and patterns in the bond and stock markets.

## 6.1 Pre-FOMC Drift Around TRA

We start the section by investigating the reciprocal relationship between FOMC and TRA meetings, specifically the influence of Treasury Refunding Announcements on the pre-FOMC drift observed in the stock market. 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. This phenomenon, characterized as a puzzle by the authors, has led to various explanations, many of which suggest information leakage prior to the announcements.

Given the parallels between pre-FOMC and pre-TRA drifts, it is plausible to consider an attention-driven mechanism potentially influencing the stock market as well. Within the context of this paper on TRAs, when an FOMC meeting and a TRA are scheduled closely in time, the proximity could enhance attention coordination, fostering information production and thereby amplifying the pre-FOMC drift in the stock market.

Specific to this paper's focus on TRAs, when an FOMC meeting and a TRA are scheduled closely in time, there might exist a stronger coordination of attention, which leads to information production and thus a more pronounced pre-FOMC drift in the stock market. To clarify, we are exploring the notion that combined investor attention to both events is heightened when they are closely scheduled, in the form of an extensive margin, rather than suggesting direct influence from TRA attention on the pre-FOMC drift. This channel is distinct from what we explored in **Section 5.3.2** as we acknowledge that FOMC meetings have historically drawn more market attention than

TRAs and FOMC meetings are more relevant to equity markets, so it is unlikely that TRAs steal attention from FOMC meetings. However, it is possible that TRAs provide extra information that is relevant to the equity market or help to coordinate attention around fiscal policy-related events, especially when occurring in close proximity to the FOMC announcement.

We categorize FOMC meetings based on whether a TRA is scheduled within a 5-day window before or after the meeting. Recognizing that TRAs held less significance before 2002 due to the Federal government's budget surplus, we conduct the analysis separately for the pre and post-2002 periods. We propose that closer scheduling of FOMC and TRA meetings intensifies the pre-FOMC drift, especially after 2002.

For each subset, **Figure 11** depicts the intraday cumulative returns of the SPY ETF around FOMC announcements, differentiating between FOMC meetings with and without a nearby TRA. In the post-2002 period, our findings align with the hypothesis: the pre-FOMC drift is markedly stronger when an FOMC meeting is close to a TRA. SPY rises by 50 bps on average—mirroring Lucca and Moench (2015)'s original observations—even amidst discussions of a waning pre-FOMC drift in the recent sample. On the day following the announcement, SPY sustains its pre-FOMC gains. In contrast, the drift is notably weaker and statistically insignificant in the absence of a proximate TRA, even reversing entirely the day after the announcement. These results lend support to the idea that FOMC and TRA meetings' attention synergy contributes to a more pronounced pre-FOMC drift in the stock market.

Conversely, the pre-2002 data reveals a stronger pre-FOMC drift in the absence of nearby TRA meetings, likely reflecting the less regular scheduling (fewer cases of proximate scheduling and thus more estimation noise) and reduced significance of TRAs during a period of lesser focus on the Federal deficit.

## 6.2 Seasonal Treasury Returns

Kamstra et al. (2015) find that there is sizable seasonal variation in Treasury returns, with excess returns being highest in October and lowest in April. They study Treasurys with maturities between

5 years and 20 years and find a difference in excess return of around 80 basis points between October and April. Given that we found that up to 19% of Treasury returns are earned over the course of just four pre-TRA days, we want to test if seasonal variation in Treasury returns is related to over- or under-performance during the pre-TRA days. TRAs are scheduled such that this is one per quarter, so we split the sample into four quarters and examine Treasury performance on pre-TRA days separately for each quarter.

Treasury returns around TRA announcements split by quarter are shown in **Table 15**. The regression does not include day-of-week or end-of-month fixed effects to help facilitate direct comparisons to Kamstra et al. (2015), though the inclusion of the fixed effects does not qualitatively alter the conclusions. In general, pre-TRA returns are large and positive across maturities for Q1, Q3, and Q4, but negative for Q2. The Q2 TRA announcement generally occurs in the week between April and May, with the pre-TRA day falling at the end of April. This is exactly the month with the lowest excess return in Kamstra et al. (2015).

Kamstra et al. (2015) find a difference of around 80 basis points in excess returns between October and April, which represents the peak-to-trough in their study. October coincides with the Q4 pre-TRA in our sample, while April coincides with the Q2 pre-TRA. For 20-year Treasurys, we find a difference in pre-TRA returns between Q4 and Q2 of around 32 basis points, representing almost 40% of the difference between October and April returns. When looking at the difference between April and other pre-TRA quarters, pre-TRA returns account for an even larger percentage of the gap. The difference between Q1 and Q2 pre-TRA returns is around 45 basis points, which is actually larger than the gap between total January and April returns (25 basis points). The difference between Q2 and Q3 pre-TRA returns is 27 basis points, which is roughly comparable in size to the total difference in returns between April and July. This suggests that it is important to take TRA into account when thinking about seasonality in Treasury 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, 2024; 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 privately-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 borrowing estimate is $76 billion lower than announced in July 2023, largely due to projections of higher receipts somewhat offset by higher outlays.[3]
- During the January – March 2024 quarter, Treasury expects to borrow $816 billion in privately-held net 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. The increase in privately-held net market borrowing was $3 billion: changes across all major components were small.

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

###

**Figure 3** Treasury Refunding Announcement From Q4 2023

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.

