Treasury Auctions and Long-Term Bond Yields*

Fabricius Somogyi** Jonathan Wallen† Lingdi Xu‡

This version: 30 January 2025

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J.E.L. classification: E43, E52, G12, G15

Keywords: Bond yields, market integration, monetary policy, Treasury auctions

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1. Introduction

From 1994 to 2021, long-term sovereign bond yields for G10 currencies have declined by about 500 basis points (bps). This decline is striking in the context of the supply of long-term sovereign debt increasing by nearly $16 trillion or seven-fold over the same period.[1] This increase in long-term debt has been nearly three times larger than the corresponding rise in output, implying that there has been a positive shift in demand for long-term sovereign debt. A large literature examines this demand shift in the context of a great moderation of macroeconomic volatility and inflation (see, e.g., Bernanke and Reinhart, 2004).

In this paper, we examine the role of US Treasury auctions in revealing this gradual, positive shift in demand. Auctions are considered an ideal setting to learn about demand (Klemperer, 1999). However, it is not obvious that this applies in the context of Treasuries. US Treasury auctions are small compared to the outstanding quantity and even smaller relative to trading volume in the secondary market.[2] Furthermore, the market may learn about global demand for long-term bonds from macroeconomic and monetary policy announcements. Therefore, it is plausible that Treasury auctions are not informative about the demand curve for Treasuries, let alone G10 sovereign bonds.

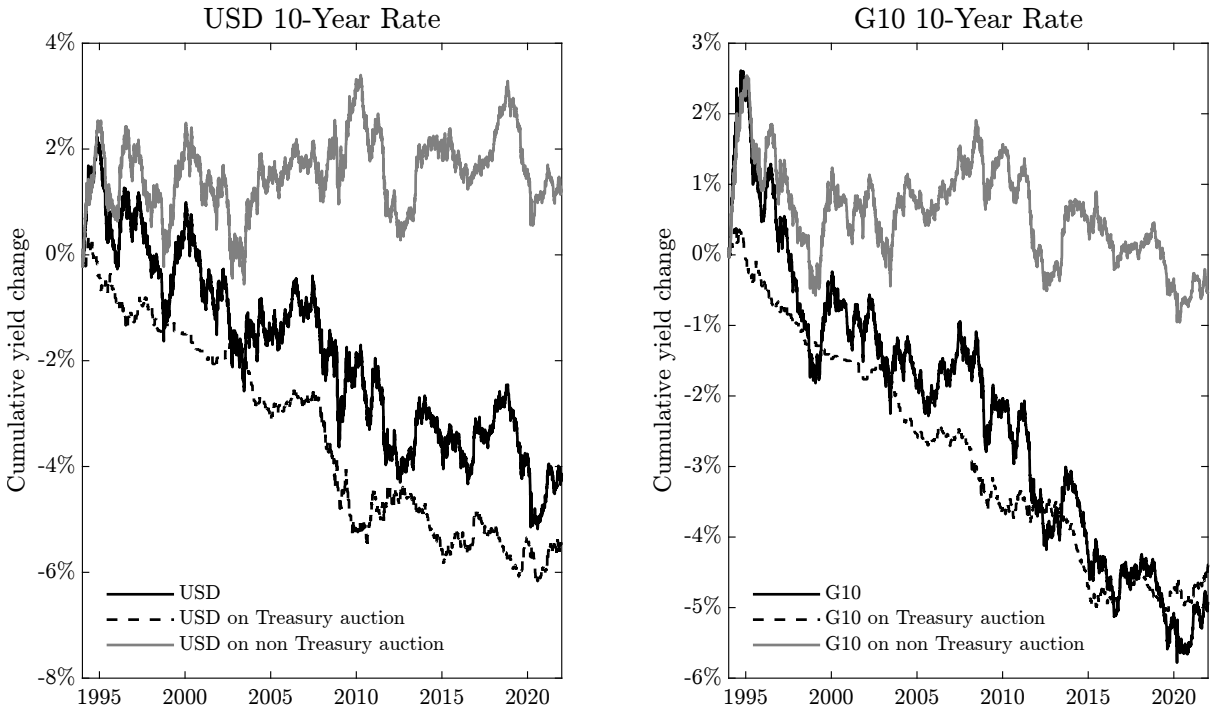
Despite all of this, Figure 1 shows that US and G10 long-term yields have declined over long-term Treasury auctions. On average, over a narrow 3-day window around each Treasury auction, US yields fall by 1.04 bps and G10 yields fall by 0.95 bps. Following Treasury auctions, the market has been consistently, mildly positively surprised by the relatively strong demand for long-term US Treasuries. These small positive surprises over Treasury auctions cumulate to large declines of 557 bps for US yields and 530 bps for G10 yields, which are similar to the actual decline in long-term yields over our sample.

These Treasury auction declines in yields are similar in magnitude to the cumulative decline in yields over our sample from January 1994 to December 2021. This highlights the economic importance of Treasury auctions in learning about this demand shift. However, this does *not* imply that Treasury auctions have caused the positive shift in demand or that

[1] We define "long-term" debt as debt securities with remaining maturities beyond 5 years. None of our results are sensitive to this particular cutoff value.

[2] In 2020, the daily trading volume in Treasuries with a maturity greater than 6 years was $185 billion, while the average Treasury auction offer amount for 5–7 year notes was around $29.15 billion (Treasury TRACE).

Figure 1: US and G10 Long-Term Rates over Treasury Auction Days



Note: The left and right panels show cumulative yield changes for the USD and average G10 interest rate, respectively. The black solid line shows the cumulative change in 10-year interest rates. The dotted black line shows cumulative yield changes that were realized over a 3-day window around long-term Treasury auctions. The gray solid line shows cumulative yield changes occurring outside of the 3-day window. The 3-day window is defined in Figure 5. The sample is daily and spans the period from January 1994 to December 2021.

they are unique to explaining the entire decline in long-term yields. Indeed, other papers document information events where Treasury yields tend to fall (FOMC announcements, Hillenbrand (2020)) and Treasury yields tend to rise (congressional budget announcements of future deficits, Gomez Cram, Kung, and Lustig (2024) and treasury auction announcements Phillot (2025)). A distinguishing feature of our study is that we examine global long-term bond yields and not only US yields. Moreover, we provide an explanation to why US Treasury auctions are informative of shifts in this global demand curve.

Long-term global bond yields are strongly integrated in levels and changes. Across G10 currencies, 10-year sovereign bond yields have a strong common factor, which explains 95% of the variation in levels and 70% of monthly changes. This high integration in yields suggests that there is a common global demand curve for long-term bonds. Indeed, Maggiori, Neiman, and Schreger (2020) document that foreign investors tend to hold local and US long-term

bonds, whereas Greenwood, Hanson, Stein, and Sunderam (2023) argue that the substitution of global bond investors across countries is important for the global integration of long-term bond yields. Therefore, any information event about shifts in the global demand for long-term bonds should explain common changes in global yields. Indeed, for each of the G10 yield curves, we reject the null of no change in long-term bond yields over Treasury auctions. This global evidence is important for ruling out potential alternative explanations that are US specific, such as intermediation rents (Lou, Yan, and Zhang, 2013) or measurement error.

During US Treasury auctions, the market learns about the global demand for long-term debt and not supply because supply is announced in advance. The Treasury makes quarterly refunding announcements where long-term bond auction dates are scheduled and then on average about one week in advance, quantity details for each auction are announced.[3] We examine a 3-day window around the Treasury auction because much of the issuance is intermediated by primary dealers and global markets are closed at the time of the auction. Primary dealers on average purchase 41% of the amount being offered at long-term Treasury auctions and partially offload this inventory during the days after the auction (Fleming, Nguyen, and Rosenberg, 2024). Direct bidders purchase the remaining share. Some of these direct bidders submit bids that are below that of the secondary market. This suggests that there are some very inelastic bidders in the primary market that are not purchasing from the secondary market.

In an effort to understand why financial markets learn about global demand for long-term bonds at Treasury auctions, we examine other sovereign bond auctions. We consider all auctions of long-term foreign sovereign bonds of G10 currencies.[4] We find that the decline in long-term yields is a unique feature of Treasury auctions and is not driven by the fact that foreign auctions tend to coincide with Treasury auction. This is because over foreign sovereign bond auctions, Treasury yields and global bond yields have not declined. There are at least two potential differences that may explain the specialness of Treasury auctions: the size of their issuances and the composition of their investors.

First, Treasury auctions are larger than foreign auctions. For instance, within the 5–7 year

[3]See https://home.treasury.gov/policy-issues/financing-the-government/quarterly-refunding for the quarterly refunding announcements.

[4]For the EUR, we use both French and German government bond auctions.

maturity bucket the average foreign auction size is $3.24 billion, whereas Treasury auctions were around nine times larger, amounting to $29.15 billion. Foreign auctions may be less informative about global demand for long-term debt because the auctions are much smaller. With smaller auctions, the market learns less about the slope of the demand curve because auction size and participation are positively correlated in single-price auctions (Milgrom, 2004). Despite this, we do not find evidence of size being the relevant difference between Treasury and foreign auctions. On days for which there are multiple foreign auctions, such that their cumulative size is similar to that of an average Treasury auction, we do not find evidence of an average decline in long-term yields. In addition, within Treasury auctions, we do not find that the declines are concentrated in the largest auctions by amount offered.

Second, Treasuries and foreign sovereign bonds differ in their composition of investors. Treasuries are the global reserve asset and therefore held by domestic and foreign investors (Maggiori et al., 2020). By contrast, foreign sovereign bonds are predominantly held by local investors that are less likely to be representative of the global demand for long-term bonds. This difference in investor composition likely extends to bidding at auctions. Unfortunately, due to data limitations we cannot directly observe the fraction of domestic versus foreign bidders for sovereign bond auctions. However, we can indirectly infer this from changes in the integration of long-term bond yields. On days with foreign sovereign debt auctions, local yields are 26% less integrated with US yields. Contrarily, there is no decline in integration on US Treasury auction days. Put differently, on foreign auction days only foreign yields move but we do not learn anything about global demand, resulting in lower integration. This suggests that US Treasury auctions attract more global bond investors than foreign sovereign debt auctions.

Global investors' demand for US Treasuries at auctions varies over time. To empirically estimate whether this is important for the specialness of US Treasury auctions, we use variation in global investors' demand due to overlapping auctions. When US Treasury auctions happen to overlap with foreign sovereign bond auctions, global investors' demand for Treasuries is lower. This is unlikely to be endogenous to market conditions because auctions are scheduled in advance. For nearly 90% of long-term Treasury auctions, there is a "neighboring" foreign sovereign bond auction that is no more than two business days apart. We quantify the extent

of overlap as the share of foreign long-term bond issuances as a fraction of total issuances (i.e., foreign plus US). For a 100 bps increase in overlap, we find that primary dealers purchase 20 bps more of the offered amount of treasuries. Moreover, neither foreign nor US long-term yields decline on such overlapping auction days. This suggests that Treasury auctions are special in part because of the direct bidding of global investors. From these direct bidders, the market learns about global investors' demand for long-term bonds.

In addition to auctions, we explore other macroeconomic and monetary policy events from which investors may learn about long-term yields. We show that although US long-term yields tend to fall during FOMC announcements (Hillenbrand, 2020), foreign long-term yields fall by much less. This suggests that FOMC announcements may be informative about the future path of US *short*-rates. This information about US short-rates has a larger effect on US long-rates than global long-rates. Foreign central bank announcements tend to have little to no effect on local or global long-term yields. We similarly find little effect of US or foreign macroeconomic announcements about GDP, unemployment, and inflation.

Furthermore, we show that our findings are not driven by intermediation rents. Lou et al. (2013) show that US Treasury yields in the secondary market tend to fall and then rise subsequently over Treasury auctions. These effects are localized in the sense that, for instance, 10-year yields fall and rise over 10-year Treasury auctions. Contrarily, our analysis focuses on the effect of auctions for all long-term Treasuries (5 to 30 years) on 10-year Treasury yields and 10-year G10 yields. We show that our findings are qualitatively unaffected to excluding 10-year Treasury auctions. We also document that our findings are robust to using overnight index swap (OIS) yields, which are not directly affected by intermediation rents.

Our primary analysis focuses on the period from 1994 to 2021. This episode coincides with a global secular decline in long-term yields. Over the more recent period from 2022 to 2024, long-term yields have increased sharply. This increase in long-term yields did not occur over Treasury auctions, suggesting that they were not driven by auction-related information about investor demand for long-term debt. Instead, this increase in long-term yields may be more related to changes in expectations about inflation. It is worth noting that these increases in long-term yields also did not occur during FOMC announcements, which implies that there may be an asymmetry in how long-term yields respond to FOMC announcements.

This paper aims to make two contributions. First and most concretely, we document an empirical fact that global long-term yields have declined over long-term Treasury auctions. Despite large and growing auction quantities, financial markets have been consistently, and mildly positively surprised by the demand for Treasuries. This suggests that Treasury auctions are an important mechanism for learning about the effects of slow moving macroeconomic trends on global demand for long-term bonds. The effect of global trends in inflation (Jotikasthira, Le, and Lundblad, 2015), demographics (Coeurdacier, Guibaud, and Jin, 2015), and savings (Caballero and Farhi, 2017) may be revealed to the market through Treasury auctions. 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 (Greenwood et al., 2023; Gourinchas, Ray, and Vayanos, 2022).

