

Demand-Driven Risk Premia in Foreign Exchange and Bond Markets

Ingomar Krohn
Financial Markets Department
Bank of Canada
IKrohn@bankofcanada.ca

Andreas Uthemann
Financial Markets Department
Bank of Canada
AUthemann@bankofcanada.ca

Rishi Vala
Financial Markets Department
Bank of Canada
RVala@bankofcanada.ca

Jun Yang
Financial Markets Department
Bank of Canada
junyang@bankofcanada.ca

Bank of Canada staff working papers provide a forum for staff to publish work-in-progress research independently from the Bank's Governing Council. This work may support or challenge prevailing policy orthodoxy. Therefore, the views expressed in this note are solely those of the authors and may differ from official Bank of Canada views. No responsibility for them should be attributed to the Bank.

Acknowledgements

We are grateful for comments from Jason Allen, Falk Brauning, Julián Caballero (discussant), Jens Christensen, Jean-Sébastien Fontaine, Amy Huber, Walker Ray (discussant), and Fabricius Somogyi as well as seminar and conference participants at the Reserve Bank of Australia, Bank of Canada, San Francisco Conference on Fixed Income Research and Implications for Monetary Policy, and Annual Conference of the Banco Central do Brasil. The views expressed in this paper are solely those of the authors and do not necessarily reflect the position of the Bank of Canada. All errors are our own.

Abstract

We establish an empirical framework that causally identifies how Treasury demand shocks transmit across foreign exchange and global bond markets, providing direct validation of quantity-driven theories of international risk premia. Our identification exploits predetermined auction supply to isolate demand shocks from high-frequency movements in Treasury futures prices around Treasury auctions. A one-standard-deviation increase in Treasury demand causes the U.S. dollar to depreciate by 2 basis points against G9 currencies while generating 10-basis-point increases in foreign bond prices. Effects persist for two weeks, indicating meaningful economic impacts. The transmission mechanism varies systematically across countries: those with lower U.S. short-rate correlations exhibit stronger currency responses but weaker bond effects, while higher-correlation countries show the opposite pattern. This cross-sectional variation provides empirical support for models of segmented markets where global arbitrageurs link exchange rates and bond risk premia.

Topics: Asset pricing, Exchange rates, International financial markets, Interest rates, Market structure and pricing

JEL codes: F30, F31, G12, G15

Résumé

Nous établissons un cadre empirique qui identifie, en faisant ressortir le lien de causalité, la façon dont les chocs de demande des bons du Trésor se transmettent au sein du marché des changes et des marchés obligataires mondiaux, validant ainsi directement les explications théoriques sur le rôle moteur des politiques quantitatives dans la variation des primes de risque internationales. Notre méthode d'identification utilise l'offre prédéterminée des adjudications pour distinguer les chocs de demande des mouvements à haute fréquence des prix des contrats à terme sur les bons du Trésor survenant autour de l'heure des adjudications de ces mêmes bons. Une hausse d'un écart-type de la demande de bons du Trésor entraîne une dépréciation du dollar américain de 2 points de base par rapport aux monnaies du G9, tout en générant une hausse de 10 points de base des prix des obligations étrangères. Les effets persistent pendant deux semaines, ce qui indique des répercussions économiques importantes. Le mécanisme de transmission varie systématiquement d'un pays à l'autre : ceux qui présentent une corrélation plus faible avec les taux à court terme aux États-Unis affichent des réactions de la monnaie plus forte, mais des effets obligataires plus faibles, tandis que le résultat inverse est visible dans les pays ayant des corrélations plus élevées des taux. Cette variation transversale conforte empiriquement les modèles de marchés segmentés dans lesquels les

arbitragistes à l'échelle internationale établissent un lien entre les taux de change et les primes de risque obligataires.

Sujets : Évaluation des actifs, Taux de change, Marchés financiers internationaux, Taux d'intérêt, Structure du marché et établissement des prix

Codes JEL : F30, F31, G12, G15

I. Introduction

Exchange rates and government bond yields move together because both assets are highly sensitive to interest rate changes. Recent theoretical work by Gourinchas et al. (2025) and Greenwood et al. (2023) formalizes this relationship through frameworks of segmented markets where specialized arbitrageurs absorb demand shocks from preferred-habitat investors across bond and foreign exchange (FX) markets.¹ In these frameworks, shifts in investor demand for government bonds generate predictable spillovers to both exchange rates and global bond yields, with the magnitude depending on the degree of market segmentation and the risk-bearing capacity of intermediaries.

We establish an empirical strategy that causally identifies how U.S. Treasury demand shocks transmit across FX and global bond markets, providing direct validation of quantity-driven theories of international risk premia. Our identification strategy follows Ray et al. (2024) and exploits the predetermined nature of Treasury auction supply. Since supply is fixed and known in advance, price movements following auctions reflect information about Treasury demand rather than fundamentals. We adapt the segmented markets framework of Greenwood et al. (2023) to derive testable hypotheses about how Treasury demand shocks transmit through specialized arbitrageurs with limited risk-bearing capacity. Our cross-sectional evidence provides direct empirical validation of this theoretical mechanism. We document that unexpected increases in Treasury demand, i.e., demand shocks, lead to a systematic depreciation of the U.S. dollar against G9 currencies and a simultaneous increase in foreign bond prices. These spillover effects of Treasury demand are economically significant and persist for approximately two weeks. Crucially, the magnitude of these effects shows a clear cross-country pattern that is predicted by the model: countries whose short-term interest rates are less correlated with that of the United States show stronger currency responses but weaker responses in bond yields.

Establishing that Treasury demand shocks systematically transmit across global financial markets has significant implications extending beyond exchange rate determination to sovereign bond pricing, monetary policy spillovers, and the international role of the dollar. With over \$7 trillion in average daily trading volume in FX markets and the outstanding amounts in G10 sovereign bond

¹Preferred-habitat investors include pension funds, insurance companies, and other mandate-driven institutional investors with regulatory or investment policy constraints that limit their flexibility across asset classes and maturities. Specialized arbitrageurs comprise global investment banks, hedge funds, and other financial intermediaries with the capacity and mandate to take leveraged positions across international bond and currency markets.

markets exceeding \$50 trillion,² the spillover effects we document translate into substantial wealth transfers and risk redistribution across borders. Our results suggest that U.S. quantity-based monetary and fiscal policies—including quantitative easing (QE) and fiscal expansion—systematically affect foreign exchange rates and sovereign borrowing costs through demand channels, independent of traditional monetary transmission mechanisms.

To examine the impact of demand shocks on FX and global bond markets, we use U.S. Treasury auction data alongside granular, high-frequency data on U.S. Treasury futures across various bond maturities and exchange rates for G9 currencies against the U.S. dollar over the period 2004–2024. Together, these currencies account for nearly two-thirds of total daily market turnover, reflecting the majority of global activity in FX markets. By focusing on highly liquid and actively traded currency pairs alongside their corresponding sovereign bond markets, our analysis provides a detailed view of how interconnected global fixed-income markets jointly respond to shifts in demand for U.S. safe assets.

Our findings reveal robust effects across both currency and bond markets. First, we document that a one-standard-deviation increase in Treasury demand—measured by Treasury futures price movements during the 20-minute auction window—causes the U.S. dollar to depreciate by approximately 2 basis points against foreign currencies. Simultaneously, the same demand shock generates positive spillovers to global bond markets, with foreign sovereign bond returns increasing by over 8 basis points. These effects are both economically large and statistically highly significant.

Second, we identify a distinct cross-sectional pattern in how currencies and bonds respond to positive Treasury demand shocks. While the U.S. dollar depreciates against all currencies, the magnitude varies substantially across countries. For example, the U.S. dollar weakens by only 0.56 and 1.67 basis points against the Canadian dollar (CAD) and Australian dollar (AUD), respectively, but shows much larger declines of 2.60 and 4.09 basis points against the Swiss franc (CHF) and the Japanese yen (JPY). In bond markets, this pattern is reversed: Treasury demand impacts range from 4.45 and 8.34 basis points for the JPY and the Norwegian krone (NOK) to as high as 13.96 and 13.03 basis points for the CAD and the British pound (GBP). This cross-sectional variation provides the foundation for testing the theoretical framework.

Third, our most important finding emerges when we link this cross-country variation to short-

²Source: 2022 Triennial Central Bank Survey of foreign exchange and over-the-counter derivatives markets (Bank for International Settlements, 2022) and Bank for International Settlements Debt security statistics for Q4 2024 (Bank for International Settlements, 2025).

rate correlations with the United States. Countries with lower short-rate correlations exhibit strong currency appreciation but minimal bond price responses following Treasury demand increases. Conversely, countries with higher correlations show muted exchange rate effects but substantial bond yield declines. Thus, the extent to which FX markets absorb shocks—and thereby dampen transmission to foreign fixed-income markets—depends crucially on the co-movement of U.S. and foreign short rates. This stark cross-sectional pattern provides strong evidence for a segmented fixed-income arbitrage mechanism and distinguishes our findings from alternative explanations based on safe-haven flows or conventional monetary transmission.

According to the theoretical framework, this pattern emerges because Treasury demand shocks reduce global arbitrageurs' exposure to U.S. interest rate risk, lowering both term premia and exchange rate risk premia. When short-rate correlations are low, interest rate differentials remain volatile, amplifying currency responses while limiting bond market spillovers. When correlations are high, synchronized rate movements dampen exchange rate effects but strengthen bond market transmission through aligned risk exposures. Higher short-rate correlations indicate that monetary policies are more closely aligned with that of the United States, potentially reflecting closer economic integration and similar exposure to shocks.

The economic effects we document are both substantial and persistent. Using local projections, we show that U.S. dollar depreciation peaks at nearly 20 basis points around 10 days after an auction, gradually reverting to insignificance after 14 days. In foreign bond markets, yields increase by more than 10 basis points initially, remain elevated for about two weeks, and taper off to insignificance after approximately 28 days. The persistence of effects over multiple weeks rules out transitory market microstructure noise and confirms that Treasury demand shocks generate lasting changes in global risk premia.

Our identification strategy is robust to alternative measurement approaches and confirms that auction days provide genuine demand shock identification. First, we demonstrate that auction days differ fundamentally from normal trading days through a block-bootstrap exercise on non-auction days. Across 10,000 randomly drawn samples, we find average coefficients of -0.25 for FX and 2.34 for bond markets—both statistically insignificant and distinct from our auction-day estimates. This placebo test confirms that the Treasury-FX-bond relationship we document is unique to auction events when genuine demand information is revealed, rather than reflecting typical correlation patterns in high-frequency price movements. Second, we validate our Treasury

futures-based demand measure using unexpected changes in bid-to-cover ratios and find similar magnitudes of dollar depreciation and foreign bond appreciation. This confirms our results do not depend on the specific shock construction methodology. Third, granular regressions show that Treasury demand shocks transmit primarily through indirect bidder participation and allocations to investment funds and foreign investors. These results demonstrate how institutional demand and cross-border flows link Treasury auctions to movements in exchange rates and global bond yields, consistent with a preferred-habitat channel of demand transmission.

Finally, following Hu et al. (2025), we demonstrate that our results are robust across different market regimes using high-frequency stock-bond correlation measures. Currency effects are smaller when Treasuries function as safe rather than risky assets, consistent with convenience-yield theories of dollar strength during stress periods (Jiang et al., 2021). Following Jarociński and Karadi (2020) and Cieslak and Schrimpf (2019), we employ sign restrictions to distinguish between convenience-yield shocks and preferred-habitat demand shocks. Convenience-yield shocks dominate during crisis episodes, but preferred-habitat demand shocks have become more important in recent years. While both mechanisms operate simultaneously, the analysis reveals the growing importance of preferred-habitat investors in Treasury markets.

Related Literature. Our paper provides the first empirical validation of quantity-driven theories of international risk premia developed by Greenwood et al. (2023) and Gourinchas et al. (2025). While these theoretical frameworks predict that Treasury demand shocks should transmit internationally through segmented arbitrageur markets, they do not provide empirical identification of the mechanism, a gap our paper addresses. We advance beyond their correlational evidence by exploiting high-frequency price changes around Treasury auctions to causally identify demand shocks, following the methodology of Phillot (2025) and Ray et al. (2024). Most importantly, we provide the first empirical evidence that the international transmission of U.S. Treasury demand shocks varies systematically with short-rate correlations: countries with lower U.S. short-rate correlations experience stronger currency responses but weaker bond yield responses, while the opposite holds for high-correlation countries. This cross-sectional pattern, absent from previous empirical analyses, provides direct evidence for the risk-sharing mechanism underlying theories of segmented markets. Our approach extends the demand-based framework to international markets, connecting to recent work on currency demand by Jiang et al. (2025) and broader asset demand approaches by Koijen and Yogo (2019).

We advance the literature on safe government debt demand (Eren et al., 2023; Jansen et al., 2025; Antolin-Diaz, 2025; Chaudhary et al., 2025) by providing the first clean identification of international spillovers from U.S. Treasury demand shocks to global financial markets. Our high-frequency identification around Treasury auctions reveals a striking empirical fact: the U.S. dollar systematically depreciates following positive Treasury demand shocks. This finding challenges the conventional safe-haven narrative, where increased demand for U.S. safe assets typically strengthens the dollar (Jiang et al., 2021). Instead, we document that Treasury demand shocks operate through portfolio balance channels, causing simultaneous dollar depreciation and foreign bond yield declines. We establish that the magnitude of these international spillovers depends critically on countries’ short-rate correlations with that of the United States. Unlike recent studies by Somogyi et al. (2025) and Zou (2024), our auction-based identification isolates pure demand effects from other channels, such as monetary policy, and focuses on the joint reaction of exchange rates and global bond yields, enabling clean measurement of international transmission channels.

Our findings provide crucial insights for understanding the international transmission of quantity-based U.S. policies, extending beyond the existing QE literature (Dedola et al., 2021; Bauer and Neely, 2014; Ferrari et al., 2021). We establish that portfolio balance effects represent an important transmission channel for any U.S. policy that alters Treasury supply, including QE, balance sheet normalization, and expansive fiscal policy. Our high-frequency identification demonstrates that these quantity-driven effects operate independently of traditional monetary policy signaling channels, resolving a key identification challenge in existing QE studies. Critically, we show that the strength of international transmission depends on monetary policy coordination between countries, proxied by short-rate correlations. This finding has direct implications for policy coordination: QE in the United States will have stronger exchange rate effects on countries with independent monetary policies (low correlations) but stronger bond yield effects on countries with synchronized policies (high correlations). These insights extend to fiscal policy, suggesting that U.S. debt expansion systematically affects global financial conditions through portfolio rebalancing, with the transmission channel varying predictably across countries based on their monetary policy independence. Our results thus inform debates about the international spillovers of both unconventional monetary policy and fiscal expansion, providing policymakers with a framework for anticipating cross-border effects of quantity-based interventions.

This paper proceeds as follows. Section II presents the theoretical framework and derives

testable hypothesis for the empirical analysis. Section III describes the data and the methodology that we use to identify demand shocks around U.S. Treasury auctions. Section IV documents the main empirical findings. Section V provides further analysis and a discussion of the economic mechanism. Section VI concludes the discussion.

II. Theoretical Framework

We adopt the framework of Greenwood et al. (2023) to develop testable hypotheses for our empirical analysis. The model explains how U.S. Treasury demand shocks propagate through global bond and currency markets. We provide a short review of the model focusing on the simplest version—a one-factor specification where short-term interest rate risk is the only source of risk. This basic framework captures the core economic channel driving our empirical results: specialized arbitrageurs absorb demand imbalances, creating co-movement in international risk premia.

