What Treasury Auctions Reveal About Investor Demand[*]

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Abstract

We measure the elasticity of demand for Treasuries at auction directly from bidding data. From 1992 to 2010, demand for Treasuries was surprisingly elastic: a 1% increase in the supply of Treasuries relative to the amount outstanding corresponded to a 2 basis point increase in long-term yields. Since 2010, demand has become almost five times more inelastic, implying that yields now rise by 9 basis points per 1% increase in supply. This deterioration of demand is also apparent in the secondary market. Prior to 2010, long-term yields declined on average by 1.5 basis points after auctions and these declines have been concentrated in auctions with strong investor demand. After 2010, this trend has reversed and yields no longer fall after auctions. This weaker demand for Treasuries coincides with less foreign investor demand and reduced secondary market liquidity.

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1. Introduction

Since World War II, the US dollar has served as the world's safe asset and underpinned the international monetary and financial system. Global investors' demand for safe assets has enabled the United States government to borrow relatively cheaply and to issue Treasuries at below market interest rates. This position, as the supplier of the world's safe assets, has been described as an exorbitant privilege. However, there is growing concern about the erosion of the dollar's status as the global reserve currency.

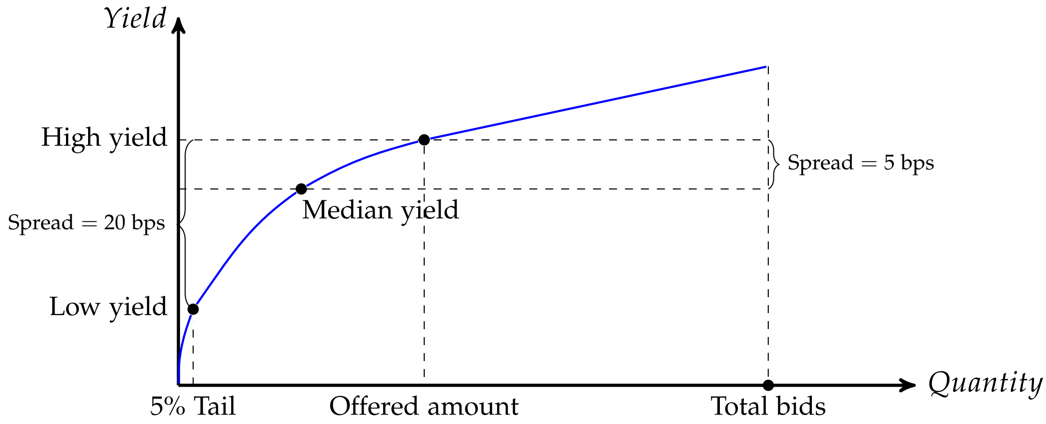
In this paper, we argue that this erosion has been apparent in investor demand for Treasuries at US Treasury auctions. We focus on Treasury auctions for two reasons. First, supply is known prior to the auction such that the market only learns about global investor demand for Treasuries. Second, we may directly observe the elasticity of demand by investors for Treasuries at auctions. This provides a high-power setting to understand how investor demand for Treasuries has changed over time. In contrast, studies that structurally estimate the elasticity of investor demand for Treasuries depend on time-series instruments, which provide noisy elasticity estimates.

The US Treasury holds a quarterly refunding press conference, where it announces expected Treasury auctions in a regular and predictable manner (Garbade, 2007). Furthermore, about a week prior to the auction of a long-term Treasuries, the Treasury announces the offering amount and auction date.[1] Therefore, at the auction itself, there is no (new) supply information released, and the market learns about global investor demand for Treasuries. These global investors bid for Treasuries by submitting demand curves in a single-price auction since 1992, which is the starting point of our main sample period. These data are aggregated and three points on the curve are publicly disclosed. Figure 1 illustrates an aggregate demand curve for Treasuries. The demand curve is upward sloping in yields as investors demand higher yields (lower prices) to buy greater quantities of Treasury securities.

From this aggregate demand curve, we directly measure information about investor demand: the market clearing level of yields and the slope of the demand curve. Since we directly observe the aggregate demand curve, we can measure this for each auction and observe time

[1] We define long-term Treasury auctions as auctions with maturities of beyond 5 years.

Figure 1: Treasury Auction Demand Schedule



Note: This figure plots a hypothetical US Treasury demand schedule that is based on the available information released shortly after Treasury auctions. *High yield* is the market clearing yield paid by every market participant in a uniform price auction. The *Median yield* is the yield where 50% of the competitive tenders is reached. At the *Low yield* 5% percent of the amount of competitive tenders was tendered at or below this yield. *Offered amount* is the total amount offered for purchase of the security being announced/ auctioned, whereas *Total bids* is the sum of all bids received for the security being auctioned. The high vs median and median vs low yield spreads are computed based on the sample period from January 1992 to January 2025.

series variation in global investor demand for Treasuries.

Our first fact is that there is a negative trend in the elasticity of demand for Treasuries at auction. The slope of the demand curve has steepened, meaning that investors are demanding higher yields to absorb the increased supply of Treasuries. This increased inelasticity is driven by both the size of auctions shrinking relative to the outstanding supply of Treasuries and the market clearing yield becoming more sensitive to the quantity auctioned. The elasticity of demand has fallen from -0.9, average over 1992 to 2010, to -0.2, average over 2011 to 2025.

A possible concern with our approach is that we are measuring a mix of investor and dealer elasticities. To address this, we compute two boundary cases for which we assume that either dealers or investors are perfectly inelastic. The decomposition shows that the erosion of auction demand elasticity has been mostly driven by investors, rather than dealers becoming more inelastic over time. The shift in elasticity coincides with a dramatic decline in dealer participation after the global financial crisis. A possible explanation for this decline is the fact that tighter regulatory constraints after the global financial crisis have reduced dealers' ability to warehouse inventory (Duffie, Fleming, Keane, Nelson, Shachar, and Van Tassel, 2023), thereby curtailing position-taking at auction (Fleming, Nguyen, and Rosenberg, 2024).

Our second fact is that changes in the level of secondary market yields over long-term Treasury auctions also show that the demand for Treasuries has weakened over the past few decades. We use changes in 10-year Treasury yields over long-term treasury auctions to measure unexpected investor demand at auction. From 1992 to 2010, US yields have risen prior to auctions and fallen afterwards, resulting in an inverse V-shaped pattern in yields around auctions. This inverse V-shaped pattern includes both a transitory and a permanent component. The former is associated with financial intermediaries limited risk bearing capacity (Lou, Yan, and Zhang, 2013; Fleming, Liu, and Nguyen, 2016; Fleming et al., 2024; Lou, Pinter, Üslü, and Walker, 2025), resulting in transitory price pressure. The permanent component amounts on average to a 1.7 basis points (bps) decline in long-term yields for Treasury auctions from 1992 to 2010. We interpret this average decline in yields over Treasury auctions as evidence that demand for Treasuries was stronger than expected. In contrast, from 2010 to 2025, US yields no longer tend to permanently decline over Treasury auctions.

To better distinguish the permanent component from the transitory intermediation effect, we use long-term sovereign bond yields for G10 countries. For global bond investors, these foreign sovereign bonds are close substitutes for Treasuries, but the foreign sovereign bonds are not directly affected by intermediary price pressures. Indeed, we find no inverse V-shaped in long-term G10 yields over Treasury auctions. However, we find similar patterns for the permanent decline in yields over Treasury auctions. From 1992 to 2010, G10 yields permanently declined by 1.5 bps over Treasury auctions, and from 2010 to 2025 there was on average no change in G10 yields.

These two pieces of evidence, taken together with the fact that Treasury auctions do not reveal any new supply information, point towards an explanation based on changes in investor demand for Treasuries and, in more general, sovereign long-term debt. In other words, up until the global financial crisis, the market has on average been positively surprised by global demand for long-term sovereign debt at US Treasury auctions. These positive surprises have been associated with both US and G10 yields falling after auctions. After the crisis, demand for Treasuries has softened, and yields do not fall after Treasury auctions.

It is natural to ask whether the spill over effect from Treasury auctions to foreign yields is unique to US Treasury auctions or whether we observe similar patters for foreign sovereign bond auctions (e.g., Gilt auctions in the UK). Global bond yields tend *not* to fall over foreign sovereign bond auctions, even those of similar size to that of Treasury auctions. Similar to how Treasuries are the global safe asset, Treasury auctions have served as a special venue for the market to learn about global demand for long-term bonds.

Next, we examine a commonly referenced measure of demand at auction, the bid-to-cover ratio. We find that large declines in global bond yields tend to be concentrated in auctions with surprisingly high bid-to-cover ratios. This suggests that the decline in long-term bond yields over Treasury auctions is related to surprise demand at auctions. However, we show that the bid-to-cover ratio is stationary and strongly mean reverting. High-frequency changes to the bid-to-cover ratio capture demand shocks, but the low-frequency trend does not show an erosion in Treasury demand. This may be because primary dealers are required to bid at auctions and the bid-to-cover ratio is a demand metric closely monitored by the Treasury.

We then provide evidence that a decline in foreign demand for Treasuries is one possible reason why demand for Treasuries at auction has eroded. Foreign holdings of Treasuries increased from 17% in 2001 to a peak of 34% in 2015 and have since declined to 24% as of 2025. This low-frequency time series trend in foreign holdings of US Treasuries closely aligns with the share of Treasuries allocated to foreigners at auction. Furthermore, at high-frequency, we show that foreign demand matters for changes in both the level and the slope of Treasury auction demand. We instrument for foreign demand using overlapping auction dates: these are days when foreign auctions happen to coincide with Treasury auctions. Consistent with a home region bias, foreign investors demand fewer Treasuries at auction when they have the opportunity to buy local sovereign bonds. On these "overlapping" Treasury auctions, both the level and the slope of the demand curve for Treasuries shows weaker demand.

Finally, we examine the implications of declining Treasury demand elasticity for secondary market fragility. Specifically, we show that more inelastic investor demand at auction is associated with worsening Treasury market conditions, which we measure by both option-implied volatility (the MOVE Index) and yield curve noise (Hu, Pan, and Wang, 2013). This relationship has strengthened considerably after the financial crisis. A one standard deviation decline in demand elasticity is associated with a 2.3 percentage point increase in implied volatility prior to 2010, whereas the association is almost twice as large after 2010. Similarly, more inelastic Treasury auction demand is associated with significantly higher secondary market illiquidity (i.e., yield curve noise) after but not before 2010. In sum, our findings suggest that the relation between Treasury demand elasticities and market conditions is non-linear and that the erosion of primary market demand has spilled over to increased fragility in the secondary market for Treasuries.

This paper aims to make three contributions. First and most concretely, we show that the demand for Treasuries at auction has exhibited a negative trend since 2010. This precedes the more recent concerns about fragility and illiquidity in the Treasury market (e.g., Duffie, 2023; Duffie et al., 2023). We provide supporting empirical evidence of the interpretation that US Treasury auctions are special in revealing global demand for long-term bonds. This suggests that Treasury auctions may be an important mechanism for revealing demand effects of slow moving macroeconomic trends about the global demand for long-term bonds, such as trends in inflation (Jotikasthira, Le, and Lundblad, 2015), demographics (Coeurdacier, Guibaud, and Jin, 2015), and savings rates (Caballero and Farhi, 2017). This empirical fact also supports a growing theoretical literature where global yields are determined by the substitution patterns of global investors in response to changes in the quantity of long-term bonds (Gourinchas, Ray, and Vayanos, 2022; Greenwood, Hanson, Stein, and Sunderam, 2023).

Second, and more broadly, we also hope to contribute to a large and growing literature on demand based asset pricing[2] by showing how demand curves from auctions can provide a direct estimate of investors' elasticity of demand. In related work, Eren, Schrimpf, and Xia (2023), Chaudhary, Fu, and Zhou (2024), Jansen, Li, and Schmid (2024), and Fang, Hardy, and Lewis (2025) apply a demand system to the US Treasury market and provide structural estimates of demand elasticities. A key challenge in this literature is addressing the endogeneity between quantities and prices. Unfortunately, finding valid instruments often proves difficult in practice. To address identification concerns, recent work (see, e.g., Gomez Cram, Kung, and Lustig, 2024; Hartley and Rigon, 2024; Phillot, 2025) uses high-frequency data to extract Treasury supply shocks. An alternative approach is to leverage auction data to directly esti-

[2]Initially applied to the cross-section of stocks Koijen and Yogo (2019b), the original framework has been adapted to study various asset classes, including equities (e.g., Gabaix and Koijen, 2020; Haddad, Huebner, and Loualiche, 2025), corporate bonds (e.g., Bretscher, Schmid, Sen, and Sharma, 2025; Chaudhary, Fu, and Li, 2022), and exchange rates (e.g., Koijen and Yogo, 2019a; An and Huber, 2024; Camanho, Hau, and Rey, 2022; Jiang, Richmond, and Zhang, 2024b).

mate investors' demand curves without requiring price instruments. For example, Hortaçsu, Kastl, and Zhang (2018) recover bidders' demand curves from US Treasury auctions using a structural model, while Albuquerque, Cardoso-Costa, and Faias (2024) and Cavaleri, Ranaldo, and Rossi (2024) quantify price elasticity directly from Portuguese and Swiss sovereign bond auction bids, respectively. Similarly, Allen, Kastl, and Wittwer (2025b) introduce a framework for estimating demand systems across multiple assets using Canadian auction bidding data. Our paper contributes to this strand of the literature by directly estimating US Treasury demand elasticities from auction data.

Lastly, we contribute to the literature on the demand for safe government debt (e.g., Krishnamurthy and Vissing-Jorgensen, 2012; Caballero and Farhi, 2017; Caballero, Farhi, and Gourinchas, 2017; Cavaleri, 2025) and how the demand for safe debt affects both bond yields and exchange rates (e.g., Feunou, Fontaine, and Krohn, 2025; Krohn, Uthemann, Vala, and Yang, 2025; Zou, 2024). Similarly, a large body of work has focused on the role of Treasury securities as the global reserve asset and sought to estimate the effect of this privilege on Treasury yields (see, e.g., Greenwood, Hanson, and Stein, 2015; Du, Im, and Schreger, 2018; Jiang, Krishnamurthy, and Lustig, 2021). Moreover, a series of papers highlights the influence of institutional demand for Treasury yields, such as, the Federal Reserve (e.g., Gagnon, Raskin, Remache, and Sack, 2010; Haddad, Moreira, and Muri, 2024), foreign investors (e.g., He, Nagel, and Song, 2022; Jiang et al., 2021; Kekre and Lenel, 2024; Tabova and Warnock, 2021), banks (e.g., Jiang, Matvos, Piskorski, and Seru, 2024a), mutual funds (e.g., Huang, Jiang, Liu, and Liu, 2024; Selgrad, 2024), insurance companies (e.g., Chaudhary, 2024; Jansen, 2024; Koijen and Yogo, 2023), and broker-dealers (e.g., Du, Hébert, and Li, 2023; Greenwood and Vayanos, 2014; Vayanos and Vila, 2021). We contribute to this literature by showing that not just Treasury securities but also Treasury auctions themselves are special compared to auctions of foreign sovereign bonds. The specialness of Treasuries and Treasury auctions shares a common underlying mechanism, which is the demand from global bond investors.