**Figure 4** Treasury Refunding Announcement From Q4 1991

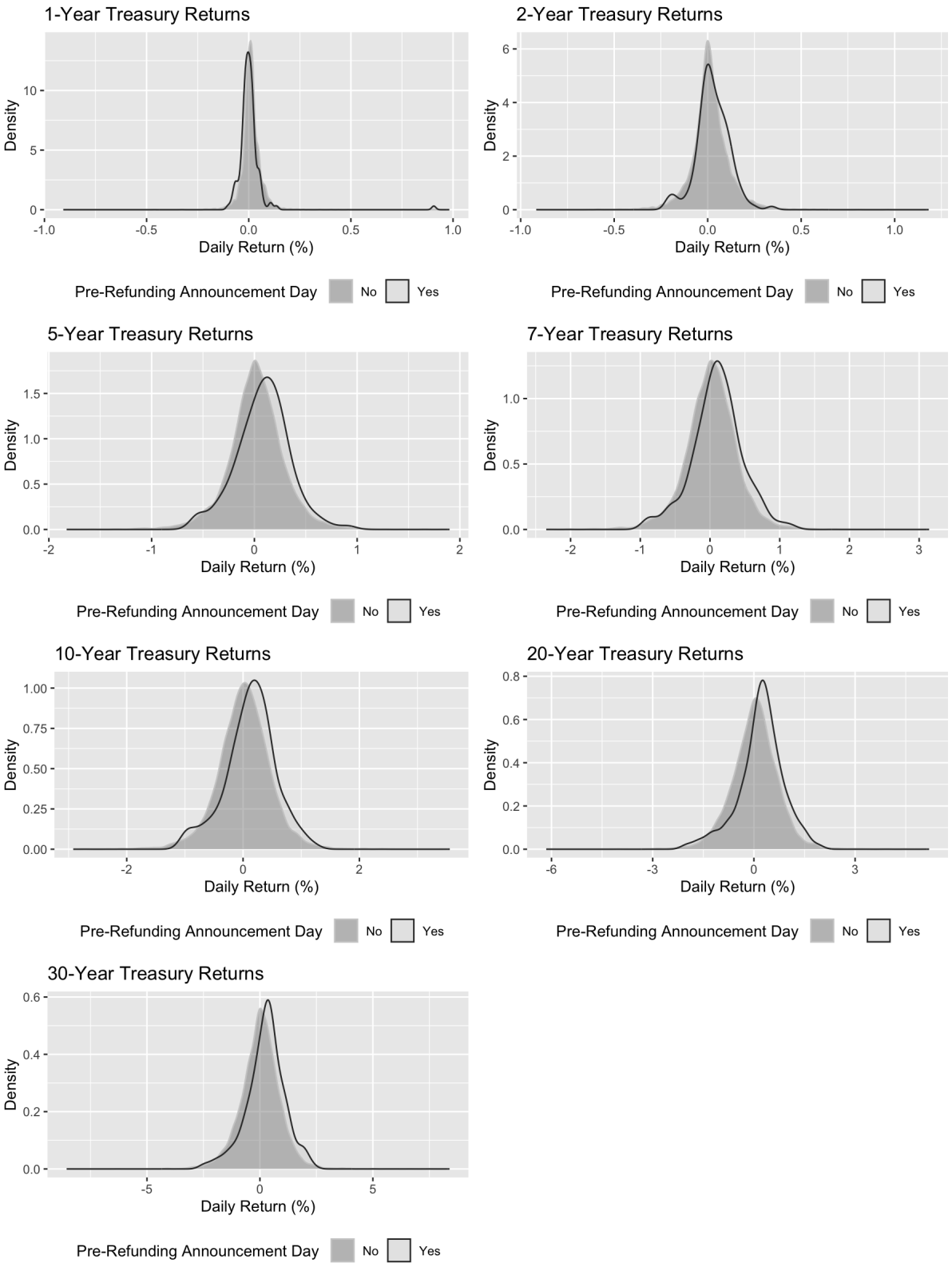



**Figure 5** Distribution of Daily Returns for Treasurys of Various Maturities, Split by Pre-TRA and Non-Pre-TRA Days

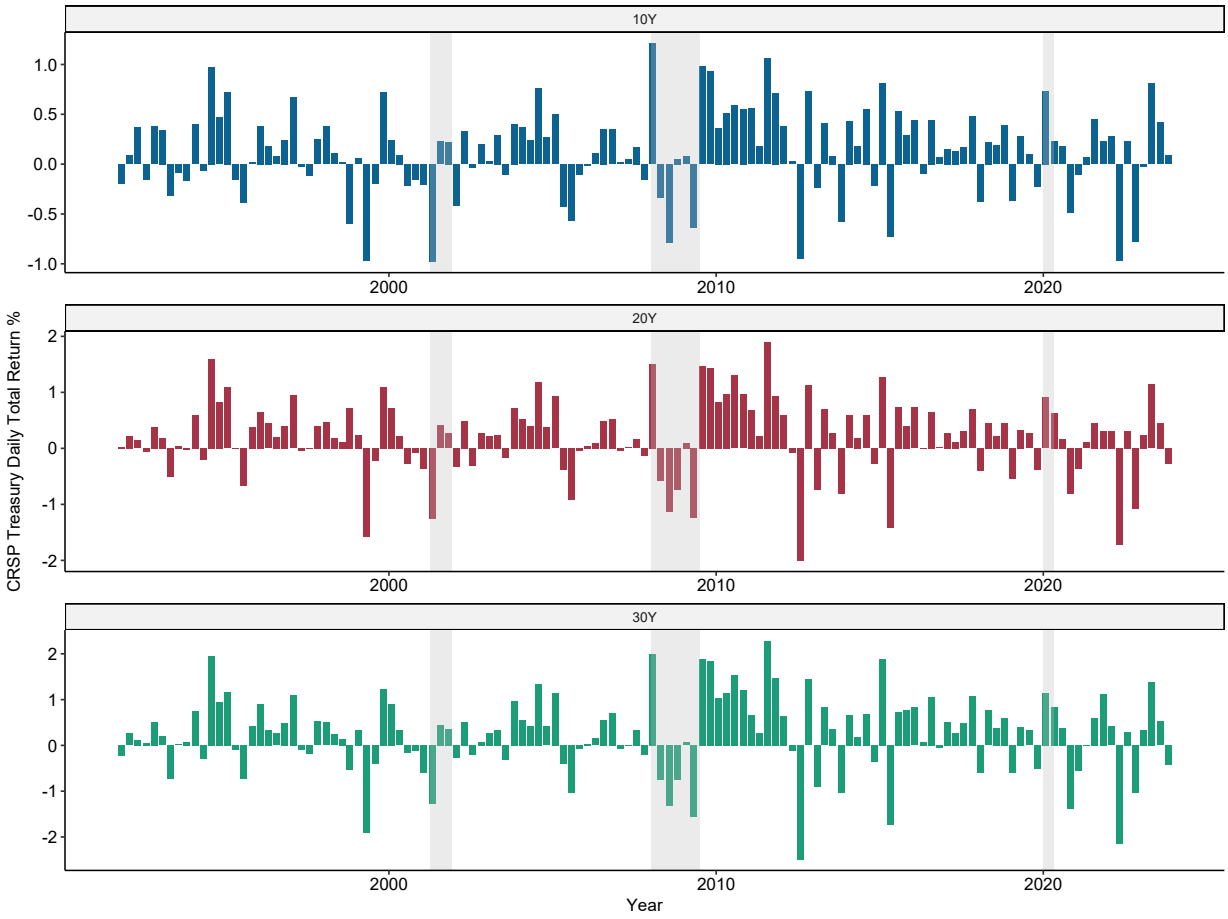



**Figure 6** 10, 20, and 30-Year Treasury Returns on Pre-TRA Days Over Time

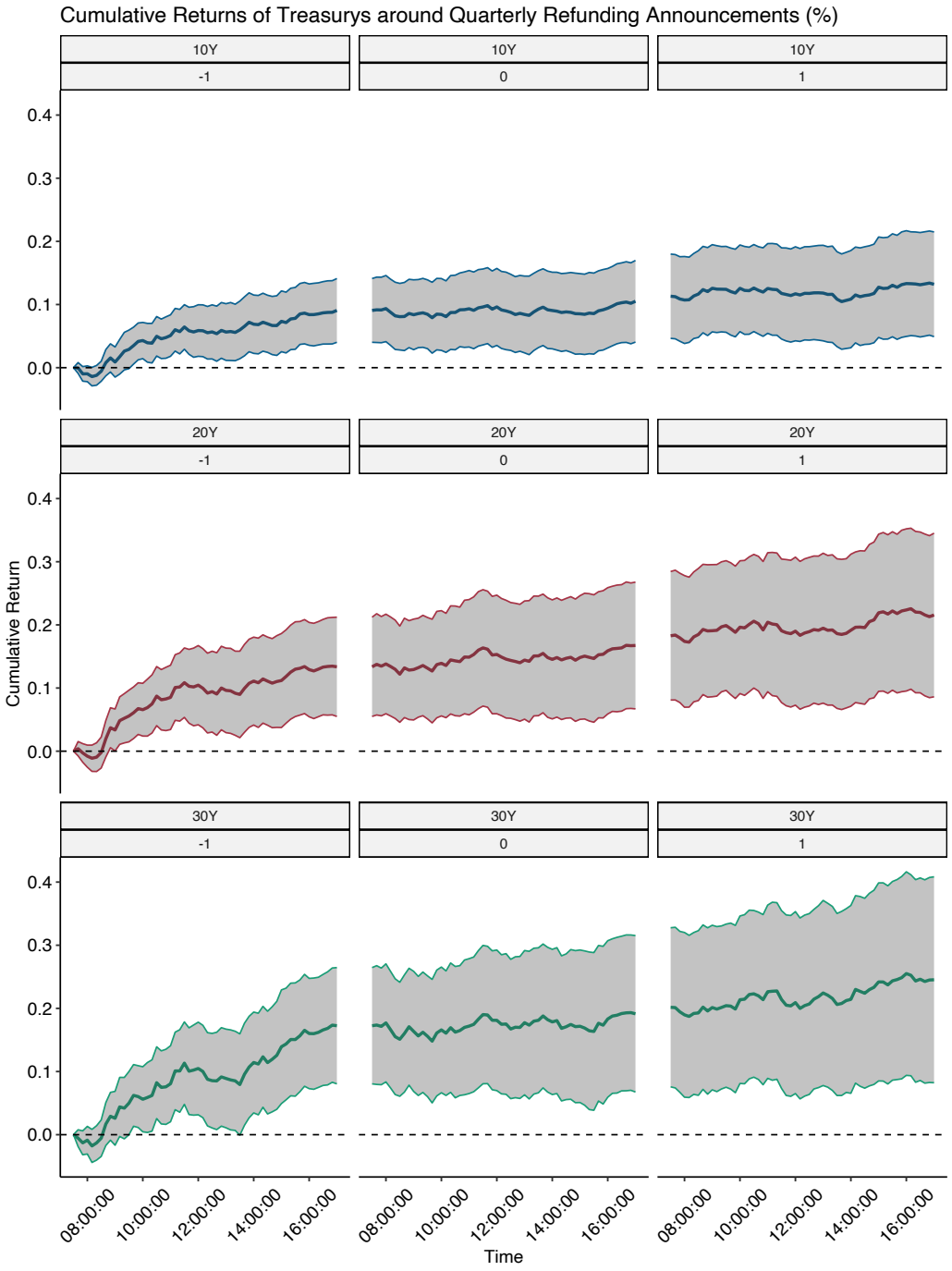



**Figure 7** Cumulative Intraday Returns of 10, 20, and 30-Year Treasurys Around TRAs

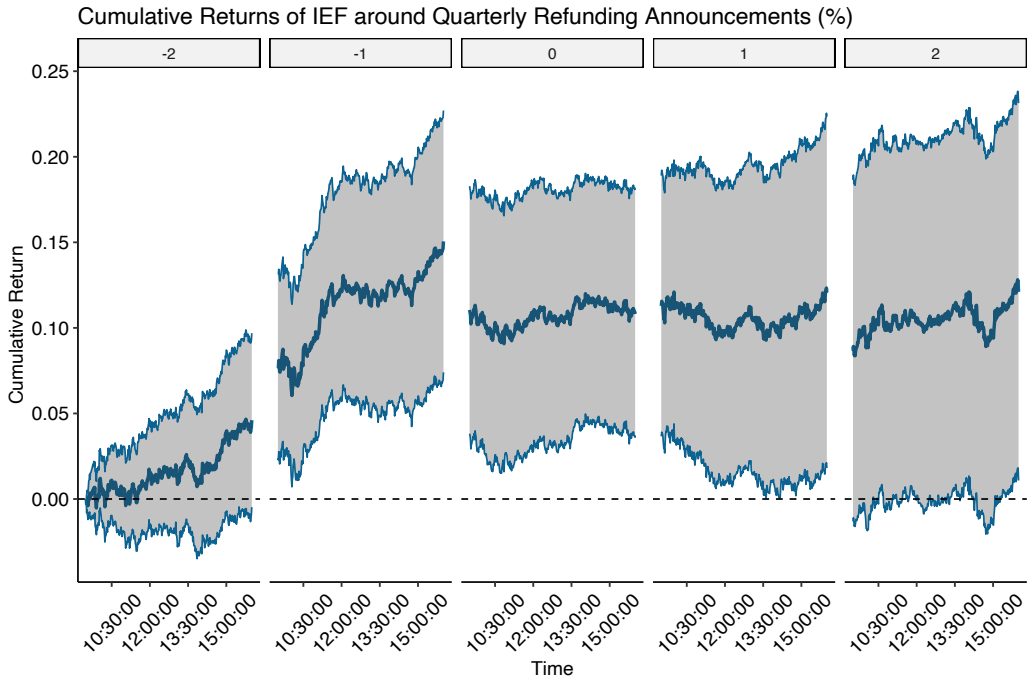



**Figure 8** Intraday Returns of a Treasury ETF (IEF) around TRAs

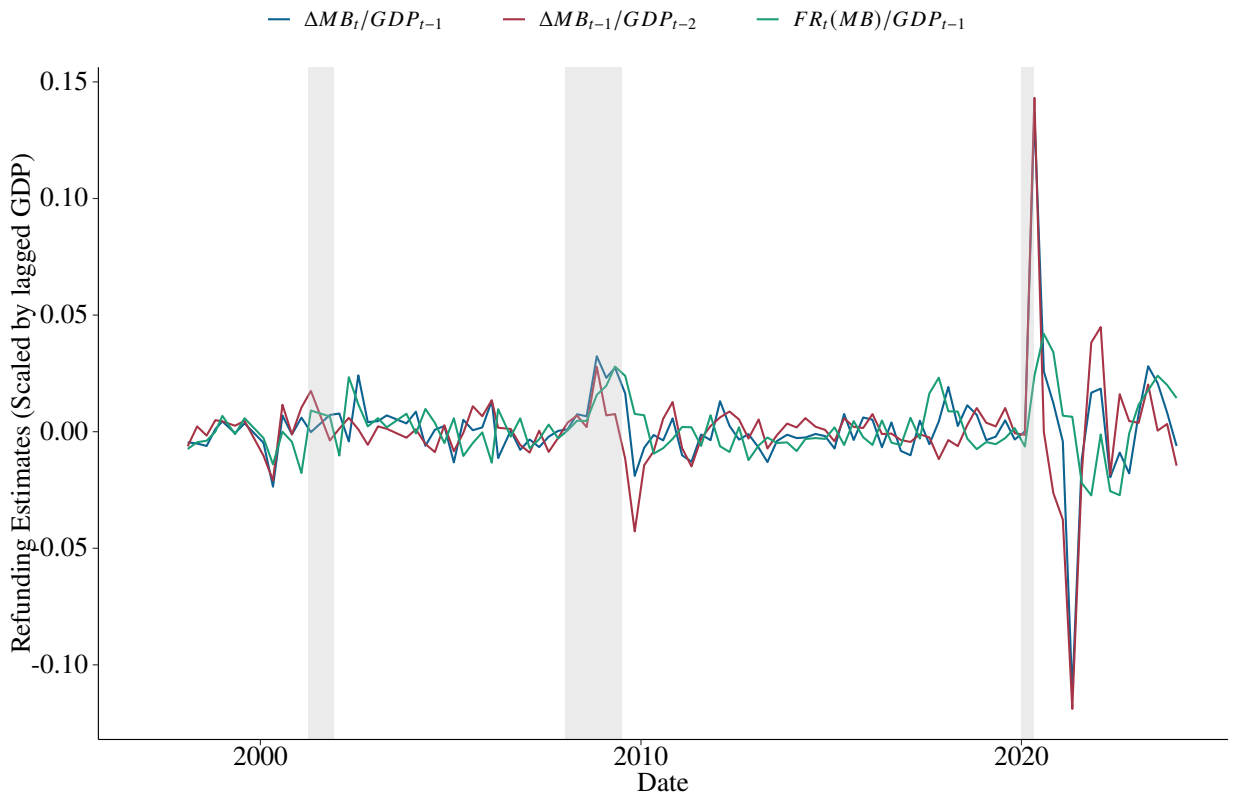