A. Economic Setting

The model features two countries with imperfectly integrated bond and FX markets. Global arbitrageurs intermediate between preferred-habitat investors with inelastic asset demands and absorb supply and demand imbalances across markets. These arbitrageurs have limited risk-bearing capacity, creating a portfolio balance channel that links risk premia across markets—when arbitrageurs are forced to adjust their portfolio positions due to demand shocks, their changing risk exposures require compensation through higher expected returns, transmitting price effects across correlated assets.

A.1. Markets and Assets

Three markets operate simultaneously: U.S. government bonds, foreign government bonds, and FX. Arbitrageurs engage in three trades. First, the U.S. term structure trade borrows at the domestic short-term interest rate (short rate) i_t and invests in long-term bonds with (log) yield-to-maturity y_t . Second, the foreign term structure trade borrows at foreign short rate i_t^* and invests in foreign long-term bonds that yield y_t^* . Third, the FX carry trade borrows dollars, converts at exchange rate s_t , and invests at the foreign short rate.³

³Our notation differs from Greenwood et al. (2023) to maintain consistency with the empirical sections. We use s_t for the exchange rate (defined as dollars per foreign currency), z_t for net supply, and x_t for arbitrageur demand.

The corresponding (linearized) excess log returns are:

$$\begin{aligned} rx_{t+1}^y &= (y_t - i_t) + \frac{\delta}{1 - \delta}(y_{t+1} - y_t) \\ rx_{t+1}^{y^*} &= (y_t^* - i_t^*) + \frac{\delta}{1 - \delta}(y_{t+1}^* - y_t^*) \\ rx_{t+1}^s &= (i_t^* - i_t) + (s_{t+1} - s_t), \end{aligned}$$

where $\delta \in (0, 1)$ captures bond duration⁴ and s_t denotes the log exchange rate (dollar per foreign currency).

The domestic and foreign short rates are exogenous auto-regressive processes with constant volatility and correlated shocks,

$$\begin{aligned} i_{t+1} &= \bar{i} + \phi(i_t - \bar{i}) + \varepsilon_{t+1}, \\ i_{t+1}^* &= \bar{i} + \phi(i_t^* - \bar{i}) + \varepsilon_{t+1}^*, \end{aligned}$$

where $Var_t(\varepsilon_{t+1}) = Var_t(\varepsilon_{t+1}^*) = \sigma$ and short-rate correlation $Corr(\varepsilon_{t+1}, \varepsilon_{t+1}^*) = \rho \geq 0$.

A.2. Arbitrageur Optimization

Global arbitrageurs have mean-variance preferences over next-period wealth with risk tolerance τ .

Their portfolio positions $\mathbf{x}_t = (x_t^y, x_t^{y^*}, x_t^s)'$ solve:

$$\max_{\mathbf{x}_t} \mathbb{E}_t[\mathbf{x}_t' \mathbf{r} \mathbf{x}_{t+1}] - \frac{1}{2\tau} \mathbf{x}_t' Var_t[\mathbf{r} \mathbf{x}_{t+1}] \mathbf{x}_t.$$

Expected excess returns compensate for bearing short-rate risk:

$$\mathbb{E}_t[\mathbf{r} \mathbf{x}_{t+1}] = \frac{1}{\tau} Var_t[\mathbf{r} \mathbf{x}_{t+1}] \mathbf{x}_t.$$

B. Equilibrium

B.1. Supply, Preferred-Habitat Demand and Market Clearing

Each market features exogenous demand from preferred-habitat investors and exogenous asset supply. Preferred-habitat investors have price-inelastic demand for specific assets based on their in-

⁴The duration of domestic and foreign long bonds is $1/(1 - \delta) > 1$.

vestment mandates or regulatory requirements. The difference between asset supply and preferred-habitat demand defines net supply that arbitrageurs must absorb.

Let z_t^y , $z_t^{y^*}$, and z_t^s denote the exogenous net supplies of U.S. bonds, foreign bonds, and FX positions, respectively. These net supplies represent the market value of positions that arbitrageurs hold in equilibrium. Market clearing requires that arbitrageurs' demand equal net supply:

$$\mathbf{x}_t = \mathbf{z}_t,$$

where $\mathbf{x}_t = (x_t^y, x_t^{y^*}, x_t^s)'$ denotes arbitrageurs' portfolio demands and $\mathbf{z}_t = (z_t^y, z_t^{y^*}, z_t^s)'$ denotes net supplies.

When preferred-habitat demand for U.S. Treasuries increases unexpectedly, net supply z_t^y decreases. Arbitrageurs reduce their U.S. bond holdings, requiring equilibrium price adjustments across all three markets to maintain market clearing.

B.2. Equilibrium Risk Premia

Given the market clearing condition $\mathbf{x}_t = \mathbf{z}_t$, we substitute arbitrageurs' equilibrium holdings into their first-order conditions. All three trades share exposure to correlated interest rate risks. Short rates correlate with coefficient ρ , creating spillovers when U.S. bond demand shifts. Following Greenwood et al. (2023), equilibrium expected returns are:

$$\begin{aligned}\mathbb{E}_t[rx_{t+1}^y] &= \frac{1}{\tau}[V_y z_t^y + C_{y,y^*} z_t^{y^*} + C_{y,s} z_t^s] \\ \mathbb{E}_t[rx_{t+1}^{y^*}] &= \frac{1}{\tau}[C_{y,y^*} z_t^y + V_{y^*} z_t^{y^*} - C_{y,s} z_t^s] \\ \mathbb{E}_t[rx_{t+1}^s] &= \frac{1}{\tau}[C_{y,s}(z_t^y - z_t^{y^*}) + V_s z_t^s],\end{aligned}$$

where V_y , V_{y^*} , and V_s denote the variances, while C_{y,y^*} and $C_{y,s}$ denote the covariances of excess returns.⁵

⁵Explicit expressions for these variances and covariances in terms of model parameters are provided in Greenwood et al. (2023), equations (24a) and (24b) on page 20.

The key comparative statics show how risk premia respond to U.S. bond holdings:

$$\begin{aligned}\frac{\partial \mathbb{E}_t[r x_{t+1}^y]}{\partial z_t^y} &= \frac{V_y}{\tau} > 0 \\ \frac{\partial \mathbb{E}_t[r x_{t+1}^{y*}]}{\partial z_t^y} &= \frac{C_{y,y^*}}{\tau} > 0 \\ \frac{\partial \mathbb{E}_t[r x_{t+1}^q]}{\partial z_t^y} &= \frac{C_{y,s}}{\tau} > 0.\end{aligned}$$

Increased U.S. bond holdings raise arbitrageurs' exposure to U.S. short-rate risk. Increases in U.S. short rates generate losses on bonds through capital losses and on FX positions through unfavorable interest differentials. Arbitrageurs require higher expected returns across all positions to bear this additional risk. The degree to which risk premia on foreign bonds and currency adjust depends on the covariances of the excess return of foreign term structure and carry trades with that of the domestic term structure trade.

B.3. The Role of Short-Rate Correlation

The strength of these cross-market spillovers depends on short-rate correlation ρ . This correlation determines risk alignment across the three trades and shapes international transmission of U.S. bond demand shocks.

Each trade has distinct interest rate exposures. U.S. term structure trades lose when U.S. rates rise. Foreign term structure trades lose when foreign rates rise. FX carry trades have mixed exposure—they benefit from foreign rate increases but suffer from U.S. rate increases.

High correlation between U.S. and foreign rates creates two effects. First, it makes bond positions more similar. When U.S. rates rise, foreign rates follow, causing losses on both U.S. and foreign bonds. This strengthens the covariance C_{y,y^*} between bond returns: $\partial C_{y,y^*} / \partial \rho > 0$. Foreign bonds become poor hedges for U.S. bond risk. Following stronger U.S. bond demand, arbitrageurs have less U.S. bond exposure. This reduces the risk compensation they demand in correlated bond markets. This is why foreign bond yields fall more strongly when correlation is high.

Second, high correlation reduces FX carry trade risk. Rising U.S. rates increase funding costs. But correlated foreign rate increases raise carry returns, providing offset. This offsetting channel reduces the carry trade's interest rate exposure. The covariance with U.S. bonds weakens:

$\partial C_{y,s}/\partial \rho < 0$. Treasury demand shocks generate smaller FX responses when correlations are high.

This mechanism creates heterogeneous cross-country effects. For example, Japan's rates correlate weakly with U.S. rates. The model predicts that Treasury demand shocks affect mainly the yen exchange rate. Canada's rates move closely with U.S. rates. The same shock is predicted to transmit more strongly through Canadian bond yields. The ratio of bond to FX impact increases with correlation.

C. Mapping Theory to Treasury Auctions

Treasury auctions provide high-frequency variation in arbitrageurs' required U.S. bond holdings. Strong auction demand reduces intermediary inventory (z_t^y falls), while weak demand increases it (z_t^y rises).

As discussed in Section III A below, we measure demand shocks for U.S. Treasuries through Treasury futures price movements in the 20-minute window around auction results following Ray et al. (2024). This price-based approach isolates surprise demand components while avoiding the challenges of comparing quantities across maturities or mapping bidder types to model agents.⁶

$$D_t \equiv -\frac{\partial \mathbb{E}_t[rx_{t+1}^y]}{\partial z_t^y} \cdot \Delta z_t^y = -\left(\frac{V_y}{\tau}\right) \Delta z_t^y. \quad (1)$$

Similarly, the model-implied responses of the foreign bond yield and the exchange rate to a change in U.S. bond demand are:

$$\Delta y_t^* = \frac{\partial \mathbb{E}_t[rx_{t+1}^{y*}]}{\partial z_t^y} \cdot \Delta z_t^y = -\left(\frac{C_{y,y*}}{V_y}\right) D_t, \quad (2)$$

$$\Delta s_t = \frac{\partial \mathbb{E}_t[rx_{t+1}^q]}{\partial z_t^y} \cdot \Delta z_t^y = \left(\frac{C_{y,q}}{V_y}\right) D_t. \quad (3)$$

D. Testable Predictions

The model generates three hypotheses about Treasury demand increases ($D_t > 0$):

Hypothesis 1 (Exchange Rates). *An unexpected increase in Treasury demand causes dollar depreciation. The magnitude equals $\Delta s_t = \left(\frac{C_{y,s}}{V_y}\right) D_t > 0$.*

⁶See III A for a complete discussion of why price-based measurement dominates quantity-based alternatives for testing the model's predictions.

Hypothesis 2 (Foreign Bond Yields). *An unexpected increase in Treasury demand reduces foreign government bond yields. The magnitude equals $\Delta y_t^* = -\left(\frac{C_{y,y^*}}{V_y}\right) D_t < 0$.*

Hypothesis 3 (Cross-Country Heterogeneity). *Effects vary with U.S.-foreign short-rate correlation ρ :*

(a) *Exchange rate responses to Treasury demand shocks decrease with correlation: $\frac{\partial}{\partial \rho} \left(\frac{\Delta s_t}{D_t} \right) < 0$.*

(b) *Bond yield responses to Treasury demand shocks increase with correlation: $\frac{\partial}{\partial \rho} \left(\frac{\Delta y_t^*}{D_t} \right) > 0$.*

Countries with higher short-rate correlation experience stronger bond spillovers but weaker currency responses due to aligned interest rate risk.

III. Methodology and Data

This section introduces the methodology used to measure demand shocks in the U.S. Treasury market, and describes the data that we obtain from various data sources.

A. Methodology

Our study exploits high-frequency variation in prices in Treasury futures around Treasury auctions to measure shifts in investor demand for U.S. safe assets. While institutional details of these auctions are well-documented in Ray et al. (2024), for the purpose of this paper, the following characteristics about Treasury auctions are worth highlighting. First, Treasury auctions are frequent and pre-announced events at which the U.S. Treasury offers newly issued debt to the public. Over our sample period, which spans 2004 to 2024, we observe 1395 auctions, resulting in more than one event per week, on average.⁷ Second, the maturity of offered contracts varies across auction dates. Contracts include 2-, 3-, 5-, and 7-year notes and 10- and 30-year bonds. The frequency of debt issuance varies over time and across contracts. During our sample, contracts with maturities of 2 years are most frequently issued (33%), followed by 7- to 10-year notes and bonds (31%), 30-year bonds (18%) and 3- to 5-year notes (18%). Third, a variety of market participants with their own objectives actively engage in auctions by submitting competitive and noncompetitive bids. The difference between these types of bids is relevant for our identification strategy. Noncompetitive

⁷The start of the sample period is determined by the availability of high-frequency Treasury futures data on GLOBEX. Following Hu et al. (2025), we start the analysis in 2004.

bidders are limited to \$5 million per bidder and subject to the terms settled at the auction. Competitive bids, in contrast, are associated with specific amounts that market participants aim to purchase. The submission cut-off times for the different types of bids vary, and competitive bids can usually be submitted until the closing time. Lastly, the vast majority of auctions (96% of all auctions in our sample) take place at 13:00, while the remaining number of auctions take place at 11:30 or 11:00. Figure 1 puts the timing of auctions into perspective relative to other intraday events in financial markets, and which have been the focus of previous work.

Daily events during the U.S. trading hours include the opening of local stock markets (e.g., the New York Stock Exchange opening at 9:30 Eastern Time, or ET), expiry time of FX options (10:00), and the publication of the WM/Reuters London fixing rate (11:00). The afternoon is comparably quieter with the closing of stock markets (16:00) and the cut-off point in time of interest rate differentials (17:00). In addition, on pre-announced dates major U.S. macroeconomic releases are published at 8:30am, and Federal Open Market Committee (FOMC) interest rate decisions are announced at 14:00. I.e., as indicated by Figure 1, these major events are generally spaced out over the trading day and do not overlap with the time of auctions.

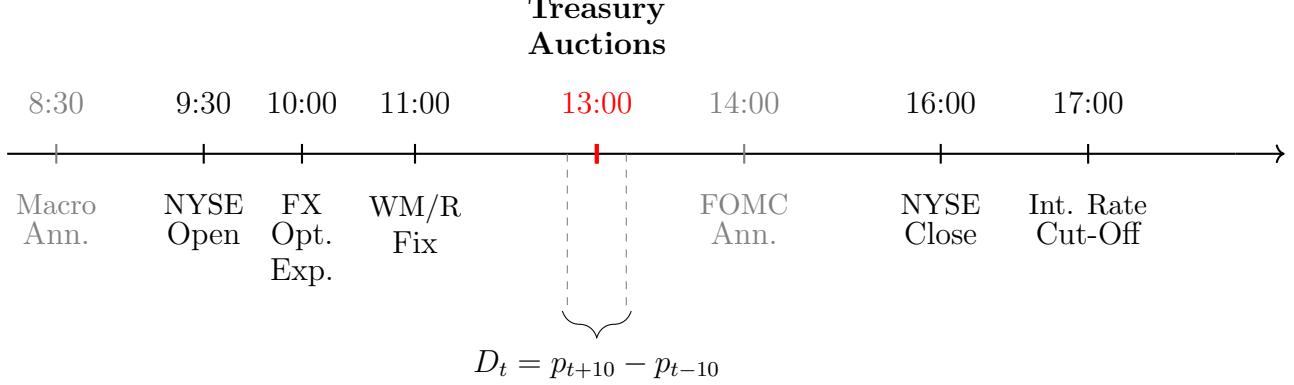
This observation is crucial, as our construction of high-frequency demand shocks rests on the assumption that price movements around Treasury auctions primarily reflect new information about demand for U.S. safe assets. The supply of these assets is predetermined: the Treasury announces the auction size well in advance, effectively fixing the quantity on offer. Consequently, any price changes between the announcement of the auction and its close can be interpreted as shifts in demand for safe assets. In this sense, our approach parallels the identification of monetary policy shocks in the high-frequency literature, e.g., Gürkaynak et al. (2005), where asset price reactions within a narrow window around policy announcements are used to capture unanticipated changes in policy. Similarly, high-frequency price variation in the tight window around Treasury auctions provides a clean measure of unexpected shifts in demand for the securities being offered. Thus, following Ray et al. (2024) the baseline shock specification is defined as:

$$D_t = p_{t+10} - p_{t-10}, \quad (4)$$

where D_t refers to the (log) change of prices in Treasury futures with maturities of 10 years from 10 minutes before the time of the auction (i.e., say at 13:00) until 10 minutes after the auction.