Second, and more broadly, we contribute to the literature on the demand for safe government debt (e.g. Eren, Schrimpf, and Xia, 2023; Jansen, Li, and Schmid, 2024) 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., Krishnamurthy and Vissing-Jorgensen, 2012; Greenwood, Hanson, and Stein, 2015; Du, Im, and Schreger, 2018; Jiang, Krishnamurthy, and Lustig, 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 sovereign bond investors.

The remainder of the paper is organized as follows. In Section 2, we present the data. In Section 3, we describe trends in long-term sovereign bond supply, bond yields, and institutional details about sovereign bond auctions. In Section 4, we present our primary empirical fact that global long-term bond yields decline over US Treasury auctions. In Section 5, we explore the underlying mechanism why markets learn about the global demand for long-term bonds over Treasury auctions. In Section 6, we examine the informativeness of macroeconomic announcements for global long-term bond yields and summarize additional robustness checks. Finally, Section 7 concludes.

2. Data

In this section, we describe the data that we use for long-term government bond yields, sovereign debt auctions, and macroeconomic announcements.

2.1. Interest Rates

We measure interest rates by retrieving long-term government bond yields and LIBOR swap rates from Bloomberg and Thomson Reuters Refinitiv, respectively. Specifically, we augment bond yields from Bloomberg with Refinitiv yields if the former are not available on any given day. We measure the long-term yield as the 10-year sovereign bond yield. We have consistent coverage of these yields for the US and G10 countries over our sample from 1 January 1994 to 31 December 2021. We also use LIBOR swap rates to address robustness concerns related to intermediation effects on yields of auctioned bonds.

For US long-term yields, some papers (e.g., Hillenbrand, 2020; Ray, Droste, and Gorodnichenko, 2024) have used intraday bond price data from GovPX for on-the-run Treasuries. While these data are not available for foreign debt instruments, we prefer using Bloomberg yields for two reasons: First, with the advent of electronic inter-dealer trading platforms (i.e., BrokerTec and eSpeed), the market share of GovPX has declined markedly due to the migration of bond trading to these electronic trading platforms (Fleming, Mizrach, and Nguyen, 2018). Second, Bloomberg yields are computed as an average based on an array of electronic (e.g., BrokerTec) as well as voice assisted trading platforms (e.g., GovPX), ensuring that our results are not driven by platform specific trading patterns.

2.2. Sovereign Bond Auctions

From 1 January 1994 to 31 December 2021, we collect data on long-term sovereign bond auctions for the US and G10 currency countries. Specifically, for the G10 we consider auctions by the following ten countries: Australia, Canada, France and Germany as proxies for Eurozone debt, Japan, New Zealand, Norway, Sweden, UK, and Switzerland. We define long-term auctions to include issuances of sovereign bonds with a time to maturity of 5-years or more. For the Treasury auctions we restrict our sample to sufficiently large auctions with

offering amounts of at least $500 million. We collect this 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. Unique to US Treasury auctions, we have more detailed information about the demand curve of bidders, which we discuss in Section 3.

2.3. Macroeconomic Disclosures

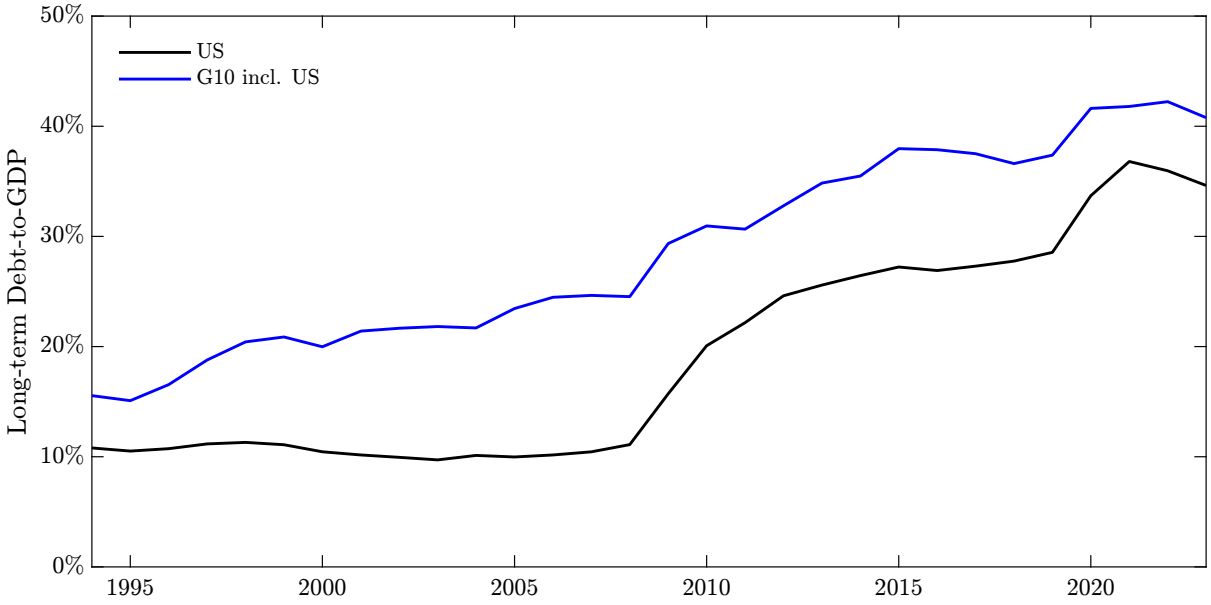
We collect data on alternative potential sources of information about the demand for long-term bonds, including US and G10 macroeconomic announcements from Bloomberg's macroeconomic calendar. These macroeconomic announcements include monetary policy, GDP, unemployment and inflation announcements. For the US, we obtain data on macroeconomic disclosures 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 1994 to 31 December 2021.

3. Trends and Institutional Details

In this section, we provide background information on trends in the supply for long-term sovereign bonds, time-variation of long-term yields, and institutional details about sovereign bond auctions.

Figure 2 shows an increase in long-term government debt securities (i.e., with remaining maturities beyond 5 years) as fraction of GDP for the US and G10 countries. Both foreign and US long-term bonds have increased steadily since the 1994 with sharp accelerations after the Global financial crisis of 2008-09 as well as the Covid-19 pandemic. The total amount of outstanding long-term government bonds of G10 countries amounted in 2021 to about 35% of GDP or equivalently $15 trillion. Holding demand constant, an increase in government bonds is associated with higher yields. Despite this increase in supply, long-term yields fell by 500 bps over the same period.

Figure 2: Global and US Long-Term Debt-to-GDP Ratios



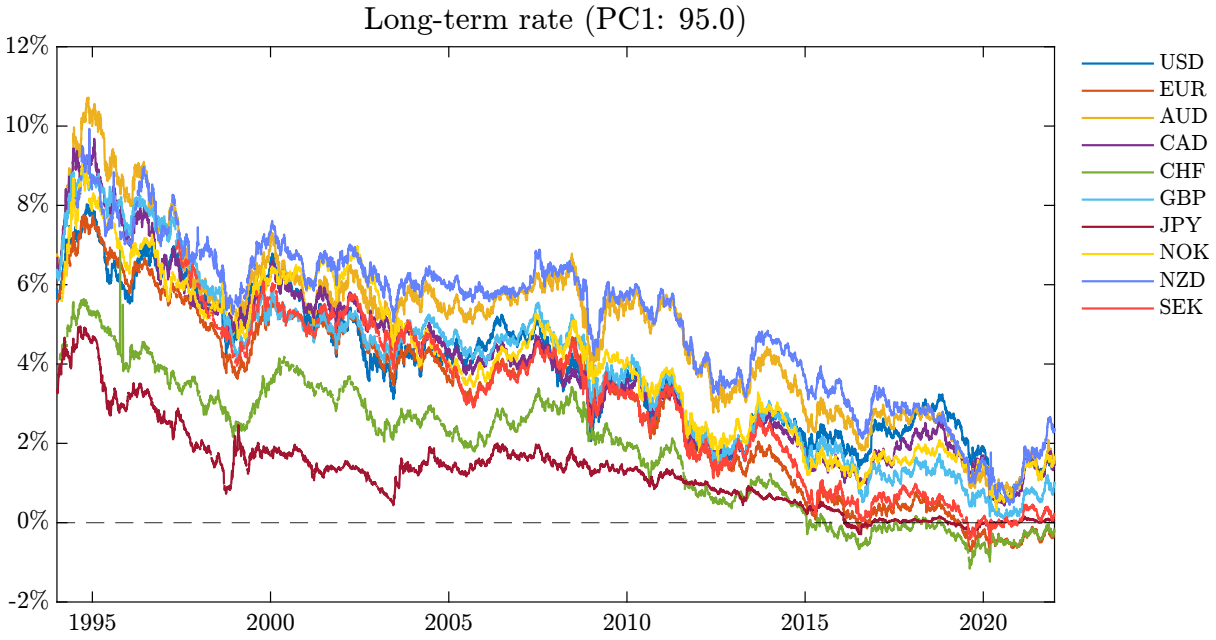
Note: This figure plots the ratio of outstanding US and global (G10 countries) long-term bonds with remaining maturities of more than 5 years relative to gross domestic output (GDP). The sample is yearly and spans the period from January 1994 to December 2023.

Figure 3 shows this global decline in long-term yields for G10 currencies. We measure long-term yields as the nominal yields on 10-year sovereign bonds. This decline has been strongly integrated across countries. We measure integration in levels using a principal component analysis of government bond interest rates. Figure 4 shows that the first principal component of long-term rates explains almost 95 percent of the daily variation in the level and nearly 50 percent of the daily variation in changes of long-term rates. The degree of integration is similar at the monthly frequency: the first principal component captures 94 percent of monthly variation in levels and around 70 percent in changes.

These slow moving trends in the supply for long-term sovereign bonds and their yields suggest that the market experienced a series of mildly positive shifts in demand. We examine whether sovereign bond auctions, in particular US Treasury auctions, were important information events concerning investors' demand for long-term bonds.

Table 1 presents summary statistics for our sample of sovereign bond auctions. In total, over our sample from January 1994 to December 2021, we have 10,241 auctions of which 8.4% are US Treasury auctions, 17.8% are euro auctions (French and German auctions), and the

Figure 3: Long-Term Sovereign Bond Yields



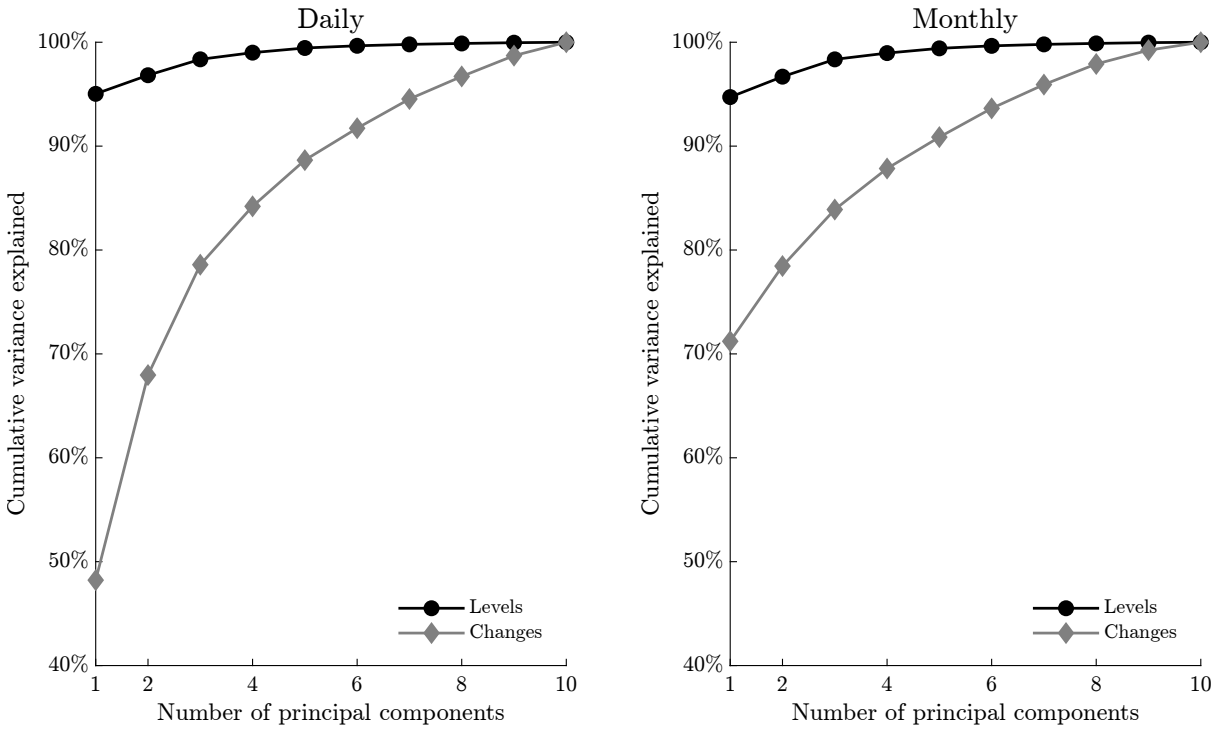
Note: This figure shows the 10-year interest rates for G10 currencies: AUD, CAD, CHF, EUR, GBP, JPY, NOK, NZD, SEK, and USD. For EUR we use the German 10-year rate. The first principal component to these long-term rates explains 95% of the time-series and cross-sectional variation. The sample is daily and covers the period from January 1994 to December 2021.

remaining 73.8% are the other G10 currencies. The tenor of the issuances ranges from 5 to 54 years, and 23.7% are for 5–7 years, 36% are for 8–10 years and 40.3% are for 11 years or greater. The average issuance size differs substantially across countries with US Treasury auctions issuing on average $24 billion and New Zealand auctions averaging $0.1 billion.