The remainder of this paper is organized as follows. In Section 2 we describe the data and provide institutional details about sovereign bond auctions and global long-term yields. In Section 3, we document and discuss our two core empirical facts about trends in the slope and level of demand for long-term Treasuries at auction. In Section 5, we conclude.

2. Data and Institutional Details

In this section, we describe the data that we use for long-term government bond yields and sovereign debt auctions for the US and foreign G10 countries. Specifically, for the G10 we consider the following ten countries: Australia, Canada, France, Germany, Japan, New Zealand, Norway, Sweden, the UK, and Switzerland. In describing the data, we also discuss institutional features of sovereign bond auctions and the global bond market. We also describe the data and measures of Treasury market liquidity.

2.1. Interest Rates

We measure interest rates by retrieving long-term government bond yields from Bloomberg and Thomson Reuters Refinitiv. Specifically, we augment bond yields from Bloomberg with Refinitiv yields if the former are not available on any given day. For the level of long-term yields, we use the 10-year sovereign bond yield. We have consistent coverage of these yields for the US as well as Australia, Canada, France, Germany, Japan, and the UK over our main sample period from 1 January 1992 to 30 April 2025. For Switzerland, Norway, New Zealand, and Sweden our sample starts on 1 February 1994, 18 February 1994, 14 July 1994, and 9 May 1997, respectively. For our baseline results we use German 10-year yields as a proxy for EUR yields but our findings are similar when using French yields.

2.2. Sovereign Bond Auctions

From 1 January 1992 to 30 April 2025, we collect data on long-term sovereign bond auctions for the US and the same set of G10 countries above. We have consistent coverage of auctions for the full sample for the US as well as Australia, Japan, New Zealand, and Switzerland. For Canada, France, Germany, Norway, Sweden, and the UK the first available auction is on 28 October 1998, 7 January 1999, 6 January 1999, 24 January 1994, 28 February 1996, and 20 May 1998 respectively. We employ French and German auctions as proxies for Eurozone debt. We define long-term auctions to include issuances of sovereign bonds with a time to maturity of 5-years or more. For US Treasury auctions we restrict our sample to sufficiently large auctions with offering amounts of at least $500 million. We collect these data from the

Treasury website of each country. The key pieces of information that we collect for all auctions are the auction date, maturity of the auctioned debt instrument, amount offered and issued. We provide additional information on auction data in Table A.1 in the Online Appendix.

Unique to US Treasury auctions, we have publicly available information on the demand curve of bidders. Specifically, the Treasury publishes the market clearing high yield, median yield, and low yield (95% of bidders). These data on the slope of demand curves at auction enables us to measure the elasticity of demand for Treasuries by global bond investors bidding at auction (see Section 3.1 for more details).

Table 1: Summary Statistics of US Treasury and Foreign Auctions

	5–7 years			8–10 years			>11 years		
Country	#Issues	Mean	Std.	#Issues	Mean	Std.	#Issues	Mean	Std.
USD	559	30.95	14.85	290	21.79	9.26	290	15.88	4.82
AUD	251	0.54	0.32	378	0.60	0.34	569	0.51	0.29
CAD	171	2.90	0.74	151	2.77	0.83	119	1.57	0.53
CHF	40	0.36	0.23	136	0.39	0.22	311	0.36	0.24
EUR	241	4.34	2.16	606	4.92	2.12	541	2.25	1.16
DEM	163	5.30	1.80	280	5.66	2.17	136	2.51	1.67
FRF	78	2.33	1.30	326	4.29	1.86	405	2.17	0.92
GBP	166	5.14	1.34	202	4.58	0.97	368	3.28	0.97
JPY	123	14.49	8.84	400	17.39	5.87	652	7.32	2.88
NOK	67	0.38	0.18	230	0.44	0.37	39	0.50	0.35
NZD	303	0.10	0.05	418	0.11	0.06	496	0.07	0.04
SEK	171	0.34	0.19	343	0.31	0.15	215	0.41	0.39

Note: This table reports summary statistics of US Treasury and foreign auctions for various maturities: 5–7 years, 8–10 years, and >11 years. *#Issues* is the total number of auctions for a given country and maturity combination. *Mean* and *Std.* are the average and standard deviation (in billion dollars) of the total dollar amount offered for purchase of the security being auctioned. Countries are abbreviated by their domestic currency prior to the formation of the Eurozone (e.g., DEM stands for the German mark and FRF for the French franc). The sample is in event time and spans the period from January 1992 to April 2025.

2.3. *Treasury Market Liquidity*

We collect data on alternative potential sources of information about the demand for long-term bonds, including US and G10 macroeconomic announcements from Bloomberg's macroeconomic calendar. These macroeconomic announcements include monetary policy, GDP, unemployment and inflation announcements. For the US, we obtain data on macroeconomic disclosure dates for Consumer Price Index growth and unemployment from the Bureau of Labor Statistics (BLS); retrieve information about GDP growth from the Bureau of the Census; and download data on Federal Open Market Committee (FOMC) meetings from the Federal Reserve. The sample period for these macroeconomic disclosure dates matches our main sample running from from 1 January 1992 to 31 April 2025.

2.4. *Volume Dynamics around Auctions*

We obtain information on secondary market trading activity at US Treasury auctions from Treasury Daily Aggregate Statistics[3] for the period from February 2023 to April 2025. Figure 2 shows the relative change in secondary market trading volume five days before and after a Treasury auction. Specifically, we estimate the following regression.

$$\log V_{t,\tau} = \alpha_t + \mu_\tau + \sum_{m=M^-}^{M^+} \beta D_{t,\tau} + \epsilon_{t,\tau}, \tag{1}$$

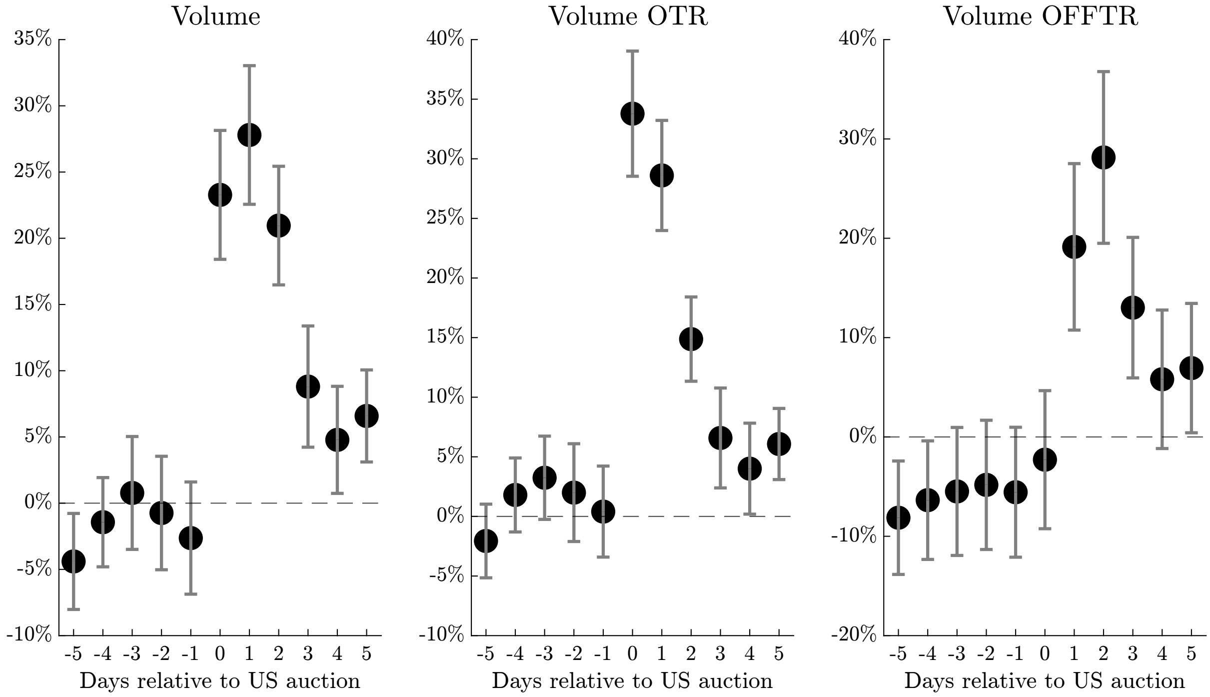
where the dependent variable is the natural logarithm of secondary Treasury market trading volume. The key regressor is $D_{t,\tau}$, which is an indicator variable equal to 1 m days before and after a long-term Treasury auction at time t. We also include time-fixed effects α_t and maturity bucket-fixed μ_τ effects to control for unobservable variation in global factors and maturity specific characteristics. We distinguish between total trading volume, on-the-run, and off-the-run trading volume, respectively. Across all three measures of trading activity we find that *secondary* market trading volume surges by around 30–35 percent on the day of the auction and then mean-reverts after four to five days on average.

3. Empirics

In this section, we begin by documenting our two key empirical facts about trends in the slope and the level of the demand for long-term Treasuries at auctions. We then compare our demand elasticity measure to the bid-to-cover ratio and measures of (secondary) Treasury market liquidity. We also highlight and discuss the role of intermediary constraints. We further provide suggestive evidence that a decline in foreign demand for Treasuries is one possible reason why auction demand has eroded. We end with a brief robustness to alternative explanations unrelated to demand.

[3] https://www.finra.org/finra-data/browse-catalog/about-treasury/daily-data

Figure 2: Secondary Market Trading Volume around US Treasury Auctions



Note: This figure plots the β regression coefficients of a fixed effects panel regression of the form $\log V_{t,\tau} = \alpha_t + \mu_\tau + \sum_{m=M^-}^{M^+} \beta D_{t,\tau} + \epsilon_{t,\tau}$ where the dependent variable is the natural logarithm of secondary Treasury market trading volume from Treasury Daily Aggregate Statistics. We distinguish between total, on-the-run (OTR), and off-the-run (OFFTR) trading volume, respectively. The main regressor is $D_{t,\tau}$, which is an indicator variable equal to 1 m days before and after a long-term Treasury auction at time t. α_t and μ_τ are time- and maturity bucket-fixed effects. The maturity buckets are from 5–7 years, 8–10 years, 11–20 years, and >20 years. The sample is daily and spans from February 2023 to April 2025.

3.1. *Elasticity of Demand at Auction*

To establish our first empirical fact, we leverage publicly available information disseminated at Treasury auctions that allows us to estimate the slope of the aggregate Treasury demand curve. We have coarse data on aggregate bidder demand curves at auctions. Specifically, the Treasury provides both quantity and price information for the market clearing (high) yield, median yield, and the low yield (top 5% of competitive bids). On average the market clearing yield is 20 bps and 5 bps higher than the low and median yield, respectively. Figure 1 illustrates an interpolated shape of a hypothetical auction demand curve based on these average spreads.

From the slope of the demand curve, we measure the aggregate elasticity of demand ($\epsilon_{b,t}$)

for bidders at each US Treasury auction.

$$\epsilon_{a,\tau} = \frac{\Delta q_{a,\tau} / Q_{a,\tau}}{\Delta y_{a,\tau}}, \tag{2}$$

where $\Delta q_{a,\tau}$ is half of the auctioned quantity of Treasuries for tenor bucket τ and auction a, $Q_{a,\tau}$ is the total outstanding Treasuries in tenor bucket τ prior to auction a, and $\Delta y_{a,\tau}$ is the spread between the high yield and the median yield.[4] We split our universe of Treasury auctions into three tenure buckets: 5 to 7 years, 8 to 10 years, and beyond 11 years. The coarseness of these tenor buckets impacts the level of our Treasury elasticity estimates but does not the time series variation, which is the core focus of our analysis.

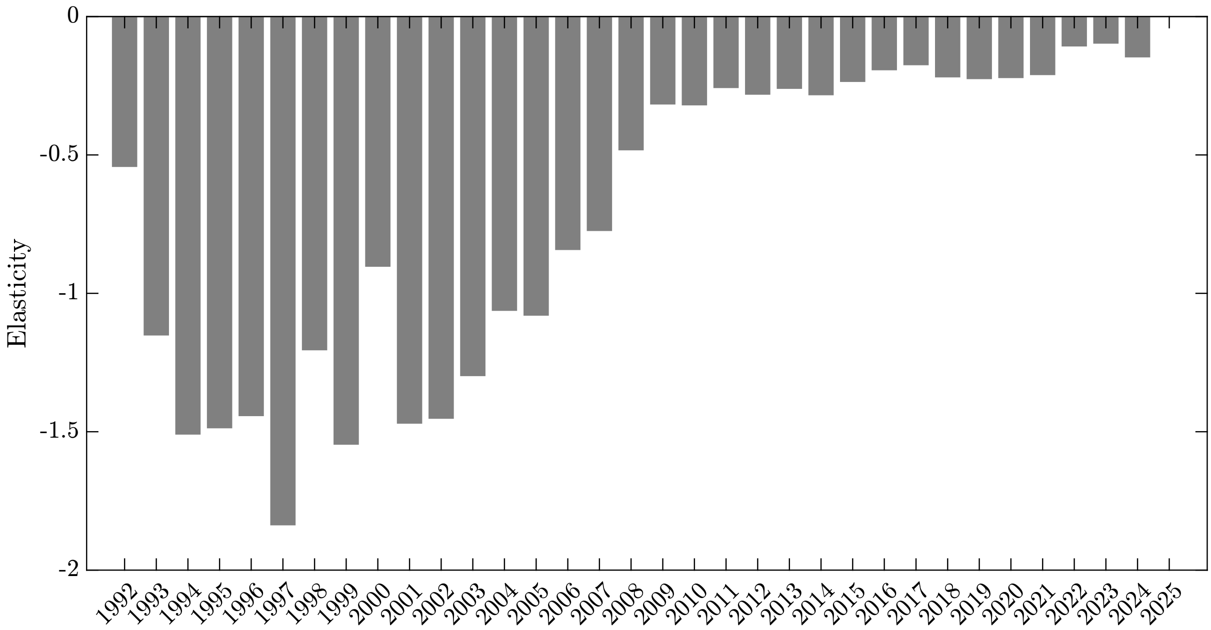
We use the high-yield and the median-yield to estimate the elasticity of demand because this is closest to the market clearing yield and more likely represents bids that may be marginal. The average spread between the high-yield and the median-yield is just about 5 bps. As a comparison, the standard deviation of daily yield changes is 6 bps. Hence, the median yield is well within the range of typical day-to-day yield variation. Moreover, when using the previous day's yield as a bidding benchmark, we find that the forecast error to the median yield is statistically indistinguishable from the forecast error to the high yield. This suggests that conditional on pre-auction information, bidding at the median yield constitutes a rational bidding strategy. In contrast, the low-yield corresponds to the 5% lowest yield bids in the auction and these extremely low bids may be from "lazy bidders" with inelastic demand who "free ride" on other bidders in the single-price auction. Recall that in a single-price auction, all accepted bids receive the same market clearing yield.