Figure 1. FX Intraday Events and Treasury Auctions

The figure illustrates the timeline of major intraday events in the foreign exchange market taking place during the main U.S. trading hours. Major macroeconomic releases and the FOMC announcement are marked in grey as they commonly take place on regular pre-announced dates, while the other time stamps refer to daily events. WM/R Fix is the WM/Reuters London fixing rate for FX benchmarks. FX Opt. Exp. is the common expiry time for FX options. All times are in Eastern Time.



This price-based approach offers three key advantages over quantity-based alternatives using bid-to-cover ratios. First, bid-to-cover ratios cannot cleanly isolate duration-adjusted demand across the 2-to-30-year maturity spectrum without imposing strong assumptions about risk perception. Second, regulatory bidder classifications (primary dealers, indirect bidders, direct bidders) do not map cleanly onto the relevant economic distinction between specialized arbitrageurs and preferred-habitat investors.⁸ Most importantly, our approach captures surprises by construction—futures price movements in narrow windows isolate unexpected demand shifts under mild market efficiency assumptions, while observable bid-to-cover ratios require auxiliary models to separate anticipated from surprise components.⁹

We match the response in FX markets to the high-frequency shock in Treasuries using the exact same short window around auctions; i.e., FX (log) returns are defined as $\Delta s_{i,t} = s_{i,t+10} - s_{i,t-10}$, where $s_{i,t+10}$ and $s_{i,t-10}$ denote (log) exchange rates 10 minutes before and 10 minutes after the auction, respectively. We define currencies as U.S. dollar per foreign currencies, i.e., an increase of the exchange rate $s_{i,t}$ (a positive return) reflects an appreciation of the foreign currency i vis-à-vis the U.S. dollar.

⁸Primary dealers have market-making obligations that mix arbitrageur and habitat characteristics. Indirect bidders include both foreign central banks (habitat-like) and hedge funds (arbitrageur-like).

⁹As a robustness exercise, we extract surprises in bid-to-cover ratios and show that our empirical results continue to hold when using this alternative, quantity-based measure of demand shocks.

When focusing on dynamics in global bond markets, we rely on daily data. Following Hanson and Stein (2015) and Albagli et al. (2024), who use bond returns based on daily low-frequency data as the dependent variable around monetary policy announcements, we allow for additional time post-auction to account for potential delays in market absorption of new information.¹⁰

B. Data

We construct a comprehensive database on Treasury auctions, relying on information from TreasuryDirect (<https://www.treasurydirect.gov/auctions/>). The website provides a detailed historical record of Treasury auctions dating back to 1975. We collect date and time stamps for each individual auction and track additional details about the auctions and the securities issued on each date. Specifically, we gather data on the amounts offered, tendered, and accepted; the maturity of the issued debt instruments; and their CUSIP codes.

Since 2003, the website has also included information on the bid-to-cover ratio and the types of bidders. This ratio represents the total bids received by the Treasury relative to the total bids accepted, with higher values indicating stronger demand. Additionally, we collect information on bidder types using two distinct datasets. First, we document the breakdown of the bid-to-cover ratio by bidder type, distinguishing among direct bidders, indirect bidders, and primary dealers. Second, we track the fraction of accepted bids by bidder type (though this data is published with a significant delay), categorizing them as depository institutions, individuals, dealers, pensions, investment funds, foreign institutions, and others.

Further, we use high-frequency quoted prices of Treasury futures with maturities of 2, 5, 10, and 30 years to measure the impact of investor demand changes around auction dates. The data are obtained from the London Stock Exchange Group (LSEG) Tickhistory and sourced at the tick-level frequency.¹¹

Next, we source data on intraday FX rates from LSEG spanning more than two decades of high-frequency data from January 2004 to December 2024. We focus on the G9 currencies, i.e., the AUD, the CAD, the CHF, the euro (EUR), the GBP, the JPY, the New Zealand dollar (NZD), the NOK, and the Swedish krona (SEK), all vis-à-vis the U.S. dollar. The cross-section represents historically the most liquid and heavily-traded currencies of advanced economies and, in aggregate,

¹⁰Our results are not sensitive to these modeling choices. We perform a range of robustness tests using alternative measures for both markets, demonstrating the consistency and validity of our findings across various specifications.

¹¹The Reuters Instrument Codes of Treasury futures contracts are TU (2-year T-note futures), FV (5-year T-note futures), TY (10-year T-note futures) and US (30-year U.S. Treasury bond futures).

covers close to two-thirds of the average total daily turnover in FX markets (Bank for International Settlements, 2022).

We use tick-by-tick quote data from LSEG TickHistory, which records best bid and ask quotes streamed by dealer banks to clients. Although indicative, prior work shows that mid-price dynamics closely track firm interdealer quotes. From this dataset, we construct mid prices by linearly interpolating between the best bid and ask, sample the latest quote in each 5-minute interval, and fill missing intervals with the most recent available price.

Following previous studies (see, e.g., Andersen et al., 2003), we exclude quotes that are submitted on days associated with low trading activity. For example, we remove all quotes on weekends between Friday 17:00 and Sunday 17:05 ET. Similarly, we drop quotes around fixed holidays, i.e., Christmas (24 to 26 December), New Year (31 December to 2 January), and 4 July, and around flexible holidays, such as Good Friday, Easter Monday, Memorial Day, Labor Day, and Thanksgiving (including the day after).

Lastly, we obtain daily data on zero-coupon bonds from Bloomberg for the G9 foreign bond markets and the United States.¹² We collect fixed-income instruments with maturities ranging from 3 months to 30 years, providing us with detailed information on the yield curve for each of the ten major economies.

C. Summary Statistics

Table I reports summary statistics on Treasury auctions, demand shocks, and the corresponding high-frequency responses in FX and global bond markets. Panel A shows that the amount offered at auctions ranges from 0.03 to 70 billion U.S. dollars, with an average of 29.79 billion. The amount offered is systematically smaller than the amount demanded by participants. On average, the amount tendered is 80.93 billion U.S. dollars, ranging from 0.07 to 179.96 billion. This excess demand for safe assets is also reflected in the bid-to-cover ratio, which averages 2.62. This implies that participants typically bid more than twice the amount offered. Demand consistently exceeds supply across the distribution of auctions, as indicated by the percentiles: the minimum bid-to-cover ratio is 1.22, while the maximum reaches 4.07. Breaking the bid-to-cover ratio down by bidder type, the largest contribution comes from primary dealers (1.75 on average), followed by indirect bidders (0.63) and direct bidders (0.24).

¹²For our main analysis, we use German bonds (Bunds) for the Eurozone and use the symbol EUR to refer to them.

Panel B summarizes our main variable capturing investor demand for Treasuries, measured from high-frequency price changes in Treasury futures. Demand shocks are reported by auction tenor, aligning the maturity of the futures contract with that of the issued Treasury security. For instance, the average shock ranges from -0.54 basis points for 2-year futures and 0.32 basis points for 5-year futures, up to 1.11 and 3.11 basis points for 10-year and 30-year futures, respectively.

Panel C presents the response of FX markets around Treasury auctions. On average, the dollar portfolio (DOL)—the unconditional average of foreign-currency-denominated returns—is 0.21 basis points. This indicates that price changes are generally close to zero, with a slight appreciation of foreign currencies against the U.S. dollar. Across currencies, however, reactions differ: the AUD and NZD appreciate the most on average (0.50 and 0.48 basis points, respectively), while the CAD and JPY show slight depreciations (-0.08 and -0.03 , respectively). Finally, the relatively large standard deviation and distributional characteristics suggest that responses vary substantially across auctions.

Lastly, Panel D shows the reaction of bond prices in global fixed-income markets, where DOL again refers to the unconditional average across foreign economies. We focus on returns to 10-year benchmark bonds. On average, the response amounts to 1.08 basis points, implying an increase in bond prices and a corresponding decline in yields. The cross-sectional pattern, however, is heterogeneous: responses reach as high as 4.29 basis points for AUD, while they are slightly negative for CAD, CHF, and EUR (German Bunds). As in the case of FX market reactions, the standard deviations are large (DOL: 49.15), highlighting that the magnitude and even the direction of responses vary substantially across auction dates. This heterogeneity already indicates that different sovereign bond markets exhibit varying sensitivities to U.S. Treasury auctions and to shifts in global safe-asset demand.

Complementing the previous table, Figure 2 provides further insights into the time series of demand dynamics and responses in FX and bond markets. Panel A shows demand shocks, Panel B shows the time series dynamics of the raw bid-to-cover ratio by bidder type, Panel C shows the response of the dollar portfolio within a 20-minute window around the auctions, and Panel D shows the average daily response in global bond markets. As illustrated by the figure, returns in Panels A, C, and D can be quite sizable, as suggested by the y-axis, ranging between -200 and 220 basis points. Unsurprisingly, movements in Treasury futures, currencies, and bond markets were large during the period of the great financial crisis, but we observe additional outliers in

Table I. Summary Statistics

This table reports summary statistics about Treasury auctions (Panel A); for demand measures based on (log) changes in U.S. Treasury futures prices in a 20-minute window around auctions (Panel B); for 20-minute foreign exchange (log) returns around auctions (Panel C); and for 10-year bond returns over two-day windows around auction dates (Panel D). In Panel B, tenors of Treasury futures correspond to the tenors of the auctions. Returns are expressed in basis points. In Panel C, a positive return means the foreign currency appreciated vis-à-vis the USD. The sample period is 2004–2024.

Panel A: Treasury Auctions								
	Mean	Std	Min	P25	P50	P75	Max	N
Offering Amount (billions)	29.79	13.13	0.03	21.00	29.00	36.00	70.00	1395
Total Tendered (billions)	80.93	36.40	0.07	53.25	78.06	105.48	197.96	1395
Total Accepted (billions)	32.40	14.96	0.03	21.24	30.45	39.23	88.77	1395
Term (years)	9.44	9.24	1.99	3.00	5.01	9.93	30.02	1395
High Yield	2.46	1.37	0.12	1.37	2.34	3.62	5.25	1395
Bid-To-Cover Ratio	2.62	0.37	1.22	2.39	2.54	2.76	4.07	1395
Direct Bidders	0.24	0.14	0.00	0.15	0.24	0.33	0.84	1395
Indirect Bidders	0.63	0.19	0.00	0.50	0.66	0.77	1.15	1395
Primary Dealers	1.75	0.37	1.02	1.45	1.66	1.95	3.43	1395
Panel B: Demand Measures – Treasury Futures								
2-year	0.32	9.13	-19.50	-0.74	0.00	0.71	191.02	460
5-year	-0.54	6.42	-38.16	-3.29	-0.34	2.67	23.76	252
10-year	1.11	11.07	-59.93	-4.73	1.18	6.14	55.26	426
30-year	3.11	23.87	-114.51	-7.98	4.95	17.45	64.85	257

all markets later during our sample. Supplementing these dynamics, Panel B presents the time series of bid-to-cover ratios by bidder type. The figure confirms that primary dealers account for the bulk of auction coverage, while the shares of indirect and direct bidders are notably smaller. Over time, however, a shift emerges: the relative contribution of indirect bidders has gradually increased, whereas that of direct bidders has declined. We interpret this evolution to be consistent with the broader trend of growing participation by foreign official institutions and investment funds, which are both captured in the indirect category.

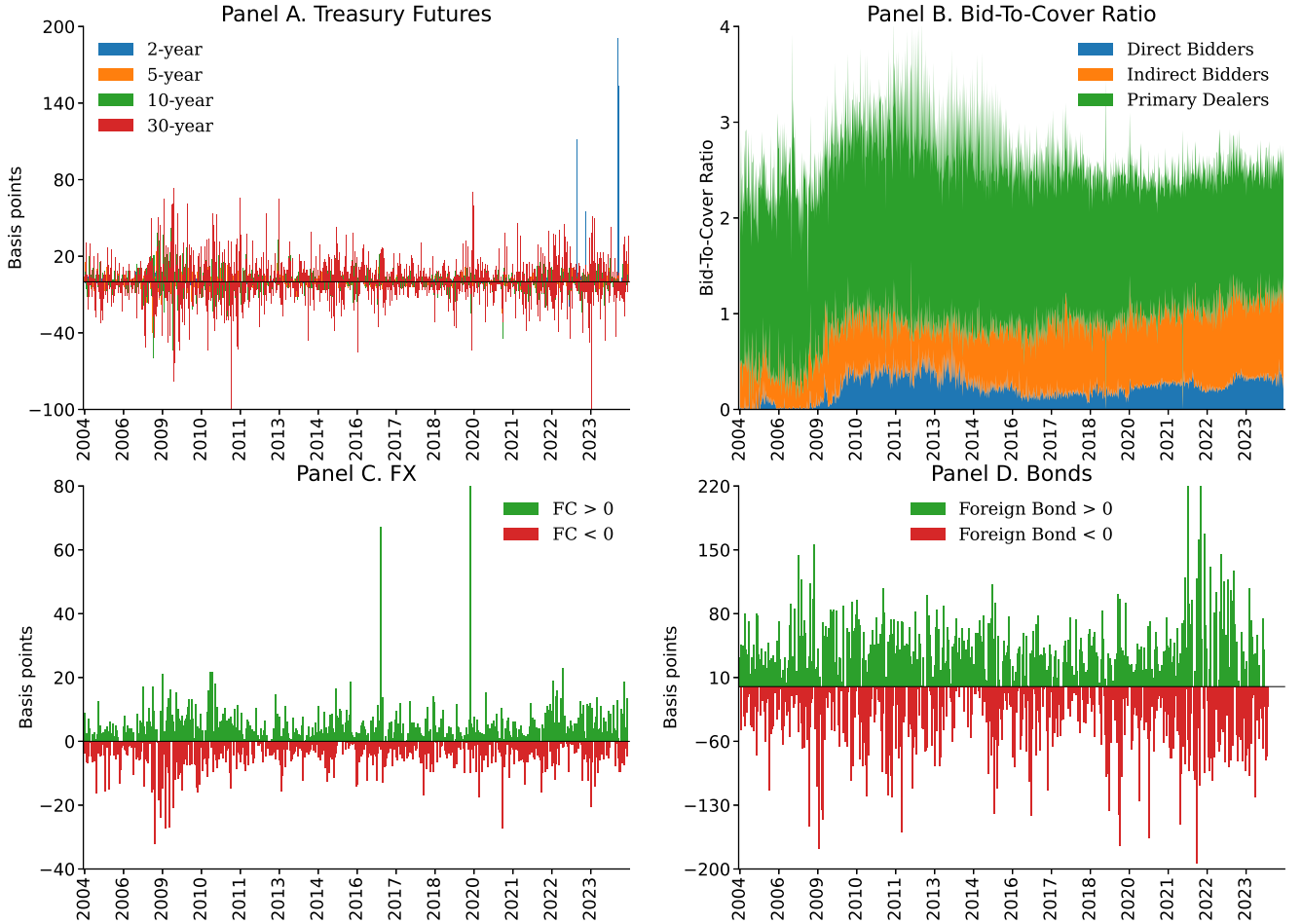
Table I. Summary Statistics (continued)

This table reports summary statistics about Treasury auctions (Panel A); for demand measures based on (log) changes in U.S. Treasury futures prices in a 20-minute window around auctions (Panel B); for 20-minute foreign exchange (log) returns around auctions (Panel C); and for 10-year bond returns over two-day windows around auction dates (Panel D). In Panel B, tenors of Treasury futures correspond to the tenors of the auctions. Returns are expressed in basis points. In Panel C, a positive return means the foreign currency appreciated vis-à-vis the USD. The sample period is 2004–2024.