These sovereign bond auctions are an ideal setting to learn about demand because auctions are scheduled in advance and bidders submit demand curves. The in advance scheduling is important because it elicits a long-run elasticity of demand, not a short-run elasticity that may be subject to frictions and inattention. Furthermore, with in advance scheduling there is no new information about changes in the supply of sovereign bonds.

Figure 5 illustrates the timeline for long-term (i.e., beyond 5 years of maturity) Treasury and foreign auctions, respectively. Note that the timelines for foreign auctions are reflecting current, rather than historical, timelines due to the lack of data availability. Crucially, for our sample period, the amount issued by the Treasury is announced on average around four business days before the auction. At the announcement date, the Treasury releases all

Figure 4: Factor Structure of Interest Rates



Note: This figure summarizes principal component analysis for 10-year interest rates across G10 currencies (including the US dollar) in both levels (black dots) and changes (gray diamonds). The horizontal axis shows the number of principal components and the vertical axis shows the cumulative proportion of variance captured by those components. The left panel is daily, whereas the right panel is based on monthly data. The sample spans the period from January 1994 to December 2021.

pertinent information regarding an upcoming auction (e.g., precise amount offered, maturity, CUSIP, coupon schedule, etc.). Starting from the announcement time, market participant can submit bids up until to the closing time (usually 1 pm New York time). On average four business days after the auction, the Treasury delivers the securities and charges awarded bidders for payment of the newly issued security. Foreign auctions follow similar timelines, for instance, Germany (DEM) and France (FRF) announce 4 business days before, whereas UK and Canada announce one calendar week in advance. Collectively, all countries announce their sovereign debt auctions before our 3-day window.[5]

For US Treasury auctions, we have coarse data on aggregate bidder demand curves at auctions. Specifically, the Treasury provides both quantity and price information for the

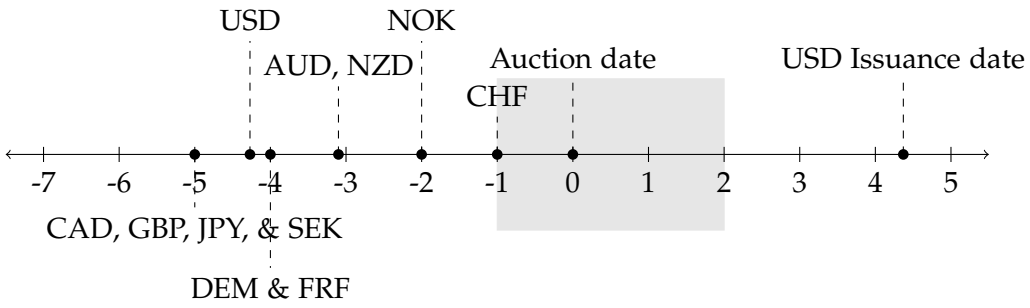
[5]Note that Switzerland has changed the information content of their announcements several times over our sample and since 2000 the announcements only contain information about the coupon and maturity of the bond but not the total borrowing size (Ranaldo and Rossi, 2016).

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	448	29.15	12.79	221	20.45	7.46	191	15.69	4.88
AUD	196	0.59	0.35	302	0.61	0.28	459	0.54	0.30
CAD	139	2.76	0.74	108	2.59	0.85	91	1.61	0.57
CHF	15	0.44	0.35	75	0.35	0.25	217	0.65	1.10
EUR	418	3.50	2.28	741	3.70	2.60	669	1.75	1.31
DEM	126	5.44	2.13	264	5.28	2.69	146	2.36	1.72
FRF	292	2.66	1.77	477	2.84	2.09	523	1.58	1.11
GBP	153	5.01	1.52	206	3.91	1.58	535	2.44	1.28
JPY	123	14.49	8.84	390	15.97	7.23	544	7.50	3.02
NOK	59	0.41	0.18	169	0.48	0.32	25	0.61	0.31
NZD	212	0.10	0.05	295	0.11	0.07	339	0.09	0.04
SEK	246	0.28	0.20	443	0.26	0.18	384	0.28	0.34

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 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 1994 to December 2021.

Figure 5: Auction Timeline

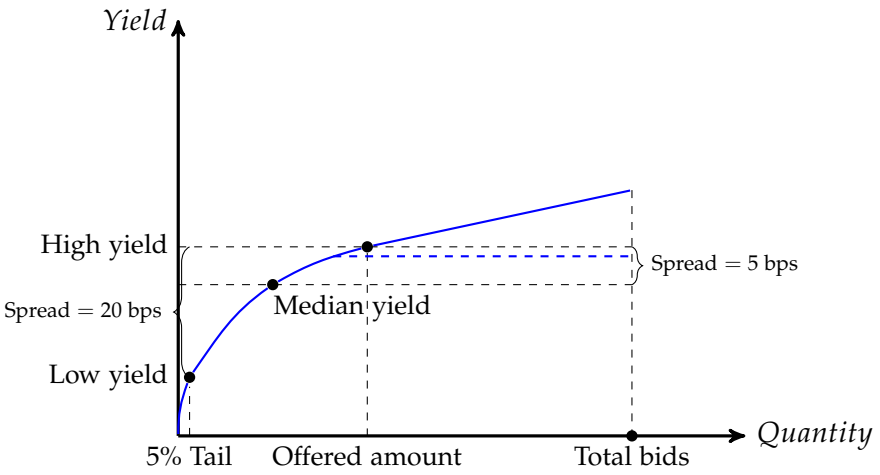


Note: This figure illustrates the timeline for long-term (i.e., beyond 5 years of maturity) Treasury and foreign auctions. The timelines for foreign auctions are reflecting current, rather than historical, timelines due to the lack of data availability. For US Treasury auctions we compute a historical average based on our sample from January 1994 to December 2021. At the *Announcement date* the Treasury releases all pertinent information regarding an upcoming auction (e.g., precise amount offered, maturity, CUSIP, coupon schedule, etc.). Up until to the auction closing time market participants can submit bids. A few days after the *Auction date*, on the *USD Issuance date*, the Treasury delivers the securities and charges awarded bidders for payment of the newly issued security.

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 6 illustrates the shape of a hypothetical auction demand curve based on these average spreads.

The steepness of the auction demand curve is surprising, given the outside option of the secondary market. The market clearing yield is on average within a few bps of secondary market yields (Ray et al., 2024). An investor who is willing to substitute between Treasuries in the primary and secondary market should not bid a yield at auction below the secondary market yield. With this secondary market outside option, one would have expected a demand curve that is flat at the secondary market yield as shown in the dashed blue line in Figure 6. However, the data show a steeply upward sloping demand curve with a spread of 20 bps. This suggests that there are inelastic investors in Treasury auctions that may be unwilling to buy Treasuries in the secondary market.

Figure 6: 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 blue dotted line illustrates a hypothetical secondary market yield that is just below the market clearing yield (Ray et al., 2024) The high vs median and median vs low yield spreads are computed based on the sample period from January 1994 to December 2021.

4. US and G10 Long-Term Yields over Auctions

In this section, we measure the change in global long-term yields over sovereign bond auctions. We find that there has been a small, but consistent, decline in global long-term yields over Treasury auctions. We find no such trend over foreign sovereign bond auctions.

We measure long-term yields as 10-year sovereign bond yields and measure 3-day changes over auctions. The 3-day window includes the day of the auction plus the two days after the auction. We choose this three day window because the vast majority of foreign investors is "asleep" 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 about long-term auctions, we keep the first 3-day window and exclude the latter from our sample. Such overlapping windows are exceedingly rare for most countries, expect for the US, where we exclude 42% of the auctions because of overlaps. Our long-term US Treasury auction windows span 21.3% of all trading days in our sample period from January 1994 to December 2021.

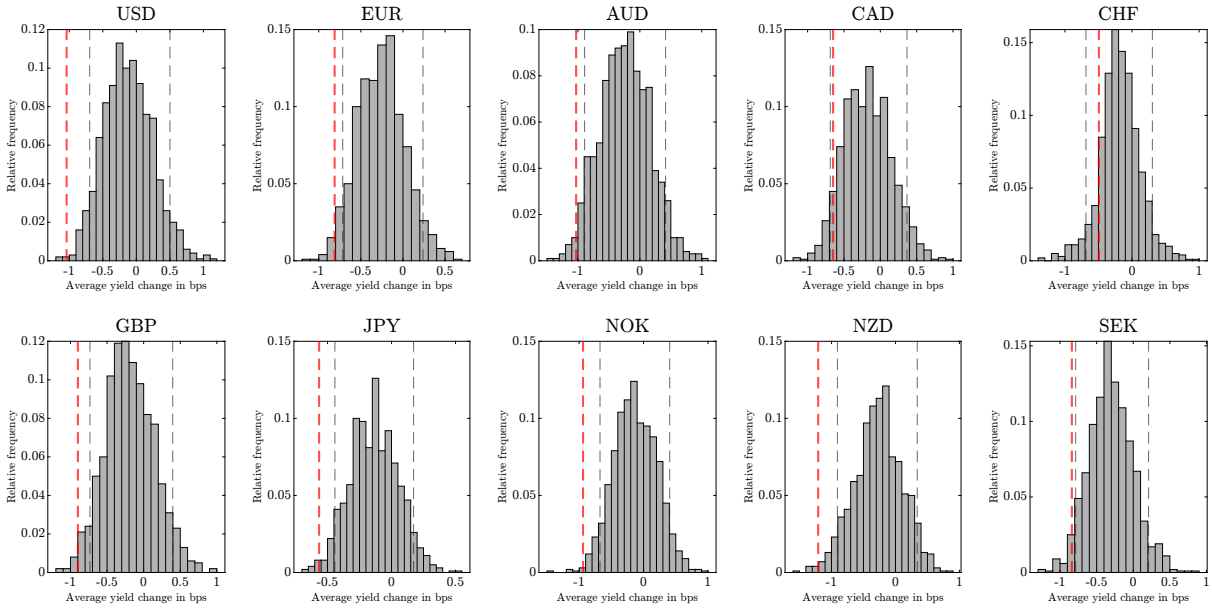
Figure 1 shows the cumulative change in US 10-year yields and average G10 yields over Treasury auction days (black dotted line), non-auction days (gray line) and all days (black solid line). Over our sample from 1994 to 2021, Treasury auction days appear to capture nearly the entire cumulative change in US and G10 yields. On non-Treasury auction days, there is on average nearly no decline in long-term yields.

Table 2 decomposes the change in G10 rates to its individual constituents and distinguishes between Treasury auctions and foreign local auctions (e.g., UK Gilt auctions). Each coefficient corresponds to a 3-day change in long-term yields around all days, auction days, and non-auctions days, respectively. The average 3-day change in US long-term yields around Treasury auctions amounts to 1 basis point. The point estimate is economically large and amounts to a cumulative decline of 5.37 percent over the full sample, which is close to the actual cumulative decline of 4.18 percent. There are 518 Treasury auction windows in our sample (after accounting for auctions that are less than two business days apart). Surprisingly, the explanatory power of Treasury auction days holds up almost uniformly across foreign rates and is especially strong for the most heavily traded currencies such as the euro, Japanese yen, and Pound sterling.

It is natural to ask if it is possible that the empirical pattern in Table 2 arose by coincidence. For instance, assuming that all days in our sample contained the same information about global demand for long-term bonds, how likely would it be that we would observe a similar pattern? To answer this question, we conduct a simple 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 the exercise above, we then compute the cumulative yield change over a 3-day window around these placebo Treasury auction days. Figure 7 shows the outcome of 1,000 simulated paths. Overall, our results are in line with the asymptotic test statistics in Table 2. For the majority of G10 currencies the 3-day cumulative change in long-term yields is significantly different from zero at the 10% significance level.

Figure 7: 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 December 2021.

Next we turn to foreign local auctions. We find that local auctions are not associated with statistically or economically significant changes in long-term rates. This is not due to the fact that foreign auctions are less frequent. For instance, 3-day windows around UK Gilt auctions span around 20 percent of our sample period, whereas Treasury auction windows correspond to 22 percent of all days. In the following section, we explore potential mechanisms for why US Treasury auctions are special.