Figure 3 shows the time series plot of investors' elasticity of demand at US Treasury auctions from 1992 to 2025. Specifically, we plot the yearly average of elasticities for all auctions within a given year. The average investor elasticity of demand has been decreasing over time. From 1992 to 2010, the average elasticity of demand was -0.9. Since 2011 to 2025, the elasticity of demand has averaged at -0.2.

This decline in the elasticity of demand for Treasuries at auction is driven by both changes in quantities and yields. From the numerator of Eq. (2), we see that the elasticity depends on the relative size of Treasury auctions to the outstanding supply of Treasuries. In Figure 4,

[4] More precisely, we measure a semi-elasticity but for simplicity we will refer to this as the elasticity of demand.

Figure 3: Average Yearly Elasticity of Demand at Treasury Auctions



Note: This figure plots the average yearly price elasticity of demand at Treasury auctions. We measure the elasticity of demand at every Treasury auction following Eq. (2). The sample is in event time and spans from January 1992 to April 2025.

Panel B shows that the relative size of Treasury auctions has decreased compared to the outstanding stock of Treasuries for each of our three tenor buckets. From 1992 to 2010, a long-term Treasury auction issued on average 2.5% of the total supply of Treasuries within the same tenor bucket. Over 2011 to 2025, this has decreased to on average 0.9%. This decline is not due to Treasury auctions issuing fewer dollars of Treasuries; indeed over these two periods the size of auctions has roughly double. However, the outstanding stock of Treasuries has outpaced this growth, increasing nearly five fold and the frequency of auctions has also doubled. This decline in the elasticity of demand for Treasuries is not entirely due to an increase in the total supply of Treasuries because Treasury yields have also become more sensitive to auctions.

From the denominator of Eq. (2), we also see that the elasticity depends on the change in yields. In Figure 4, Panel C shows that the spread between the high-yield and the median-yield has widened over time. From 1992 to 2010, the spread was on average 4.1 bps, while over 2011 to 2025 the spread increased to 5.3 bps on average. This increase in the spread is especially noteworthy because the level of interest rates has also declined over this period.

Note that our elasticity measure is a semi-elasticity as it does not include the level of yields. This avoids the issue of near-zero 10-year yields from December 2008 to December 2015 during the Great Recession and March 2020 at the onset of the Covid-19 pandemic.

A valid concern with our approach is that we are measuring a mix of investor and dealer elasticities. To address this worry, we compute two boundary cases for which we assume that either dealers or investors are perfectly inelastic. Specifically, we rescale our elasticity in Eq. (2) by the inverse of the share of Treasuries purchased by dealers and non-dealers, respectively, at auction. Figure B.2 in the Online Appendix shows that the deterioration of auction demand elasticity in Panel A of Figure 4 has been primarily driven by investors, rather than dealers becoming more inelastic over time. This shift in elasticity coincides with a dramatic decline in dealer participation at auction, driven by tighter regulatory constraints that reduced the flexibility of dealer balance sheets (Duffie et al., 2023). Specifically, from 2000 to 2025, the primary dealer share of auctioned long-term Treasuries has steadily decreased from 71% to 11%. Allen, Hortacsu, Richert, and Wittwer (2025a) find similar trends for Canadian Treasury auctions, where the dealer share has declined from around 80% in the early 2000s to about 50% in the early 2020s.

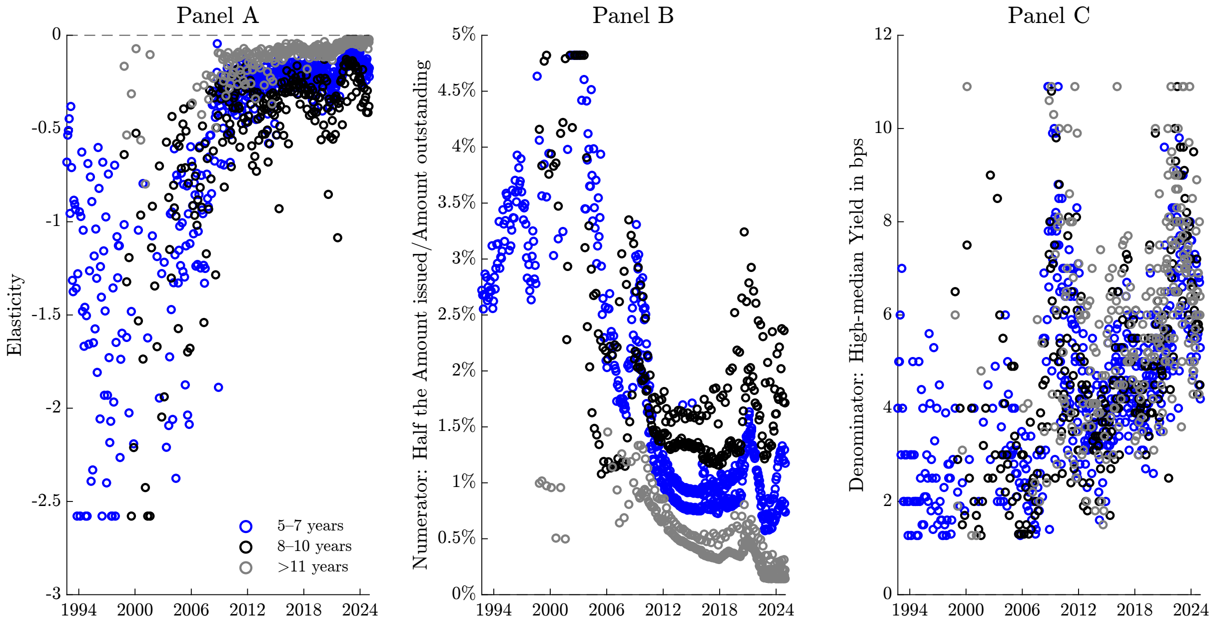
This negative trend in the elasticity of demand over Treasury auctions suggests that investor demand for Treasuries in the primary market has eroded since 2010. In the following section, we study whether similar trends have been at play in the secondary market following Treasury auctions.

3.2. *Changes in the Level of Yields at Auction*

For our second empirical fact, we examine changes in the level of secondary market yields over Treasury auctions. Auctions do not reveal any (new) information about supply, but they potentially reveal information about investor demand. If the market is positively surprised by strong auction demand, we expect to see higher Treasury prices and lower yields and the reverse if the market is negatively surprised by demand at auction.

We examine 10-year sovereign bond yields and measure 3-day changes over auctions for the US and G10 yields. The 3-day window includes the day of the auction plus the two days after the auction. The reason why we look at this particular 3-day window is because we are

Figure 4: Decomposing the Elasticity of Demand at Treasury Auctions



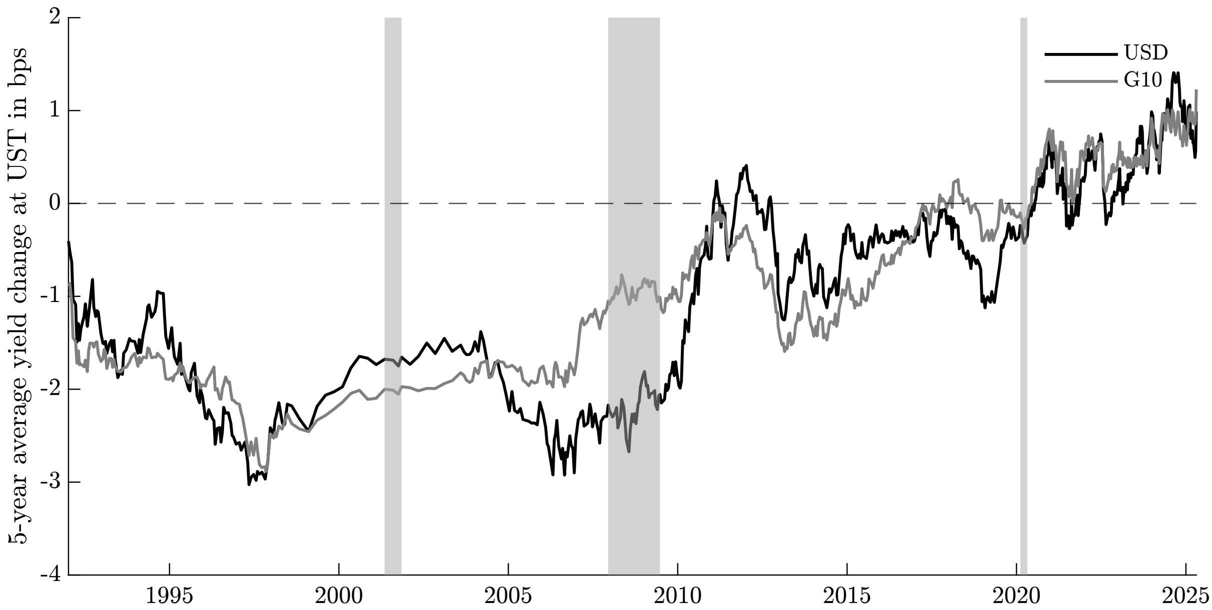
Note: Panel A plots the elasticity of demand at every Treasury auction following Eq. (2) broken down by three maturity buckets. Panel B shows the numerator, that is, half of the amount issued at a given Treasury auction relative to the amount of debt outstanding within a given maturity bucket. Panel C displays the denominator, that is, the spread between the market clearing high-yield and the median-yield (at which 50% where 50% of the accepted competitive tenders is reached). We winsorize all variables at the 1% level. The sample is in event time and spans from January 1992 to December 2024.

interested in studying how yields behave *after* demand at auction has materialized. Moreover, our goal is *not* to identify any high-frequency demand shocks but to be able to observe the slow-moving impact of Treasury auctions on long-term yields. Specifically, Ray, Droste, and Gorodnichenko (2024) show that such high-frequency demand shocks are on average zero. One possible explanation is that the majority of foreign bond markets are closed at the time of the Treasury auction, which usually takes place at 1 pm New York time.

For cases, where we have overlapping 3-day windows over long-term Treasury auctions, we keep the first 3-day window and exclude the latter from our sample. Such overlapping windows are exceedingly rare for most countries, except for the US, where we exclude 40% of long-term auctions because of overlaps. Our main sample contains 675 long-term Treasury auctions (that is, with maturities beyond 5 years) because, starting from 1139 auctions in Table 1 (sum the number of issues in the row labeled "USD"), we consolidate 5 auctions that occur on the same day and lose another 440 and 19 auctions that occur one and two days after the Treasury auction, respectively. In sum, our 675 long-term US Treasury auction 3-day windows span 24% of all trading days in our sample period from January 1994 to April 2025.

Figure 5 shows a time series plot of changes in long-term bond yields (USD in black and G10 in gray) over Treasury auctions from 1992 to 2025. Specifically, we plot a 5-year moving average of changes in long-term yields over our 3-day Treasury auction windows. It is visually apparent that, up until the global financial crisis, both USD and G10 yields have almost always declined over our 3-day window. Specifically, from 1992 to 2010, the average change in long-term bond yields was a negative 1.7 bps for US yields and 1.5 for the average G10 yield per year. In contrast, starting around 2010, this average change switched sign from negative to on average zero from 2011 to 2025. This result is driven the fact that in several years the yield change at auction was often positive and economically large. For instance, in 2024 yields on average rose by about 2.9 bps at each Treasury auction.

Figure 5: Long-Term Yield Changes over Treasury Auctions



Note: This figure plots the 5-year average yield change at US Treasury auctions for 10-year US and G10 yields. Yield changes are measured over our 3-day event window that includes the day of the auction plus two days after and are cumulated up within each year. The sample is daily and spans from January 1992 to April 2025.

To better illustrate the difference between these two periods (1992 to 2010 and 2011 to 2025) on an auction by auction basis, we estimate the following event-study regression for both periods:

$$\Delta Y_{t,c} = \alpha_c + \sum_{m=M^-}^{M^+} \beta_{c,m} D_{t,m} + \epsilon_{t,c}, \tag{3}$$

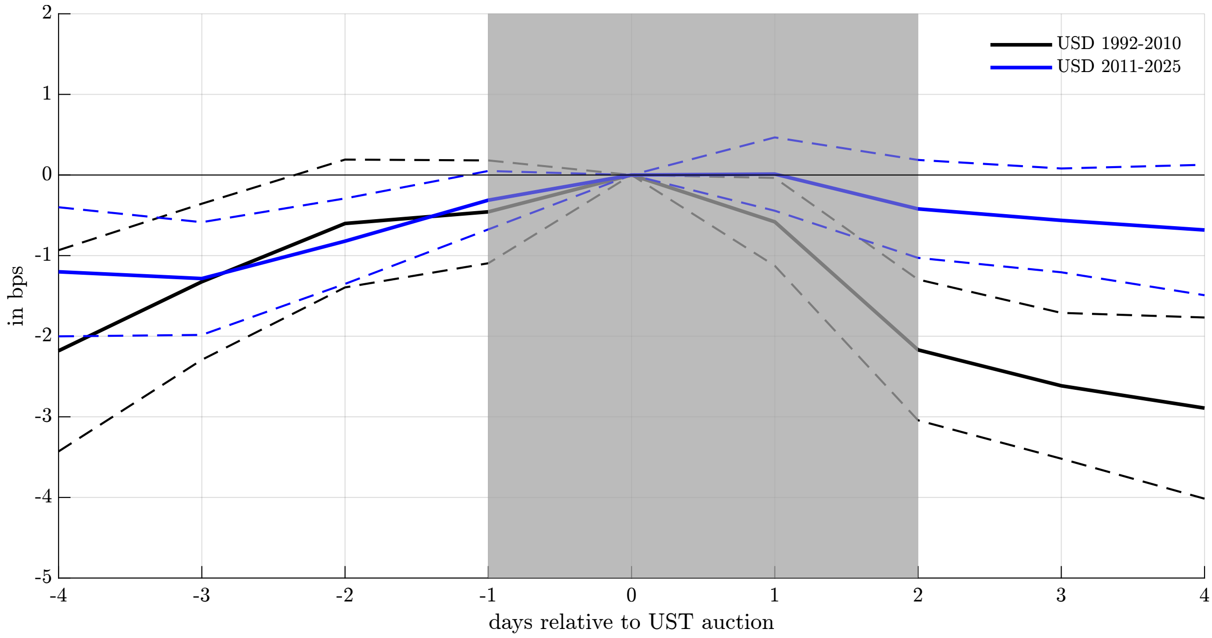
where the dependent variable is the change in the 10-year government bond yield of currency c over time interval t. The main regressor is $D_{t,m}$, which is an indicator variable equal to 1 m units of time before and after a long-term Treasury auction at time t and is 0 otherwise. Specifically, time 0 denotes the end of the day of the Treasury auction. The key parameters of interest (the β_i's) are identified from how long-term yields change before and after auctions.