Panel C: Returns – Currency Markets								
DOL	0.21	6.45	-32.15	-2.82	0.19	3.13	80.93	1395
AUD	0.50	8.89	-53.22	-3.63	0.00	4.50	128.55	1395
CAD	-0.08	7.04	-40.32	-3.27	0.00	3.34	77.67	1395
CHF	-0.00	6.99	-34.90	-3.48	0.00	3.69	58.20	1395
EUR	0.29	6.78	-37.41	-3.12	0.00	3.64	64.27	1395
GBP	0.33	7.42	-43.51	-3.02	0.00	3.60	80.29	1395
JPY	-0.03	8.43	-53.09	-3.70	0.00	3.37	106.57	1395
NOK	0.14	10.44	-68.70	-4.63	0.00	4.90	185.24	1395
NZD	0.48	9.49	-41.38	-4.19	0.00	4.46	121.78	1395
SEK	0.30	9.34	-41.43	-4.07	0.29	4.76	129.30	1395
Panel D: Returns – Global Bond Markets								
DOL	1.08	49.15	-193.71	-29.30	3.80	32.58	237.09	1356
AUD	4.29	76.66	-335.74	-40.61	5.80	51.02	380.40	1356
CAD	-0.49	66.76	-316.66	-38.51	1.96	35.89	304.97	1356
CHF	-0.10	50.82	-247.24	-28.10	1.96	29.09	221.13	1356
EUR	-0.14	63.62	-238.92	-34.14	3.99	37.13	330.74	1356
GBP	0.67	76.34	-607.12	-44.39	1.96	45.69	384.23	1356
JPY	1.24	28.02	-151.72	-10.99	1.98	13.99	114.81	1356
NOK	1.21	65.10	-253.71	-34.47	3.85	37.73	364.51	1356
NZD	1.71	78.02	-578.41	-37.50	3.92	43.10	470.09	1356
SEK	1.29	61.46	-359.68	-33.61	4.97	37.98	185.02	1356

Figure 2. High-Frequency Measures and Demand Dynamics.

The figure shows the time series of demand dynamics on U.S. Treasury auction days and responses in FX and global bond markets. Panel A shows returns of Treasury futures in a 20-minute window around auctions, where different colors indicate different maturities of futures contracts. Panel B shows the time series dynamics of the bid-to-cover ratio, distinguishing between indirect bidders, direct bidders, and primary dealers. Panel C shows the returns of the DOL portfolio, an equal-weight portfolio that is long on G9 currencies and short on the USD. In Panel C, returns are measured in a 20-minute window around an auction, and positive (negative) values refer to foreign currency appreciation, i.e., foreign currency $FC > 0$ ($FC < 0$) and are marked in green (red). Panel D shows the average return of 10-year G9 foreign sovereign bonds between days $t - 1$ and $t + 1$, when an auction occurs on day t . The sample period is 2004 to 2024.



IV. Treasury Demand, FX, and Global Bond Dynamics

In this section, we investigate how prices in currency and government bond markets react to investor demand shifts around U.S. Treasury auctions. Our empirical analysis is guided by the three empirical hypotheses derived in the previous section. We show that they are confirmed in our data. In particular, we show that the U.S. dollar depreciates and the yields of G9 government bonds fall in response to an increase in investor demand for U.S. bonds. The transmission varies with interest rate correlations: when domestic and U.S. short-term rates co-move closely, shocks propagate primarily through bond yields, whereas weaker co-movement results in stronger exchange rate responses.

A. The Impact of Treasury Demand Shocks on Currency and Bond Markets

As a first step, we document asset prices in both markets, FX and global bond markets, instantaneously react to demand shift around Treasury auctions. Table II reports results to the following regression

$$\Delta s_t = \alpha + \beta D_t + \varepsilon_t, \quad (5)$$

$$\Delta p_t^* = \alpha + \gamma D_t + \varepsilon_t, \quad (6)$$

where $\Delta s_{i,t}$ denotes spot returns in a 20-minute window, Δp_t^* denotes 10-year bond returns between days $t - 1$ and $t + 1$, and D_t denotes (log) price changes in 10-year U.S. Treasury futures over a 20-minute window, all measured around an auction on date t . The last column, DOL, refers to the dollar portfolio, i.e., the unconditional average of returns in FX or bond markets, respectively.

First, focusing on FX markets, we find that, on average, foreign currencies appreciate against the U.S. dollar by 2.26 basis points in response to a one-standard-deviation demand shift in 10-year Treasury futures. This effect is not only economically meaningful but also statistically significant. Second, the response is broad-based across the cross-section of currencies. All nine individual currency pairs exhibit statistically significant appreciation: at the 10% level for the CAD and at the 1% level for the remaining eight currencies. In terms of magnitude, appreciations range from 0.56 basis points (CAD) to 4.09 basis points (JPY). Given that daily close-to-close FX returns are notoriously small and often indistinguishable from zero, these shifts represent sizable and economically relevant movements.

Table II
Demand Shocks in Currency and Bond Markets

The table reports results to the following regressions:

$$\Delta s_t = \alpha + \beta D_t + \varepsilon_t,$$

$$\Delta p_t^* = \alpha + \gamma D_t + \varepsilon_t,$$

where Δs_t refers to spot returns in a 20-minute window around an auction on date t (Panel A), and Δp_t^* refers to 10-year bond returns between day $t - 1$ and $t + 1$ around an auction on date t (Panel B). D_t refers to (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around an auction on date t . The last column, DOL, refers to the dollar portfolio, i.e., the unconditional average of returns in FX or bond markets, respectively. Numbers in parentheses refer to t-statistics, based on Newey and West (1987)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Panel A: Currency Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D_t	1.67*** (0.55)	0.56* (0.33)	2.60*** (0.28)	2.12*** (0.33)	1.88*** (0.35)	4.09*** (0.43)	2.60*** (0.39)	2.49*** (0.44)	2.30*** (0.41)	2.26*** (0.32)
N	1395	1395	1395	1395	1395	1395	1395	1395	1395	1395
R^2	0.04	0.01	0.14	0.10	0.06	0.23	0.06	0.07	0.06	0.12
Panel B: Bond Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D_t	13.03*** (2.20)	13.96*** (1.83)	7.28*** (1.69)	10.78*** (1.72)	14.89*** (2.39)	4.45*** (0.97)	8.34*** (2.16)	8.30*** (2.19)	9.13*** (1.68)	10.02*** (1.45)
N	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356
R^2	0.03	0.04	0.02	0.03	0.04	0.03	0.02	0.01	0.02	0.04

In Panel B, we re-estimate the regression with changes in bond prices on the left-hand side. The global DOL portfolio of sovereign bonds appreciates by about 10 basis points in response to investor demand shifts in U.S. Treasury futures. As in FX markets, this response is statistically significant at the 1% level. Moreover, the effect extends broadly across the cross-section of foreign government bond markets. Returns to Japanese government bonds show the smallest appreciation (4.45 basis points), while U.K. gilts (GBP) exhibit the largest (14.89 basis points). All individual bond market responses are statistically significant at the 1% level. These findings underscore that demand shifts for U.S. safe assets transmit meaningfully into global fixed-income markets, reinforcing the central role of the U.S. Treasury market in international asset pricing. Collectively, the findings support the predictions of Hypotheses 1 and 2.

To ensure our findings are not driven by specific measurement choices, we conduct a compre-

hensive set of robustness checks. For brevity, the full results are presented in the appendix. These include varying the length of the event window around auctions, using alternative FX datasets that rely on firm quotes and traded prices rather than indicative quotes, experimenting with different horizons for bond return calculations, and excluding subperiods such as crises or end-of-month rebalancing days. Across all specifications, we find that the main results remain intact: the estimated coefficients are stable in magnitude and significance, and the positive link between Treasury demand shocks and responses in currency and bond markets persists.

B. Bilateral Short-Rate Correlations and Demand Shocks

While we have thus far assessed currency and bond markets in isolation, the next step is to evaluate their joint dynamics. This added layer of complexity is crucial for testing Hypotheses 3a and 3b in light of Greenwood et al. (2023) and Gourinchas et al. (2025), where market segmentation limits investors' ability to intermediate shocks across different asset classes. Studying the two markets jointly allows us to trace how demand shocks propagate across currencies and sovereign bonds, thereby highlighting the role of investor preferences and market structures in shaping global price dynamics.

Figure 3 contrasts the estimated price-impact coefficients in both markets with each country's short-rate correlation vis-à-vis the United States. Short-rate correlations are computed from a 5-year rolling window of monthly changes in 3-month interest rates.¹³ The left panel presents the cross-section of FX markets, while the right panel reports country-specific estimates for 10-year foreign bonds. The individual coefficients correspond to the regression estimates in Table II, but several key observations in the cross-section of assets emerge.

First, across currencies, the price impact of Treasury demand shocks is strongly negatively correlated with short-rate correlations (-0.89). In other words, currencies whose domestic short-term rates move less in tandem with U.S. rates experience a stronger appreciation against the dollar following Treasury demand shocks.

Second, the opposite pattern arises for bond markets. There, price impacts are strongly positively correlated (0.88) with short-rate correlations. Countries whose rates co-move more closely with U.S. short rates display larger shifts in bond yields when U.S. Treasury demand shocks occur.

Taken together, the joint distribution of coefficients reveals a striking cross-market asymmetry.

¹³Results are robust to alternative measures of short-rate correlations.

Countries with high FX price impacts tend to have low bond price impacts, and vice versa. At the extremes, the JPY exhibits the strongest FX response (above 4 basis points) but one of the weakest bond market responses (4.45 basis points). Conversely, the CAD, associated with the highest short-rate correlation, shows the smallest FX response (0.56 basis points) but the strongest bond market adjustment (nearly 14 basis points).

Finally, the differing scales of the y-axes across FX and bond markets underscore the central role of exchange rates in transmitting U.S. demand shocks internationally. Exchange rates appear to act as the first margin of adjustment, absorbing shocks where local bond markets are less responsive, while in highly integrated markets with stronger monetary linkages to the United States, local bond yields bear the brunt of adjustment. This asymmetric propagation is consistent with the model Hypotheses 3a) and 3b), highlighting that the degree of financial integration shapes whether global shocks primarily manifest in exchange rates or in bond yields.

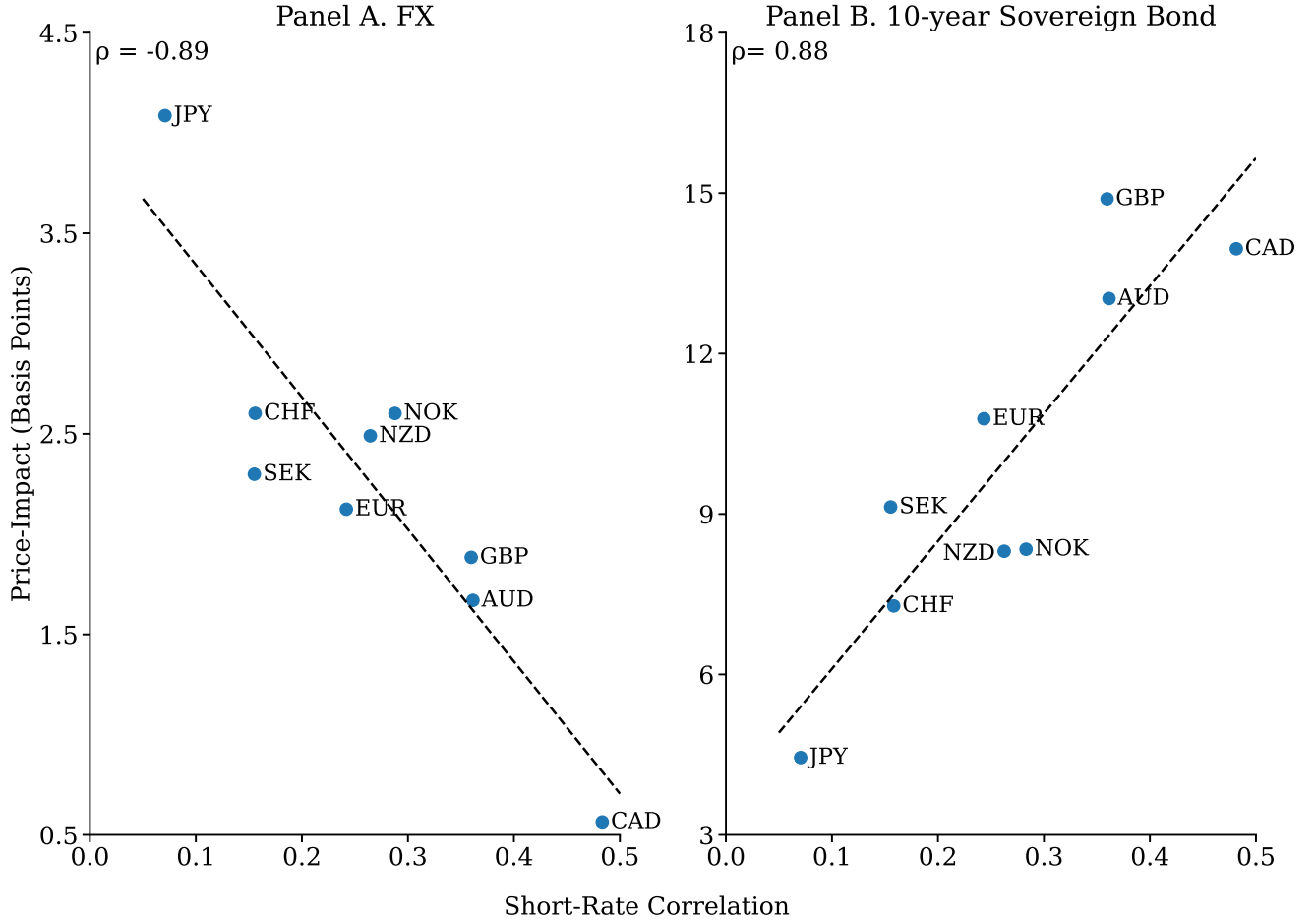
To provide further evidence on the role of short-rate correlations in shaping cross-market dynamics, we extend our baseline regressions to a panel specification and augment them with an interaction term between the Treasury demand shock and each foreign country’s short-rate correlation with the United States. The coefficient on this interaction term captures how strongly the propagation of U.S. Treasury demand shocks into foreign exchange and bond markets depends on the degree of interest rate co-movement across countries.