**Figure 9** Time Series of Refunding Estimates Announced by the Treasury Department

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.

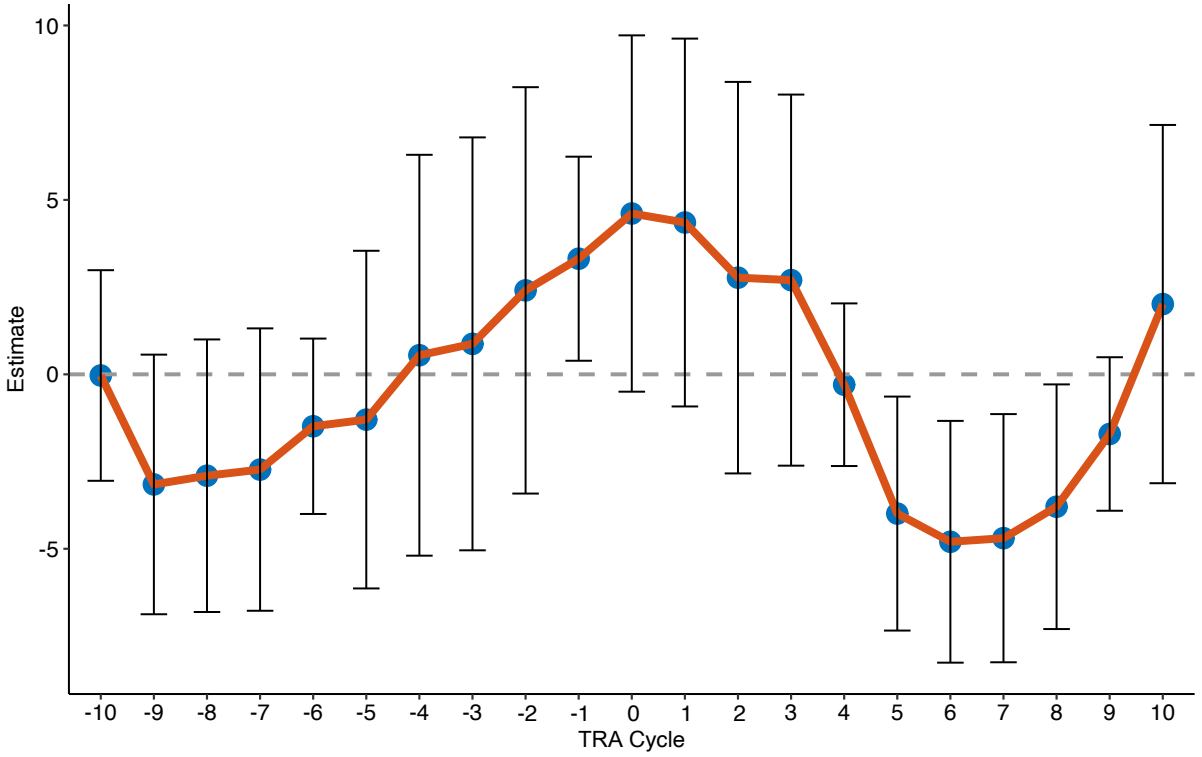
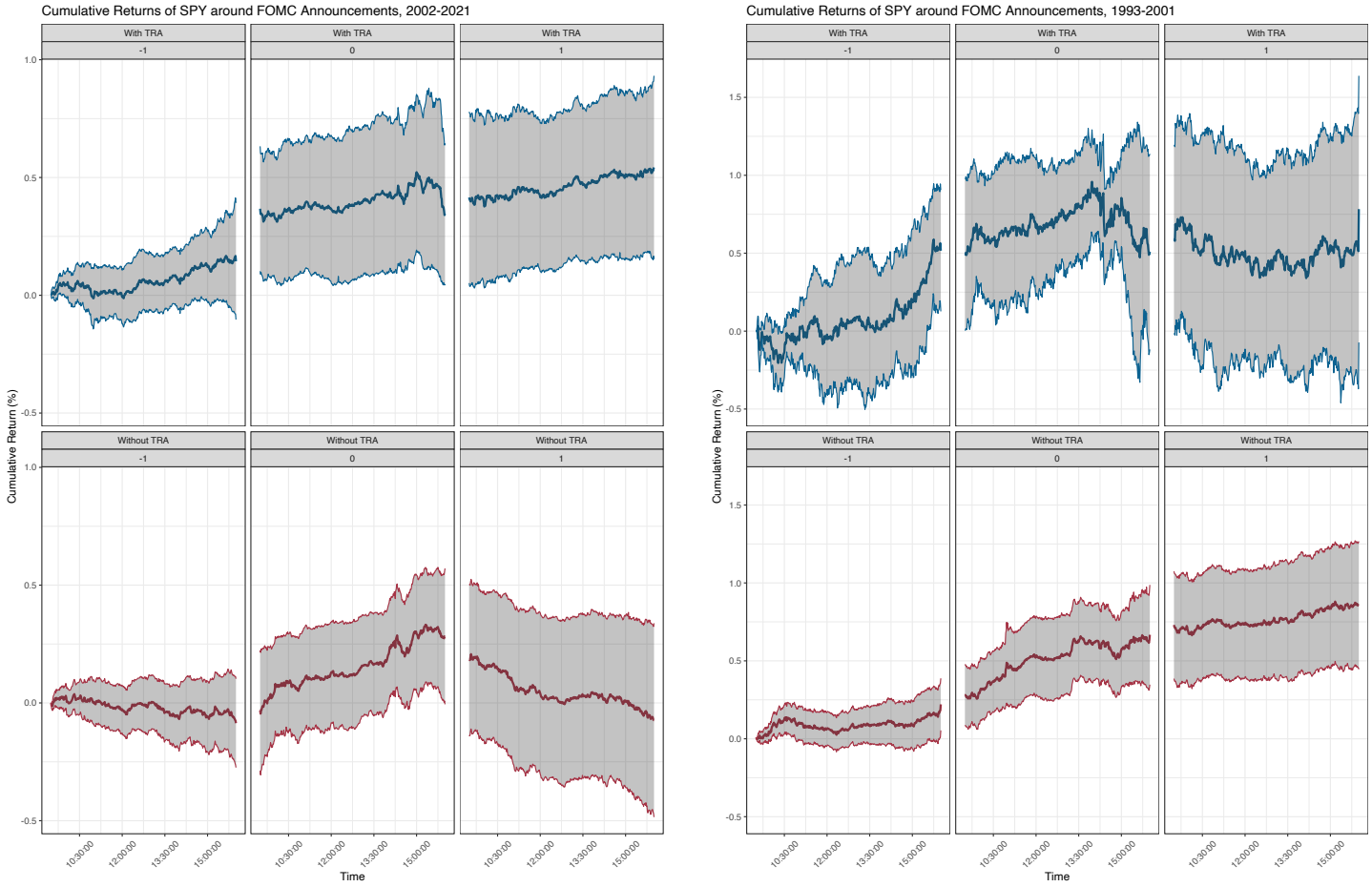



**Figure 10** Google Search Volume for "Treasury Refunding Announcements" Around TRAs




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

**Figure 11** Pre-FOMC Drift, Split by Time Period and FOMC Announcements With and Without a Proximate TRA

**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 the summary statistics of the 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, Panel B presents GSW Treasury bond yields, and Panel C presents bond and equity ETF returns.