In Figure 6, Panel A plots the event study estimates for the 10-year USD rate across our two sample periods (1992 to 2010 and 2011 to 2025). From 1992 to 2010 USD yields rise by about 1.3 bps in the three days ahead of Treasury auctions (including the day of the auction), and fall by about 1.7 bps over our 3-day window. This finding is consistent with Lou et al. (2013) whose sample ends in 2008. In contrast, from 2010 to 2025 foreign long-term yields no longer decline *after* Treasury auctions. Focusing on foreign G10 yields in Panel B, we find no evidence of foreign G10 yields exhibiting any systematic changes before auctions. This result is not surprising given that the rise in yields before Treasury auctions has been associated with the limited risk-bearing capacity of primary dealers (see Fleming et al. (2016) for recent evidence) and is therefore specific to the US market, which heavily relies on the flexibility of dealer balance sheets (Duffie, 2023). Moreover, the decline in yields after auctions also extends to G10 yields, which fall by about 1.5 bps over our 3-day window. However, from 2010 to 2025, G10 long-term yields no longer decline after Treasury auctions.

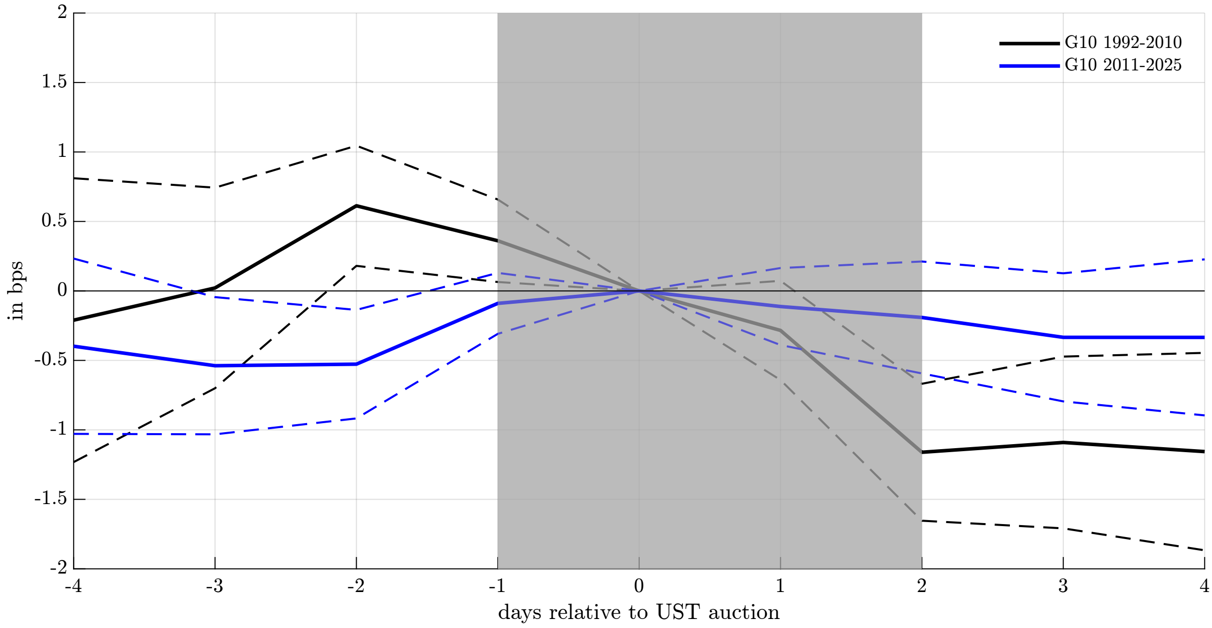
In sum, the evidence in Figure 6 corroborates our narrative that up until the global financial crisis, the market has been on average positively surprised by global demand for long-term sovereign debt at Treasury auctions. These positive surprises have been associated with both US and G10 yields falling after auctions. In contrast, after the crisis, demand for Treasuries has softened and hence, yields do not fall after auctions. Next, we explore whether Treasury auctions have served a special role in revealing information about global investor demand for long-term bonds or whether this is a common feature of sovereign bond auctions.

We extend our analysis for US Treasury auctions to foreign sovereign bond auctions. For each G10 currency, we estimate the change in long-term yields when there is a local sovereign bond auctions. For example, for the GBP we measure changes in 10-year GBP yields for

Figure 6: Event Study: US and G10 Long-Term Rates over Treasury Auctions



Panel A: USD Long-Term Yields



Panel B: G10 Long-Term Yields

Note: Panel A (*Panel B*) plots the cumulative yield changes for 10-year US (*G10*) interest rates 4 days before and after long-term US Treasury auctions from January 1992 to December 2010 and from January 2011 to April 2025, respectively. The gray shaded area marks our 3-day event window that includes for every long-term Treasury auction the day of the auction plus two days after the meeting. Time zero indicates the end of the auction day. The black and blue solid lines indicate the actual cumulative yield change, whereas the black and blue dotted lines indicate 90% confidence bands that are based on Newey and West (1987) standard errors.

Table 2: Decline of Long-Term Yields Around Auctions

	All days	UST auctions		Local auctions		
		Auction	No auction	Auction	No auction	Share in %
	(1)	(2)	(3)	(4)	(5)	(6)
USD	−0.09	−0.75**	0.13	−0.75**	0.13	24.29
	[0.46]	[1.98]	[0.56]	[1.98]	[0.56]	
G10	−0.18	−0.76***	−0.03	−0.01	−0.41*	19.47
	[1.60]	[2.91]	[0.22]	[0.16]	[1.76]	
EUR	−0.22	−0.46	−0.13	−0.26	−0.20	19.29
	[1.44]	[1.54]	[0.78]	[0.76]	[1.23]	
AUD	−0.20	−0.70*	−0.04	0.48	−0.36	19.57
	[0.94]	[1.73]	[0.15]	[1.02]	[1.53]	
CAD	−0.16	−0.65*	−0.01	0.91*	−0.28	9.78
	[0.91]	[1.86]	[0.03]	[1.65]	[1.48]	
CHF	−0.15	−0.47**	−0.02	0.39	−0.16	4.89
	[0.98]	[2.06]	[0.15]	[0.91]	[1.15]	
GBP	−0.20	−0.69*	−0.04	−0.25	−0.19	14.37
	[1.08]	[1.77]	[0.20]	[0.54]	[0.95]	
JPY	−0.15	−0.57***	−0.02	−0.04	−0.19	26.38
	[1.44]	[3.21]	[0.13]	[0.19]	[1.58]	
NOK	−0.07	−0.69**	0.14	0.26	−0.09	5.53
	[0.41]	[2.24]	[0.73]	[0.40]	[0.51]	
NZD	−0.22	−0.71**	−0.03	−0.87**	−0.03	19.46
	[1.15]	[2.09]	[0.15]	[2.09]	[0.16]	
SEK	−0.22	−0.45*	−0.09	0.07	−0.21	12.80
	[1.41]	[1.85]	[0.62]	[0.18]	[1.63]	

Note: This table reports the average change in 10-year US and foreign yields in basis points around long-term debt auctions. *All days* shows the average 3-day change over the entire sample. *UST auctions* shows the average cumulative change during a 3-day window around US Treasury auctions. This 3-day window includes for every long-term Treasury auction the day of the event plus two days after. *Local auctions* is defined analogously to *UST auctions* but is based on the long-term auctions of each foreign country and excludes any days that overlap with the 3-day window for US Treasury auctions. For the euro (EUR) we consider both French and German auctions. The column *Share in %* displays the fraction of 3-day windows for both UST and local auctions. The numbers inside the brackets are the corresponding test statistics based on robust standard errors (Newey and West, 1987). The row G10 is estimated from a panel regression of 9 foreign rates and the test statistics are based on Driscoll and Kraay (1998) standard errors. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is daily and spans from January 1992 to April 2025.

long-term Gilt auctions.[5] Table 2 shows the decline long term yields over Treasury auctions vs local auctions for each currency, except for the EUR. Columns 2 and 3 of Table 2 show that the decline in long-term yields over Treasury auctions from 1992 to 2025 occurred for each currency.[6] However, for local currency auctions shown in columns 4 and 5, we find that local auctions are not associated with statistically or economically significant changes in long-term

[5]For the EUR, we measure changes in 10-year German government bond yields and use German and French sovereign bond auctions.

[6]See Figure B.1 in the Online Appendix for event studies akin to Figure 6 but individually for each G10 currency.

rates.[7] This difference is unlikely to be due to differences in the frequency of foreign auctions (shown in column 6). For instance, 3-day windows around Japanese debt auctions span around 26 percent of our sample period, whereas US Treasury auction windows correspond to 24 percent of all days.

To shed some light on why US Treasury auctions may be special, we examine the differentiating features of US Treasury auctions. Table 1 shows that US Treasury auctions tend to be an order of magnitude larger in size than other sovereign bond auctions of G10 currencies. Similar to how size may be an important feature of US Treasuries in their role as the global reserve asset (He, Krishnamurthy, and Milbradt, 2019), the size of Treasury auctions may also contribute to their informativeness about global investor demand.

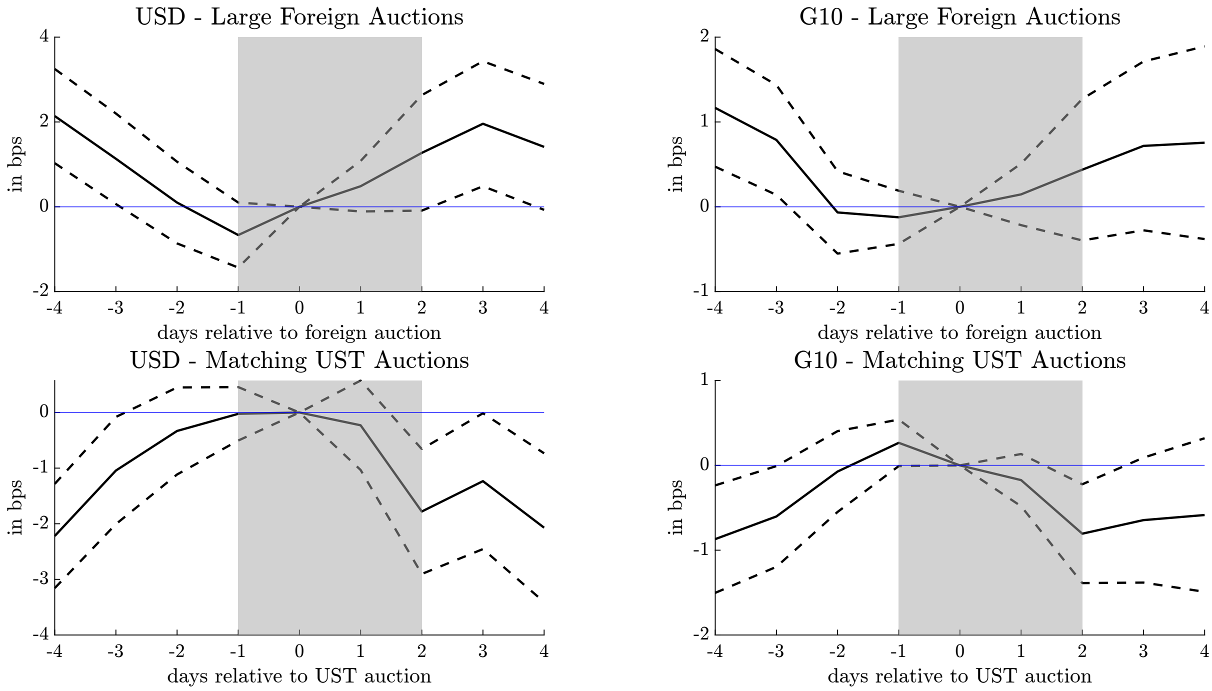
To empirically test this hypothesis, we match foreign and US Treasury auctions by size. In particular, within each quarter, we identify days for which multiple foreign countries have auctions for sovereign bonds that are cumulatively similar in size to Treasury auctions. Specifically, we define large foreign auctions as follows: First, we sum up the offering amount across foreign sovereign debt auctions for every given day in our sample. Second, within each quarter, we identify those days for which we can find a US auction (within the same quarter) that is no more than $100 million larger than the cumulative foreign offering amount. The average offering amount for these large foreign auctions is $26.4 billion and we are able to match 25.5 percent of US Treasury auctions with similar-sized foreign auctions.

Figure 7 shows the same event study as in Eq. (3) but conditional on days with large foreign auctions (upper panel) and the matching US auctions (lower panel). Again, we show cumulative yield changes for both 10-year US and G10 rates four days before and after the large foreign sovereign bond auctions and the matching US auctions, respectively. Unlike for the matching sample of US auctions (lower panel), where we find an average decline in both USD and G10 10-year yields of around 1.76 bps and 1.07 per auction, respectively, we find no such consistent pattern for large foreign auctions. G10 yields are on average unchanged over large foreign auctions, while US yields exhibit increases of about 2.62 bps, which is

[7] The two notable exceptions are the USD, for which we have already shown that US Treasury auctions matter locally and globally, and the NZD for which there is a significant negative association. Note that from the foreign 3-day auction windows, we exclude any days that overlap with the 3-day window for US Treasury auctions. However, even when we include these overlapping days we tend not to find significant change in foreign yields on foreign auction days.

statistically insignificant. This suggests that it is not the case that large foreign sovereign bond auctions have been particularly informative about the positive shifts in global demand for long-term sovereign debt. Moreover, we note that the confidence bands are somewhat wider for the large foreign auctions than the matching US auctions, suggesting that integration of long-term yields tends to be weaker in the presence of foreign auctions.

Figure 7: Event Study: US and G10 Long-Term Rates at Large Foreign Auctions



Note: The upper panel labeled *USD - Large Foreign Auctions* plot the cumulative yield change for 10-year USD government bond yields 4 days before and after a large foreign auction. Large foreign auctions are defined as any foreign auction that occurs within the same quarter as the US auction and is not more than $100 million smaller than the closest matching US auction. The gray area marks the 3-day event window that includes for every long-term Treasury auction the day of the auction plus two days after. The panel labeled *G10 - Large Foreign Auctions* is based on foreign G10 government bond yields. The panels labeled *USD - Large Foreign Auctions* and *G10 - Large Foreign Auctions* are defined analogously based on the closest matching US auctions. Time zero indicates the end of the auction day. The black solid lines indicate the actual cumulative yield change, whereas the black dotted lines indicate 90% confidence bands that are based on Newey and West (1994) standard errors. The sample is daily and spans from January 1992 to April 2025.

3.3. *Comparisons with the Bid-to-Cover Ratio*

Both changes in the level of yields and the elasticity of demand suggest that there has been a gradual erosion of investor demand for Treasuries at auction since 2010. However, these trends are not apparent in a commonly referenced measure of Treasury market demand, the bid-to-cover ratio. The bid-to-cover ratio is total bids divided by offered amount (the latter two points are depicted in Figure 1).

Figure 8 shows the time series plot of the bid-to-cover ratio at US Treasury auctions from 1992 to 2025. The bid-to-cover ratio has averaged around 2.5 over the sample and does not exhibit a statistically significant time-trend. This may be because primary dealers are required to bid at auction and the Treasury uses the bid-to-cover ratio as the primary indicator of demand for Treasuries.[8] In quarterly meetings with primary dealers, the Treasury Borrowing Advisory Committee regularly seeks input about market demand for Treasuries of various maturities. The Treasury adjusts the maturity structure of its issuance in response to market input, in particular the composition of Treasury bills, notes, and bonds.