Table III reports the results. Columns (1) and (3) present the baseline panel regression specifications for FX and bond markets, respectively, while columns (2) and (4) add the interaction term. The findings strongly support the asymmetric propagation of demand shocks across the two markets. In the FX market, positive Treasury demand shocks exert a smaller impact on currencies whose short-term rates are more tightly correlated with U.S. short rates. Consistent with this, the interaction coefficient is negative (-0.62) and highly statistically significant. By contrast, in the bond market, higher short-rate correlations amplify the effect of Treasury demand shocks. The corresponding interaction coefficient is positive (3.39) and also highly statistically significant.

Taken together, these results provide direct and robust evidence that relative short-rate correlations play a significant and non-negligible role in shaping cross-market spillovers. They demonstrate that the transmission of U.S. Treasury demand shocks depends critically on the degree of financial integration and monetary policy co-movement: when correlations are low, exchange rates act as the primary adjustment margin, whereas when correlations are high, bond yields bear the

Figure 3. Short-Rate Correlations and Demand Shocks

The figure shows the relationship between short-rate correlations and the price impact of U.S. Treasury demand shocks on FX (Panel A) and 10-year foreign sovereign bonds (Panel B). Short-rate correlations are computed using a 5-year rolling window of monthly changes in 3-month sovereign yields. The price impact of U.S. Treasury demand shocks are the beta coefficients from regressing each G9 country's currency and 10-year sovereign bond returns on the (log) price change in the 10-year U.S. Treasury futures in a 20-minute window around auctions. For FX (Panel A), currency returns are measured in the same 20-minute window around auctions. For foreign bonds (Panel B), returns around an auction on day t are calculated as the (log) price change between $t - 1$ and $t + 1$. The sample period is 2004 to 2024.



adjustment burden.

Collectively, these findings lend strong support to the predictions of preferred-habitat models, and confirming Hypotheses 3a and 3b. Figure 3 and Table III suggest that shocks to the quantity of safe assets have a more (less) significant impact on the exchange rates (government bonds) of countries whose short rates are less correlated with those of the United States. The mechanism is straightforward: when short rates exhibit lower correlation, domestic quantity shocks exert a

Table III
Short-Rate Correlation and Demand Shock Pass-Through

The table reports results to the following regressions:

$$\Delta s_{i,t} = \lambda_t + \beta D_t \times \rho_{i,t}^{SR} + \varepsilon_{i,t}, \quad \Delta p_{i,t}^* = \lambda_t + \gamma D_t \times \rho_{i,t}^{SR} + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ refers to the returns of currency i in a 20-minute window around an auction on date t , and $\Delta p_{i,t}^*$ refers to 10-year bond returns of country i between days $t-1$ and $t+1$. $D_t \times \rho_{i,t}^{SR}$ refers to an interaction term between (log) price changes in 10-year Treasury futures in a 20-minute window around an auction on date t and the short-rate correlation between foreign country i and the United States, using the past 5-year monthly changes of 3-month sovereign yields. Numbers in parentheses refer to t-statistics, based on Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

	FX		Bonds	
	(1)	(2)	(3)	(4)
D_t	2.26*** (0.31)		10.02*** (1.47)	
$\rho_{i,t}^{SR}$		0.08 (0.07)		-0.55 (0.72)
$D_t \times \rho_{i,t}^{SR}$		-0.62*** (0.14)		3.39*** (0.76)
Currency FE	Yes	No	Yes	No
Time FE	No	Yes	No	Yes
N	12555	12555	12204	12204
R^2	0.07	0.01	0.02	0.00

smaller effect on the price of risk associated with foreign short-term rates. Consequently, less of the shock is absorbed into the foreign country's long-term yields, and the impact manifests more prominently in the exchange rate.

V. Further Discussion

In this section, we further explore the economic drivers of the pass-through from demand shocks to global financial markets. To this end, we first conduct a placebo exercise comparing auction days with the average non-auction day, and assess the persistence of the demand shocks. Further, we extend the analysis and use unexpected changes of the bid-to-cover ratio as a quantity-based measure of demand shocks. This allows us to differentiate between different types of investors that are participating in auctions, and highlight the heterogeneous impact on prices from different

agents bidding at auctions. Similarly, using the allocation of funds provides an even more granular decomposition of agents’ impact at the auctions. Finally, we assess how the pass-through of demand shocks from Treasuries to FX and global bond markets vary over time—across risky and safe days—and we relate our findings to the literature on the U.S. convenience yield.

A. *Placebo Exercise*

While the positive link between U.S. Treasury demand shocks and currency and global bond markets appears robust across countries, one concern is that our results may be mechanically driven by a general afternoon co-movement between Treasury futures and asset prices during U.S. trading hours. To address this concern, we conduct a block-bootstrap placebo exercise designed to test whether similar dynamics emerge on days when no Treasury auction is scheduled.

Specifically, we resample (with replacement) from “non-auction” days 10,000 times and construct placebo 10-year Treasury futures shocks ($D^{Placebo}$) around 13:00. For each draw, we re-estimate equations 5 and 6 for both FX and bond markets. We then record the estimated β - and γ -coefficients from each regression and plot their empirical distributions in Figure 4. Panel A reports results for FX markets and Panel B for bond markets. In each panel, the black dashed line shows the mean of the bootstrap distribution, red dashed lines indicate the 95% confidence bounds, and the dotted line denotes the corresponding coefficient estimated on auction days.

Figure 4 reveals that dynamics between Treasury futures and both market segments are systematically different on non-auction days. In FX markets, the distribution of placebo coefficients is centered just below zero, with a 95% confidence interval spanning roughly -0.5 to 0.5 , while the auction-day coefficient is clearly positive and exceeds a value of 2. In bond markets, a similar picture emerges: the auction-day coefficient lies far outside the 95% bootstrap confidence interval, indicating that the strong co-movement between Treasury demand shocks and bond yields is unique to auction dates and not a generic afternoon phenomenon.

Taken together, this placebo exercise provides compelling evidence that our results are not driven by spurious correlations in afternoon trading. Instead, the significant responses of currencies and foreign bonds reflect auction-specific demand dynamics. This finding strengthens our identification strategy: by focusing on high-frequency variation around auction times, we isolate shocks to U.S. Treasury demand that generate excess price pressure, rather than capturing general intraday co-movement across global asset markets.

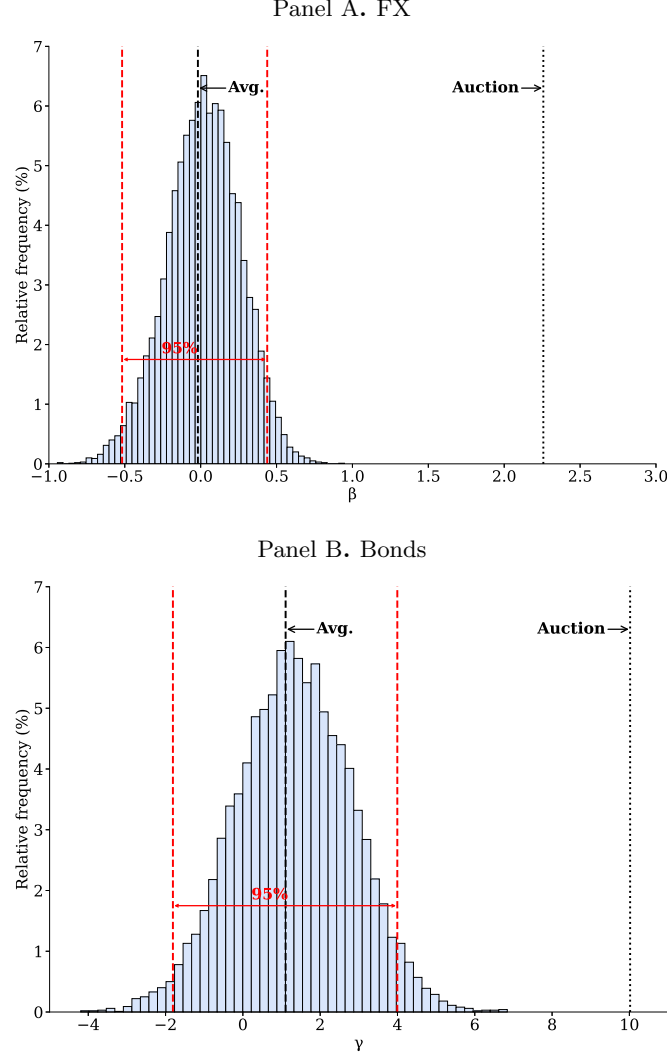
Figure 4. Placebo Exercise: Treasury Shocks on Non-Auction Days

The figure shows the distributions of the β - and γ -coefficients from price-impact panel regressions of the form

$$\Delta s_{i,t} = \alpha_i + \beta D_t^{Placebo} + \varepsilon_{i,t},$$

$$\Delta p_{i,t}^* = \alpha_i + \gamma D_t^{Placebo} + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ refers to the returns of currency i in a 20-minute window around the timing of auctions on non-auctions days (Panel A), and $\Delta p_{i,t}^*$ refers to bond returns of country i between days $t - 1$ and $t + 1$ on non-auction days (Panel B). $D_t^{Placebo}$ refers to a placebo demand shock, constructed for the same time frame as when Treasury auctions typically occur, but based on the (log) price change in the 10-year Treasury futures on non-auction days. The distributions are obtained from repeating each regression 10,000 times, each time randomly drawing samples (with repetition) from non-auction days. The red dashed lines indicate the 95% confidence intervals, the black dashed line is the average of the distribution, and the dotted line indicates the size of the coefficient on auction days. The sample period is 2004 to 2024.



B. Shock Persistence

The previous section established that safe asset demand shocks have a significant and immediate impact on global FX markets in short windows around U.S. Treasury auctions. We now turn to assessing the persistence of these shocks beyond the immediate aftermath. Following Ray et al. (2024), we compute long-run difference returns as the change in (log) prices between the day of the auction and subsequent horizons. Specifically, for currency and foreign bonds of country i we compute the log change between the value at horizon $t + h$ — $s_{i,t+h}$ for exchange rates and $p_{i,t+h}^*$ for bond prices—and the corresponding value on the day prior to the auction, $s_{i,t-1}$ and $p_{i,t-1}^*$, respectively.

We vary h from 1 day up to 30 days and estimate corresponding panel regressions, plotting the impulse responses in Figure 5. The shaded blue bands denote 10% confidence intervals based on Driscoll and Kraay (1998) standard errors.¹⁴

Panel A of Figure 5 shows the results for FX markets. The impact of Treasury demand shocks does not dissipate immediately; instead, it exhibits pronounced persistence. On the next day ($h = 1$), the estimated β coefficient already exceeds 5 basis points. The effect builds further over the subsequent trading week, peaking around day 7–10, before gradually reversing from approximately day 11 onward. The coefficient remains statistically significant for nearly 20 trading days, underscoring that the influence of auction-induced demand shocks on exchange rates is long-lived rather than transitory.

Panel B repeats the exercise for global bond markets. The initial impact is similar in magnitude to FX markets, with bond yields rising by around 5 basis points on the day following the shock. The response then intensifies, reaching roughly 10 basis points within the first week, and only slowly reverts thereafter. The confidence bands suggest that the effect remains statistically significant for nearly three weeks, highlighting the durability of demand-driven spillovers into sovereign bond yields.

Overall, these results indicate that Treasury demand shocks generate persistent effects in both currency and bond markets, with adjustment unfolding over several weeks. The extended horizon of significance suggests that spillovers across borders and asset classes occur only gradually, consistent with frictions in global capital mobility and segmentation across investor clienteles. In this sense, the evidence not only demonstrates long-lived spillovers from U.S. safe asset demand but

¹⁴Individual time-series regressions for each currency are reported in the Appendix.

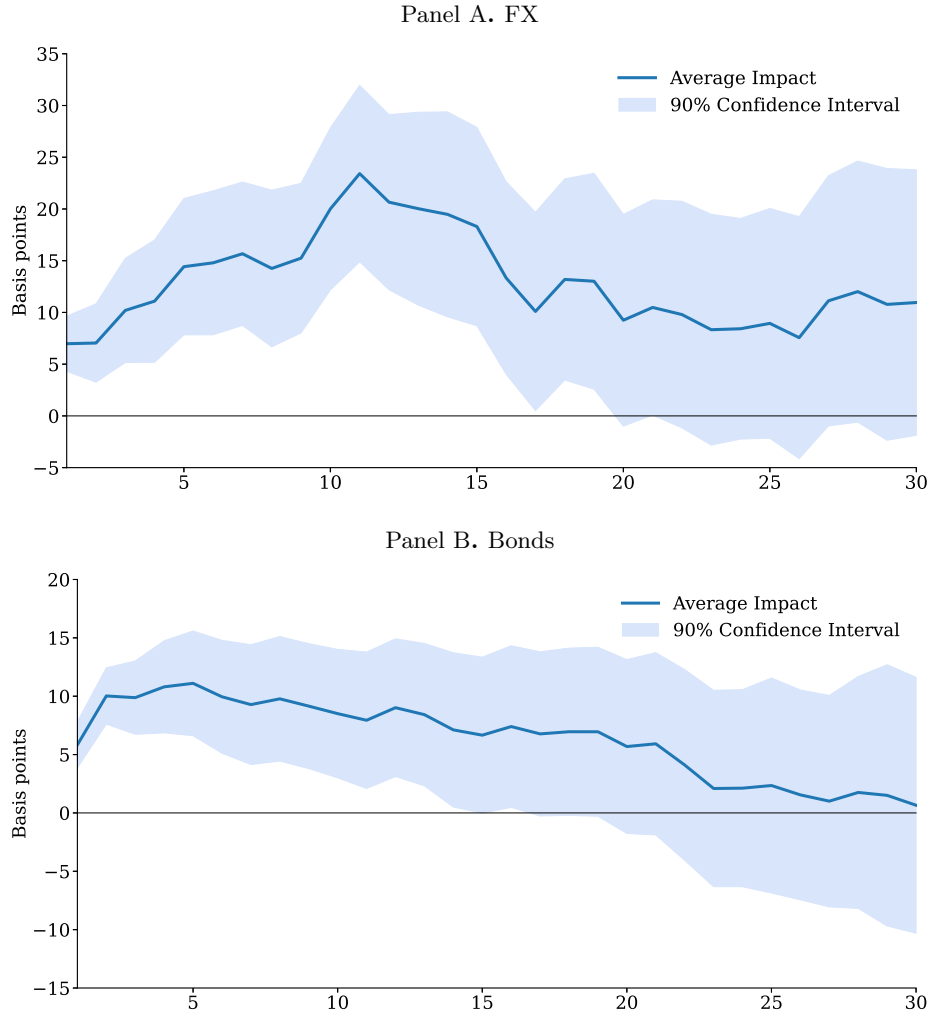
Figure 5. Persistence of Demand Shock Impact.

The figure shows the persistence of the impact from U.S. Treasury demand shocks on FX and bond markets from panel regressions of the form

$$\Delta s_{i,t \rightarrow t+h} = \alpha_i + \beta_h D_t + \varepsilon_{i,t \rightarrow t+h},$$

$$\Delta p_{i,t \rightarrow t+h}^* = \alpha_i + \gamma_h D_t + \varepsilon_{i,t \rightarrow t+h},$$

where $\Delta s_{i,t \rightarrow t+h}$ and $\Delta p_{i,t \rightarrow t+h}^*$ are the h day return of currency (Panel A) and of 10-year sovereign bonds for country i (Panel B) between day $t - 1$ and day $t + h$, and D_t refers to the return of the 10-year U.S. Treasury futures in a 20-minute window around an auction on day t . The solid blue line refers to the estimated coefficients β_h for FX and γ_h for bonds, while the blue shaded areas indicate 90% confidence intervals. The sample period is 2004 to 2024.



also emphasizes that the speed of adjustment varies across market segments, with exchange rates and bond yields both serving as channels through which global capital markets absorb shocks over time.