**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 | 8,080 | 1.22 | 4.94 | -90.75 | 98.17 |
| 2Y | 129 | 2.66 | 8.78 | -21.33 | 34.15 | 8,080 | 1.36 | 10.40 | -91.66 | 118.14 |
| 5Y | 129 | 8.25 | 25.88 | -57.33 | 91.08 | 8,080 | 1.74 | 27.26 | -182.72 | 189.87 |
| 7Y | 129 | 10.27 | 36.36 | -90.97 | 115.28 | 8,080 | 1.92 | 36.97 | -234.92 | 314.23 |
| 10Y | 129 | 12.62 | 43.15 | -97.92 | 121.41 | 8,080 | 1.79 | 45.16 | -291.93 | 355.48 |
| 20Y | 129 | 19.89 | 67.69 | -200.41 | 189.87 | 8,080 | 2.22 | 68.91 | -615.60 | 519.17 |
| 30Y | 129 | 24.33 | 84.44 | -249.16 | 228.21 | 8,080 | 1.93 | 89.37 | -855.62 | 839.07 |
| **Return Accumulated Per Year (%)** | | | | | | | | | | |
| 1Y | 33 | 0.03 | 0.18 | -0.17 | 0.92 | 33 | 3.07 | 2.72 | -0.68 | 9.43 |
| 2Y | 33 | 0.10 | 0.19 | -0.38 | 0.53 | 33 | 3.43 | 3.65 | -3.60 | 11.92 |
| 5Y | 33 | 0.32 | 0.54 | -0.81 | 1.53 | 33 | 4.44 | 6.30 | -8.90 | 17.92 |
| 7Y | 33 | 0.40 | 0.74 | -1.17 | 2.21 | 33 | 4.93 | 7.93 | -11.68 | 20.65 |
| 10Y | 33 | 0.49 | 0.83 | -1.24 | 2.53 | 33 | 4.57 | 8.71 | -15.43 | 23.34 |
| 20Y | 33 | 0.78 | 1.34 | -2.18 | 4.12 | 33 | 5.76 | 12.86 | -24.77 | 29.45 |
| 30Y | 33 | 0.95 | 1.62 | -2.47 | 5.03 | 33 | 5.16 | 16.69 | -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 | 127 | -0.05 | 3.33 | -13.12 | 9.85 | 7,722 | -0.04 | 4.32 | -59.54 | 40.47 |
| 2Y | 127 | -0.91 | 4.64 | -19.97 | 13.73 | 7,722 | -0.03 | 5.30 | -51.58 | 37.47 |
| 5Y | 127 | -1.58 | 5.74 | -23.89 | 15.38 | 7,722 | -0.04 | 5.91 | -47.08 | 32.47 |
| 10Y | 127 | -1.53 | 5.80 | -20.48 | 17.15 | 7,722 | -0.05 | 5.79 | -51.89 | 33.09 |
| 20Y | 127 | -1.72 | 5.54 | -20.90 | 15.14 | 7,722 | -0.03 | 5.36 | -33.22 | 36.10 |
| 30Y | 127 | -1.69 | 5.92 | -26.21 | 16.72 | 7,722 | -0.03 | 5.61 | -33.14 | 34.21 |
| **Yield Changes Accumulated Per Year (%)** | | | | | | | | | | |
| 1Y | 33 | 0.00 | 0.07 | -0.18 | 0.18 | 33 | -0.10 | 1.45 | -3.08 | 3.62 |
| 2Y | 33 | -0.04 | 0.10 | -0.27 | 0.21 | 33 | -0.08 | 1.33 | -2.37 | 3.11 |
| 5Y | 33 | -0.06 | 0.12 | -0.35 | 0.10 | 33 | -0.08 | 1.11 | -2.23 | 2.37 |
| 10Y | 33 | -0.06 | 0.12 | -0.37 | 0.14 | 33 | -0.11 | 0.93 | -2.02 | 1.63 |
| 20Y | 33 | -0.07 | 0.11 | -0.33 | 0.15 | 33 | -0.08 | 0.85 | -1.68 | 1.87 |
| 30Y | 33 | -0.06 | 0.12 | -0.49 | 0.14 | 33 | -0.07 | 0.85 | -2.06 | 2.21 |

**Panel C: ETF Returns**

| | Pre-TRA Days | | | | | Other Days | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Maturity | N | Mean | SD | Min | Max | N | Mean | SD | Min | Max |
| **Daily Return (bps)** | | | | | | | | | | |
| SHY | 84 | 3.33 | 7.66 | -19.26 | 26.42 | 5,289 | 0.63 | 9.535 | -65.66 | 99.74 |
| IEI | 101 | 17.96 | 105.87 | -439.56 | 366.49 | 6,487 | 2.33 | 93.571 | -829.69 | 1,066.67 |
| IEF | 84 | 15.11 | 38.90 | -72.13 | 121.05 | 5,289 | 1.18 | 43.421 | -250.73 | 342.63 |
| TLH | 67 | 14.60 | 58.84 | -109.33 | 155.99 | 4,183 | 1.12 | 66.415 | -514.62 | 512.18 |
| TLT | 84 | 23.87 | 79.77 | -188.62 | 197.88 | 5,289 | 1.61 | 91.277 | -666.83 | 751.96 |
| SPY | 122 | -0.46 | 119.88 | -369.56 | 248.354 | 7,642 | 4.49 | 118.229 | -1,094.24 | 1,451.98 |
| **Return Accumulated Per Year (%)** | | | | | | | | | | |
| SHY | 21 | 0.13 | 0.17 | -0.32 | 0.35 | 22 | 1.542 | 2.32 | -3.574 | 7.16 |
| IEI | 27 | 0.68 | 2.40 | -4.41 | 8.36 | 26 | 4.973 | 10.78 | -22.38 | 36.02 |
| IEF | 21 | 0.59 | 0.87 | -0.78 | 2.49 | 22 | 2.890 | 7.17 | -14.49 | 17.91 |
| TLH | 17 | 0.58 | 1.30 | -1.87 | 3.07 | 16 | 2.443 | 11.64 | -23.83 | 21.78 |
| TLT | 21 | 0.94 | 1.70 | -2.21 | 4.59 | 22 | 4.031 | 15.39 | -29.69 | 35.58 |
| SPY | 30 | -0.01 | 2.23 | -4.66 | 3.72 | 31 | 11.421 | 18.28 | -36.80 | 37.13 |

**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 | -0.55 | 1.32* | 6.51*** | 8.36*** | 10.83*** | 17.72*** | 22.40*** |
| | (0.77) | (0.78) | (2.29) | (3.21) | (3.81) | (5.97) | (7.44) |
| TRA | 0.75 | 0.37 | -1.71 | -1.90 | -2.96 | -2.92 | -5.65 |
| | (0.79) | (0.76) | (2.16) | (2.83) | (3.58) | (5.73) | (7.57) |
| post-TRA | -0.09 | 0.43 | 1.86 | 2.26 | 2.74 | 6.24 | 5.63 |
| | (0.40) | (0.93) | (2.64) | (3.58) | (4.39) | (6.68) | (8.78) |
| Constant | 1.21*** | 1.34*** | 1.74*** | 1.91*** | 1.79*** | 2.17*** | 1.93** |
| | (0.06) | (0.12) | (0.30) | (0.39) | (0.48) | (0.72) | (0.92) |
| DOW FE | | | | | | | |
| EOM FE | | | | | | | |
| $R^2$ | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $N$ | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 |
| **Panel B** | | | | | | | |
| pre-TRA | 0.42 | 2.66*** | 8.04*** | 10.06*** | 12.63*** | 17.88*** | 21.42*** |
| | (0.78) | (0.83) | (2.40) | (3.33) | (3.95) | (6.18) | (7.72) |
| TRA | -0.84 | -1.22 | -3.19 | -3.72 | -4.62 | -4.41 | -6.63 |
| | (0.80) | (0.80) | (2.24) | (2.93) | (3.69) | (5.88) | (7.76) |
| post-TRA | -0.13 | 0.28 | 1.14 | 1.32 | 1.38 | 5.54 | 5.11 |
| | (0.42) | (0.95) | (2.72) | (3.71) | (4.53) | (6.92) | (9.09) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | | | |
| $R^2$ | 0.026 | 0.008 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 |
| $N$ | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 |
| **Panel C** | | | | | | | |
| pre-TRA | 0.51 | 1.86** | 6.01** | 7.45** | 9.33** | 13.18** | 14.82* |
| | (0.79) | (0.83) | (2.43) | (3.38) | (4.02) | (6.29) | (7.85) |
| TRA | -0.80 | -1.55* | -4.05* | -4.81 | -6.00 | -6.37 | -9.39 |
| | (0.80) | (0.80) | (2.24) | (2.94) | (3.71) | (5.93) | (7.82) |
| post-TRA | -0.11 | 0.13 | 0.76 | 0.83 | 0.76 | 4.66 | 3.87 |
| | (0.42) | (0.95) | (2.71) | (3.69) | (4.50) | (6.89) | (9.05) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.026 | 0.009 | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 |
| $N$ | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 |