Figure 8: Bid-to-Cover Ratio

Note: This figure plots the time-series of the bid-to-cover ratio at Treasury auctions. The sample is in event time and spans from November 1999 to April 2025. Note that we remove one outlier on September 28, 1994, which is the only data point that we have from the Treasury prior to November 1999.

Due to Treasury issuance being endogenous to bid-to-cover and requirements of dealers to bid at auction, the bid-to-cover ratio may not capture long term trends in demand for Treasuries. However, Ray et al. (2024) show that high-frequency changes in the bid-to-cover

[8]In the 2024 annual Treasury presentation to the Treasury Borrowing Advisory Committee the level of bid-to-cover is listed as the first demand metric and plotted for various tenor buckets; https://home.treasury.gov/system/files/221/TreasuryPresentationToTBACQ22024.pdf.

Table 3: Yield Changes, Bid-to-cover Ratio, and Elasticity at Treasury Auctions

	Yield change	Bid-to-cover	Elasticity	Yield change AR(3)	Bid-to-cover AR(3)	Elasticity AR(3)
Yield change	100.00					
Bid-to-cover	−8.09	100.00				
Elasticity	12.32	1.21	100.00			
Yield change AR(3)	98.36	−7.34	10.99	100.00		
Bid-to-cover AR(3)	−12.20	75.76	−11.33	−12.10	100.00	
Elasticity AR(3)	14.53	−15.78	53.84	14.33	−33.85	100.00

Note: This table shows the correlation between changes in the 10-year Treasury yield measured over our 3-day window (day of the auction, plus two days after), the bid-to-cover ratio, and the elasticity of demand at auction. We also report correlations for AR(3) innovations (computed maturity bucket by bucket) in yield changes, bid-to-cover ratio, and elasticity. The sample is in event time and spans all long-term Treasury auctions (not just the ones occurring at least two business days apart) over the period from November 1999 to April 2025.

ratio are informative about demand shocks at US Treasury auctions. Thus, we can use this measure to empirically test whether the changes in the level of US and G10 yields over Treasury auctions are associated with demand shocks. Specifically, we use the bid-to-cover ratio to measure demand shocks by using the innovations to an autoregressive model with 3 lags:

$$B2C_{a,\tau} = \alpha + \sum_{t=1}^{3} \beta_t B2C_{a-t,\tau} + \epsilon_{a,\tau}, \tag{4}$$

where $B2C_{a,\tau}$ is Treasury auction a for tenor bucket τ and is regressed on the three previous Treasury auctions for the same tenor bucket.[9]

Table 3 summarizes the relations across our key variables in both levels and changes (i.e., AR(3) residual): 3-day yield changes around auctions, the bid-to-cover ratio, and the elasticity of demand. There are three main observations: First, the correlation between yield changes and surprises in yield changes is close to one, which is in line with interest rates following a first order autoregressive process. Second, in line with our prior, the association between yield changes and the bid-to-cover ratio is negative, whereas yield changes and demand elasticity are positively correlated. Put differently, stronger demand at auctions is associated with a larger decline in yields, whereas a more inelastic market is associated with rising rather than falling yields. It is worth noting that the correlations are somewhat larger in changes than in levels. Lastly, the correlation between the elasticity of demand and bid-to-cover is close

[9]We choose 3 lags because the autocorrelation function the bid-to-cover ration flattens out beyond 3 lags. The autocorrelation of the estimated residualized bid-to-cover ratio is statistically indistinguishable from zero across all maturity buckets. Our core findings are qualitatively similar when using only 1 lag or up to 6 lags.

to zero in levels but strongly negative in changes. We interpret this as evidence that high-frequency changes to the bid-to-cover ratio capture demand shocks, whereas low-frequency trends do not capture the erosion in Treasury demand.

Next, we estimate the association between changes in long-term yields over US Treasury auctions and surprise demand at auctions for each currency c:

$$\Delta y_{a,c} = \alpha_c + \beta_i B2C_a^s + \epsilon_{a,c}, \tag{5}$$

where $\Delta y_{a,c}$ is the 3-day window change in 10-year yields for currency c over US Treasury auction a and the primary explanatory variable of interest is the innovation to the bid-to-cover ratio of US Treasury auction a, that is, $B2C_a^s$.

The first column of Table 4 reports the β_i estimates for each currency. We find a negative relationship between surprise demand at auction and changes in long-term yields for all currencies and a significantly negative relationship for the USD, EUR, AUD, CHF, JPY, and SEK, respectively. When demand at auction is surprisingly strong, long-term yields tend to decline even more. To show the economic magnitude of the effect, we split the sample into high-demand and low-demand auctions. High-demand auctions have above median bid-to-cover surprise, while low-demand auctions have below median bid-to-cover surprise. We find that the declines in long-term yields for the USD and G10 tend to be concentrated in auctions with surprisingly high demand (column labeled *High* $B2C^s$). Over high demand auctions, long-term yields on average fall by 1.77 bps for the USD and 1.14 bps for the G10, while for low demand auctions, long-term yields on average do not significantly decrease or increase.

As a placebo test, we consider the predictable component of Treasury auction demand for which we find no significant association with changes in long-term yields at auctions (column labeled $\widehat{B2C}$). Moreover, the difference between high and low residual bid-to-cover auctions is also statistically insignificant for both the USD and G10 currencies (column labeled *High−Low* $\widehat{B2C}$). Overall, the evidence in Table 4 is consistent with the notion that asset prices respond to news that is unanticipated and unpredictable using past information.

Figure 9 visualizes the event study estimates Eq. (3) for the USD and G10 10-year yields for high-demand and low-demand Treasury auctions. We show the four days before and after the Treasury auction (time zero). For high-demand Treasury auctions, we find no evidence of

Table 4: Decline of Long-Term Yields Around Auctions — Bid-to-Cover Ratio

	B2C^s	High *B2C*^{s}	Low *B2C*^{s}	High−Low *B2C*^{s}	$\widehat{B2C}$	High−Low $\widehat{B2C}$
USD	−1.42***	−1.77***	0.73	−2.50***	0.88*	1.32
	[3.52]	[2.93]	[1.27]	[3.06]	[1.83]	[1.50]
G10	−0.70**	−1.14***	0.29	−1.43***	0.47*	0.42
	[2.42]	[3.02]	[0.76]	[2.67]	[1.73]	[0.78]
EUR	−1.08**	−1.46**	0.41	−1.87**	0.31	−0.39
	[2.33]	[2.48]	[0.71]	[2.29]	[0.65]	[0.45]
AUD	−0.96***	−1.36***	0.70	−2.05***	0.61	1.03
	[3.00]	[2.71]	[1.39]	[2.85]	[1.60]	[1.31]
CAD	−0.26	−0.70*	−0.20	−0.50	0.55*	0.89
	[0.93]	[1.65]	[0.56]	[0.91]	[1.68]	[1.47]
CHF	−0.75*	−1.41**	0.51	−1.92**	0.56	0.93
	[1.80]	[2.48]	[0.94]	[2.51]	[1.28]	[1.12]
GBP	−0.28	−0.60***	0.06	−0.66**	0.03	−0.15
	[1.44]	[2.77]	[0.27]	[2.05]	[0.14]	[0.47]
JPY	−1.04**	−1.49***	0.38	−1.87***	0.86**	0.65
	[2.55]	[2.75]	[0.83]	[2.61]	[1.99]	[0.85]
NOK	−0.65	−1.05**	0.03	−1.08	0.32	0.47
	[1.51]	[2.04]	[0.05]	[1.37]	[0.85]	[0.57]
NZD	−0.50	−1.03**	0.22	−1.25*	0.42	−0.26
	[1.49]	[2.04]	[0.48]	[1.85]	[1.12]	[0.37]
SEK	−0.71**	−1.15***	0.33	−1.48***	0.48	0.44
	[2.49]	[2.94]	[0.90]	[2.78]	[1.59]	[0.75]

Note: This table reports the average change in 10-year US and foreign yields in basis points conditional on various sample splits and regressions. *Bid-to-cover*^{s} *(B2C*^{s}*)* shows the standardized point estimate of a univariate regression of the cumulative 3-day change in the 10-year yield (on the day of the Treasury auction plus the two days after) on AR(3) surprises in the bid-to-cover (B2C) ratio. *High B2C*^{s} and *Low B2C*^{s} show the average cumulative yield change conditional on high and low B2C 3-day auction windows, respectively. The cutoff values are based on the median surprise. *High−Low B2C*^{s} computes the difference between the columns *High B2C*^{s} and *Low B2C*^{s}. $\widehat{B2C}$ and *High−Low* $\widehat{B2C}$ are analogous columns *Bid-to-cover (B2C*^{s}*)* and *High−Low B2C* but the difference is that the $\widehat{B2C^s}$ designates the AR(3) fitted value rather than residual. The numbers inside the brackets are the corresponding test statistics based on robust standard errors (Newey and West, 1987). The row G10 is estimated from a panel regression of 9 foreign rates and the test statistics are based on Driscoll and Kraay (1998) standard errors. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is daily and spans from November 1999 to April 2025.

any pre-trends; long-term yields decline over the auction window and subsequently level off. In other words, high auction demand mitigates the need for intermediaries to absorb excess supply, alleviating pre-auction downward pressure while fueling post-auction price appreciation (Fleming et al., 2016). Notably, much of the decline in USD and G10 yields occurs on the second trading day after the auction, not immediately after the auction. This is consistent with two institutional details about US Treasury auctions that may contribute to more gradual adjustments. First, primary dealers gradually offload their inventory after auctions to investors (Fleming et al., 2024). Such intermediation may pose a friction to Treasury yields responding to investor demand immediately after the auction. Second, the auctions occur at 1 pm New York time, when European and Asian bond markets are closed. As we discuss in Section 3.4, foreign demand is important for explaining the specialness of Treasury auctions. This suggests that taking too narrow of a window around the Treasury auction may miss much of the economic effect of the auction on yields. Indeed, Ray et al. (2024) find no average change in US yields for a narrow 10-minute window before and after Treasury auctions.

The right two panels in Figure 9 show that for low-demand auctions, USD long-term yields exhibit a hump shape and G10 yields are flat. The hump shape in US long-term yields likely reflect intermediation spreads (Lou et al., 2013), especially since primary dealers make up a larger share of bids for low-demand auctions.[10] Meanwhile, for G10 yields where there is no need for primary market intermediation, we find no hump shape and on average no change in the 10-year yield.

In sum, we have shown that high-frequency changes to the bid-to-cover ratio suggests that the US and G10 yield declines over Treasury auctions are driven by investor demand at auction. However, the bid-to-cover ratio does *not* capture the gradual erosion of demand for Treasury at auction. This may be because the bid-to-cover ratio is a closely monitored metric by the Treasury and that primary dealers are required to bid at auction.

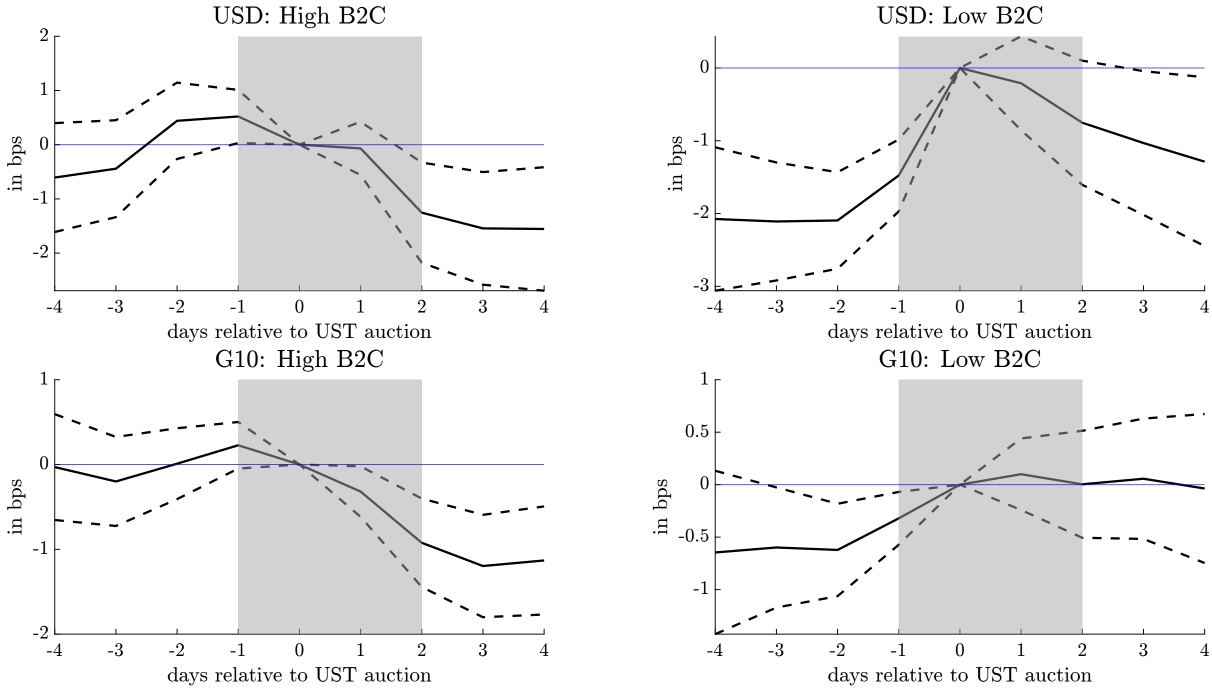
3.4. *Foreign Demand for Treasuries*

We have shown that changes in the level of yields over auctions and the elasticity of investor demand suggest a gradual erosion of the demand for Treasuries since 2010. One potential driver of this is a contemporaneous decline in foreign demand for Treasuries. Figure 10 shows the trend in the foreign share of outstanding Treasuries (including intergovernmental holdings) and auctioned Treasuries. The foreign share of outstanding Treasuries peaked at 34% in 2015 and has since declined to 24% as of 2025. This peak occurred even earlier for the largest two foreign investors in US Treasuries, China and Japan, respectively, which peaked at 15% in 2011 and their share has since more than halved. Similarly, the foreign share of long-term Treasuries at auction peaked at 23% in 2009 and has more than halved by 2025.[11]

[10] For auctions with below median surprise bid-to-cover, primary dealers make up 37 percent of bids, which is 200 bps larger than their unconditional average and corresponds to 11 percent of their standard deviation.