However, prior to delving into the mechanism, we show the change in yields using a sim-

Table 2: Decline of Long-Term Yields Around Auctions

		UST auctions		Local auctions		
	All days	Auction	No auction	Auction	No auction	Share in %
USD	−0.18	−1.04**	0.07	−1.04**	0.07	22.14
	[0.84]	[2.39]	[0.27]	[2.39]	[0.27]	
G10	−0.23**	−0.95***	−0.06	−0.03	−0.55**	21.41
	[1.98]	[3.57]	[0.43]	[0.48]	[2.12]	
EUR	−0.27*	−0.81**	−0.11	−0.41	−0.21	26.47
	[1.72]	[2.47]	[0.63]	[1.37]	[1.18]	
AUD	−0.23	−1.02**	0.00	0.67	−0.44	19.11
	[0.94]	[2.21]	[0.00]	[1.27]	[1.61]	
CAD	−0.23	−0.65*	−0.10	0.62	−0.31	9.58
	[1.24]	[1.80]	[0.50]	[1.11]	[1.64]	
CHF	−0.18	−0.48**	−0.08	0.05	−0.17	3.47
	[0.78]	[1.97]	[0.29]	[0.09]	[0.79]	
GBP	−0.21	−0.90**	−0.02	−0.06	−0.25	20.04
	[1.12]	[2.21]	[0.09]	[0.14]	[1.16]	
JPY	−0.14	−0.56***	−0.02	−0.08	−0.16	27.87
	[1.27]	[2.75]	[0.16]	[0.37]	[1.27]	
NOK	−0.16	−0.92***	0.06	0.55	−0.20	5.47
	[0.92]	[2.75]	[0.32]	[0.82]	[1.13]	
NZD	−0.33	−1.15***	−0.07	−0.80*	−0.20	18.43
	[1.57]	[2.70]	[0.31]	[1.69]	[0.91]	
SEK	−0.35**	−0.72***	−0.16	−0.31	−0.28**	21.94
	[2.24]	[2.80]	[1.10]	[1.07]	[1.97]	

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 of 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 1994 to December 2021.

ple event study methodology. Specifically, we estimate the following event-study regression:

$$\Delta y_{t,i} = \alpha + \sum_{m=M^-}^{M^+} \beta_m D_{t,m} + \epsilon_t, \tag{1}$$

where the dependent variable is either the change in the 10-year government bond yield (i.e., cash rate) or the change in the 10-year LIBOR swap interest rate $y_{t,i}$ of country i over time interval t. We use swap rates in addition to government bond rates to mitigate the effect of dealer intermediation rents around Treasury auctions (see Lou et al., 2013; Fleming, Liu, and

Nguyen, 2016; Fleming et al., 2024). Moreover, swap rates are also not subject to the on-the-run premium phenomenon (e.g., Duffie and Kan, 1996). 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's) are identified from how long-term yields change before and after auctions.

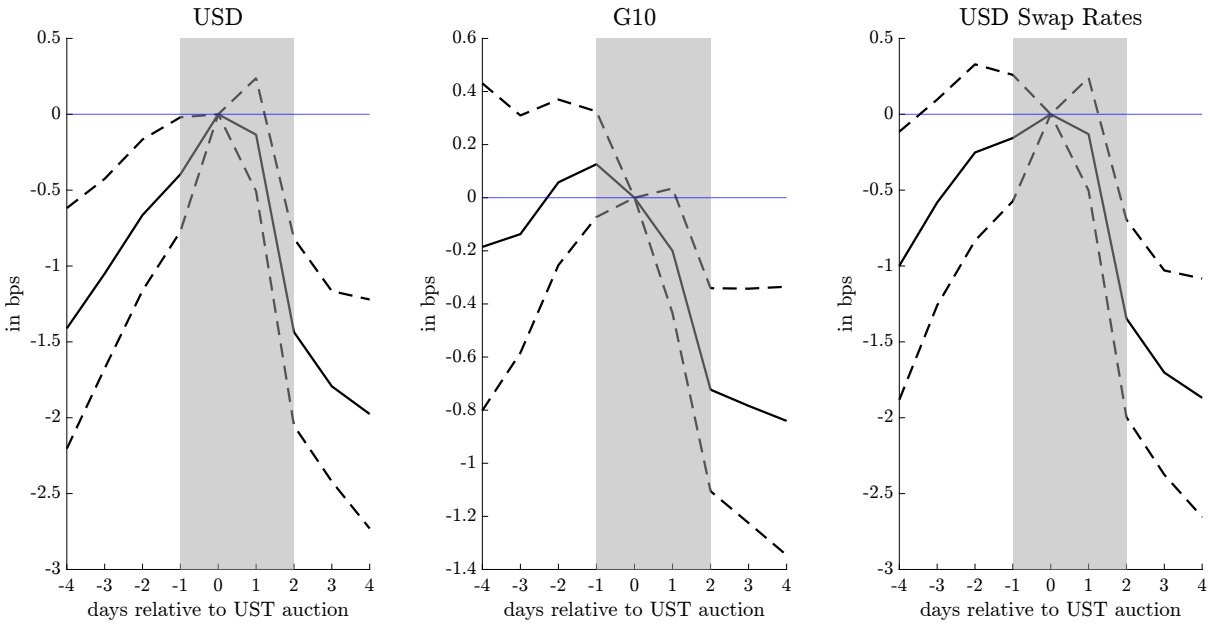
Figure 8 visualizes the results from estimating Eq. (1) for both the US and the average G10 interest rate, respectively. Specifically we focus on four days before and after the Treasury auction (time zero). The left-most panel shows that US long-term yields decline by about 1 basis point over the full 3-day window. The majority of the decline can be attributed to the two days after the auction. This is in line with our conjecture that foreign participation is crucial for the integration in long-term yields. The panel labeled *G10* shows the decline in foreign yields over the same window. Unlike, for USD yields, which suffer from intermediation rents, that is, yields increase prior to Treasury auctions, G10 rates are remarkably unaffected, with the pre-trend being statistically indistinguishable from zero. This result is not driven by the fact that we have positive pre-trends for some currencies and negative pre-trends for others, rather the pre-trends are statistically insignificant for all individual G10 currencies.[6] Moreover, a similar picture arises for *USD Swap Rates*, which are based on LIBOR swap rates instead of government bond yields.

Against this backdrop, we believe that there are two likely reasons for why our results are novel in the context of the related literature. First, the extant literature has mostly focused on cash rather than swap rates. Second, to the best of our knowledge, we are the first to consider foreign yields around Treasury auctions.

In addition, Figure 8 also underscores that interest rate movements are on average zero prior to Treasury auction days Ray et al. (2024). This is especially true for the day of the auction. Put differently, we do not find any pre-trends despite the fact that the amount issued at auctions is known on average four days ahead of auctions. We interpret this as suggestive evidence that the market only learns about demand rather than supply at auctions and provide more comprehensive evidence in the next section.

[6]We document disaggregated results for individual G10 currencies in the Online Appendix.

Figure 8: Event Study: US and G10 Long-Term Rates at Treasury Auctions



Note: The panel labeled *USD* plots 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 panel labeled *G10* is based on foreign G10 government bond yields. The panel labeled *USD Swap Rates* is based on US dollar LIBOR swap rates. 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 December 2021.

5. Specialness of US Treasury Auctions

Thus far, we have established, that global long-term bond yields have declined over a narrow window around Treasury auctions but not other sovereign bond auctions. In this section, we explore two potential explanations for the specialness of US Treasury auctions: size and investor composition.

US Treasury auctions are on average an order of magnitude larger than foreign sovereign bond auctions. 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 government 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 give 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 $17.5 billion and we are able to match 12 percent of US Treasury auctions with similar-sized foreign auctions.

Figure 9 shows the same event study as in Eq. (1) but conditional on days with large foreign auctions. Again, the three panels show cumulative yield changes for 10-year US and G10 cash rates and US dollar LIBOR swap rates, respectively, four days before and after a 3-day window around large foreign sovereign bond auctions. Unlike US auctions, where we find an average decline in 10-year yields of around 1 bps, we find no such pattern for large foreign auctions. This suggests that it is not the case that large 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 substantially wider relative to Figure 8, suggesting that integration tends to be weaker in the presence of foreign auctions. We investigate this idea more closely in the next paragraph by analyzing high-frequency changes in integration.

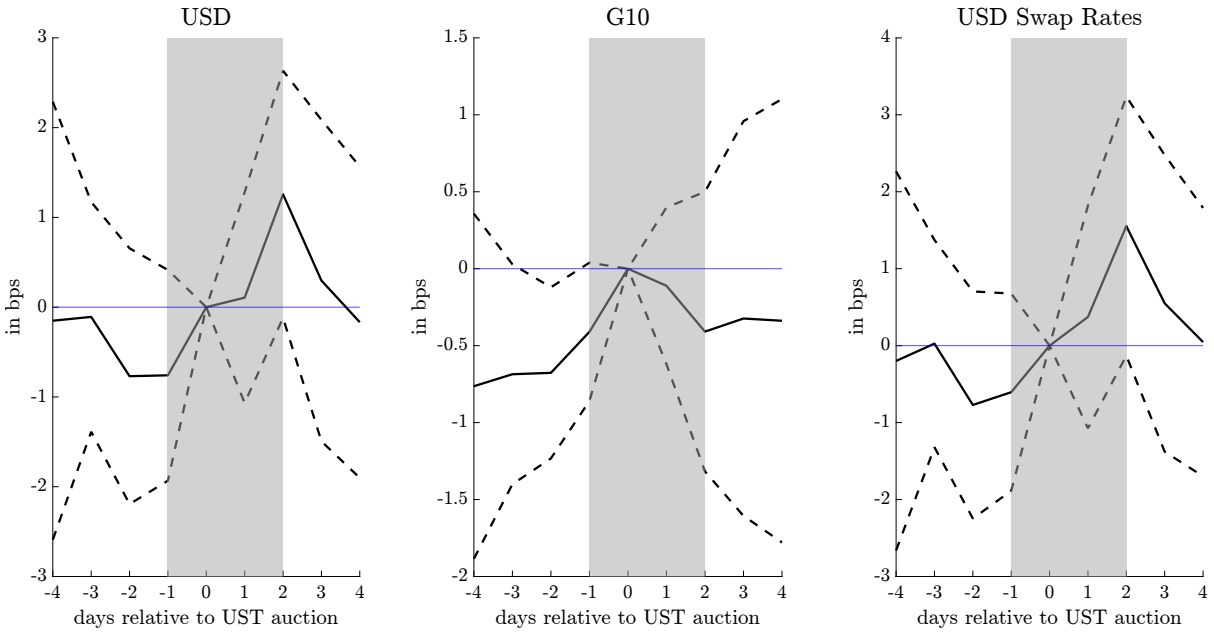
The evidence in Figure 9 points toward foreign auctions having a detrimental effect on the integration in long-term rates. We argue that this is because at foreign auctions investors learn about local demand rather than global demand for long-term government debt. To test this conjecture, we run the following regression:

$$\Delta y_{t,i} = \alpha + \beta \Delta y_{t,USD} + \gamma \text{Foreign auction}_t + \varphi(\Delta y_{t,USD} \times \text{Foreign auction}_t) + \epsilon_{t,i} \qquad (2)$$

where the dependent variable is the change in the daily 10-year foreign interest rate of country i. The regressors are changes in the 10-year US yield $\Delta y_{t,USD}$, foreign long-term debt auctions (i.e., with maturities beyond 5 years), and the interaction of these two variables.

Table 3 presents the results of estimating Eq. (2) for our sample of G10 currencies. Two results stand out: First, foreign and US long-term rates are highly integrated. For instance, outside of foreign long-term auctions, a 100 basis point increase in the USD long-term yield is associated with a 42 basis point increase in the EUR long-term yield. Second, on foreign

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



Note: The panel labeled *USD* plots 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 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* is based on foreign G10 government bond yields. The panel labeled *USD Swap Rates* is based on US dollar LIBOR swap rates. 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 December 2021.

auction days, this relation weakens markedly: for a 100 basis point increase in the USD long-term yield the EUR yield increases by only about 37 bps. This drop in the correlation between foreign and US yields is consistent with foreign auctions being local in the sense that they do not reveal information about the global demand for sovereign debt.

Table 4 estimates Eq. (2) as a panel with country fixed effects, controlling for any unobserved heterogeneity at the country-level. The average foreign long-term yield increases by around 30 bps for a 100 bps increase in US yields. However, this relation weakens by about 18 percent conditional on days with foreign long-term auctions. On such days, a 100 basis point increase in the US long-rate is only associated with a 25 basis point surge in foreign yields. Contrarily, US Treasury auction days are not associated with any significant decline in integration. This is especially true when foreign countries' long-term yields are weighted

Table 3: Foreign Yield Changes and US Yield Changes around Foreign Auctions

	EUR	AUD	CAD	CHF	GBP	JPY	NOK	NZD	SEK
Intercept (α)	0.00*	0.00	0.00	0.00	0.00	0.00**	0.00	0.00	0.00**
	[1.67]	[1.49]	[1.27]	[0.57]	[1.06]	[2.12]	[0.87]	[1.12]	[2.48]
$\Delta y_{t,USD}$	0.42***	0.26***	0.66***	0.24***	0.44***	0.04***	0.25***	0.13***	0.32***
	[49.22]	[18.66]	[115.70]	[18.53]	[43.93]	[5.75]	[26.54]	[10.67]	[34.25]
Foreign auction$_t$	0.00*	0.01***	0.00**	0.00	0.00	0.00***	0.01	0.00	0.00**
	[1.85]	[2.58]	[2.20]	[0.51]	[0.45]	[2.81]	[1.64]	[0.86]	[2.38]
$\Delta y_{t,USD} \times$ Foreign auction$_t$	−0.05**	−0.12**	0.00	−0.10	0.03	0.00	−0.14*	−0.04	−0.03
	[2.23]	[2.41]	[0.13]	[0.98]	[0.85]	[0.21]	[1.76]	[0.89]	[1.03]
$\bar{R}^2$ in %	32.09	4.91	70.58	4.88	27.17	0.62	9.38	1.71	18.18
#Obs	5749	6973	5811	6675	5915	6822	6823	6631	5784

Note: This table reports the estimates from daily regressions of the form $\Delta y_{t,i} = \alpha + \beta \Delta y_{t,USD} + \gamma$Foreign auction$_t$ $+ \varphi(\Delta y_{t,USD} \times$ Foreign auction$_t) + \epsilon_{t,i}$, where the dependent variable is the change in the 10-year foreign interest rate of country i. The regressors are changes in the 10-year US yield $\Delta y_{t,USD}$, foreign long-term debt auctions, and the interaction of these two variables. The test statistics are reported in brackets. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is daily and spans the period from January 1994 to December 2021.

by the average size of their long-term debt issuance in the last column.