**Table 4** Treasury Returns Around Quarterly Refunding Announcements: Bond 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), 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. The sample starts when a given ETF is issued.

| | Daily Return (bps) | | | | | |
|---|---|---|---|---|---|---|
| | Bond ETFs | | | | | Stock ETF |
| Ticker | **SHY** | **IEI** | **IEF** | **TLH** | **TLT** | **SPY** |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A** | | | | | | |
| pre-TRA | 2.67*** | 15.84 | 13.87*** | 13.51* | 22.21** | -4.72 |
| | (0.84) | (10.64) | (4.25) | (7.19) | (8.72) | (10.87) |
| TRA | -1.57* | 19.32* | -6.16 | -1.17 | -9.64 | 10.39 |
| | (0.83) | (10.57) | (4.25) | (7.70) | (9.90) | (10.72) |
| post-TRA | -0.24 | -5.03 | 2.73 | 3.62 | 6.50 | 3.95 |
| | (0.94) | (9.72) | (4.87) | (8.42) | (10.99) | (10.74) |
| Constant | 0.66*** | 2.12** | 1.24** | 1.09 | 1.66 | 4.26*** |
| | (0.12) | (1.07) | (0.57) | (0.95) | (1.16) | (1.20) |
| DOW FE | | | | | | |
| EOM FE | | | | | | |
| $R^2$ | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 |
| $N$ | 5,373 | 6,587 | 5,373 | 4,250 | 5,373 | 7,764 |
| **Panel B** | | | | | | |
| pre-TRA | 2.80*** | 13.62 | 13.38*** | 13.23* | 18.35** | -3.70 |
| | (0.89) | (10.88) | (4.44) | (7.46) | (9.10) | (11.16) |
| TRA | -0.96 | 15.86 | -5.40 | -1.21 | -8.25 | 11.06 |
| | (0.87) | (10.89) | (4.39) | (7.95) | (10.12) | (11.29) |
| post-TRA | -0.02 | -2.37 | 2.35 | 3.55 | 6.45 | 1.06 |
| | (0.96) | (9.81) | (5.04) | (8.72) | (11.34) | (11.00) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | | |
| $R^2$ | 0.004 | 0.002 | 0.002 | 0.001 | 0.002 | 0.000 |
| $N$ | 5,373 | 6,587 | 5,373 | 4,250 | 5,373 | 7,764 |
| **Panel C** | | | | | | |
| pre-TRA | 1.91** | 9.97 | 10.28** | 8.95 | 12.68 | -4.92 |
| | (0.91) | (11.32) | (4.52) | (7.58) | (9.26) | (11.32) |
| TRA | -1.30 | 14.44 | -6.57 | -2.84 | -10.39 | 10.55 |
| | (0.87) | (10.82) | (4.41) | (8.00) | (10.17) | (11.36) |
| post-TRA | -0.15 | -2.96 | 1.89 | 2.88 | 5.61 | 0.83 |
| | (0.96) | (9.78) | (5.05) | (8.73) | (11.35) | (10.99) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.006 | 0.003 | 0.004 | 0.002 | 0.003 | 0.000 |
| $N$ | 5,373 | 6,587 | 5,373 | 4,250 | 5,373 | 7,764 |

**Table 5** GSW Yield Changes Around Treasury Refunding Announcements

This table reports estimation results of Regression (2) using the GSW daily yield changes 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 Yield Change (bps) | | | | | |
|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A** | | | | | | |
| pre-TRA | 0.00 | -0.87** | -1.54*** | -1.48*** | -1.69*** | -1.66*** |
| | (0.30) | (0.42) | (0.51) | (0.52) | (0.49) | (0.53) |
| TRA | 0.59* | 0.77** | 0.78* | 0.75* | 0.58 | 0.57 |
| | (0.30) | (0.39) | (0.45) | (0.45) | (0.44) | (0.46) |
| post-TRA | -0.28 | -0.45 | -0.62 | -0.78 | -0.77 | -0.73 |
| | (0.35) | (0.45) | (0.54) | (0.53) | (0.52) | (0.55) |
| Constant | -0.05 | -0.04 | -0.04 | -0.05 | -0.03 | -0.03 |
| | (0.05) | (0.06) | (0.07) | (0.06) | (0.06) | (0.06) |
| DOW FE | | | | | | |
| EOM FE | | | | | | |
| $R^2$ | 0.000 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 |
| $N$ | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 |
| **Panel B** | | | | | | |
| pre-TRA | -0.19 | -1.12** | -1.78*** | -1.60*** | -1.65*** | -1.56*** |
| | (0.32) | (0.44) | (0.54) | (0.54) | (0.51) | (0.55) |
| TRA | 0.26 | 0.56 | 0.70 | 0.74 | 0.57 | 0.62 |
| | (0.32) | (0.41) | (0.47) | (0.46) | (0.45) | (0.48) |
| post-TRA | -0.24 | -0.36 | -0.40 | -0.58 | -0.65 | -0.74 |
| | (0.36) | (0.46) | (0.55) | (0.55) | (0.53) | (0.57) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | | |
| $R^2$ | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| $N$ | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 |
| **Panel C** | | | | | | |
| pre-TRA | -0.04 | -0.70 | -1.31** | -1.28** | -1.29** | -1.18** |
| | (0.32) | (0.45) | (0.55) | (0.55) | (0.52) | (0.56) |
| TRA | 0.32 | 0.73* | 0.90* | 0.87* | 0.72 | 0.78 |
| | (0.32) | (0.41) | (0.47) | (0.46) | (0.45) | (0.48) |
| post-TRA | -0.22 | -0.28 | -0.31 | -0.52 | -0.58 | -0.67 |
| | (0.36) | (0.46) | (0.55) | (0.55) | (0.53) | (0.57) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.003 |
| $N$ | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 | 7,849 |

**Table 6** Term Premium Changes Around Treasury Refunding Announcements

This table reports regression results using the daily changes of term premia estimated by Kim and Wright (2005) as dependent variables. The maturities range from 1 to 10 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 Term Premium Changes (bps) | | | | |
|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** |
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A** | | | | | |
| pre-TRA | -0.21*** | -0.35*** | -0.53*** | -0.57*** | -0.60*** |
| | (0.08) | (0.13) | (0.20) | (0.22) | (0.23) |
| TRA | -0.02 | -0.05 | -0.08 | -0.07 | -0.03 |
| | (0.07) | (0.12) | (0.17) | (0.19) | (0.20) |
| post-TRA | -0.18** | -0.30** | -0.45** | -0.46** | -0.45* |
| | (0.08) | (0.14) | (0.21) | (0.22) | (0.24) |
| Constant | 0.00 | 0.00 | -0.01 | -0.01 | -0.02 |
| | (0.01) | (0.02) | (0.03) | (0.04) | (0.04) |
| DOW FE | | | | | |
| EOM FE | | | | | |
| $R^2$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $N$ | 7,901 | 7,901 | 7,901 | 7,901 | 7,901 |
| **Panel B** | | | | | |
| pre-TRA | -0.28*** | -0.47*** | -0.70*** | -0.75*** | -0.77*** |
| | (0.08) | (0.14) | (0.21) | (0.23) | (0.24) |
| TRA | 0.01 | 0.01 | 0.03 | 0.05 | 0.09 |
| | (0.07) | (0.12) | (0.18) | (0.19) | (0.20) |
| post-TRA | -0.11 | -0.18 | -0.26 | -0.26 | -0.25 |
| | (0.09) | (0.14) | (0.21) | (0.23) | (0.24) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | | | | | |
| $R^2$ | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| $N$ | 7,901 | 7,901 | 7,901 | 7,901 | 7,901 |
| **Panel C** | | | | | |
| pre-TRA | -0.20** | -0.33** | -0.51** | -0.54** | -0.56** |
| | (0.08) | (0.14) | (0.21) | (0.23) | (0.25) |
| TRA | 0.04 | 0.06 | 0.11 | 0.14 | 0.18 |
| | (0.07) | (0.12) | (0.18) | (0.20) | (0.21) |
| post-TRA | -0.09 | -0.16 | -0.22 | -0.22 | -0.21 |
| | (0.08) | (0.14) | (0.21) | (0.23) | (0.24) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.005 | 0.006 | 0.006 | 0.006 | 0.005 |
| $N$ | 7,901 | 7,901 | 7,901 | 7,901 | 7,901 |

**Table 7** Treasury Returns Around Quarterly Refunding Announcements: Trading Strategies

This table reports the performance of trading strategies around Treasury Refunding Announcements. "Pre-TRA Days" refers to the strategies that long the respective maturity Treasury bonds on the day before the TRA, and "Other Days" refers to the strategies that long the respective maturity Treasury bonds on all other days. Returns (%), standard deviations (%), and Sharpe ratios are annualized. We use the 1-month Treasury bill rate as the risk-free rate. The sample period is from 1991Q4 to 2023Q4.