[11] Note that Figure 10 plots the foreign share of Treasuries outstanding, which includes short-term Treasuries. We find similar trends when we only focus on long-term Treasuries, for which we can only distinguish foreign

Figure 9: Event Study: US and G10 Long-Term Rates at Treasury Auctions



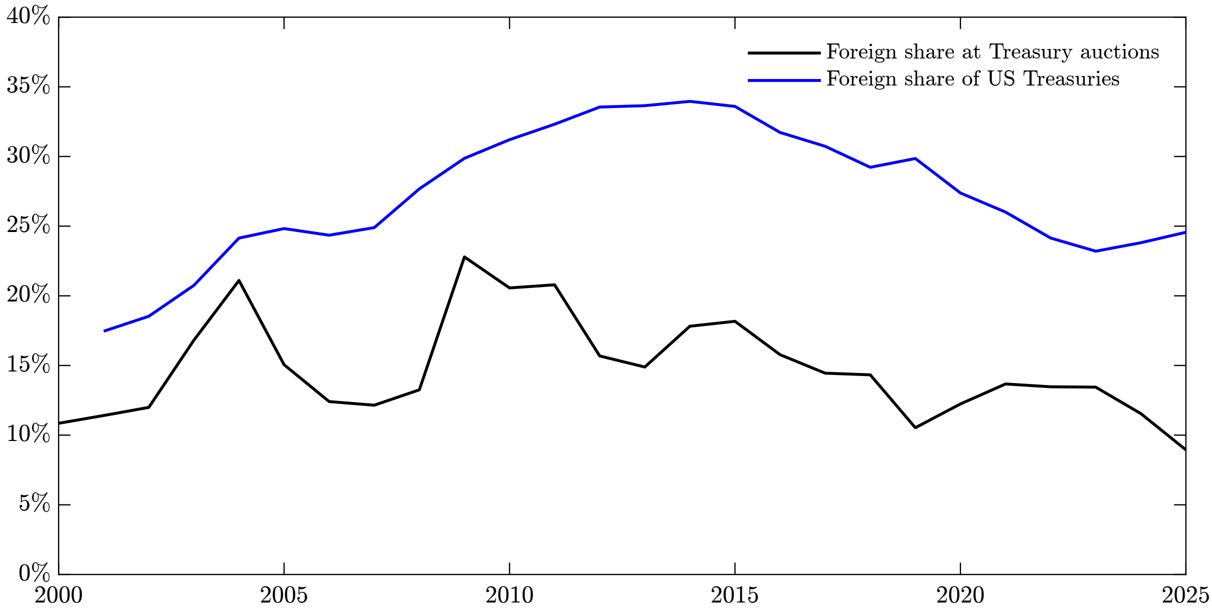
Note: The panels labeled *USD* plot the cumulative yield change for 10-year USD government bond yields 4 days before and after a long-term US Treasury auction. The gray area marks the 3-day event window that includes for every long-term Treasury auction the day of the auction plus two days after. The panels labeled *G10* are based on foreign G10 government bond yields. Time zero indicates the end of the auction day. "High B2C" and "Low B2C" periods are defined based on the AR(3) surprise component in the bid-to-cover ratio and cutoff values are based on the median surprise. The black solid lines indicate the actual cumulative yield change, whereas the black dotted lines indicate 90% confidence bands that are based on Newey and West (1994) standard errors. The sample is daily and spans from January 1999 to April 2025.

Although these two contemporaneous trends, declining foreign ownership and weaker aggregate demand at auction, are suggestive of a relationship, they are far from causal.

To examine whether foreign investor participation in Treasury auctions is important for demand, we instrument for their participation using plausibly exogenous variation in auction schedules. For some US Treasury auctions, there is an overlapping foreign sovereign bond auction that occurs on the same day. Due to home-bias, we expect foreign investors to participate less at US Treasury auctions when there is a contemporaneous foreign sovereign bond auction. Maggiori, Neiman, and Schreger (2020) document such home-bias in the portfolios of global bond investors: they tend to hold a portfolio of local currency bonds and US

ownership in Treasury bills, notes, and bonds for a shorter sample, starting in 2011.

Figure 10: Foreign Investor Participation at Auctions and Foreign US Treasury Holdings



Note: This figure plots the yearly average share of Treasuries purchased by foreign and international investors at any US Treasury auction (not just long-term auctions) and the yearly average share of US Treasuries held by foreigners, respectively. The underlying data stem from the Treasury International Capital (TIC) System and the US Treasury, respectively. The sample is yearly and spans from 2000 to 2025.

Treasuries. We measure the overlap of foreign sovereign bond auctions as

$$Overlap_{a(t)} = \frac{\sum_c q_{a(t),c}}{q_{a(t)}}, \tag{6}$$

where $q_{a(t),c}$ is the dollar quantity of foreign sovereign bonds auctioned on date t for currency c, and $q_{a(t)}$ is the dollar quantity of US Treasuries auctioned on the same date t. For example, on April 24, 2025, the Treasury auctioned \$44 billion of a 7-year Treasury note, while Canada, UK, and New Zealand also had long-term sovereign bond auctions for \$3.8, \$2.9, and \$0.3 billion, respectively. This yields and overlap of 13.7%, that is, the US Treasury auction accounted for the bulk of the issuance on that day. For 27.3% of US Treasury auction days, there is no overlap. A one standard deviation increase in $Overlap_{a(t)}$ is 16.4%.

For each Treasury auction, there are four main groups of investors: dealers and brokers, investment funds, foreign and international, and other participants.[12] For each investor

[12]Other participants include System Open Market Account (SOMA) banks, depository institutions, private individuals, and non-banks financials.

group, we estimate the following regression:

$$Share_{a(t),i} = \alpha_{y(t),i} + \beta_i Overlap_{a(t)} + \epsilon_{a(t),i}, \tag{7}$$

where the dependent variable is the share of long-term Treasuries bought at auction $a(t)$ on a given date t by investor group i, $\alpha_{y(t)}$ is a year-fixed effect, and $\text{Overlap}_{a(t)}$ is the dollar-weighted overlap defined in Eq. (6).

Table 5 shows how investor group shares at auction respond to overlapping foreign auctions. For a one standard deviation increase in $Overlap_{a(t)}$ foreign investor share decreases by 1.3 percentage points, which is 8.4% of their average share. The instrument is strongly relevant: the F-stat is 20, which is above the conventional threshold of 10. This decrease in foreign investor participation is primarily offset by a greater share for dealers and brokers and investment funds. The changes in shares (the β_i coefficients) sum to zero by market clearing.

Table 5: Overlapping Long-Term Auctions and Treasury Auction Participation

	Foreign and international	Dealers and brokers	Investment funds	Others
$\text{Overlap}_{a(t)}$	-1.255***	1.284***	0.250	-0.021**
	[4.470]	[2.817]	[0.796]	[2.193]
Overall R^2 in %	30.68	84.04	86.31	19.60
Year FE	yes	yes	yes	yes
#Obs	971	971	971	971

Note: This table reports estimates from a regression of the form $Share_{a(t),i} = \alpha_{y(t),i} + \beta_i Overlap_{a(t)} + \epsilon_{a(t),i}$, where the dependent variable is the share (in percentage points) of long-term Treasuries bought at auction $a(t)$ on a given date t by investor group i, $\alpha_{y(t)}$ is a year-fixed effect, and $\text{Overlap}_{a(t)}$ is the dollar-weighted overlap defined in Eq. (6). The investor groups are listed in the column header and include dealers and brokers, investment funds, foreign and international, and other participants (i.e., SOMA banks, depository institutions, private individuals, and non-banks financials). All regressors are measured in units of standard deviations. The numbers inside the brackets are the corresponding test statistics based on heteroskedasticity robust standard errors that are clustered by year. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is in event time and spans the period from January 2000 to April 2025.

Next, we then estimate how foreign investor demand for Treasuries at auction impacts yields and the elasticity of demand:

$$Y_{a(t)} = \alpha_{y(t)} + \beta Share_{a(t),f} + \epsilon_{a(t)}, \tag{8}$$

where $Y_{a(t)}$ is the change in the 10-year Treasury yield measured over our 3-day window (day of the auction plus two days after), or the elasticity of demand at auction or the bid-to-cover ratio at auction $a(t)$. $Share_{a(t),f}$ is the share of long-term Treasuries bought by foreigners at auction. Table 6 shows the OLS estimates and the IV estimates, where we use overlapping foreign auctions to instrument for foreign investor share.

Table 6: Foreign Investor Share and Treasury Auction Demand

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		OLS	IV	OLS	IV	OLS	IV
	$Share_{a(t),f}$	Yield change	Yield change	Elasticity	Elasticity	Bid-to-cover	Bid-to-cover
$\text{Overlap}_{a(t)}$	−1.255***						
	[4.470]						
$Share_{a(t),f}$		−0.111	−0.381**	−0.873***	−1.621**	0.938***	0.541
		[1.612]	[2.170]	[4.315]	[2.197]	[6.759]	[0.930]
Overall R^2 in %	30.67	4.19	N/A	20.90	N/A	47.74	N/A
Year FE	yes	yes	yes	yes	yes	yes	yes
#Obs	971	971	971	951	951	971	971

Note: This table reports estimates from a regression of the form $Y_{a(t)} = \alpha_{y(t)} + \beta Share_{a(t),f} + \epsilon_{a(t)}$, where $Y_{a(t)}$ is the change in the 10-year Treasury yield measured over our 3-day window (day of the auction plus two days after), the elasticity of demand at auction (see Eq. (2)) or the bid-to-cover ratio at auction $a(t)$. $Share_{a(t),f}$ is the share of long-term Treasuries bought by foreigners at auction. $\alpha_{y(t)}$ is a year-fixed effect and $\text{Overlap}_{a(t)}$ is the dollar-weighted overlap defined in Eq. (6). The regressor in column 1 is measured in units of standard deviations. The numbers inside the brackets are the corresponding test statistics based on heteroskedasticity robust standard errors that are clustered by year. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is in event time and spans the period from January 2000 to April 2025.

The primary endogeneity concern with the simple OLS estimate are demand shocks of other investor groups. For example, if domestic investors have a positive demand shock for US Treasuries, then the foreign share decreases and yields fall. More generally, since shares sum up to one, the demand shocks of other investor groups would positively bias the OLS estimates to zero. The calendar schedules of US and foreign sovereign bond auctions are set far in advance of the auction and therefore not endogenous to such investor demand shocks.

For changes in the level of long-term yields over Treasury auctions, the OLS estimates show a negative but insignificant association between foreign share and yield changes. Table 6 column 2 shows that for a one percentage point increase in foreign share, yields tend to fall by -0.111 bps. When we instrument for foreign share using variation in overlapping auctions in column 3, we find a more negative relationship between foreign share and yield changes. This positive bias to the OLS estimate is consistent with the endogeneity of foreign share to other investor demand shifts. For a one percentage point increase in foreign share due to exogenous variation in auction schedules, yields on average fall by an additional -0.381 bps. This effect is statistically significant and economically large: a standard deviation of foreign share is 7.4%, corresponding to a 2.8 bps effect on yields, which is roughly three times the average change in yields over auctions and 29% of their standard deviation.

For the elasticity of demand, we similarly find that foreign demand at auction causes a more elastic aggregate demand curve. From the IV estimates, we show that a one percentage point increase in foreign share from our demand shift instrument is associated with a demand elasticity that is 1.621 bps more negative. Recall that a more negative elasticity means that the slope of the demand curve is flatter, that is, yields are less sensitive to issuance quantity. This effect is twice as large as that of the OLS estimates, which is consistent with positive bias due to endogenous demand shocks to other investors. This effect is also economically large, where a one standard deviation of foreign share corresponds to a 12.1 bps effect on the elasticity, which is about 60% of the average elasticity from 2011 to 2025.

For comparison, we also estimate the effect of foreign demand on bid-to-cover. We find a positive association between foreign share and the bid-to-cover ratio, meaning that there is more bidding when foreign demand is relatively high. Furthermore, the OLS estimated coefficient is close to 1, suggesting that for a $1 increase in the foreign share of accepted bids, total bidding also increased by $1. This ratio is much lower than the average bid-to-cover ratio of 2.5, suggesting that there may be a negative correlation between foreign and domestic investor demand shocks. This negative correlation is consistent with a "home flight" effect of uncertainty shocks. Giannetti and Laeven (2012) document that global investors tend to retrench to home markets in response to financial crises. Perhaps surprisingly, there is a positive bias to the OLS estimates. In contrast, the IV estimates show a smaller and insignificant positive association between bid-to-cover and foreign demand. This further highlights the potential endogeneity of the aggregate quantity of bidding, which may be explained by broker dealers being required to submit bids for auctions that experience low demand.

3.5. Implications for Treasury Market Fragility

So far, we have shown that the demand for US Treasuries seems to have gradually eroded since 2010: yields no longer tend to fall over Treasury auctions and demand has become more inelastic, meaning that yields are now more sensitive to the auctioned quantity. In this section, we examine how these changes in the primary market can help explain the increased fragility of Treasuries in the secondary market.

We measure fragility in the Treasury market using option-implied volatility and yield curve noise. These two measures capture different dimensions of the Treasury market. We use the MOVE Index, which is similar to the VIX but for US Treasuries, to measure the riskiness of term-premia at a short horizon of 1 month.[13] We use the yield curve noise measure of Hu et al. (2013) that measures deviations from the (Svensson, 1994) yield curve model. This measure captures illiquidity in the Treasury market, where frictions to arbitrage cause local deviations in the yield curve that appear to be law of one price violations.[14] We choose these measures of Treasury market conditions because they are based on traded prices, which are commonly studied in the literature, and cover our long sample period.[15]

Figure 11 plots the time series of Treasury option implied volatility and yield curve noise. The series are strongly correlated in levels (73%) and in monthly changes (41%), which is in line with the existing literature (see, e.g., Fleming, Mizrach, and Nguyen, 2018; Nguyen, Engle, Fleming, and Ghysels, 2020). Both measures show worsening Treasury market conditions since 2012. This trend coincides with the more inelastic investor demand for Treasuries at auctions since 2010. In levels, Treasury demand elasticity is strongly positively correlated with Treasury market conditions.

In addition to the relationship in levels, we also measure whether monthly changes in the elasticity of investor demand at auctions are associated with changes in Treasury market conditions. We estimate the following regression model:

$$\Delta \log Y_t = \alpha + \beta \Delta \epsilon_t + \eta \text{Inelastic}_t \times \Delta \epsilon_t + \gamma \text{Inelastic}_t + \varepsilon_t, \tag{9}$$

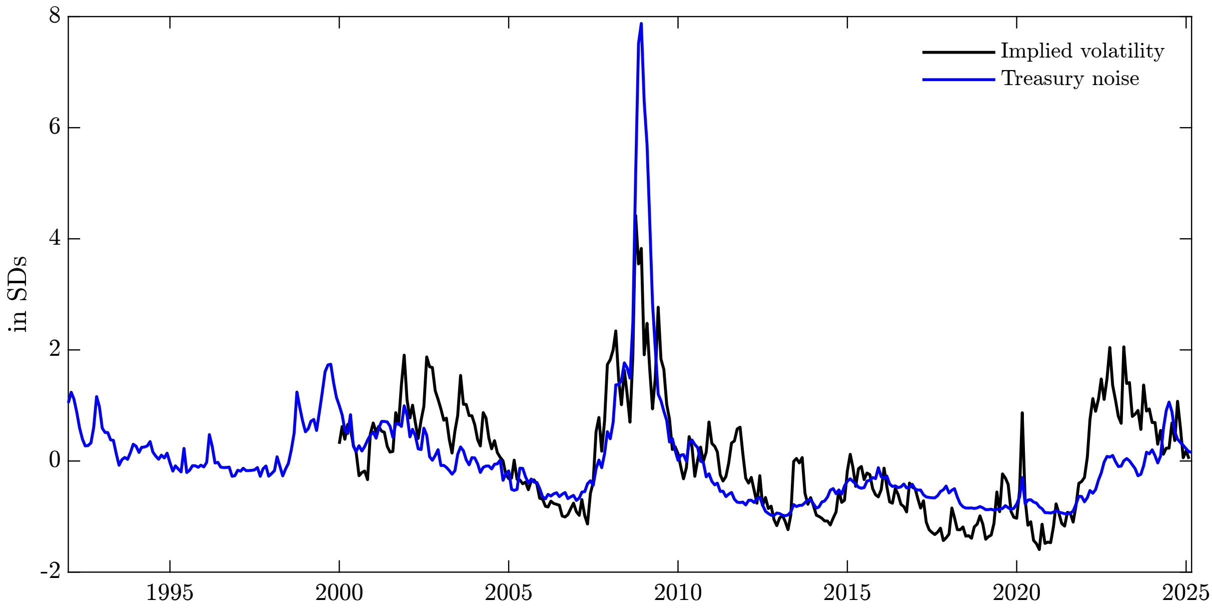
where $\Delta \log Y_t$ is either the monthly log change in the Treasury implied volatility (MOVE index) or the Treasury noise measure from (Hu et al., 2013). $\Delta \epsilon_t$ is the monthly average

[13] The MOVE Index is the average of 1-month option implied volatility on Treasury futures for the tenors of 2, 5, 10, and 30 years.