Table 4: Foreign Yield Changes and US Yield Changes around Foreign and US Auctions

	(1)	(2)	(3)	(4)
$\Delta y_{t,USD}$	0.292***		0.301***	0.243***
	[38.483]		[35.526]	[33.648]
Foreign auction$_{t,i}$		0.003***	0.003***	0.003***
		[3.753]	[3.616]	[3.410]
$\Delta y_{t,USD} \times$ Foreign Auction$_{t,i}$			−0.054***	−0.061***
			[3.522]	[3.550]
US auction$_t$			−0.001	0.000
			[1.311]	[0.560]
$\Delta y_{t,USD} \times$ US Auction$_t$			−0.038*	−0.015
			[1.811]	[0.898]
Overall R^2 in %	11.20	0.03	11.27	11.43
Avg. #Time periods	7003	7005	7003	7003
#Currencies	9	9	9	9
Currency FE	yes	yes	yes	yes

Note: This table reports the estimates from daily fixed effects panel regressions of the form $\Delta y_{t,i} = \mu_i + \beta \Delta y_{t,USD} + \gamma$Foreign auction$_{t,i}$ $+ \varphi(\Delta y_{t,USD} \times$ Foreign auction$_{t,i}) + \gamma_{US}$US auction$_t$ $+ \varphi_{US}(\Delta y_{t,USD} \times$ US auction$_t) + \epsilon_{t,i}$, where the dependent variable is the change in the 10-year foreign interest rate of country i. The regressors are changes in the 10-year US yield $\Delta y_{t,USD}$, foreign and US long-term debt auctions, and the interaction of these two variables. The last column weighs each currency by the average size of their long-term debt issuance. The test statistics based on heteroskedasticity robust standard errors clustered by day are reported in brackets. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is daily and spans the period from January 1994 to December 2021.

This difference between local and global investor demand for long-term bonds motivates the second difference between US Treasury auctions and foreign sovereign bond auctions. US Treasuries attract a much more global investor base. The participation of global bond in-

vestors in US Treasury auctions may be important for learning about global investor demand. To empirically test this hypothesis, we identify a novel source of variation in foreign investor participation: overlapping auctions. When Treasury auctions overlap with foreign sovereign bond auctions, fewer global bond investors participate.

At Treasury auctions, we have four groups of investors: dealers and brokers, investment funds, foreign and international, and other participants (i.e., SOMA banks, depository institutions, private individuals, and non-banks financials). In Table 5 we report the results from the following regression:

$$Share_{t,c} = \alpha + \beta \text{Relative overlap}_t + \gamma D_t + \epsilon_{t,c}, \tag{3}$$

where the dependent variable is the share of long-term Treasuries bought at auction by each of the four groups. The key regressor is $Relative\ overlap_t$, which measures the share of foreign long-term bond issuances as a fraction of total long-term bond issuances (i.e., foreign plus US) on Treasury auction days and is zero if there is no overlapping auction. D_t is a dummy variable matrix that captures month fixed effects. For conciseness we only report the α and β regression coefficient estimates.

There are two key insights from Table 5: First, the share of long-term Treasuries directly bought by foreign and international investors is roughly 19%. Notice that foreign holdings of long-term Treasury securities are even higher because some foreign investors do not participate directly in auctions but buy in the secondary market. The share of long-term Treasuries held by foreign investors in G10 countries has increased to almost 40% in recent years.[7] Second, direct participation of global bond investors (investment funds and foreign investors) declines as the share of foreign long-term bond issuances increases. Specifically, a 100 basis point increase in the share of foreign bond issuances is associated with a 7 and 14 basis point decline in the participation of foreign investors and investment funds, respectively. On the contrary, participation by brokers and dealers increases by 20 bps. This is in line with the fact that primary dealers have to buy at Treasury auctions when investor demand is weaker than expected. Moreover, our findings are also in line with concurrent work by Tabova and

[7] In the Online Appendix we provide a detailed breakdown of foreign long-term Treasury holdings based on data provided by the Treasury International Capital (TIC) System.

Warnock (2021), showing that foreign private investors earn higher Sharpe ratios on their Treasury holdings due to higher duration risk rather than because of market timing.

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

	Dealers and brokers	Investment funds	Foreign and international	Others
Intercept (α)	0.33***	0.43***	0.19***	0.05***
	[9.15]	[11.16]	[14.55]	[4.20]
Relative overlap$_t$	0.20***	−0.14***	−0.07***	0.00
	[5.18]	[3.18]	[3.23]	[0.09]
$\bar{R}^2$ in %	4.66	4.66	2.00	16.12
#Obs	711	711	711	711

Note: This table reports estimates from a regression of the form $Share_{t,c} = \alpha + \beta \text{Relative overlap}_t + \gamma D_t + \epsilon_{t,c}$, where the dependent variable is the share of long-term Treasuries bought at auction by dealers and brokers, investment funds, foreign and international, and other participants (i.e., SOMA banks, depository institutions, private individuals, and non-banks financials). The key regressor is *Relative overlap*$_t$, which measures the share of foreign long-term bond issuances as a fraction of total long-term bond issuances (i.e., foreign plus US) on Treasury auction days and is zero if there is no overlapping auction. D_t is a dummy variable matrix that captures month fixed effects. The numbers inside the brackets are the corresponding test statistics based on robust standard errors (Newey and West, 1987) correcting for serial correlation and heteroskedasticity. Asterisks *, **, and *** denote significance at the 90%, 95%, and 99% confidence levels. The sample is in event time and spans the period from January 1994 to December 2021.

Using this variation in global bond investors' direct participation at US Treasury auctions, we empirically test whether the composition of investors at US Treasury auctions is important for learning about demand. Table 6 splits Treasury auctions into two groups: overlapping and non-overlapping auction days. Specifically, overlaps are identified based on the 3-day window for US Treasury and foreign long-term auctions, respectively. For US yields we measure overlaps with respect to any other foreign G10 auction. The remaining share of non-overlapping auction days is just around 2.5 percent of the full sample. For each of these non-overlapping 3-day windows US long-term yields fall by around 4 bps. We find similar results for disaggregated G10 yields, where overlaps are defined between Treasury auctions and, for instance, UK Gilt auctions. Except for Norway, we do not observe any statistically significant decline on overlapping auction days. We interpret these results as indicative that US Treasury auctions are special because they attract global bidders. From the participation of global bidders, the market learns about global demand for long term bonds at US Treasury auctions.

Table 6: Decline of Long-Term Yields — Overlapping Auctions

	All days	Non-overlapping UST auctions	Overlapping UST and local auctions	Other days	Non-overlapping % of days	Overlapping % of days
USD	−0.18	−3.83**	−0.70	0.07	2.41	19.73
	[0.84]	[2.55]	[1.54]	[0.27]		
G10	−0.23**	−1.23***	−0.71	−0.06	15.03	7.11
	[1.98]	[3.92]	[1.55]	[0.43]		
EUR	−0.27*	−1.05**	−0.43	−0.11	13.46	8.68
	[1.72]	[2.51]	[0.82]	[0.63]		
AUD	−0.23	−1.38**	−0.53	0.00	12.82	9.32
	[0.94]	[2.23]	[0.76]	[0.00]		
CAD	−0.23	−0.80*	−0.08	−0.10	17.64	4.50
	[1.24]	[1.94]	[0.10]	[0.50]		
CHF	−0.18	−0.78***	0.46	−0.08	16.79	5.35
	[0.78]	[2.85]	[0.87]	[0.29]		
GBP	−0.21	−1.24**	−0.35	−0.02	13.59	8.55
	[1.12]	[2.23]	[0.62]	[0.09]		
JPY	−0.14	−0.75***	−0.31	−0.02	12.53	9.61
	[1.27]	[2.61]	[1.11]	[0.16]		
NOK	−0.16	−0.82**	−1.61*	0.06	19.30	2.84
	[0.92]	[2.24]	[1.95]	[0.32]		
NZD	−0.33	−1.18**	−1.08	−0.07	16.07	6.07
	[1.57]	[2.46]	[1.20]	[0.31]		
SEK	−0.35**	−0.80**	−0.62	−0.16	13.08	9.06
	[2.24]	[2.40]	[1.50]	[1.10]		

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. *Non-overlapping UST auctions* shows the average of cumulative change during a 3-day window around US Treasury auctions that do not overlap with local auctions. This 3-day window includes for every long-term Treasury auction the day of the event plus two days after. *Overlapping UST and local auctions* is based on the overlap between the 3-day window for US Treasury and foreign long-term auctions. *Other days* is the change in long-term yields outside of the 3-day windows around UST and local auctions. For the euro (EUR) we consider both French and German 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 1994 to December 2021.

6. Macroeconomic Announcements and Robustness

Here we summarize robustness checks and additional analyses supporting our main findings. Specifically, we study i) changes in long-term sovereign bond yields around macroeconomic news announcements, ii) the impact of dealer intermediation rents, iii) the Sharpe ratio of a trading strategy that is long 10-year Treasuries around long-term auctions, and iv) the recent up-tick in long-term yields after 2022.

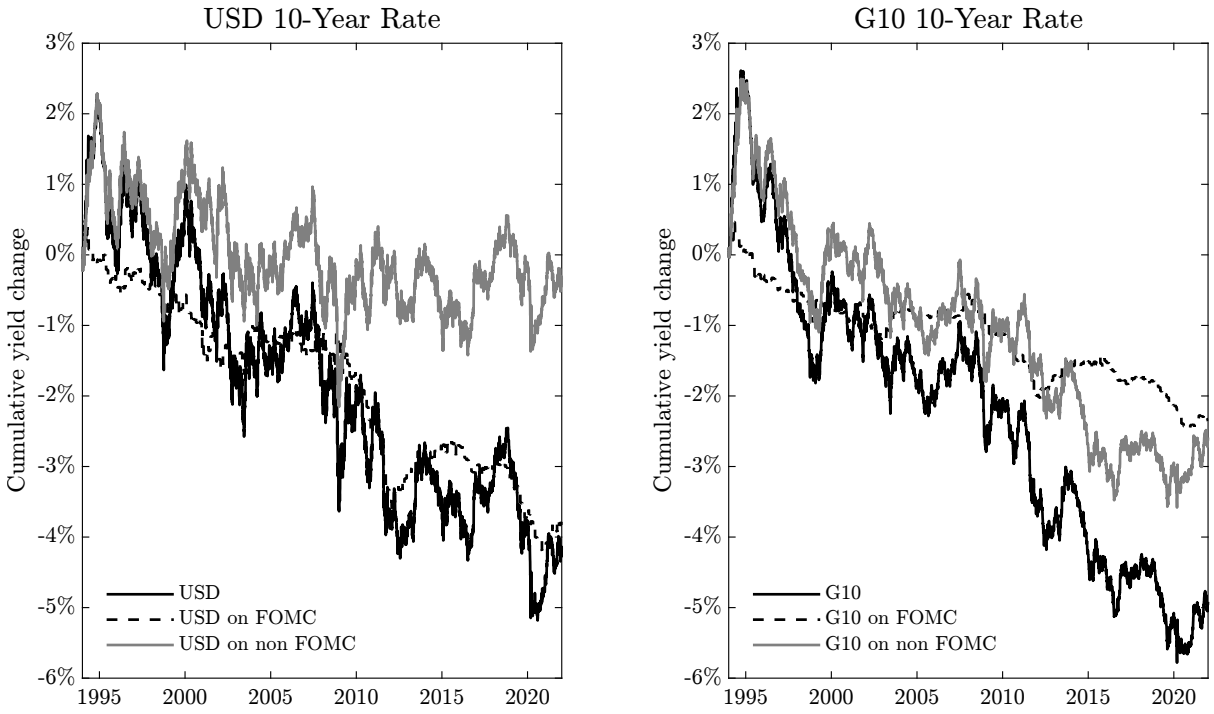
6.1. *Macroeconomic News*

In recent work, Hillenbrand (2020) shows that changes in USD long-term rates over FOMC announcements tend to be permanent, while changes outside of FOMC announcements tend to be transitory. This fact implies that FOMC announcements are informative about the path of US long-term rates. We conjecture that if information is integrating long-term rates, then we would also expect to see that FOMC announcements are also informative about the path of foreign long-term rates. Figure 10, extends the work by Hillenbrand (2020) and shows that FOMC announcements do appear to capture the permanent changes in US long-term rates but do *not* for foreign G10 long-term rates (excluding the US). Over this period, the 3-day window around FOMC announcements captures 85 percent of the trend to US long-term rates. By contrast, FOMC announcements only capture 60 percent of the trend in G10 long-term rates. This is not due to a sluggish response of foreign G10 long-term rates: extending the FOMC window up to 11 days (5 days before and 5 days after) does not increase the explained fraction of the trend to more than 65 percent.

It is natural to ask whether macroeconomic announcements other than FOMC might be able to explain the integration in long-term interest rates. Hence, in Table 7 we extend our analysis to a host of macroeconomic news announcements (i.e., CPI, Unemployment, and Trade Balance) as well as foreign government bond auctions.[8] We draw three observations: First, country specific auctions, such as UK auctions for the Pound sterling interest rate, have very little explanatory power with the exception of New Zealand. Second, local monetary policy announcements (e.g., European Central Bank (ECB) for the EUR) do not capture any of the secular decline in long-term rates. We interpret this as evidence that US monetary policy is leading the global financial cycle as documented in Brusa, Savor, and Wilson (2019) and Miranda-Agrippino and Rey (2020). Lastly, US as well as local macroeconomic news announcement about CPI, Unemployment, and Trade Balance capture on average less than 10 percent of the long-term trend to 10-year long-term yields.