| | Pre-TRA Days | | | Other Days | | |
|---|---|---|---|---|---|---|
| Maturity | Return | Std | Sharpe Ratio | Return | Std | Sharpe Ratio |
| **Panel A: Treasury bond** | | | | | | |
| 1Y | 0.74 | 1.39 | 0.54 | 2.15 | 0.77 | 2.77 |
| 2Y | 5.78 | 1.39 | 4.15 | 2.50 | 1.64 | 1.52 |
| 5Y | 19.86 | 4.12 | 4.82 | 3.48 | 4.32 | 0.81 |
| 7Y | 24.95 | 5.78 | 4.32 | 3.93 | 5.86 | 0.67 |
| 10Y | 30.87 | 6.86 | 4.50 | 3.60 | 7.16 | 0.50 |
| 20Y | 49.20 | 10.75 | 4.58 | 4.68 | 10.93 | 0.43 |
| 30Y | 60.39 | 13.41 | 4.50 | 3.96 | 14.18 | 0.28 |
| EW Average | 27.40 | 5.90 | 4.65 | 3.47 | 6.10 | 0.57 |
| **Panel B: Treasury ETF** | | | | | | |
| SHY | 7.85 | 1.21 | 6.46 | 1.07 | 1.51 | 0.71 |
| IEI | 44.39 | 16.80 | 2.64 | 4.97 | 14.85 | 0.33 |
| IEF | 37.54 | 6.18 | 6.08 | 2.45 | 6.89 | 0.36 |
| TLH | 36.36 | 9.34 | 3.89 | 2.42 | 10.54 | 0.23 |
| TLT | 59.62 | 12.67 | 4.71 | 3.53 | 14.49 | 0.24 |
| **Panel C: Stock ETF** | | | | | | |
| SPY | -2.07 | 19.03 | -0.11 | 10.16 | 18.78 | 0.54 |

**Table 8** Treasury Returns Around Quarterly Refunding Announcements: Subsamples

This table reports estimation results of Regression (1) using the CRSP Treasury bond returns in two subsamples: 1991-2002 and 2003-2023. The maturities range 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.

| | Daily Return (bps) | | | | | | |
|---|---|---|---|---|---|---|---|
| Maturity | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: 1991-2002** | | | | | | | |
| pre-TRA | 1.66 | 0.93 | 2.28 | 1.65 | 2.27 | 12.33 | 11.19 |
| | (2.11) | (1.57) | (4.07) | (5.56) | (6.13) | (8.83) | (10.38) |
| TRA | -2.63 | -1.68 | -5.15 | -6.29 | -8.32 | -9.59 | -11.23 |
| | (2.19) | (1.51) | (4.15) | (4.91) | (6.01) | (7.85) | (9.46) |
| post-TRA | 0.15 | 1.63 | 3.38 | 4.91 | 6.45 | 10.62 | 12.60 |
| | (0.95) | (1.95) | (4.73) | (5.87) | (7.56) | (9.90) | (11.63) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.034 | 0.014 | 0.005 | 0.006 | 0.006 | 0.006 | 0.006 |
| $N$ | 2,995 | 2,995 | 2,995 | 2,995 | 2,995 | 2,995 | 2,995 |
| **Panel B: 2003-2023** | | | | | | | |
| pre-TRA | -0.07 | 2.40** | 8.01*** | 10.56** | 13.14** | 13.50 | 16.49 |
| | (0.37) | (0.96) | (3.00) | (4.21) | (5.19) | (8.42) | (10.68) |
| TRA | 0.27 | -1.39 | -3.34 | -3.94 | -4.71 | -4.50 | -8.25 |
| | (0.33) | (0.90) | (2.62) | (3.66) | (4.70) | (8.09) | (10.91) |
| post-TRA | -0.23 | -0.63 | -0.57 | -1.28 | -2.24 | 1.53 | -0.67 |
| | (0.36) | (0.96) | (3.27) | (4.67) | (5.54) | (9.13) | (12.40) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.027 | 0.009 | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 |

**Table 9** Pre-Announcement Returns and Recessions

This table reports estimation results of Regressions (3) in Panel A and (4) in Panel B. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years. NBER Recession is an indicator that equals 1 if the month is designated as in recession by the NBER and 0 otherwise. Day of week (DOW) and end of month (EOM) fixed effects are included in all specifications in Panel A. 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) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** | **SHY** | **IEI** | **IEF** | **TLH** | **TLT** | **SPY** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| **Panel A: All Days** | | | | | | | | | | | | | |
| pre-TRA | 0.73 | 2.30*** | 7.02*** | 9.28*** | 11.33*** | 17.19*** | 19.45** | 1.99** | 7.87** | 12.24*** | 12.61* | 18.01* | -6.85 |
| | (0.84) | (0.82) | (2.42) | (3.36) | (3.96) | (6.24) | (7.84) | (0.89) | (3.11) | (4.54) | (7.56) | (9.20) | (11.77) |
| NBER Recession | 0.86*** | 1.19** | 1.57 | 2.12 | 1.67 | 2.29 | 3.61 | 1.40** | 2.44 | 2.86 | 4.03 | 4.43 | -10.36 |
| | (0.31) | (0.61) | (1.46) | (2.11) | (2.45) | (3.73) | (5.05) | 1.40** | 2.44 | 2.86 | 4.03 | 4.43 | -10.36 |
| pre-TRA × NBER Recession | -2.90 | -5.76 | -13.32 | -24.81 | -26.88 | -56.29* | -63.95* | -0.56 | -9.55 | -27.02 | -42.62 | -75.80* | 26.37 |
| | (2.08) | (4.48) | (12.04) | (16.68) | (21.59) | (30.39) | (37.01) | (4.90) | (12.17) | (20.37) | (33.00) | (42.16) | (41.74) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.028 | 0.010 | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 | 0.008 | 0.006 | 0.004 | 0.003 | 0.004 | 0.001 |
| $N$ | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 8,209 | 5,312 | 4,198 | 5,312 | 4,198 | 5,312 | 7,679 |
| **Panel B: pre-TRA Only** | | | | | | | | | | | | | |
| Constant | 0.81 | 2.98*** | 9.06*** | 11.84*** | 14.36*** | 23.63*** | 28.50*** | 3.26*** | 10.58*** | 16.82*** | 18.01** | 28.93*** | -1.65 |
| | (0.84) | (0.90) | (2.47) | (3.52) | (3.99) | (6.26) | (7.83) | (0.96) | (3.30) | (5.04) | (8.15) | (10.01) | (11.29) |
| NBER Recession | -2.06 | -4.50 | -11.58 | -22.48* | -24.94 | -53.58** | -59.74* | 0.91 | -6.83 | -23.90 | -38.10 | -70.89* | 16.15 |
| | (1.41) | (2.91) | (7.54) | (11.53) | (15.20) | (24.07) | (30.22) | (3.50) | (7.46) | (18.02) | (29.36) | (39.17) | (26.42) |
| $R^2$ | 0.004 | 0.017 | 0.013 | 0.025 | 0.022 | 0.041 | 0.033 | 0.0009 | 0.007 | 0.025 | 0.035 | 0.053 | 0.001 |
| $N$ | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 83 | 67 | 83 | 67 | 83 | 83 |

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

This table reports OLS regression results of pre-TRA day Treasury returns on the actual 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: Marktable 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 |
| Observations | 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 |
| Observations | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| **Panel C: Marktable 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 |
| Observations | 101 | 101 | 101 | 101 | 101 | 101 | 101 |

**Table 11** Pre-Announcement Returns and Accumulation-Period $\Delta MOVE$

This table reports estimation results of Regressions (5) in Panel A and (6) in Panel B. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years. $\Delta MOVE[-7,-2]$ is the changes in the MOVE index from 7 to 2 days before the TRA. Day of week (DOW) and end of month (EOM) fixed effects are included in all specifications in Panel A. 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 2002:11 to 2023:12.

| | Daily Return (bps) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** | **SHY** | **IEI** | **IEF** | **TLH** | **TLT** | **SPY** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| **Panel A: All Days** | | | | | | | | | | | | | |
| pre-TRA | -0.17 | 1.97** | 6.72** | 8.98** | 11.27** | 11.04 | 13.31 | 1.55* | 6.31** | 8.51* | 7.92 | 10.07 | -3.34 |
| | (0.36) | (0.93) | (2.98) | (4.20) | (5.15) | (8.44) | (10.63) | (0.90) | (3.11) | (4.53) | (7.63) | (9.33) | (14.03) |
| $\Delta MOVE[-7,-2]$ | 0.00 | -0.03 | -0.14** | -0.19** | -0.23** | -0.32** | -0.35* | -0.02 | -0.10* | -0.22*** | -0.29** | -0.34** | 0.39 |
| | (0.01) | (0.02) | (0.06) | (0.08) | (0.10) | (0.15) | (0.20) | (0.02) | (0.05) | (0.08) | (0.13) | (0.16) | (0.32) |
| pre-TRA $\times$ $\Delta MOVE[-7,-2]$ | 0.15*** | 0.42*** | 0.93*** | 1.23*** | 1.58*** | 2.18*** | 2.59** | 0.32*** | 0.50 | 1.32*** | 1.79** | 2.39** | -2.28 |
| | (0.05) | (0.10) | (0.31) | (0.42) | (0.56) | (0.82) | (1.03) | (0.11) | (0.31) | (0.44) | (0.80) | (0.95) | (1.54) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.029 | 0.011 | 0.007 | 0.006 | 0.006 | 0.005 | 0.005 | 0.007 | 0.006 | 0.006 | 0.004 | 0.004 | 0.002 |
| $N$ | 5,157 | 5,157 | 5,157 | 5,157 | 5,157 | 5,157 | 5,157 | 5,153 | 4,125 | 5,153 | 4,125 | 5,153 | 5,153 |
| **Panel B: pre-TRA Only** | | | | | | | | | | | | | |
| Constant | -0.58 | 2.28** | 8.94*** | 11.90*** | 14.57*** | 19.48** | 26.37** | 2.87*** | 9.31*** | 13.23*** | 13.95* | 21.57** | 1.90 |
| | (0.42) | (0.98) | (2.97) | (4.28) | (4.98) | (8.79) | (10.75) | (0.88) | (3.03) | (4.76) | (8.15) | (10.07) | (12.47) |
| $\Delta MOVE[-7,-2]$ | 0.14*** | 0.39*** | 0.79** | 1.04** | 1.35** | 1.86** | 2.25** | 0.30*** | 0.40 | 1.10** | 1.50* | 2.06** | -1.88 |
| | (0.05) | (0.10) | (0.32) | (0.43) | (0.55) | (0.82) | (1.04) | (0.11) | (0.34) | (0.44) | (0.81) | (0.97) | (1.39) |
| $R^2$ | 0.147 | 0.171 | 0.073 | 0.062 | 0.068 | 0.049 | 0.045 | 0.121 | 0.024 | 0.061 | 0.053 | 0.051 | 0.019 |
| $N$ | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 80 | 64 | 80 | 64 | 80 | 80 |