[14] From January 1, 1992 to August 7, 2007, we use the Hu et al. (2013) data and from August 8, 2007 to April 30, 2025, the Bloomberg illiquidity measure that follows a similar methodology, while using best bid and ask quotes.

[15] Duffie et al. (2023) show that the Treasury yield curve noise measure is highly correlated with other measures of Treasury illiquidity that rely on confidential regulatory data.

Figure 11: Treasury Market Conditions



Note: This figure plots the monthly (standardized) time series of Treasury option implied volatility (1-month MOVE Index) and yield curve noise (Hu et al., 2013). Observations have been standardized by subtracting the sample mean and dividing by the standard deviation of every variable. The sample is monthly and spans from January 2000 to April 2025 for the implied volatility and from January 1992 to April 2025 for the yield curve noise measure, respectively.

AR(3) surprise (computed maturity bucket by bucket) in the elasticity of demand at auction, $Inelastic_t$ is an indicator variable equal to 1 for the inelastic period of demand (2011–2025) and 0 otherwise (1992–2010). We interact changes in the elasticity of demand with an indicator variable for inelastic demand to account for non-linear effects on market conditions. Duffie et al. (2023) motivates this interaction by showing that there are important non-linear relationships between volatility and liquidity in the Treasury market.

Table 7 shows that more inelastic investor demand at auction tends to be negatively associated with Treasury market conditions. Furthermore, the effect is significantly larger for the more recent period from 2011 to 2025, when demand has been more inelastic. For implied volatility, a one standard deviation decrease in elasticity (that is, an increase in ϵ_t) is associated with a 2.26 percentage point increase in implied volatility. This effect more than doubles during the inelastic period amounting to 3.77 percentage points. This effect is statistically significant and economically large, corresponding to about 4.2 percent of the average implied volatility over the sample period. For Treasury yield curve noise, we find no significant relationship during the elastic period from 1992 to 2009, but a significant and negative association during the inelastic period from 2011 to 2025. The evidence here complements Duffie et al. (2023) by highlighting the importance of non-linear effects in the relation between Treasury demand elasticities and market conditions.

Table 7: Demand Elasticity at Auction and Treasury Market Conditions

	Implied volatility	Implied volatility	Treasury noise	Treasury noise
Intercept (α)	-0.24	-0.27	-0.27	-0.82
	[0.39]	[0.26]	[0.33]	[0.64]
$\Delta\epsilon_t$	2.26**	1.74**	-0.20	-0.38
	[2.46]	[1.99]	[0.34]	[0.63]
$\Delta\epsilon_t \times \text{Inelastic}_t$		2.03***		1.62***
		[2.64]		[2.66]
Inelastic_t		-0.49		0.11
		[0.73]		[0.15]
$\bar{R}^2$ in %	0.98	3.28	-0.28	0.74
#Obs	272	272	333	333

Note: This table reports estimates from a regression of the form $\Delta \log Y_t = \alpha + \beta\Delta\epsilon_t + \eta\text{Inelastic}_t \times \Delta\epsilon_t + \gamma\text{Inelastic}_t + \varepsilon_t$, where $\Delta \log Y_t$ is either the monthly log change in the Treasury implied volatility (MOVE index) or the Treasury noise measure from Hu et al. (2013) (see header row). The regressors are the monthly average AR(3) surprise (computed maturity bucket by bucket) in the elasticity of demand ϵ_t at auction (see Eq. (2)), a dummy variable *Inelastic* that is equal to unity after January 1, 2011, and their interaction. All regressors are measured in units of standard deviations. The numbers inside the brackets are the corresponding test statistics based on heteroskedasticity and autocorrelation robust standard errors (Newey and West, 1987). Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is monthly and spans the period from January 1992 to April 2025.

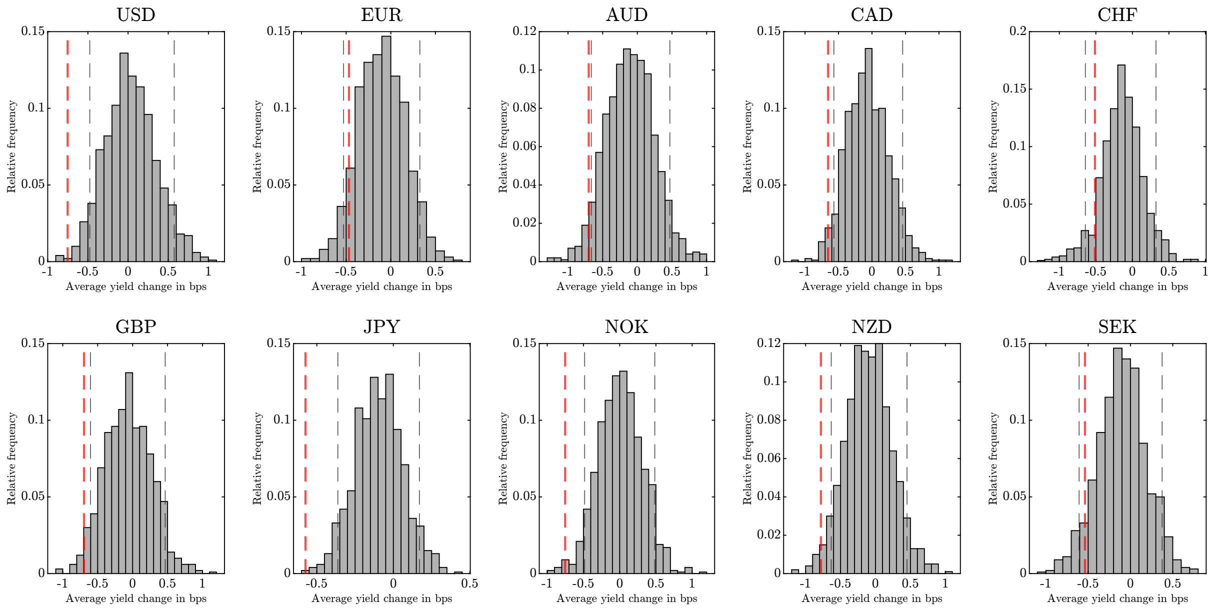
4. Robustness and Alternative Explanations

Here we summarize robustness checks and additional analyses supporting our main findings. Specifically, we i) ask if it is possible that the empirical pattern in Table 2 arose by coincidence and ii) compute the information ratio of a trading strategy that is long 10-year Treasuries around long-term auctions.

4.1. *Simulation Exercise*

It is natural to ask whether the empirical pattern in Table 2 is systematic or simply a coincidence. For instance, assuming that all days in our sample contained the same information about the global demand for long-term bonds, how likely would it be that we would observe such a pattern? To answer this question, we conduct a simulation exercise where we randomly draw days in the amount equal to the actual long-term Treasury auctions within a given quarter. These days represent "placebo Treasury auctions." We repeat this procedure for all quarters in our sample, which yields a simulated path for Treasury auction days. Analogous to Table 2, we then compute the cumulative yield change over a 3-day window around these placebo Treasury auction days. In Figure 12 we show the outcome of 1,000 simulated paths. Overall, our results are in line with the asymptotic test statistics in Table 2.

Figure 12: Simulation Exercise with Random Treasury Auction Days



Note: Each of these figures plots the distribution of 1,000 simulated paths of placebo Treasury auctions. Each of the placebo auction paths is obtained by sampling the number of days within a quarter equal to the actual number of long-term Treasury auction days. The red dotted line indicates the actual cumulative yield change in a 3-day window around Treasury auctions. The gray dotted lines designate the top and bottom 5 percentiles of the simulated distribution. The sample spans the period from January 1994 to April 2025.

4.2. *Risk Premia*

A potential concern about our empirical finding is that these predictable decreases in long-term yields over Treasury auctions are inconsistent with forward looking, efficient markets. Simply put, does our empirical fact suggest that there are implausibly large trading profits that could have been earned over nearly three decades of Treasury auctions? To empirically evaluate this concern, we estimate the information ratios of a strategy that buys and holds long-term bonds over the 3-day auction windows.

Table 8 shows that such a trading strategy earns an information ratio of 0.71 for US Treasuries and 0.91 for a portfolio of G10 sovereign bonds. Such information ratios are large, but we cannot reject the null that they are statistically significantly larger than 1 at conventional significance levels. Furthermore, this estimate is an upper bound because it does not account for trading costs, such as bid-ask spreads and price impact. Such information ratios are similar, and around half to what could have been earned over other macroeconomics event days, such as FOMC announcements.

Table 8: Information Ratios of Long-Term Yields over Auctions and Macroeconomic News

	All days	Treasury auctions	Local auctions	FOMC	Local MP news	US macro news	Local macro news
USD	−0.08	−0.71**	−0.71**	−1.44**	−1.44**	0.09	0.09
	[0.44]	[1.99]	[1.99]	[2.50]	[2.50]	[0.24]	[0.24]
G10	−0.29*	−0.91**	−0.04	−1.44**	−0.31	0.02	−0.03
	[1.68]	[2.52]	[0.13]	[2.47]	[0.91]	[0.04]	[0.05]
EUR	−0.25	−0.55	−0.28	−1.28**	0.20	−0.23	−0.08
	[1.45]	[1.53]	[0.71]	[2.21]	[0.37]	[0.62]	[0.21]
AUD	−0.15	−0.63*	0.40	−1.28**	0.58	0.40	−0.44
	[0.88]	[1.74]	[1.05]	[2.25]	[0.82]	[1.05]	[1.10]
CAD	−0.16	−0.67*	0.84*	−1.72***	−0.37	0.11	0.05
	[0.92]	[1.87]	[1.70]	[2.98]	[0.56]	[0.28]	[0.18]
CHF	−0.13	−0.68*	0.59	−0.65	−0.61	−0.19	0.36
	[0.69]	[1.90]	[0.88]	[1.11]	[0.41]	[0.50]	[0.85]
GBP	−0.19	−0.63*	−0.22	−0.96*	−0.31	0.04	0.23
	[1.07]	[1.76]	[0.54]	[1.67]	[0.57]	[0.12]	[0.63]
JPY	−0.26	−1.13***	−0.06	−0.56	−0.75	−0.28	0.18
	[1.45]	[3.19]	[0.19]	[0.88]	[0.64]	[0.74]	[0.43]
NOK	−0.08	−0.75**	0.25	−1.47**	−1.28*	−0.03	−0.25
	[0.43]	[2.07]	[0.38]	[2.37]	[1.84]	[0.09]	[0.71]
NZD	−0.20	−0.71**	−0.67*	−0.36	−0.67	0.25	0.30
	[1.06]	[2.00]	[1.94]	[0.61]	[1.04]	[0.67]	[0.57]
SEK	−0.27	−0.58	0.07	−1.07*	−0.28	−0.27	−0.09
	[1.35]	[1.59]	[0.16]	[1.89]	[0.36]	[0.71]	[0.25]

Note: This table reports the annualized information ratio of a long position in 10-year US and G10 interest rates around long-term debt auctions and macroeconomic events. *All days* is based on the entire sample. *Treasury auctions* is computed based on a 3-day window around US Treasury auctions. This 3-day window includes for every long-term Treasury auction the day of the event plus two days after. *Local auctions* is defined analogously to *Treasury auctions* but is based on the long-term auctions of each foreign country and excludes any days that overlap with the 3-day window for US Treasury auctions. For each of the macro-economic announcement events (i.e., FOMC, local monetary policy (MP) news, US macro news, and local macro news) we consider a 3-day window that we define in line with Hillenbrand (2025) to include the day prior to the event, the day of the event, and the day after the event. Macro news include information about GDP, unemployment, and CPI. For *US macro news* we exclude any days that overlap with our 3-day window for US Treasury auctions. The row G10 is based on the average across 9 foreign yields excluding the USD. The numbers inside the brackets are the corresponding test statistics based on robust standard errors (Newey and West, 1987). Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is daily and spans from January 1994 to to April 2025.

5. Conclusion

In this paper, we document a gradual decline in investor demand for US Treasuries at Treasury auctions from 2011 to 2025. We measure investor demand at auction by the change in long-term yields and the elasticity of investor demand. In the earlier sample, from 1992 to 2010, we show evidence of persistently positive demand shocks: US and global long-term yields have declined over Treasury auctions and demand has been highly elastic. By contrast, from 2011 to 2025, yields have been on average unchanged over Treasury auctions and the elasticity of demand has decreased by nearly five-fold. We find that this decline in investor demand at auction has coincided with less foreign demand for Treasuries and a more illiquid secondary market.

Treasury auctions are especially convenient for studying investor demand because we may directly measure the elasticity of demand from the slope of the aggregate demand curve. This clean measurement is helpful for identifying changes in investor demand over time. A growing literature on demand based asset pricing uses instruments for supply to estimate demand elasticity in the Treasury market. A challenge with this approach is that it is difficult to find instruments with large variation in supply, which do not also contain information that is relevant for term-premia. We hope that demand curves from sovereign bond auctions may be a helpful direct measure of investor demand elasticity.

Our findings suggest that the erosion of the dollar's "exorbitant privilege" may have been gradually occurring for longer than expected. A growing literature documents a decline in the convenience to Treasuries. During the March 2020 "dash for cash" episode, Treasuries exhibited illiquidity and yields rose (He et al., 2022). During the tariff policy shock of 2025, Treasury yields increased in combination with the dollar depreciating, which tends to be a characteristic of emerging market economies (Jiang, Krishnamurthy, Lustig, Richmond, and Xu, 2025). The decline in investor demand for Treasuries at auction may have foretold some of these more salient events.