[8]The row G10 is estimated from a panel regression of 9 foreign yields. Due to the fact that the long-term yield data contains missing values, the point estimate for G10 is not going to be identical to a simple average computed across individual yield declines across the 9 foreign countries.

Figure 10: Long-term Rate Changes over FOMC



Note: The left and right panels show cumulative yield changes for the USD and G10 interest rate, respectively. The black solid line shows the cumulative change in 10-year interest rates. The dotted black line shows cumulative yield changes that were realized over a 3-day window around FOMC meetings. Following Hillenbrand (2020), this 3-day window includes for every FOMC meeting the day prior to the meeting, the day of the meeting, and the day after the meeting. The gray solid line shows cumulative yield changes occurring outside of the 3-day window. The sample is daily and spans the period from January 1994 to December 2021.

6.2. Intermediation Rents

In earlier work, Lou et al. (2013) show that US Treasury security prices in the secondary market decrease significantly in the few days before Treasury auctions and recover shortly thereafter. The authors link these results to limited risk-bearing capacity of primary dealers as well as end-investors' imperfect capital mobility. Specifically, the authors estimate localized versions of our event-study analysis, that is, they match 10-year auctions with 10-year interest rates. Hence, to rule out that our result are driven by dealer banks' limited risk bearing capacity we exclude any 10-year Treasury note auctions from our sample.

Table 8 reports the cumulative decline in 10-year US and foreign yields around long-term debt auctions (excluding the 10-year auctions). Our results improve even further compared to the baseline result in Table 7: long-term Treasury auctions explain 99 percent of the secular

Table 7: Secular Decline of Long-Term Yields — Macroeconomic News

	All days	Treasury auctions	Local auctions	FOMC	Local MP news	US macro news	Local macro news
USD	−4.18	−5.37**	−5.37**	−3.83**	−3.83**	−0.72	−0.72
	[0.84]	[2.39]	[2.39]	[2.11]	[2.11]	[0.27]	[0.27]
G10	−5.36**	−4.90***	−0.44	−3.23***	−0.68	−0.96	−0.84
	[1.98]	[3.57]	[0.48]	[2.76]	[0.92]	[0.63]	[0.79]
EUR	−6.17*	−4.17**	−2.53	−2.66**	0.51	−2.39	−2.05
	[1.72]	[2.47]	[1.37]	[2.20]	[0.37]	[1.32]	[1.05]
AUD	−5.29	−5.29**	2.99	−4.06**	0.77	1.96	−2.30
	[0.94]	[2.21]	[1.27]	[2.18]	[0.57]	[0.73]	[0.98]
CAD	−5.26	−3.36*	1.38	−3.32**	−0.21	−0.45	−0.14
	[1.24]	[1.80]	[1.11]	[2.41]	[0.19]	[0.22]	[0.06]
CHF	−3.90	−2.48**	0.04	−1.19	0.02	−1.89	0.77
	[0.78]	[1.97]	[0.09]	[1.34]	[0.06]	[1.42]	[0.58]
GBP	−5.00	−4.64**	−0.26	−1.78	−0.63	−1.10	1.17
	[1.12]	[2.21]	[0.14]	[1.27]	[0.41]	[0.53]	[0.53]
JPY	−3.26	−2.89***	−0.51	−0.84	−0.24	−1.06	−0.06
	[1.27]	[2.75]	[0.37]	[0.98]	[0.92]	[0.81]	[0.06]
NOK	−3.63	−4.77***	0.70	−3.12**	−2.30**	−1.39	−1.77
	[0.92]	[2.75]	[0.82]	[2.39]	[2.28]	[0.71]	[0.83]
NZD	−7.19	−5.95***	−3.46*	−1.18	−1.14	1.13	−0.36
	[1.57]	[2.70]	[1.69]	[0.91]	[0.98]	[0.53]	[0.25]
SEK	−6.66**	−3.75***	−1.57	−2.48**	−0.59	−2.19	−1.85
	[2.24]	[2.80]	[1.07]	[2.32]	[0.68]	[1.34]	[1.05]

Note: This table reports the cumulative decline in 10-year US and foreign yields in percent around long-term debt auctions and macroeconomic events. *All days* shows the total cumulative decline over the entire sample. *Treasury auctions* shows cumulative changes 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 *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 (2020) 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 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 yields 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 1994 to to December 2021.

decline in G10 long-term yields. We observe a similar pattern for individual currencies. For instance, Treasury auctions capture now 85 percent, instead of 68 percent, of the cumulative decline in EUR long-term yields. These results corroborate the notion that banks' limited risk-bearing capacity alone cannot explain the integration of long-term interest rates across developed economies.

Table 8: Secular Decline of Long-Term Yields — No 10-year Treasury auctions

		UST auctions without 10-year		Local auctions		
	All days	Auction	No auction	Auction	No auction	Share in %
USD	−4.18	−5.57***	1.40	−5.57***	1.40	20.99
	[0.84]	[2.58]	[0.31]	[2.58]	[0.31]	
G10	−5.36**	−5.30***	−0.74	0.12	−5.52**	22.03
	[1.98]	[4.01]	[0.30]	[0.13]	[2.34]	
EUR	−6.17*	−5.22***	−0.95	−1.50	−4.67	27.69
	[1.72]	[3.25]	[0.30]	[0.79]	[1.53]	
AUD	−5.29	−5.07**	−0.22	2.97	−8.26	20.54
	[0.94]	[2.17]	[0.04]	[1.22]	[1.62]	
CAD	−5.26	−3.49*	−1.78	1.64	−6.90*	10.05
	[1.24]	[1.94]	[0.46]	[1.30]	[1.70]	
CHF	−3.90	−2.87**	−1.03	0.67	−4.57	4.68
	[0.78]	[2.37]	[0.21]	[1.28]	[0.92]	
GBP	−5.00	−4.23**	−0.78	−0.12	−4.88	21.46
	[1.12]	[2.10]	[0.19]	[0.06]	[1.21]	
JPY	−3.26	−2.94***	−0.32	−0.35	−2.91	29.11
	[1.27]	[2.94]	[0.14]	[0.25]	[1.35]	
NOK	−3.63	−4.31***	0.68	1.18	−4.81	5.91
	[0.92]	[2.58]	[0.19]	[1.33]	[1.26]	
NZD	−7.19	−7.78***	0.59	−2.18	−5.01	17.22
	[1.57]	[3.87]	[0.14]	[1.10]	[1.21]	
SEK	−6.66**	−4.14***	−2.52	−1.39	−5.28**	22.47
	[2.24]	[3.19]	[0.94]	[0.93]	[2.05]	

Note: This table reports the cumulative decline in 10-year US and foreign yields in percent around long-term debt auctions (excluding 10-year US Treasury auctions). *All days* shows the total cumulative decline over the entire sample. *UST auctions* shows cumulative changes 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 1994 to December 2021.

6.3. 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 Sharpe ratios of a strategy that buys and holds long-term bonds over the 3-day auction windows.

Table 9 shows that such a trading strategy earns a Sharpe ratio of 1.02 for US Treasuries and 1.26 for a portfolio of G10 sovereign bonds. Such Sharpe 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 Sharpe ratios are similar, and slightly smaller, to what could have been earned over FOMC announcements.

Lastly, our results are distinct from the on-the-run premium phenomenon studied, for instance, in Duffie and Kan (1996), Jordan and Jordan (1997), and Krishnamurthy (2002). While this mechanism is consistent with the yield increase of the on-the-run Treasury before the next auction of the same maturity, it cannot explain the post-auction yield decrease and the spillover effects to other maturities and foreign interest rates.

6.4. Inflation Swaps

Another possible worry is that around Treasury auctions the market learns about inflation risk, which has been shown to be an important driver of the decline in long-term rates (Jotikasthira et al., 2015). To address this possibility, we collect data on inflation swaps for the US, Australia, UK, Japan, and Sweden from Bloomberg. We focus on swaps with maturities of 10-years. An inflation swap is an agreement to swap a fixed rate payment for floating rate payments that are linked to inflation. When inflation is high, the inflation swap rate raises. In Table 10 we replicate our analysis in Table 2 for the five aforementioned countries and find no evidence that inflation swap yields have declined over Treasury auctions. If anything, we find some statistical, but economically small evidence that inflation premia in Japan and Sweden have increased around Treasury auctions. This implies that our core results would be even stronger when estimated based on real, rather than nominal yields.

6.5. Recent Period

Figure 11 extends the results in Figure 3 to the most recent high-inflation period. Similar to some of the other contractionary periods (e.g., after the Global Financial Crisis), Treasury auctions do not pick up the transitory increase in long-term rates. This is consistent with our interpretation that at Treasury auctions investors learn about the global demand for

Table 9: Sharpe Ratios of Long-Term Yields — Macroeconomic News

	All days	Treasury auctions	Local auctions	FOMC	Local MP news	US macro news	Local macro news
USD	−0.16	−1.02**	−1.02**	−1.28**	−1.28**	−0.11	−0.11
	[0.84]	[2.47]	[2.47]	[2.11]	[2.11]	[0.27]	[0.27]
G10	−0.34*	−1.26***	−0.14	−1.49**	−0.32	−0.20	−0.42
	[1.77]	[3.02]	[0.43]	[2.38]	[0.89]	[0.51]	[0.71]
EUR	−0.33*	−0.98**	−0.51	−1.35**	0.19	−0.49	−0.40
	[1.71]	[2.36]	[1.35]	[2.20]	[0.34]	[1.25]	[1.06]
AUD	−0.18	−0.96**	0.56	−1.48**	0.48	0.30	−0.47
	[0.93]	[2.33]	[1.34]	[2.47]	[0.63]	[0.76]	[1.07]
CAD	−0.24	−0.72*	0.65	−1.44**	−0.14	−0.08	−0.02
	[1.24]	[1.76]	[1.16]	[2.37]	[0.19]	[0.21]	[0.06]
CHF	−0.15	−0.73*	0.08	−0.72	0.14	−0.49	0.24
	[0.76]	[1.76]	[0.09]	[1.17]	[0.08]	[1.24]	[0.53]
GBP	−0.21	−0.89**	−0.05	−0.79	−0.22	−0.19	0.19
	[1.11]	[2.12]	[0.13]	[1.31]	[0.40]	[0.49]	[0.50]
JPY	−0.24	−1.09***	−0.12	−0.63	−1.14	−0.34	−0.03
	[1.25]	[2.72]	[0.37]	[0.94]	[0.85]	[0.85]	[0.06]
NOK	−0.18	−0.98**	0.53	−1.40**	−1.67**	−0.25	−0.27
	[0.91]	[2.36]	[0.76]	[2.12]	[2.29]	[0.63]	[0.72]
NZD	−0.30	−1.19***	−0.63	−0.52	−0.58	0.19	−0.12
	[1.52]	[2.87]	[1.59]	[0.84]	[0.86]	[0.49]	[0.20]
SEK	−0.43**	−0.99**	−0.34	−1.25**	−0.48	−0.42	−0.36
	[2.03]	[2.38]	[0.87]	[2.10]	[0.58]	[1.07]	[0.88]

Note: This table reports the annualized Sharpe 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 (2020) 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 December 2021.

long-term debt rather than about transitory movements in long-term rates that are driven by contractionary central bank policy (through the expectations hypothesis).