**Table 12** Pre-Announcement Returns and Primary Dealer Meetings

This table reports estimation results of Regressions (7) in Panel A and (8) in Panel B. The dependent variables are CRSP Treasury bond returns with maturities ranging from 1 to 30 years. *PD_Start* is an indicator equal to 1 on days when there is a meeting between the Treasury ODM officials and Primary Dealers. Day of week (DOW) and end of month (EOM) fixed effects are included in all specifications in Panel A. 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 2003:01 to 2023:12.

| | Daily Return (bps) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1Y** | **2Y** | **5Y** | **7Y** | **10Y** | **20Y** | **30Y** | **SHY** | **IEI** | **IEF** | **TLH** | **TLT** | **SPY** |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| **Panel A: All Days** | | | | | | | | | | | | | |
| pre-TRA | 0.10 | 1.82* | 5.36* | 6.87 | 8.67 | 5.45 | 7.30 | 1.35 | 4.02 | 5.60 | 1.37 | 4.30 | -3.02 |
| | (0.39) | (1.05) | (3.14) | (4.42) | (5.49) | (8.79) | (11.21) | (0.99) | (3.06) | (4.68) | (7.59) | (9.77) | (14.83) |
| PD Meeting Start | -0.10 | -0.62 | -2.81 | -4.42 | -6.39 | -12.33 | -14.88 | -0.94 | -5.64 | -7.18 | -15.42* | -13.51 | 6.28 |
| | (0.49) | (1.32) | (3.54) | (4.53) | (5.65) | (8.71) | (10.92) | (1.25) | (3.55) | (5.30) | (8.48) | (10.10) | (13.79) |
| pre-TRA × PD Meeting Start | -1.28 | 5.11*** | 22.68*** | 31.85*** | 39.30*** | 70.57*** | 81.61*** | 4.38*** | 32.06*** | 40.64*** | 82.38*** | 75.41*** | -46.92 |
| | (1.00) | (1.64) | (6.77) | (9.75) | (11.22) | (20.11) | (25.49) | (1.58) | (7.64) | (11.75) | (17.89) | (22.51) | (34.74) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.027 | 0.009 | 0.005 | 0.005 | 0.005 | 0.004 | 0.004 | 0.006 | 0.007 | 0.005 | 0.004 | 0.004 | 0.001 |
| $N$ | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 | 5,214 | 5,264 | 4,250 | 5,264 | 4,250 | 5,264 | 5,264 |
| **Panel B: pre-TRA Only** | | | | | | | | | | | | | |
| Constant | -0.31 | 2.08* | 7.45*** | 9.63** | 11.78*** | 13.59* | 19.88** | 2.69*** | 7.18*** | 10.29** | 7.55 | 15.44 | 3.10 |
| | (0.49) | (1.10) | (2.71) | (3.81) | (4.42) | (7.50) | (9.41) | (1.01) | (2.66) | (4.24) | (7.33) | (9.35) | (13.23) |
| PD Meeting Start | -1.39 | 4.57*** | 20.07*** | 27.67*** | 33.21*** | 58.70*** | 67.40** | 3.52*** | 26.73*** | 33.76*** | 67.51*** | 62.46*** | -40.38* |
| | (1.25) | (1.16) | (6.50) | (9.94) | (11.34) | (20.31) | (26.58) | (1.16) | (5.55) | (11.54) | (11.92) | (22.71) | (22.38) |
| $R^2$ | 0.022 | 0.036 | 0.071 | 0.067 | 0.063 | 0.074 | 0.061 | 0.025 | 0.124 | 0.087 | 0.125 | 0.070 | 0.013 |
| $N$ | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 83 | 67 | 83 | 67 | 83 | 83 |

**Table 13** Treasury Bond Returns, Conditional on the Relative Timing between TRA 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. "TRA Earlier" is an indicator that equals 1 if the TRA occurs before the FOMC announcement within 5 days, and 0 otherwise. "FOMC Earlier" is an indicator that equals 1 if the FOMC occurs before the TRA within 5 days, and 0 otherwise. 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) |
| pre-TRA | 2.67 | 2.59* | 4.92 | 3.31 | 4.36 | 12.51 | 9.59 |
| | (2.16) | (1.54) | (4.41) | (6.24) | (6.96) | (10.82) | (12.86) |
| TRA Earlier × pre-TRA | -0.85* | 3.37*** | 12.94*** | 18.06*** | 21.08*** | 24.34** | 30.24** |
| | (0.45) | (1.01) | (3.28) | (4.68) | (5.70) | (9.74) | (12.32) |
| FOMC Earlier × pre-TRA | -0.22 | 0.25 | 2.57 | 4.14 | 6.23 | 6.38 | 9.41 |
| | (0.50) | (1.39) | (4.07) | (5.73) | (7.21) | (11.34) | (14.57) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.025 | 0.009 | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 7,709 | 7,709 | 7,709 | 7,709 | 7,709 | 7,709 | 7,709 |

**Table 14** Treasury Bond Returns, Conditional on Current FOMC Rate Announcements

This table reports regression results using the CRSP Treasury bond returns with maturities ranging from 1 to 30 years as dependent variables. "Cut" is an indicator for each day that equals 1 if the most recent FOMC meeting announces a rate cut. "Hike" is an indicator for each day that equals 1 if the most recent FOMC meeting announces a rate 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) |
| pre-TRA | 0.74 | 2.61*** | 8.58*** | 10.23*** | 12.33*** | 15.24** | 18.61* |
| | (1.20) | (0.85) | (2.66) | (3.86) | (4.72) | (7.69) | (9.77) |
| Hike × pre-TRA | -0.09 | -1.40 | -3.81 | -1.99 | -1.91 | 2.73 | 3.19 |
| | (1.46) | (2.30) | (6.47) | (8.89) | (9.81) | (15.38) | (18.56) |
| Cut × pre-TRA | -0.86 | -2.69 | -11.54 | -16.92 | -18.06 | -18.83 | -34.05 |
| | (1.64) | (2.87) | (7.79) | (11.11) | (14.26) | (21.08) | (25.22) |
| Hike | 0.07 | -0.40 | -1.19 | -1.73* | -1.97* | -3.24* | -3.89* |
| | (0.14) | (0.30) | (0.75) | (0.99) | (1.20) | (1.78) | (2.20) |
| Cut | 1.19*** | 1.33** | 1.32 | 0.96 | 0.15 | -0.91 | 0.60 |
| | (0.26) | (0.52) | (1.23) | (1.69) | (2.03) | (3.03) | (4.05) |
| DOW FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EOM FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.029 | 0.011 | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 |
| $N$ | 7,708 | 7,708 | 7,708 | 7,708 | 7,708 | 7,708 | 7,708 |