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Online Appendix

“Treasury Auctions and Long-Term Bond Yields”

Appendix A. Additional Information on Data

From the US Treasury website, we collect detailed information regarding auctions for Treasury notes and bonds (e.g., we exclude TIPS, CMB, FRN Notes, and Bills), with maturities ranging from 2 to 30 years. Such information includes the auction date, issue date, bids submitted, total tender amount received, total tender amount accepted, lowest and highest winning rates, etc. In recent years, 2-, 3-, 5- and 7-year notes are auctioned each month, whereas 10-year notes and 30-year bonds are auctioned in February, May, August, and November with reopenings in the other 8 months. Our sample also includes these reopened issues. The frequency of auctions has changed over time. For example, 30-year bonds were not issued between 1999 and 2006 and were issued only twice a year between 1993 and 1999. Moreover, 20-year bonds were auctioned in May 2020, for the first time since 1986.

For the remaining G10 currencies, we collect data on auction date, issue date, maturity date, amount offered (in local currency), total amount issued (in local currency), and bid-to-cover ratio. Australia’s government bond auction data is sourced from the Australian Office of Financial Management. Canada’s data come from the Bank of Canada. Data for France are published by Agence France Trésor, Germany by the Finanzagentur, Japan by the Ministry of Finance Japan, New Zealand by New Zealand Debt Management (a division of the New Zealand Treasury), Norway by Norges Bank, Sweden by the Swedish National Debt Office, Switzerland by the Swiss National Bank, and the UK by the UK Debt Management Office.

Table A.1: Overview of Auction Mechanism

Country	Mechanism	Description
Australia	Multi-price auction	Acceptance of bids will be made in ascending order of Yield bid, that is, from the lowest Yield bid to the highest Yield accepted. Allotments will be made at the Yields bid.
Canada	Multi-price auction	Subject to the bidding limits set out in the summary tables in Section 5 of the Terms of Participation, Government securities distributors may submit competitive tenders or non-competitive tenders, or both. Subject to the conditions set out in (a) and (b) below, non-competitive bids for Government of Canada securities will be accepted in full, and then competitive bids will be accepted in rising order of yield (or in the case of Real Return Bonds, real yield), until the full amount of the issue (or tranche, in the case of treasury bills) is allotted. In the case of nominal bonds and treasury bills, non-competitive bids will be allotted at the average yield of the accepted competitive bids. In the case of Real Return Bonds, all non-competitive and successful competitive bids will be allotted at the highest real yield of accepted competitive bids.
France	Multi-price auction	Participants compete in the auction on an equal footing through a transparent system of open bidding according to a planned issuance program. The bid price system consists of supplying securities at the bid price or the effective bid rate as opposed to the marginal price or rate. This type of auction is known as an "auction with several prices and sealed prices." The highest bids are served first, followed by lower bids and so on, up to AFT's target amount. Participants pay different prices that are equal to their different bid prices.
Germany	Multi-price auction	The Federal government uses a multi-price auction process, that is, bids accepted by the Federal government are allocated at the price quoted in the respective bid and are not settled at a single price. Bids that are above the lowest accepted rate will be fully allocated, while bids that are below the lowest accepted rate will not receive an allocation. Bids without a price indication will be allocated at the weighted average price of the accepted price bids. The Federal government reserves the right to reject all bids as well as to repair both the bids at the lowest accepted price and the bids without price indication, i.e. to allocate only a certain percentage.
Japan	Multi-price auction	Price-competitive & multi-price auction methods are used in Japan, except for the auctions for 40-year bonds (yield-competitive & single-price auction), Inflation-indexed bonds (price-competitive & single-price auctions) and Liquidity Enhancement Auctions (yield-spread-competitive & multi-price auctions).
New Zealand	Multi-price auction	For the issuance of all Government Securities by way of tender, allocations for each maturity will be made in ascending order of yields bid and (except as described below) the issue yield for each allocation will be equal to: for Nominal Bonds and Treasury Bills, the relevant yield bid; and for Inflation-Indexed Bonds, the highest yield bid and accepted for the relevant maturity in the tender.
Norway	Multi-price auction	F-loans are the instrument primarily used to supply liquidity to the banking system. F-loans are issued at a floating rate and specified maturity against collateral in the form of securities. The maturity of F-loans is determined by Norges Bank and varies depending on liquidity in the banking system. The interest rates on F-loans are normally determined by multi-price auctions. In a multi-price auction, also referred to as an American auction or an ordinary auction, banks submit bids for a desired amount and interest rate. For F-loans, the interest rate bids that banks' submit must be equal to or greater than the sight deposit rate on the auction date. Norges Bank decides the aggregate amount of the allotment. The banks' interest rate bids are ranked in descending order. Banks that place bids within the aggregate amount will be awarded an amount at the interest rate submitted. If a bank receives an allotment for more than one bid, the interest rate will be a volume-weighted average of the interest rates submitted. If the sight deposit rate changes during the operation's time to maturity, the banks' allotment yield will be adjusted accordingly, from the same date that the sight deposit rate changes.
Sweden	Multi-price auction	The allotted yield is determined using the multi-price method. This means that the bidders offering the highest price – i.e., the lowest yield – are allotted securities at the yield that they bid. Bidders receiving allotment thereby pay the prices they offered.
Switzerland	Single-price auction	Almost all of our debt (bills as well as bonds, both new issues and reopenings) is issued under an auction system with a Dutch tender (the one exception are our "own tranches", see below). The reopening of already issued bonds (implemented by auction) is comparable with the auctioning of new bonds. To support market liquidity, we aim to have only one outstanding bond per year with a volume of around 4 billion CHF at maturity. Because of our limited financial needs and limited market demand, we do not auction the entire volume at once but reopen individual bonds several times over their entire lifetime until they reach our target volume.
UK	Multi-price auction	Conventional gilt auctions are generally held on a bid or multi-price basis (i.e., successful bidders pay the price that they bid), with non-competitive bids allocated at the weighted average accepted price.
US	Single-price auction	US Treasury Bills, Notes, Bonds, TIPS, and FRNs are sold at single-price auctions. In a single-price auction, all successful competitive bidders and all noncompetitive bidders are awarded securities at the price based on the highest rate, yield, or discount margin of awarded competitive tenders.

Appendix B. Additional Empirical Results

Table B.1: Foreign Investor Share and Treasury Auction Demand

	(1)	(2) OLS	(3) IV	(4) OLS	(5) IV	(6) OLS	(7) IV
	$Share_{a(t),f}$	Yield change	Yield change	Multiplier	Multiplier	Bid-to-cover	Bid-to-cover
$\text{Overlap}_{a(t)}$	−1.255***						
	[4.470]						
$Share_{a(t),f}$		−0.111	−0.381**	−0.331***	−1.763***	0.938***	0.541
		[1.612]	[2.170]	[8.503]	[3.947]	[6.759]	[0.930]
Overall R^2 in %	30.67	4.19		47.74		20.90	
Year FE	yes	yes	yes	yes	yes	yes	yes
#Obs	971	971	971	971	971	971	971

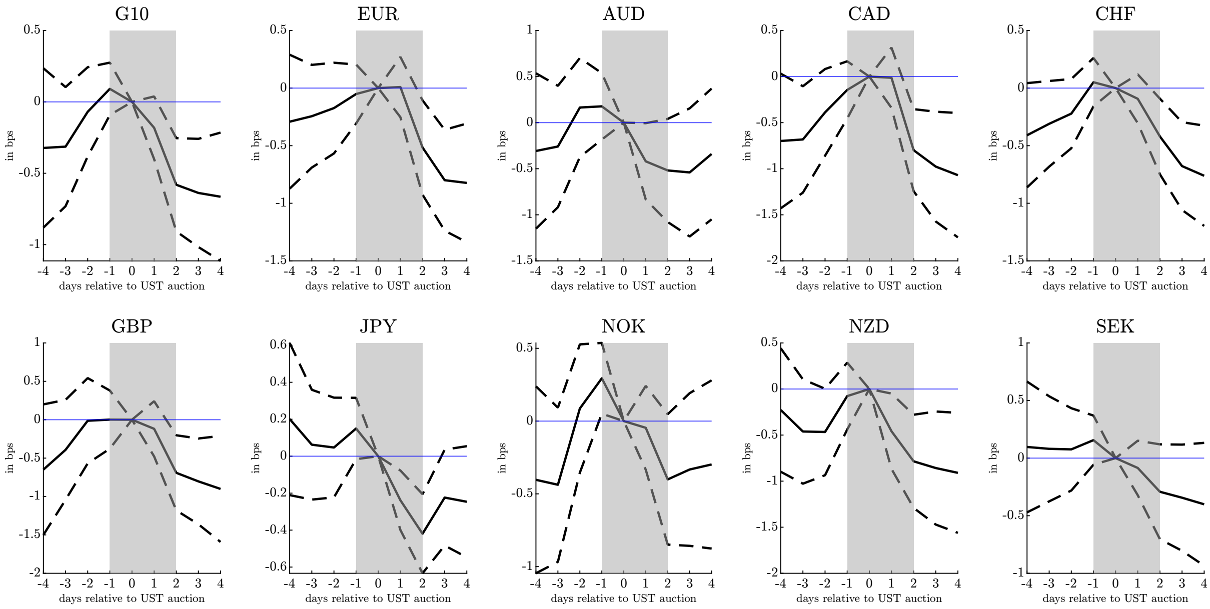
Note: This table reports estimates from a regression of the form $Y_{a(t)} = \alpha_{y(t)} + \beta Share_{a(t),f} + \epsilon_{a(t)}$, where $Y_{a(t)}$ is the change in the 10-year Treasury yield measured over our 3-day window (day of the auction plus two days after), the multiplier at auction defined as the median yield spread times the ratio of the average Treasury auction offering amount divided by half the offering amount at auction $a(t)$. $Share_{a(t),f}$ is the share of long-term Treasuries bought by foreigners at auction. $\alpha_{y(t)}$ is a year-fixed effect and $\text{Overlap}_{a(t)}$ is the dollar-weighted overlap defined in Eq. (6). The regressor in column 1 is measured in units of standard deviations. The numbers inside the brackets are the corresponding test statistics based on heteroskedasticity robust standard errors that are clustered by year. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is in event time and spans the period from January 2000 to April 2025.

Table B.2: Demand Elasticity at Auction and Treasury Market Conditions

	Implied volatility	Implied volatility	Treasury noise	Treasury noise
Intercept (α)	−0.42	−1.00	−0.38	−0.88
	[0.67]	[1.12]	[0.50]	[0.78]
$\Delta\mu_t$	2.98***	2.03**	0.32	−0.10
	[3.18]	[2.25]	[0.44]	[0.12]
$\Delta\mu_t \times \text{Inelastic}_t$		1.64**		1.26*
		[2.06]		[1.90]
Inelastic_t		0.71		0.66
		[1.17]		[0.89]
$\bar{R}^2$ in %	3.96	5.21	−0.23	0.21
#Obs	274	274	344	344

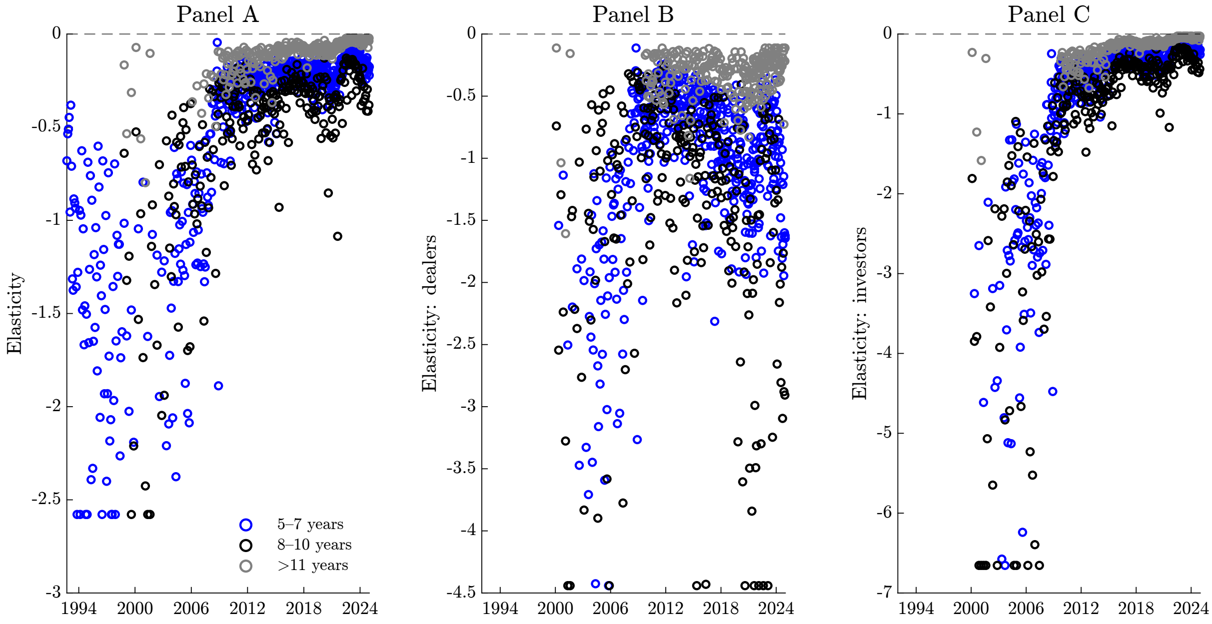
Note: This table reports estimates from a regression of the form $\Delta \log Y_t = \alpha + \beta\Delta\mu_t + \eta\text{Inelastic}_t \times \Delta\mu_t + \gamma\text{Inelastic}_t + \varepsilon_t$, where $\Delta \log Y_t$ is either the monthly log change in the Treasury implied volatility (MOVE index) or the Treasury noise measure from Hu et al. (2013) (see header row). The regressors are the monthly average AR(3) surprise (computed maturity bucket by bucket) in the multiplier of demand μ_t at auction defined as the median yield spread times the ratio of the average Treasury auction offering amount divided by half the offering amount at auction, a dummy variable *Inelastic* that is equal to unity after January 1, 2011, and their interaction. All regressors are measured in units of standard deviations. The numbers inside the brackets are the corresponding test statistics based on heteroskedasticity and autocorrelation robust standard errors (Newey and West, 1987). Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is monthly and spans the period from January 1992 to April 2025.

Figure B.1: Event Study: Long-Term Yield Changes at Treasury Auctions



Note: This figure plots the cumulative yield change for 10-year sovereign government bond yields 4 days before and after a long-term US Treasury auction. Countries are abbreviated by their domestic currency (e.g., GBP stands for the UK). The gray area marks the 3-day event window that includes for every long-term Treasury auction the day of the auction plus two days after. Time zero indicates the end of the auction day. The black and blue solid lines indicate the actual cumulative yield change, whereas the black and blue dotted lines indicate 90% confidence bands that are based on Newey and West (1994) standard errors. The sample is daily and spans from January 1994 to April 2025.

Figure B.2: Decomposing the Elasticity of Demand at Treasury Auctions



Note: Panel A plots the elasticity of demand at every Treasury auction following Eq. (2) broken down by three maturity buckets. Panel B and C rescale our elasticity in Eq. (2) by the inverse of the share of Treasuries purchased by dealers and non-dealers, respectively, at auction. We winsorize all variables at the 1% level. The sample is in event time and spans from January 1992 to December 2024.