7. Conclusion

In this paper, we show that both domestic and foreign long-term yields decline in concert around long-term US Treasury auctions. We provide evidence that this integration occurs because investors learn about the global demand for long-term sovereign debt at Treasury auctions. To show this, we leverage the fact that Treasury auctions are scheduled far in

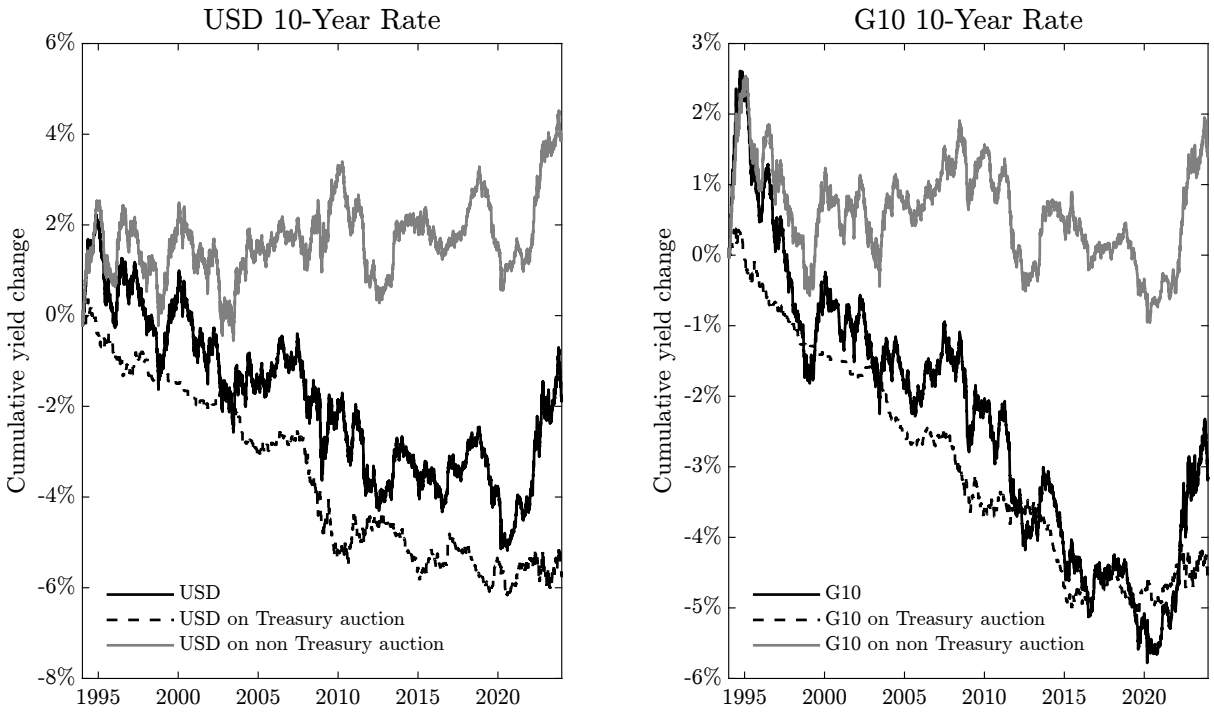
Table 10: Decline of Inflation Swap Yields Around Auctions

		UST auctions		Local auctions		
	All days	Auction	No auction	Auction	No auction	Share in %
USD	−0.01	−0.18	0.04	−0.18	0.04	22.41
	[0.08]	[0.64]	[0.30]	[0.64]	[0.30]	
G4	0.11	1.12	0.00	−0.13	0.40	22.82
	[0.73]	[1.25]	[0.01]	[0.44]	[1.10]	
AUD	−0.05	−0.06	−0.01	0.04	−0.04	19.61
	[0.39]	[0.41]	[0.19]	[0.28]	[0.58]	
GBP	0.08	0.23	0.01	−0.23	0.14	22.45
	[0.62]	[0.99]	[0.09]	[1.01]	[1.41]	
JPY	0.36***	0.10***	−0.01	0.04***	0.01	29.19
	[2.64]	[5.09]	[1.37]	[4.81]	[0.94]	
SEK	0.36***	0.16***	0.01	0.02	0.05***	24.08
	[2.87]	[3.34]	[0.75]	[0.85]	[2.75]	

Note: This table reports the average change in 10-year US and foreign inflation swap 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 of 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. 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 G4 is estimated from a panel regression of 4 foreign inflation swap yields (Australia (AUD), UK (GBP), Japan (JPY), and Sweden (SEK)) 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 1994 to December 2021.

advance, such that the auction does not convey information about the supply of long-term bonds. This enables us to identify information about investors' demand over Treasury auctions. To sharpen the identification, we compare Treasury auctions that overlap with foreign local long-term auctions to non-overlapping Treasury auctions. Across G10 currencies, we find that long-term yields drop significantly around non-overlapping Treasury auctions. The opposite holds for overlapping auctions. Moreover, foreign investors' participation declines as the share of foreign debt securities offered at overlapping auction days increases. Collectively, our results are consistent with the notion that Treasury auctions are special because investors learn about the global demand for long-term sovereign debt. Lastly, we provide robustness to alternative explanations based on other macroeconomic announcements, dealer intermediation rents, and time-varying risk premia.

Figure 11: US and G10 Long-Term Rates over Treasury Auction Days until 2023



Note: The left and right panels show cumulative yield changes for the USD and average G10 interest rate, respectively. The black solid line shows the cumulative change in 10-year interest rates. The dotted black line shows cumulative yield changes that were realized over a 3-day window around long-term Treasury auctions. The gray solid line shows cumulative yield changes occurring outside of the 3-day window. The 3-day window is defined in Figure 5. The sample is daily and spans the period from January 1994 to December 2023.

References

Bernanke, B. S. and Reinhart, V. R., 2004. Conducting monetary policy at very low short-term interest rates. *American Economic Review*, 94(2):85–90.

Brusa, F., Savor, P., and Wilson, M., 2019. One central bank to rule them all. *Review of Finance*.

Caballero, R. J. and Farhi, E., 2017. The safety trap. *The Review of Economic Studies*, 85(1):223–274.

Coeurdacier, N., Guibaud, S., and Jin, K., 2015. Credit constraints and growth in a global economy. *American Economic Review*, 105(9):2838–2881.

Driscoll, J. C. and Kraay, A. C., 1998. Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80(4):549–560.

Du, W., Im, J., and Schreger, J., 2018. The U.S. treasury premium. *Journal of International Economics*, 112:167–181.

Duffie, D. and Kan, R., 1996. A yield-factor model of interest rates. *Mathematical Finance*, 6(4):379–406.

Eren, E., Schrimpf, A., and Xia, F. D., 2023. The demand for government debt. *BIS Working Papers No 1105*.

Feunou, B., Fontaine, J.-S., and Krohn, I., 2025. Twin stars: Neutral rates and currency risk premia. *Bank of Canada Working Paper*.

Fleming, M., Nguyen, G., and Rosenberg, J., 2024. How do treasury dealers manage their positions? *Journal of Financial Economics*, 158:103885.

Fleming, M. J., Liu, W., and Nguyen, G., 2016. Intraday pricing and liquidity effects of U.S. treasury auctions. *Federal Reserve Bank of New York Working Paper*.

Fleming, M. J., Mizrach, B., and Nguyen, G., 2018. The microstructure of a u.s. treasury ecn: The brokertec platform. *Journal of Financial Markets*, 40:2–22.

Gomez Cram, R., Kung, H., and Lustig, H. N., 2024. Can U.S. treasury markets add and subtract? *Stanford University Graduate School of Business Research Paper No. 4693279*.

Gourinchas, P.-O., Ray, W., and Vayanos, D., 2022. A preferred-habitat model of term premia, exchange rates, and monetary policy spillovers. *National Bureau of Economic Research Working Paper No. 29875*.

Greenwood, R., Hanson, S. G., and Stein, J. C., 2015. A comparative-advantage approach to government debt maturity. *The Journal of Finance*, 70(4):1683–1722.

Greenwood, R., Hanson, S., Stein, J. C., and Sunderam, A., 2023. A quantity-driven theory of term premia and exchange rates. *The Quarterly Journal of Economics*, 138(4):2327–2389.

He, Z., Krishnamurthy, A., and Milbradt, K., 2019. A model of safe asset determination. *American Economic Review*, 109(4):1230–1262.

Hillenbrand, S., 2020. The secular decline in long-term yields around fomc meetings. *Review of Financial Studies, forthcoming*.

Jansen, K. A., Li, W., and Schmid, L., 2024. Granular treasury demand with arbitrageurs. Working pape, National Bureau of Economic Research No 33243.

Jiang, Z., Krishnamurthy, A., and Lustig, H., 2021. Foreign safe asset demand and the dollar exchange rate. *The Journal of Finance*, 76(3):1049–1089.

Jordan, B. D. and Jordan, S. D., 1997. Special repo rates: An empirical analysis. *The Journal of Finance*, 52(5):2051–2072.

Jotikasthira, C., Le, A., and Lundblad, C., 2015. Why do term structures in different currencies co-move? *Journal of Financial Economics*, 115(1):58–83.

Klemperer, P., 1999. Auction theory: A guide to the literature. *Journal of Economic Surveys*, 13(3): 227–286.

Krishnamurthy, A., 2002. The bond/old-bond spread. *Journal of Financial Economics*, 66(2–3):463–506.

Krishnamurthy, A. and Vissing-Jorgensen, A., 2012. The aggregate demand for treasury debt. *Journal of Political Economy*, 120(2):233–267.

Krohn, I., Uthemann, A., Vala, R., and Yang, J., 2025. Demand-driven risk premia in fx and bond markets. *Bank of Canada Working Paper*.

Lou, D., Yan, H., and Zhang, J., 2013. Anticipated and repeated shocks in liquid markets. *Review of Financial Studies*, 26(8):1891–1912.

Maggiori, M., Neiman, B., and Schreger, J., 2020. International currencies and capital allocation. *Journal of Political Economy*, 128(6):2019–2066.

Milgrom, P., 2004. *Putting Auction Theory to Work*. Cambridge University Press. ISBN 9780511813825.

Miranda-Agrippino, S. and Rey, H., 2020. U.S. monetary policy and the global financial cycle. *The Review of Economic Studies*, 87(6):2754–2776.

Newey, W. K. and West, K. D., 1994. Automatic lag selection in covariance matrix estimation. *The Review of Economic Studies*, 61(4):631–653.

Newey, W. K. and West, K. D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3):703.

Phillot, M., 2025. Us treasury auctions: A high-frequency identification of supply shocks. *American Economic Journal: Macroeconomics*, 17(1):245–273.

Ranaldo, A. and Rossi, E., 2016. Uniform-price auctions for swiss government bonds: Origin and evolution. *University of St.Gallen, School of Finance Research Paper No. 2016/09*.

Ray, W., Droste, M., and Gorodnichenko, Y., 2024. Unbundling quantitative easing: Taking a cue from treasury auctions. *Journal of Political Economy*.

Tabova, A. and Warnock, F., 2021. Foreign investors and us treasuries. *National Bureau of Economic Research Working Paper No. 29313*.

Zou, D., 2024. Bond demand and the yield-exchange rate nexus: Risk premium vs. convenience yield. *Wharton School Working Paper*.

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 & multiple-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 & multiple-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 multiple-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 multiple 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: Secular Decline of Long-Term Yields

		UST auctions		Local auctions		
	All days	Auction	No auction	Auction	No auction	Share in %
USD	−4.18	−5.37**	1.20	−5.37**	1.20	22.14
	[0.84]	[2.39]	[0.27]	[2.39]	[0.27]	
G10	−5.36**	−4.90***	−1.06	−0.44	−5.03**	21.41
	[1.98]	[3.57]	[0.43]	[0.48]	[2.12]	
EUR	−6.17*	−4.17**	−2.01	−2.53	−3.64	26.47
	[1.72]	[2.47]	[0.63]	[1.37]	[1.18]	
AUD	−5.29	−5.29**	0.00	2.99	−8.28	19.11
	[0.94]	[2.21]	[0.00]	[1.27]	[1.61]	
CAD	−5.26	−3.36*	−1.91	1.38	−6.64	9.58
	[1.24]	[1.80]	[0.50]	[1.11]	[1.64]	
CHF	−3.90	−2.48**	−1.42	0.04	−3.94	3.47
	[0.78]	[1.97]	[0.29]	[0.09]	[0.79]	
GBP	−5.00	−4.64**	−0.37	−0.26	−4.74	20.04
	[1.12]	[2.21]	[0.09]	[0.14]	[1.16]	
JPY	−3.26	−2.89***	−0.37	−0.51	−2.76	27.87
	[1.27]	[2.75]	[0.16]	[0.37]	[1.27]	
NOK	−3.63	−4.77***	1.14	0.70	−4.33	5.47
	[0.92]	[2.75]	[0.32]	[0.82]	[1.13]	
NZD	−7.19	−5.95***	−1.24	−3.46*	−3.73	18.43
	[1.57]	[2.70]	[0.31]	[1.69]	[0.91]	
SEK	−6.66**	−3.75***	−2.91	−1.57	−5.09**	21.94
	[2.24]	[2.80]	[1.10]	[1.07]	[1.97]	

Note: This table reports the cumulative decline in 10-year US and foreign yields in percent around long-term debt auctions. *All days* shows the total cumulative decline over the entire sample. *UST auctions* shows cumulative changes 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 1994 to December 2021.

Table B.2: Secular Decline of Long-Term Yields — Overlapping Auctions

	All days	Non-overlapping UST auctions	Overlapping UST and local auctions	Other days	Non-overlapping % of days	Overlapping % of days
USD	−4.18	−2.15**	−3.22	1.20	2.41	19.73
	[0.84]	[2.55]	[1.54]	[0.27]		
G10	−5.36**	−4.30***	−1.18	−1.06	15.03	7.11
	[1.98]	[3.92]	[1.55]	[0.43]		
EUR	−6.17*	−3.30**	−0.87	−2.01	13.46	8.68
	[1.72]	[2.51]	[0.82]	[0.63]		
AUD	−5.29	−4.14**	−1.15	0.00	12.82	9.32
	[0.94]	[2.23]	[0.76]	[0.00]		
CAD	−5.26	−3.28*	−0.08	−1.91	17.64	4.50
	[1.24]	[1.94]	[0.10]	[0.50]		
CHF	−3.90	−3.06***	0.57	−1.42	16.79	5.35
	[0.78]	[2.85]	[0.87]	[0.29]		
GBP	−5.00	−3.93**	−0.71	−0.37	13.59	8.55
	[1.12]	[2.23]	[0.62]	[0.09]		
JPY	−3.26	−2.20***	−0.69	−0.37	12.53	9.61
	[1.27]	[2.61]	[1.11]	[0.16]		
NOK	−3.63	−3.70**	−1.07*	1.14	19.30	2.84
	[0.92]	[2.24]	[1.95]	[0.32]		
NZD	−7.19	−4.43**	−1.52	−1.24	16.07	6.07
	[1.57]	[2.46]	[1.20]	[0.31]		
SEK	−6.66**	−2.44**	−1.31	−2.91	13.08	9.06
	[2.24]	[2.40]	[1.50]	[1.10]		

Note: This table reports the cumulative decline in 10-year US and foreign yields in percent around long-term debt auctions. *All days* shows the total cumulative decline over the entire sample. *Non-overlapping UST auctions* shows cumulative changes during a 3-day window around US Treasury auctions that do not overlap with local auctions. This 3-day window includes for every long-term Treasury auction the day of the event plus two days after. *Overlapping UST and local auctions* is based on the overlap between the 3-day window for US Treasury and foreign long-term auctions. *Other days* is the change in long-term yields outside of the 3-day windows around UST and local auctions. For the euro (EUR) we consider both French and German 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 1994 to December 2021.