C. Bid-To-Cover Ratio

While the previous section relied on high-frequency variation in Treasury futures to measure the impact of demand shocks, this section follows Ray et al. (2024) and uses the unexpected component of the bid-to-cover ratio as an alternative measure of excess demand. This shock measure is constructed as the residual from an AR(3) process, which captures predictable variation in auction demand and isolates deviations from expected bidding behavior. By focusing on unanticipated shifts in investor demand, the measure provides a direct lens on changes in demanded quantities and offers a complementary perspective on auction dynamics. Importantly, it also allows us to examine the underlying nature of demand pressures—an aspect explored further in the next subsection.¹⁵

Table IV presents the results for both currency and bond markets. The findings provide strong support for our baseline specification. Although the estimated coefficients are somewhat smaller in magnitude compared with the high-frequency futures-based shocks, the average impact of demand shocks remains both economically and statistically significant. In FX markets (Panel A), the estimated effect is 1.18 basis points, while in global bond markets (Panel B) it is 5.71 basis points. Moreover, the results are robust across the cross-section: in both markets, the coefficients are significant for the vast majority of countries (8 out of 9). The consistency across methodologies strengthens the interpretation of these shocks as capturing genuine demand pressures in U.S. Treasury markets that spill over internationally.

D. Nature of Demand Shocks - Heterogeneous Investor Landscape

An advantage of using quantity-driven measures of demand shocks is that they allow us to account for the heterogeneous investor landscape in Treasury auctions and to analyze how shocks differ across participants. As a next step, we therefore examine two key dimensions of heterogeneity.

First, we decompose the unexpected bid-to-cover ratio by bidder type, distinguishing between primary dealers, direct bidders, and indirect bidders. This decomposition enables us to identify which categories of auction participants contribute most strongly to variation in demand shifts. Since each group might differ in its motivations, regulatory constraints, and ability to warehouse risk, understanding their relative roles sheds light on the mechanisms through which demand shocks originate.

¹⁵Additional summary statistics for these measures are reported in Table B-VII in the Appendix.

Table IV
Bid-to-Cover Ratio: Currency and Global Bond Markets

The table reports results to the following regressions:

$$\Delta s_t = \alpha + \beta D_t^{BC} + \varepsilon_t,$$

$$\Delta p_t^* = \alpha + \gamma D_t^{BC} + \varepsilon_t,$$

where Δs_t refers to spot returns in a 20-minute window around an auction on date t (Panel A), and Δp_t^* refers to 10-year bond returns between days $t - 1$ and $t + 1$ around an auction on date t (Panel B). D_t^{BC} refers to the unexpected changes in the total bid-to-cover ratio (BC). Numbers in parentheses refer to t-statistics, based on Newey and West (1987)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Panel A: Currency Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D_t^{BC}	0.90** (0.38)	0.32 (0.27)	1.14*** (0.31)	1.00*** (0.27)	1.08*** (0.28)	2.07*** (0.39)	1.37*** (0.37)	1.66*** (0.38)	1.11*** (0.34)	1.18*** (0.23)
N	1392	1392	1392	1392	1392	1392	1392	1392	1392	1392
R^2	0.01	0.00	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
Panel B: Global Bond Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D_t^{BC}	7.96** (3.17)	6.42*** (2.47)	4.76*** (1.84)	6.18*** (2.33)	9.28*** (2.71)	1.05 (1.24)	4.87** (2.37)	5.17** (2.45)	5.70** (2.64)	5.71*** (1.83)
N	1353	1353	1353	1353	1353	1353	1353	1353	1353	1353
R^2	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01

Second, we exploit data on the amounts allocated to different investor categories. While this measure does not reveal the precise amounts bid by each group and is only published with a delay, we hypothesize that higher allocations to a particular category nonetheless provide valuable insights into their underlying demand for safe assets. This measure also offers a more granular breakdown than the bid-to-cover decomposition, distinguishing between investment funds, foreign investors, and a residual “miscellaneous” group that includes depository institutions, individuals, dealers, pension funds, and other investors. By analyzing these subgroups, we obtain a deeper understanding of which investor segments drive the propagation of shocks across market segments.

Tables V and VI summarize the results, which are based on the following regression specifications:

$$\begin{aligned}\Delta s_t &= \alpha + \beta_j \sum D_t^j + \varepsilon_t, \\ \Delta p_t^* &= \alpha + \gamma_j \sum D_t^j + \varepsilon_t,\end{aligned}$$

$$\begin{aligned}\Delta s_t &= \alpha + \psi_k \sum All_t^k + \varepsilon_t, \\ \Delta p_t^* &= \alpha + \phi_k \sum All_t^k + \varepsilon_t,\end{aligned}$$

where D_t^j denotes the unexpected demand shock attributable to bidder type j , and All_t^k refers to the unexpected allocation amount to investor category k .

Table V
Demand Shocks by Bidder Type

The table reports results to the following regressions:

$$\Delta s_t = \alpha + \beta_j \sum D_t^{BC,j} + \varepsilon_t, \quad \Delta p_t^* = \alpha + \gamma_j \sum D_t^{BC,j} + \varepsilon_t.$$

Δs_t refers to the returns of currency in a 20-minute window around an auction on date t (Panel A), and Δp_t^* refers to the returns of foreign bonds between days $t + 1$ and $t - 1$ around an auction on date t (Panel B). $D_t^{BC,j}$ refers to the unexpected change in the bid-to-cover ratio (BC) of bidder type j , distinguishing between direct bidders (DB), indirect bidders (IB), and primary dealers (PD). Numbers in parentheses refer to t-statistics, based on Newey and West (1987)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Panel A: Currency Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
$D_t^{BC,DB}$	0.09 (0.53)	0.12 (0.42)	0.26 (0.38)	0.37 (0.34)	0.20 (0.42)	1.35** (0.55)	0.36 (0.49)	-0.01 (0.56)	0.64 (0.52)	0.37 (0.35)
$D_t^{BC,IB}$	2.58*** (0.50)	1.40*** (0.34)	1.74*** (0.38)	1.84*** (0.37)	1.63*** (0.40)	2.28*** (0.35)	3.12*** (0.60)	3.08*** (0.49)	2.40*** (0.50)	2.23*** (0.34)
$D_t^{BC,PD}$	0.02 (0.48)	-0.20 (0.37)	0.81** (0.37)	0.51* (0.30)	0.69 (0.43)	1.48*** (0.44)	0.36 (0.52)	0.94** (0.48)	0.34 (0.42)	0.55* (0.31)
N	1392	1392	1392	1392	1392	1392	1392	1392	1392	1392
R^2	0.04	0.04	0.03	0.04	0.03	0.06	0.05	0.05	0.04	0.06
Panel B: Global Bond Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
$D_t^{BC,DB}$	8.66** (3.97)	3.19 (2.91)	3.37 (2.46)	2.50 (3.18)	5.13 (3.73)	2.04 (1.41)	6.20 (4.25)	9.55*** (3.67)	-0.24 (3.32)	4.49* (2.54)
$D_t^{BC,IB}$	6.67** (3.28)	8.75*** (3.13)	4.94** (2.17)	8.93*** (2.76)	10.91*** (3.38)	1.60 (1.31)	4.23 (3.07)	4.81 (3.12)	8.33*** (2.83)	6.57*** (2.14)
$D_t^{BC,PD}$	6.94* (3.98)	4.35 (2.89)	4.75* (2.48)	4.79 (2.99)	7.62** (3.19)	-0.07 (1.66)	2.21 (3.00)	2.87 (2.95)	5.43* (3.10)	4.32* (2.30)
N	1353	1353	1353	1353	1353	1353	1353	1353	1353	1353
R^2	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02

Table V highlights the heterogeneous impact of bidder types across both FX and global bond markets. In both panels, it is indirect bidders—a group that typically includes foreign central banks, sovereign wealth funds, and global financial institutions—that drive the bulk of the international spillovers from Treasury auctions. Their coefficients are consistently positive and mostly statistically significant, indicating that global investors with strong demand for U.S. safe assets are the key channel through which auction shocks propagate into international asset prices.

By contrast, the role of primary dealers appears more limited. While their coefficients occasionally reach statistical significance at the individual currency level, their average effects—gauged by the dollar portfolio—are smaller in magnitude and less precisely estimated than those of indirect bidders. Finally, direct bidders play virtually no role: their coefficients are close to zero and remain statistically insignificant in almost all cases.

We further investigate the heterogeneous investor landscape using granular information on allocation amounts (Table VI). In FX markets, both foreign investors and investment funds contribute to the appreciation of foreign currencies following Treasury demand shocks. Across all currencies, the coefficients for investment funds are positive, highly significant, and slightly larger in magnitude than those for foreign investors. In bond markets, the allocations to investment funds are associated with stronger increases in bond returns, whereas the impact of foreign investors is more muted and less consistently significant across countries.

Taken together, these results reinforce the view that foreign and globally active investors are pivotal in transmitting U.S. Treasury demand shocks across international markets. While domestic actors such as primary dealers and direct bidders appear to play a more limited role, cross-border investors—captured through indirect bidding activity and allocations to foreign and institutional funds—seem to represent an important channel through which U.S. Treasury auctions influence global currency and bond markets.

E. Exchange Rate Movements and the Convenience Demand for U.S. Safe Assets

Changes in demand by investment funds and foreign investors’ demand for the relative safety of U.S. dollar assets can provide an alternative explanation for the co-movement of bond yields and exchange rates. Theoretical frameworks centered around changes in the convenience yields of U.S. and foreign safe assets predict that the U.S. dollar appreciates when the demand for U.S. Treasuries increases because of a higher convenience yield (Jiang et al., 2021). Our empirical results show that,

Table VI
Auction Allocation: Heterogeneous Investor Types

The table reports results to the following regressions:

$$\Delta s_t = \alpha + \psi_j \sum All_t^k + \varepsilon_t, \quad \Delta p_t^* = \alpha + \phi_j \sum All_t^k + \varepsilon_t.$$

Δs_t refers to the returns of currency in a 20-minute window around an auction on date t (Panel A), and Δp_t^* refers to the returns of foreign bonds between days $t + 1$ and $t - 1$ around an auction on date t (Panel B). All_t^k refers to the unexpected allocation of Treasuries to investor group k , distinguishing between investment funds (Inv. Funds), foreign investors (For. Inv.), and miscellaneous investors (Misc.). Numbers in parentheses refer to t-statistics, based on Newey and West (1987)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Panel A: Currency Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
$All_t^{Inv.Funds}$	3.58*** (0.85)	1.46*** (0.49)	1.89*** (0.57)	2.41*** (0.51)	1.69** (0.71)	2.03*** (0.59)	4.07*** (1.03)	3.37*** (0.82)	3.29*** (0.83)	2.65*** (0.60)
$All_t^{For.Inv.}$	1.38*** (0.38)	0.83*** (0.30)	0.80** (0.31)	1.15*** (0.27)	0.71** (0.30)	1.11*** (0.31)	1.44*** (0.35)	1.30*** (0.46)	1.14*** (0.37)	1.09*** (0.27)
$All_t^{Misc.}$	0.30 (0.32)	0.27 (0.19)	0.52** (0.24)	0.50** (0.21)	0.37 (0.25)	0.76** (0.30)	0.68** (0.31)	0.35 (0.33)	0.82*** (0.30)	0.51** (0.21)
N	1392	1392	1392	1392	1392	1392	1392	1392	1392	1392
R^2	0.04	0.03	0.02	0.04	0.03	0.03	0.04	0.04	0.04	0.05
Panel B: Global Bond Markets										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
$All_t^{Inv.Funds}$	7.08 (5.24)	14.52*** (4.65)	5.55* (3.15)	9.83** (4.19)	11.37** (5.09)	3.41* (2.06)	6.74 (4.96)	9.34** (4.71)	7.62* (4.12)	8.38** (3.35)
$All_t^{For.Inv.}$	2.19 (2.42)	1.72 (2.42)	1.89 (1.55)	2.11 (1.97)	2.99 (2.63)	0.79 (0.97)	2.11 (1.93)	-0.55 (2.21)	4.54** (1.86)	1.98 (1.54)
$All_t^{Misc.}$	1.05 (3.56)	3.73 (2.76)	1.84 (2.15)	2.76 (2.46)	2.27 (2.99)	0.76 (1.56)	-1.57 (2.82)	0.66 (3.55)	-0.48 (2.52)	1.23 (2.19)
N	1353	1353	1353	1353	1353	1353	1353	1353	1353	1353
R^2	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01

on average, the U.S. dollar depreciates when investor demand for U.S. Treasuries unexpectedly increases at auction. These results are not necessarily mutually inconsistent. Changes in the relative convenience yields of U.S. Treasuries over foreign bonds are not the only driver of bond demand. Recent research on the time variation in the stock-bond correlation finds that the safety demand for U.S. Treasuries is a less important factor for the pricing of Treasuries and the U.S. dollar during days when the covariance of Treasury returns with the aggregate U.S. stock market

return is high (Acharya and Laarits, 2023; Hu et al., 2025).

We follow Hu et al. (2025) and classify days in our sample as risky or safe days, depending on the correlation between equity and bond markets. To achieve this classification, we leverage high-frequency 5-minute data of equity and Treasury futures, and compute daily correlations between the two market segments.¹⁶ Following Hu et al. (2025), we then compute an exponentially weighted average of the daily correlations, in order to reduce the level of noise in the estimate. As the correlation is mostly positive during our sample, we use the median to identify safe and risky regimes. Days on which the co-movement between markets is above the median are considered risky days, while days with a correlation below the median indicate safe days.

Hu et al. (2025) show that pricing on risky days is dominated by heightened interest rate risk. As discussed in the previous section, we see our results about the co-movement of bond yields and exchanges rates as being consistent with changes in the price of interest risk as the underlying economic driver. Hence, we expect these results to strengthen if we restrict our sample to auction days where interest rate risk is the dominant pricing factor, that is, risky days in the terminology of Hu et al. (2025). In this subsection, we show that this is indeed the case. Interestingly, we also show that on safe days, the U.S. dollar appreciates in response to positive demand shifts at U.S. Treasury auctions and the pass-through of price increases from U.S. Treasuries to global bonds is muted. These pricing patterns point to the safety properties of U.S. safe assets as being an important driver of U.S. Treasury demand on these days.

Table VII reports results to the regression:

$$\Delta s_{i,t} = \alpha_i + \beta_1 D_t^{10Y} + \beta_2 \rho_t^{SP500,10Y} + \gamma D_t^{10Y} \times \rho_t^{SP500,10Y} + \varepsilon_{i,t}$$

$$\Delta p_{i,t}^* = \alpha_i + \beta_1 D_t^{10Y} + \beta_2 \rho_t^{SP500,10Y} + \gamma D_t^{10Y} \times \rho_t^{SP500,10Y} + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ ($\Delta p_{i,t}^*$) refers to returns of currency (foreign bonds) i , D_t^{10Y} refers to the demand shock for Treasuries with maturity 10Y, $\rho_t^{SP500,10Y}$ measures the daily correlation between equity futures and Treasuries with maturity 10Y, and $D_t^{10Y} \times \rho_t^{SP500,10Y}$ is the interaction term between the two variables. The regression setup allows us to disentangle how the transmission of demand for U.S. Treasuries changes across safe and risky days.