**Table 15** Treasury Returns Around Quarterly Refunding Announcements: By Quarter

This table reports estimation results of Regression (1) using the CRSP Treasury bond returns for each quarter of the year. The maturities range from 1 to 30 years. No fixed effects are included in any 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: Q1 (N=1,961)** | | | | | | | |
| pre-TRA | -0.70 | 2.88** | 13.38*** | 19.28*** | 23.70*** | 37.04*** | 46.42*** |
| | (0.54) | (1.43) | (3.99) | (5.40) | (6.58) | (9.53) | (12.20) |
| TRA | 1.06** | 0.04 | -3.20 | -3.91 | -3.24 | -8.93 | -11.70 |
| | (0.50) | (1.12) | (3.64) | (4.58) | (5.99) | (10.56) | (13.27) |
| post-TRA | -0.31 | 0.43 | 0.46 | -1.41 | 0.32 | -2.34 | -7.53 |
| | (0.79) | (1.70) | (5.19) | (7.68) | (8.67) | (14.18) | (19.49) |
| Constant | 1.22*** | 1.14*** | 1.13* | 1.14 | 0.85 | 0.55 | -0.49 |
| | (0.12) | (0.25) | (0.63) | (0.85) | (1.02) | (1.51) | (1.95) |
| $R^2$ | 0.001 | 0.001 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 |
| **Panel B: Q2 (N=2,024)** | | | | | | | |
| pre-TRA | 0.21 | -1.10 | -3.00 | -4.73 | -4.36 | -8.22 | -9.79 |
| | (2.90) | (1.61) | (4.40) | (6.58) | (7.70) | (12.39) | (15.03) |
| TRA | -1.28 | 0.22 | -2.98 | -5.03 | -8.37 | -10.99 | -19.21 |
| | (2.92) | (1.44) | (3.88) | (5.18) | (6.52) | (9.60) | (12.29) |
| post-TRA | 0.22 | 1.65 | 3.94 | 4.72 | 6.05 | 12.54 | 10.68 |
| | (0.71) | (1.80) | (4.61) | (6.12) | (7.49) | (11.92) | (15.41) |
| Constant | 1.09*** | 1.11*** | 1.40** | 1.73** | 1.55* | 2.08 | 1.96 |
| | (0.10) | (0.23) | (0.57) | (0.75) | (0.93) | (1.38) | (1.72) |
| $R^2$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| **Panel C: Q3 (N=2,029)** | | | | | | | |
| pre-TRA | -1.22 | 1.71 | 8.37 | 10.17 | 11.60 | 18.95 | 25.48 |
| | (0.75) | (1.72) | (5.31) | (7.24) | (8.27) | (13.77) | (16.66) |
| TRA | 1.27* | -0.30 | -3.76 | -3.98 | -5.78 | -4.77 | -9.92 |
| | (0.70) | (1.68) | (4.72) | (6.40) | (8.05) | (12.20) | (15.92) |
| post-TRA | -0.29 | -1.45 | -3.81 | -2.63 | -5.21 | -2.93 | -0.87 |
| | (0.67) | (1.70) | (5.22) | (6.83) | (8.36) | (11.85) | (15.83) |
| Constant | 1.39*** | 1.84*** | 3.15*** | 3.63*** | 3.89*** | 4.55*** | 4.93*** |
| | (0.12) | (0.24) | (0.59) | (0.77) | (0.93) | (1.44) | (1.84) |
| $R^2$ | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 |
| **Panel D: Q4 (N=1,932)** | | | | | | | |
| pre-TRA | -0.47 | 1.98 | 7.72* | 9.02 | 12.95* | 23.62** | 28.28** |
| | (0.60) | (1.35) | (4.05) | (5.67) | (7.16) | (10.50) | (13.95) |
| TRA | 1.95** | 1.67 | 3.41 | 5.42 | 5.90 | 13.20 | 18.45 |
| | (0.86) | (1.72) | (4.77) | (6.07) | (7.61) | (12.66) | (17.48) |
| post-TRA | 0.07 | 1.32 | 7.31 | 8.66 | 10.39 | 18.34 | 21.15 |
| | (1.02) | (2.14) | (5.91) | (7.78) | (10.23) | (14.98) | (18.87) |
| Constant | 1.13*** | 1.08*** | 0.83 | 0.84 | 0.28 | 0.84 | 0.40 |
| | (0.11) | (0.22) | (0.61) | (0.87) | (1.08) | (1.63) | (2.13) |
| $R^2$ | 0.002 | 0.001 | 0.003 | 0.002 | 0.002 | 0.004 | 0.003 |

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# Appendix

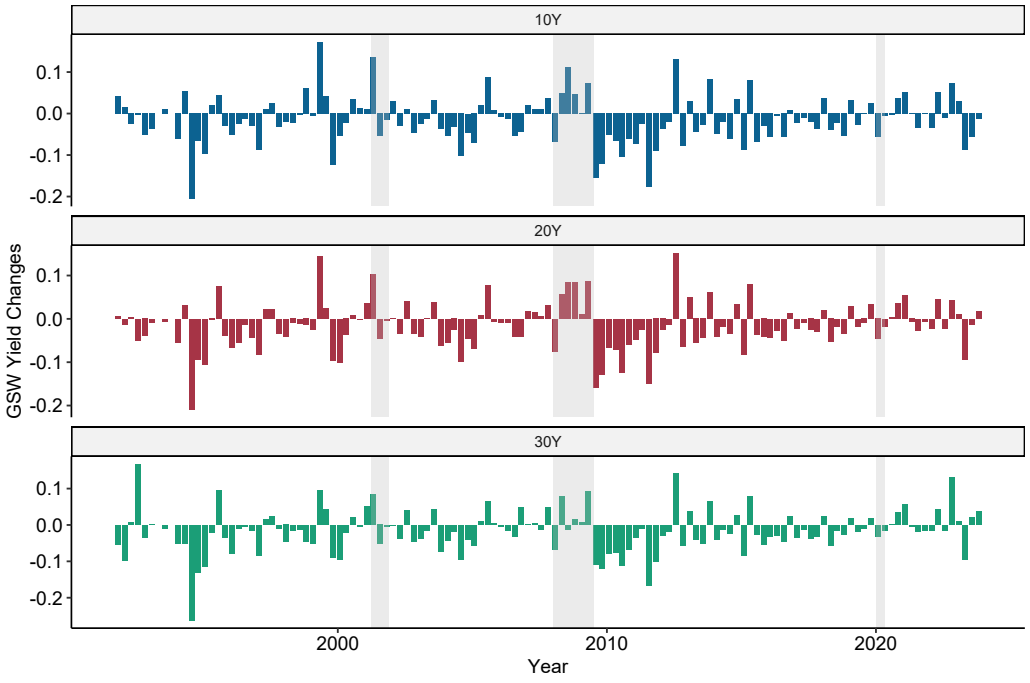


**Figure A.1** Daily Changes of 10-Year GSW Yields on the Day Prior to Quarterly Refunding Announcements

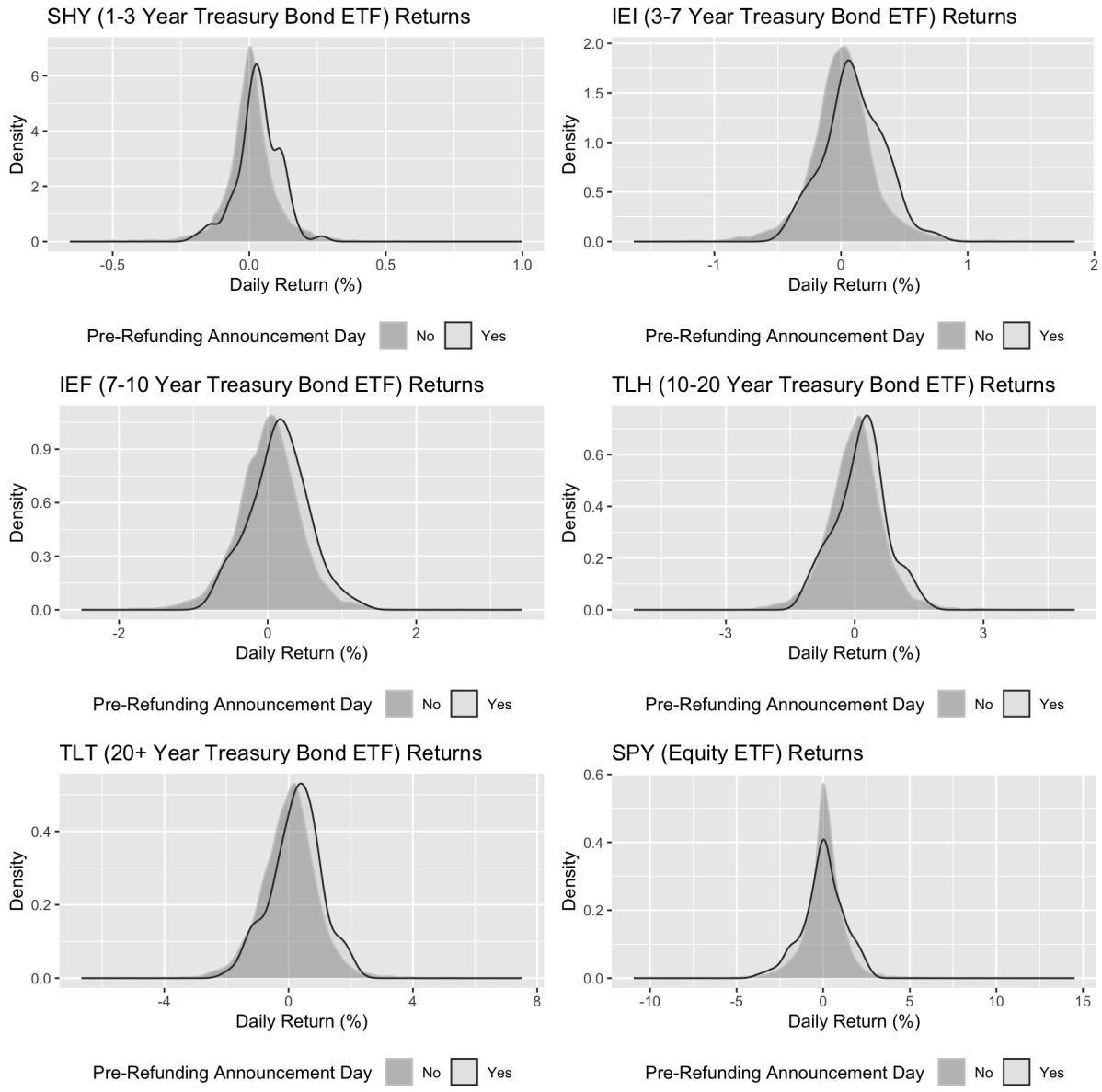


**Figure A.2** Distribution of Daily ETF Returns, Split by Pre-TRA and Non-Pre-TRA Days