Table B.3: Decline of US Long-Term Yields Around Treasury and Local Auctions

		UST auctions			Local auctions		
	All days	Auction	No Auction		Auction	No Auction	Share in %
USD	−0.18	−1.04**	0.07	USD	−1.04**	0.07	22.14
	[0.84]	[2.39]	[0.27]		[2.39]	[0.27]	
G10	−0.23**	−0.95***	−0.06	USD	0.04	−0.52	21.41
	[1.98]	[3.57]	[0.43]		[0.49]	[1.12]	
EUR	−0.27*	−0.81**	−0.11	USD	0.34	−0.36	26.47
	[1.72]	[2.47]	[0.63]		[0.85]	[1.47]	
AUD	−0.23	−1.02**	0.00	USD	0.50	−0.34	19.11
	[0.94]	[2.21]	[0.00]		[1.07]	[1.43]	
CAD	−0.23	−0.65*	−0.10	USD	0.73	−0.27	9.58
	[1.24]	[1.80]	[0.50]		[1.08]	[1.23]	
CHF	−0.18	−0.48**	−0.08	USD	0.08	−0.18	3.47
	[0.78]	[1.97]	[0.29]		[0.09]	[0.87]	
GBP	−0.21	−0.90**	−0.02	USD	0.24	−0.28	20.04
	[1.12]	[2.21]	[0.09]		[0.51]	[1.19]	
JPY	−0.14	−0.56***	−0.02	USD	0.21	−0.32	27.87
	[1.27]	[2.75]	[0.16]		[0.53]	[1.35]	
NOK	−0.16	−0.92***	0.06	USD	0.61	−0.22	5.47
	[0.92]	[2.75]	[0.32]		[0.78]	[1.02]	
NZD	−0.33	−1.15***	−0.07	USD	−0.64	−0.06	18.43
	[1.57]	[2.70]	[0.31]		[1.38]	[0.28]	
SEK	−0.35**	−0.72***	−0.16	USD	−0.20	−0.13	21.94
	[2.24]	[2.80]	[1.10]		[0.56]	[0.66]	

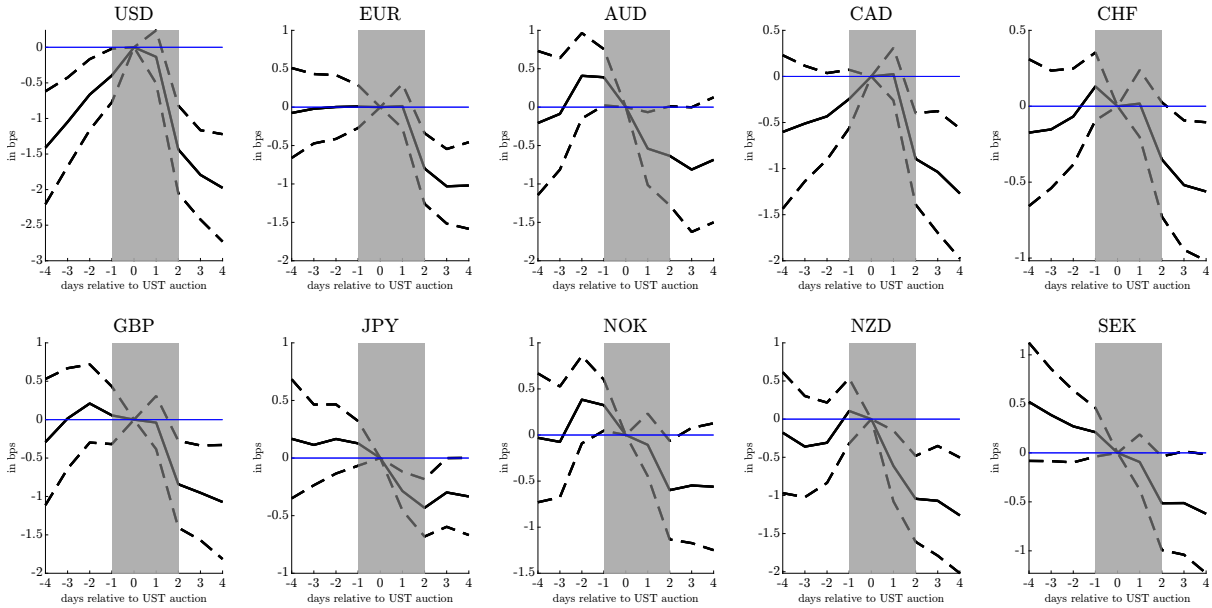
Note: This table reports the average change in 10-year US and foreign yields in basis points around long-term debt auctions. *All days* shows the average 3-day change over the entire sample. *UST auctions* shows the average of cumulative changes during a 3-day window around US Treasury auctions. This 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 1994 to December 2021.

Table B.4: Auction Characteristics and Long-Term Yield Changes

	5–7 years	8–10 years	>11 years	Long-term
High yield	0.08***	0.07	0.03	0.06
	[3.07]	[1.24]	[0.47]	[1.56]
Median yield	0.08***	0.07	0.03	0.06
	[2.92]	[1.17]	[0.35]	[1.55]
High–median yield	0.03	0.04	0.10*	0.04
	[0.59]	[0.73]	[1.91]	[1.07]
Bid-to-cover	−0.05	0.02	−0.09*	−0.05
	[0.96]	[0.37]	[1.79]	[1.18]
Bid-to-cover dealer	−0.04	0.10	0.01	−0.02
	[0.82]	[1.60]	[0.07]	[0.36]
Bid-to-cover direct	−0.01	−0.04	−0.03	−0.01
	[0.21]	[0.60]	[0.49]	[0.22]
Bid-to-cover indirect	−0.03	−0.10*	−0.11*	−0.04
	[0.84]	[1.71]	[1.74]	[1.12]
Share of dealers and brokers	−0.01	0.13***	0.06	0.03
	[0.18]	[3.13]	[1.15]	[0.78]
Share of investment funds	0.03	−0.06	−0.05	−0.01
	[0.91]	[1.13]	[0.94]	[0.14]
Share of foreign and international	0.02	−0.11**	0.02	−0.02
	[0.74]	[2.26]	[0.34]	[0.45]
#Auctions	386	216	188	438
#Currencies	10	10	10	10
Currency FE	yes	yes	yes	yes

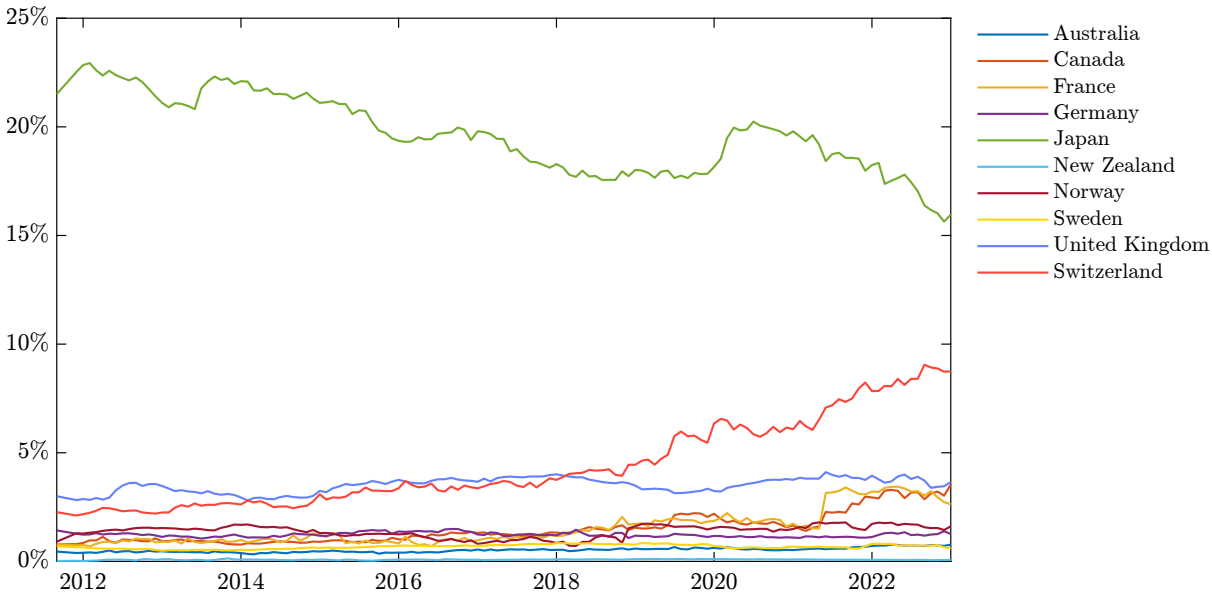
Note: This table reports results from regressing cumulative long-term yield changes around US Treasury auctions for various maturity buckets (shown in the headers) on the information revealed at auctions: $\sum_{t=0}^{2} \Delta y_{t,i} = \mu_i + \Delta X_t + \varepsilon_{t,i}$, where $\sum_{t=0}^{2} \Delta y_{t,i}$ is the cumulative 3-day change in the 10-year long-term yield of country i (on the day of the Treasury auction plus the two days after). μ_i are country fixed effects. Each of the coefficients reported stems from a *univariate* panel regression, where the regressor X_t contains a piece of information revealed at US Treasury auctions given in the column rows (e.g., bid-to-cover ratio). Both dependent and independent variables are measured in units of standard deviations, supporting the interpretation of the regression coefficients (i.e., betas) as correlation coefficients. The test statistics based on heteroskedasticity robust standard errors clustered by event time and countries are reported in brackets. The sample period is in event time and spans from November 1999 to December 2021 due to limited data availability.

Figure B.1: Event Study: US and Foreign Long-Term Rates at Treasury Auctions



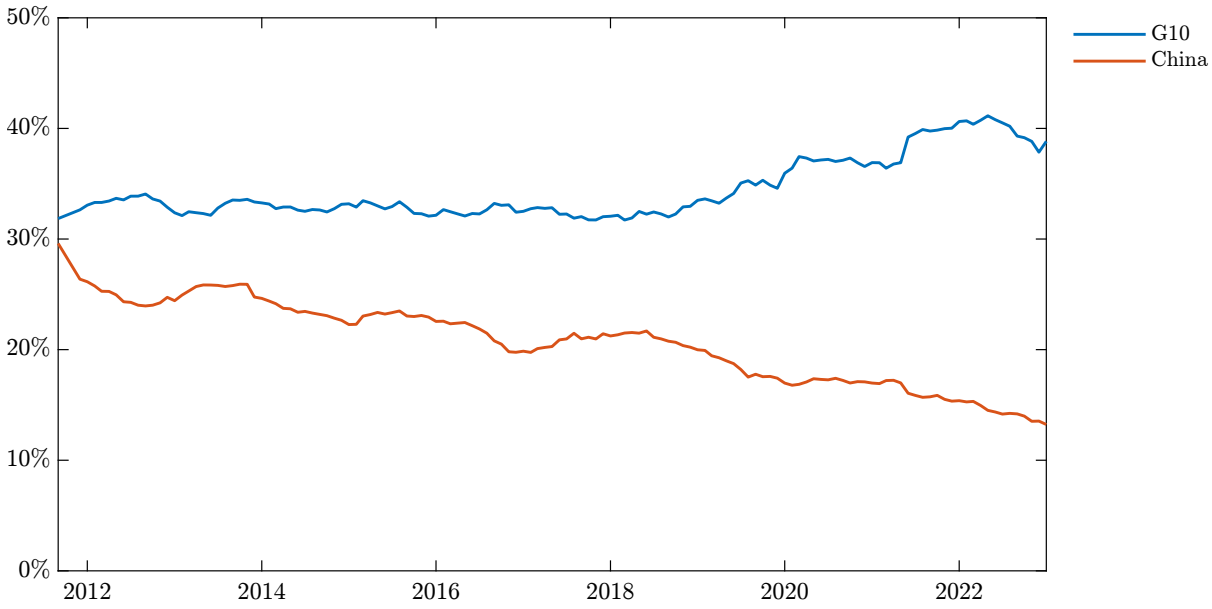
Note: This figure plots the cumulative yield change for 10-year US and foreign government bond yields 4 days before and after a long-term US Treasury auction. Countries are abbreviated by their domestic currency (e.g., GBP stands for the UK). The gray area marks the 3-day event window that includes for 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 December 2021.

Figure B.2: Foreign Treasury Holdings: G10 Countries



Note: This figure plots the share of long-term Treasuries (i.e., with remaining maturities beyond 5 years) held by foreign investors that are based in G10 countries. The underlying data stem from the Treasury International Capital (TIC) System. The sample is daily and spans from January 1994 to December 2023.

Figure B.3: Foreign Treasury Holdings: G10 and China



Note: This figure plots the share of long-term Treasuries (i.e., with remaining maturities beyond 5 years) held by foreign investors that are based in G10 countries and China, respectively. The underlying data stem from the Treasury International Capital (TIC) System. The sample is daily and spans from January 1994 to December 2023.