For both markets, FX and bond markets, we observe a similar pattern of the following form.

¹⁶As futures are traded nearly 24 hours a day, the correlation measure is based on almost 288 intraday observations every day.

Table VII
Treasury Demand Pass-through on Safe and Risky Days

This table reports regression results of the form:

$$\Delta s_{i,t} = \alpha_i + \beta_1 D_t^{10Y} + \beta_2 \rho_t^{SP500,10Y} + \gamma D_t^{10Y} \times \rho_t^{SP500,10Y} + \varepsilon_{i,t}$$

$$\Delta p_{i,t}^* = \alpha_i + \beta_1 D_t^{10Y} + \beta_2 \rho_t^{SP500,10Y} + \gamma D_t^{10Y} \times \rho_t^{SP500,10Y} + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ refers to return of currency i in a 20-minute window around the auction on date t ; $\Delta p_{i,t}^*$ refers to the bond return of country i between $t - 1$ and t ; D_t^{10Y} refers to the demand shock for Treasuries, which is the 20-minute (log) change in the 10-year U.S. Treasury futures price around the auction on date t ; $\rho_t^{SP500,10Y}$ measures the daily correlation between equity futures returns and 10-year U.S. Treasury futures returns; and $D_t^{10Y} \times \rho_t^{SP500,10Y}$ is the interaction term between the two variables. Numbers in parentheses refer to t-statistics based on Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels. The sample period is 2004-2024.

	FX		Bonds	
D_t^{10Y}	2.26*** (0.31)	2.41*** (0.25)	10.02*** (1.47)	10.48*** (1.39)
ρ_t^{10Y}		0.33** (0.15)		-0.88 (2.08)
$D_t^{10Y} \times \rho_t^{10Y}$		1.03*** (0.20)		3.38** (1.32)
Currency FE	Yes	Yes	Yes	Yes
N	12555	12555	12204	12204
R^2	0.07	0.09	0.02	0.03

Without the interaction term, the regressions resemble the previous benchmark results, i.e., an increase in demand for Treasuries—as captured by changes in prices of Treasuries in a short window around auctions—leads to an appreciation of foreign currencies. However, the regressions including the intercept terms suggest the response varies, depending on whether Treasuries are considered a risky or safe asset. Across the regression specifications we find that the pass-through of U.S. Treasury demand shocks to foreign exchange markets is higher when Treasuries are considered risky, while the combined impact is considerably muted when Treasuries are considered a safe haven.

For example, when Treasuries are perceived as extremely risky (i.e., $\rho_t^{SP500,m} = 1$), the combined effect of a demand shock amounts to nearly 3.5 basis points in FX markets and about 14 basis points in bond markets. By contrast, when Treasuries are viewed as safe (i.e., $\rho_t^{SP500,m} = -1$),

the effects are much smaller—around 1.4 and 7.2 basis points, respectively. This pattern suggests that demand shocks transmit more forcefully when U.S. Treasuries carry higher risk, whereas the safe-haven status of Treasuries dampens their international spillovers.

Complementing the results, Figure 6 decomposes the cross-sectional pattern across currencies into periods when Treasuries are perceived as safe versus risky assets. Blue (orange) markers denote risky (safe) periods. Several observations stand out.

First, the cross-sectional pattern is robust across both types of days, confirming the findings from Section IV. In FX (global bond) markets, the cross-sectional relationship remains negative (positive) regardless of the subsample. However, in FX markets the magnitude of the coefficient is notably smaller on safe days, as seen in the level shift between the top-left and top-right panels. When Treasuries are perceived as risky assets, price-impact coefficients range between 2 and 4.5 basis points, whereas on safe days the cross-sectional average is closer to 1 basis point. The divergence is especially pronounced for currencies with high short-rate correlations, while the JPY’s response remains comparatively muted. These dynamics could be interpreted as an increase in the convenience yield on those days, which attenuates the impact of preferred-habitat investors.

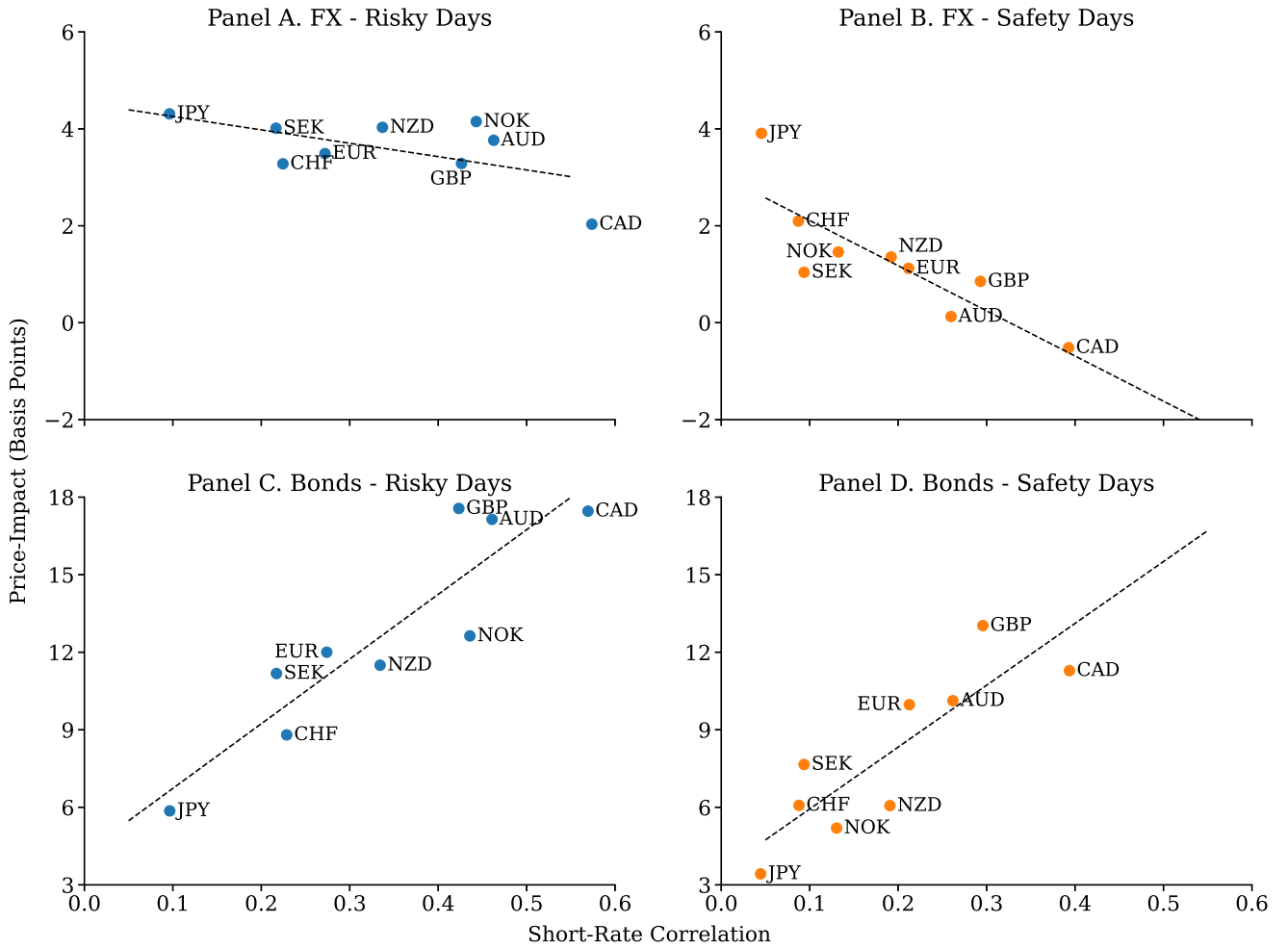
Second, in bond markets, price-impact coefficients are more tightly clustered on safe days, whereas on risky days the effects are larger and more dispersed. This pattern is primarily driven by countries with high short-rate correlations, whose yields co-move more strongly with U.S. yields during risky periods. In particular, the UK, Canada, Australia, and Germany (EUR) show stronger co-movement with the United States, while for other countries yields move in the opposite direction.

F. Decomposing Demand Shock Dynamics

While the previous results suggest broadly similar responses across currency and bond markets during both risky and safe days, our final step seeks to more rigorously disentangle the underlying drivers of demand shocks, by exploiting high-frequency co-movement in asset prices. Specifically, we build on the identification approaches of Jarociński and Karadi (2020) and Cieslak and Schrimpf (2019), and focus on the joint dynamics of U.S. Treasury futures and the U.S. dollar to identify the nature of the demand shocks.

Figure 6. Short-Rate Correlations and Demand Shocks: Safe and Risky Days

The figure shows the relationship between short-rate correlations and the price impact of U.S. Treasury demand shocks on FX (top panels) and 10-year foreign sovereign bonds (bottom panels), distinguishing between auction days when U.S. Treasuries are considered risky assets (left, blue) or safe assets (right, orange). Short-rate correlations are computed using a 5-year rolling window of monthly changes in 3-month yields. The price impact of U.S. Treasury demand shocks are the beta coefficients from regressing each G9 country's currency and 10-year sovereign bond returns on the (log) price change in the 10-year U.S. Treasury futures in a 20-minute window around auctions. Currency returns are calculated in the same 20-minute window, whereas bond returns around an auction on day t are calculated as the (log) price change between day $t-1$ and day $t+1$. Days when U.S. Treasuries are considered safe are those when the intraday return correlation between 10-year U.S. Treasury futures and equity futures is below its sample median. The sample period is 2004 to 2024.



F.1. Shock Classifications and Sign Restrictions

We exploit the high-frequency co-movement of Treasury futures and exchange rates and use sign restrictions to distinguish between two conceptually different demand shocks. When both U.S.

Treasury prices and the dollar appreciate simultaneously, this reflects a surge in the demand for U.S. safe assets—a channel we refer to as a *convenience-yield shock*. By contrast, when Treasury prices increase while the dollar depreciates, this points to shifts in the demand of segmented investor clienteles who selectively reallocate across asset classes without uniformly valuing the safety of dollar-denominated securities. We label such shocks *preferred-habitat shocks*.

Formally, we use high-frequency returns on 10-year Treasury futures and on the dollar (DOL) portfolio as reduced-form innovations:

$$u_t = \begin{bmatrix} \tilde{r}_t^{\text{TY10}} \\ \tilde{r}_t^{\text{DOL}} \end{bmatrix}.$$

We identify two structural shocks,

$$\varepsilon_t = \begin{bmatrix} \varepsilon_t^c \\ \varepsilon_t^h \end{bmatrix},$$

corresponding to convenience-yield and preferred-habitat shocks, with

$$u_t = A^{-1}\varepsilon_t, \quad \text{Var}(\varepsilon_t) = I.$$

Identification relies on *sign restrictions* on contemporaneous responses. A convenience-yield shock is required to raise Treasury futures returns while lowering DOL returns (that is, the U.S. dollar appreciates as Treasuries rise). By contrast, a preferred-habitat shock is required to raise both Treasury futures and DOL returns (that is, foreign currencies appreciate as Treasuries rise). In matrix form, this corresponds to:

$$A^{-1} = \begin{bmatrix} + & + \\ - & + \end{bmatrix},$$

where the first column corresponds to convenience-yield shocks and the second to preferred-habitat shocks.

To implement this, we follow the algorithm of Rubio-Ramírez et al. (2010) to generate admissible decompositions and adopt the median target solution of Fry and Pagan (2011), which selects the decomposition whose responses are closest to the median across all admissible draws. The resulting structural shocks form the basis for historical decompositions of Treasury and dollar

returns, allowing us to assess the relative importance of convenience-yield and preferred-habitat shocks over time.

F.2. Results

The results are summarized in Figure 7, which plots the cumulative contribution of the identified shocks to the returns of Treasury futures with 10-year maturity (left panel) and to the DOL (right panel). In both graphs, the blue line captures the overall response, while the orange and green lines capture the contributions of the preferred-habitat demand shocks and convenience demand shocks, respectively.

First, both types of demand shocks played a meaningful role over the sample period, but their relative importance has shifted over time. For Treasury futures, convenience demand shocks dominate early in the sample: the green line rises sharply during the global financial crisis, consistent with a surge in demand for U.S. safe assets. However, after 2015 the contribution of these shocks levels off, and from 2022 onward even declines, suggesting that safety-driven inflows have diminished more recently. In contrast, the cumulative contribution of preferred-habitat demand shocks (orange line) continues to rise steadily after 2010, and accelerates from 2020 onward. This highlights the increasing role of investor segmentation and reallocation motives in driving Treasury market dynamics in recent years.

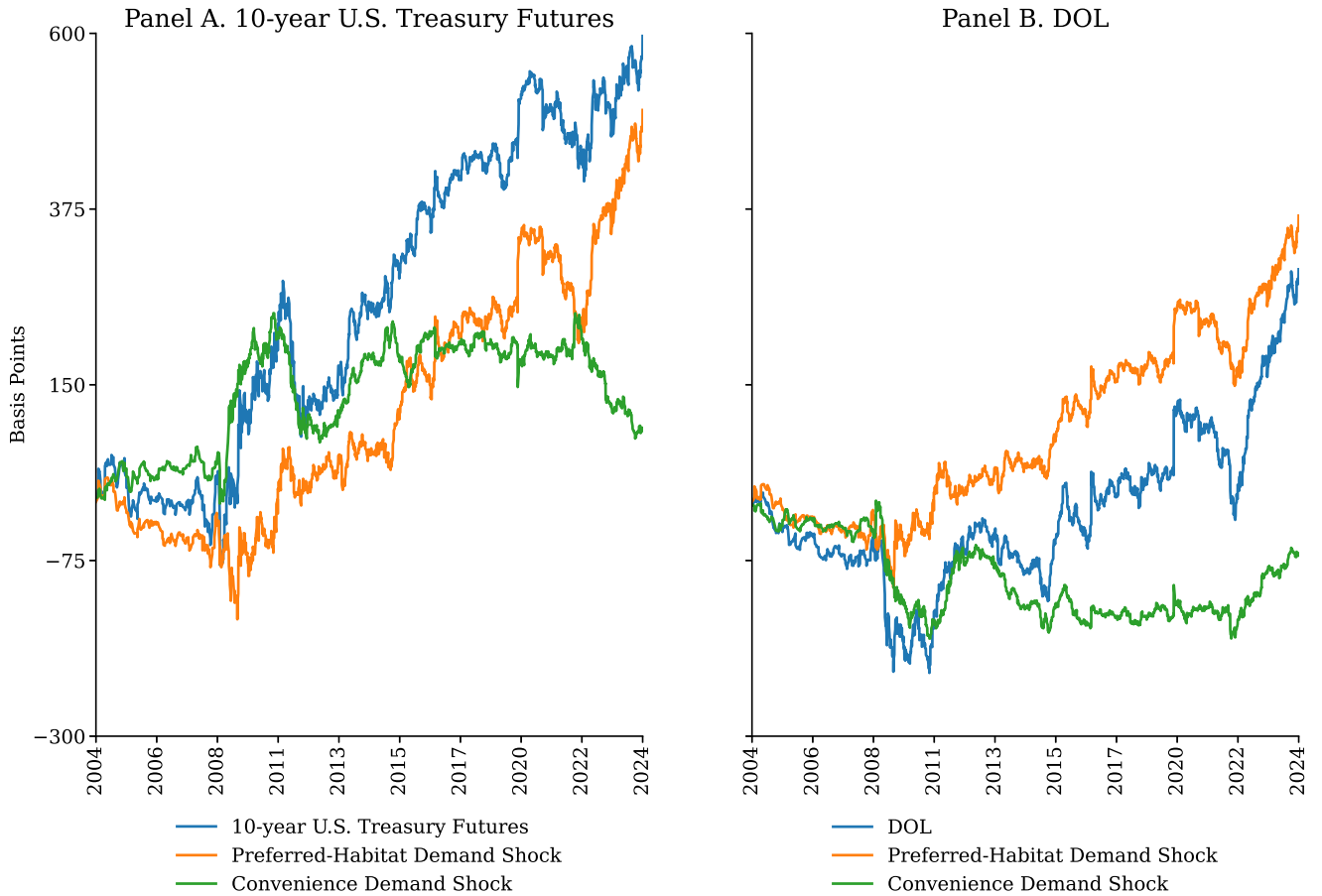
Second, the dollar portfolio displays broadly similar dynamics, though with some differences in timing. Here, the relative importance of preferred-habitat shocks begins to increase shortly after the financial crisis and becomes particularly pronounced following the COVID-19 pandemic. By the end of the sample, the U.S. dollar's response is overwhelmingly explained by preferred-habitat shocks, while the role of convenience-yield shocks is comparatively muted.

Taken together, the graphs suggest a shift in the relative importance of the two types of shocks over time. Our findings are not at odds with earlier studies that emphasize the central role of convenience yields in driving exchange rate dynamics, particularly during periods of heightened risk aversion and global stress. Indeed, our evidence confirms that convenience-yield shocks were the dominant driver in the aftermath of the global financial crisis, consistent with the literature that highlights the U.S. dollar's special role as a safe-haven asset. At the same time, however, the more recent data reveal that preferred-habitat shocks have grown in magnitude and persistence, accounting for an increasingly large share of the variation in both Treasury and FX markets. This

underscores that, while safety-driven demand remains an important channel, investor heterogeneity and segmented demand across asset classes have become equally—if not more—relevant in shaping the cross-market transmission of U.S. shocks during the current sample period.

Figure 7. Preferred-Habitat Demand vs. Convenience Demand

The figure shows the decomposition of intraday returns of the 10-year U.S. Treasury futures and the DOL portfolio around auctions into preferred-habitat demand shocks and convenience demand shocks, with the former reflecting shifts in U.S. Treasury future prices and the DOL portfolio in the same direction, and the latter, shifts in the opposite direction. Returns are cumulated over the sample of auctions. The sample period is 2004 to 2024.



VI. Conclusion

This paper provides causal identification of how U.S. Treasury demand shocks transmit internationally through FX and bond markets. Using high-frequency price changes around Treasury auctions to isolate demand shocks, we document two novel empirical findings. First, the U.S. dollar systematically depreciates following positive Treasury demand shocks in contrast to the conven-

tional safe-haven channel where increased demand for U.S. safe assets typically strengthens the dollar. Second, the transmission channel of these demand shocks varies predictably across countries based on their short-rate correlation with the United States: countries with lower correlations experience stronger currency responses but weaker bond yield responses, while high-correlation countries show the opposite pattern.

Our empirical patterns are consistent with segmented market models featuring specialized global arbitrageurs with limited risk-bearing capacity, as developed by Greenwood et al. (2023) and Gourinchas et al. (2025). When Treasury demand increases, these arbitrageurs absorb the excess demand but must rebalance their portfolios across markets, creating systematic spillovers to foreign exchange and international bond markets. Most importantly, we provide the first empirical validation of the theoretical prediction that short-rate correlations determine the cross-sectional pattern of international transmission. This finding directly confirms the risk-sharing mechanism underlying segmented markets theories: arbitrageurs adjust their portfolios differently depending on whether foreign and U.S. short rates move together, causing the transmission to occur primarily through exchange rates for uncorrelated countries and through bond yields for correlated ones.

Our findings offer crucial insights for understanding how quantity-based U.S. policies transmit internationally, extending beyond existing QE research. We show that portfolio balance effects can represent an important transmission channel for any U.S. policy altering Treasury supply, including QE, balance sheet normalization, and fiscal expansion. The strength of international transmission depends critically on monetary policy synchronization between countries, as captured by short-rate correlations. Higher correlations reflect more synchronized interest rate movements, whether due to closer economic integration or similar exposure to global shocks. QE in the United States will generate stronger exchange rate effects on countries with more independent monetary policies but stronger bond yield effects on countries with synchronized rate movements. These insights extend to fiscal policy, suggesting that U.S. debt expansion systematically affects global financial conditions through portfolio rebalancing, with transmission channels varying predictably based on countries' degree of monetary policy synchronization.

A. Appendix: Figures

Figure A-1. Persistence of Demand Surprise Impact: Individual Currencies

The figure shows results from local projections for individual currencies whereby the independent variable is the demand shock in Treasury markets, as measured by (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around auctions. The dependent variable is the change in log prices starting from the end of the auction day t and to the end of the trading day h days after the auction ($t + h$). The solid blue line refers to the regression coefficient, while the shaded areas indicate 90% confidence intervals. The sample period is 2004 to 2024.

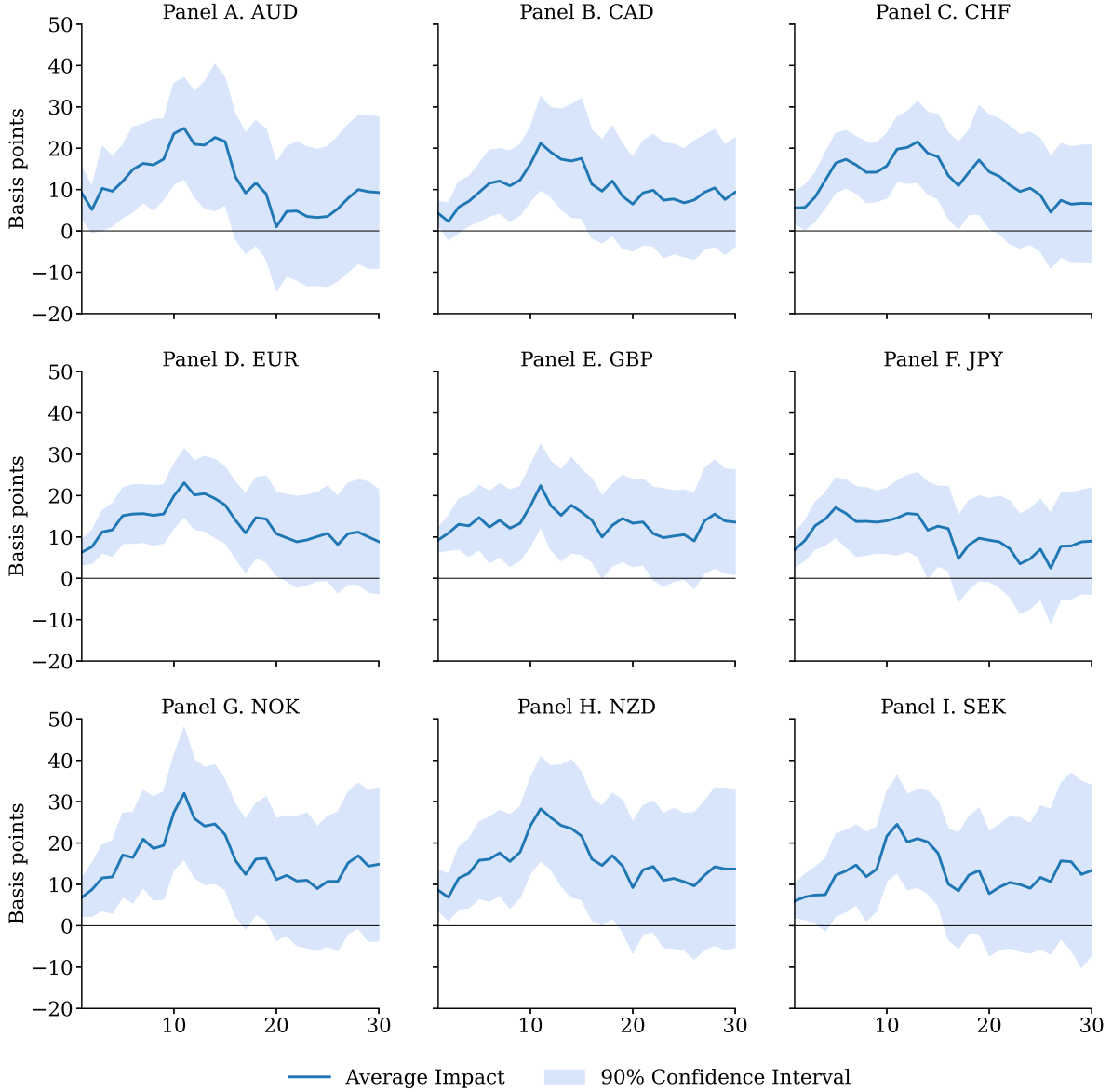
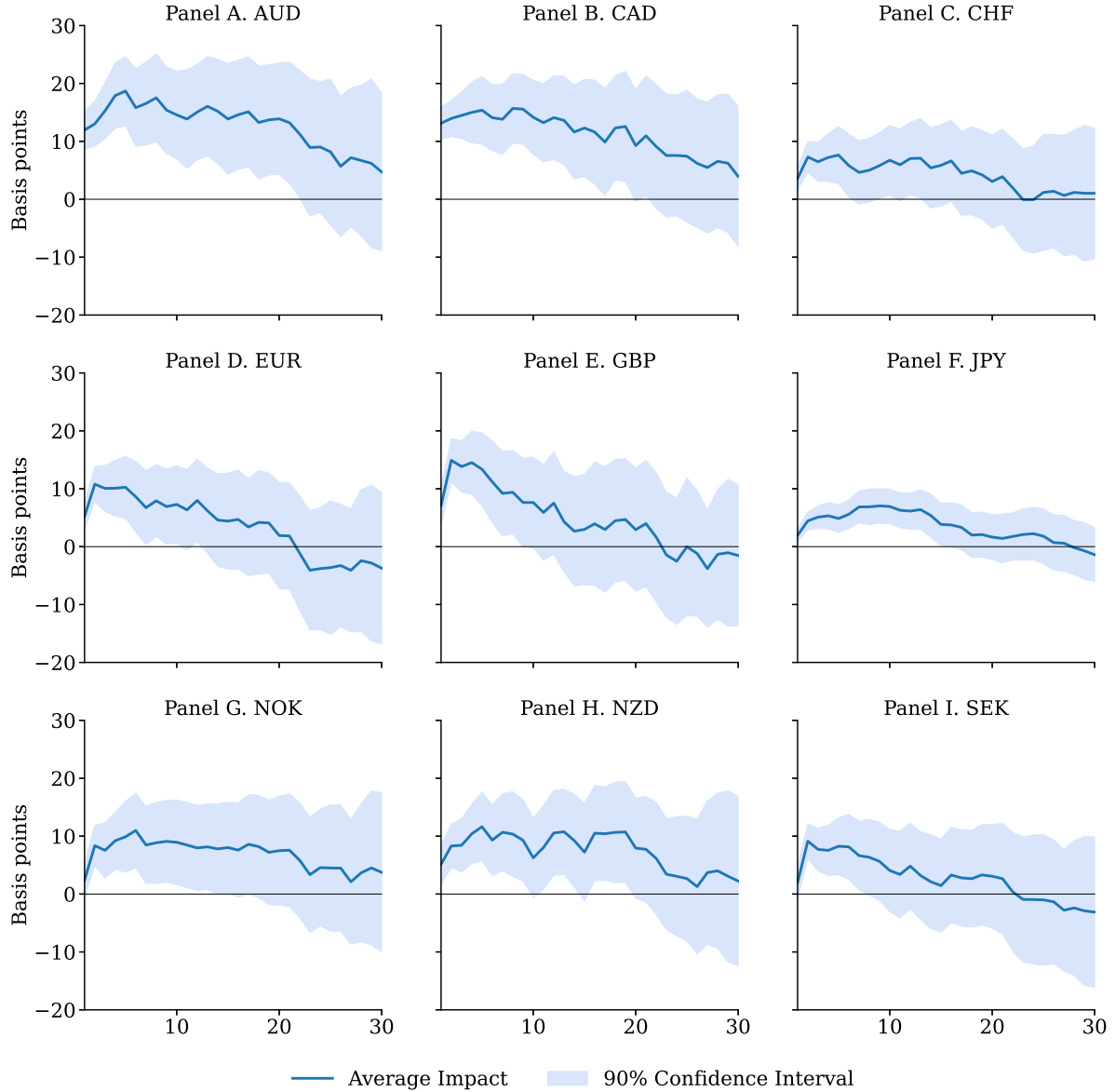


Figure A-2. Persistence of Demand Surprise Impact: Foreign Bonds

The figure shows results from local projections for individual country 10-year sovereign bonds whereby the independent variable is the shock in demand in Treasury markets, as measured by (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around auctions. The dependent variable is the return of the 10-year foreign bond from the end of the auction t and to the end of the trading h days after the auction ($t+h$). The solid blue line refers to the regression coefficient, while the shaded areas indicate 90% confidence intervals. The sample period is 2004 to 2024.



B. Appendix: Tables

Table B-I
Foreign Short-Rates

This table reports regression results of daily returns in 3-month (Panel A) and 6-month (Panel B) foreign country Treasury bills on (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around auctions. Columns 1-9 report results for individual foreign countries. Column 10 reports the result for the DOL portfolio, defined as the average return across the 3-month Treasury bills of the countries reported in columns 1-9. Coefficients are standardized to represent a 1-standard-deviation change in 10-year U.S. Treasury futures returns. Numbers in parentheses refer to Newey and West (1987)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Panel A: 3-Month Yields										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D	0.01 (0.01)	0.00 (0.00)	0.01** (0.00)	-0.00 (0.00)	-0.00 (0.01)	0.00 (0.00)	-0.02 (0.02)	0.02 (0.01)	-0.01 (0.01)	0.00 (0.00)
N	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356
R^2	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Panel B: 6-Month Yields										
	AUD	CAD	CHF	EUR	GBP	JPY	NOK	NZD	SEK	DOL
D	0.02 (0.02)	0.01** (0.01)	0.00 (0.01)	0.02*** (0.01)	0.02 (0.01)	-0.00 (0.00)	-0.02 (0.02)	0.04 (0.02)	-0.01 (0.01)	0.01 (0.01)
N	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356
R^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B-II
Demand Shocks: Alternative Window Sizes

The table reports results to the following regression:

$$\Delta s_{i,t} = \alpha_i + \beta D_t + \varepsilon_{i,t}, \quad (7)$$

where $\Delta s_{i,t}$ refers to the returns of currency i in a small window around an auction on date t , and D_t refers to demand measures based on price changes of U.S. Treasury futures across different window lengths. Numbers in parentheses refer to t-statistics, based on Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is January 2002 to December 2018.

U.S. Treasury Futures		
	FX	Bonds
-10mto+10m	2.26*** (0.31)	10.02*** (1.47)
-30mto+30m	1.64*** (0.29)	10.05*** (1.35)
-60mto+60m	1.3*** (0.3)	12.48*** (1.41)
-90mto+90m	0.75** (0.36)	15.43*** (1.66)

Table B-III
Alternative High-Frequency FX Datasets

This table reports panel regressions of high-frequency currency returns calculated from different datasets on (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around auctions. Currency returns are calculated over the same 20-minute window. Numbers in parentheses refer to Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2011 to March 2024.

U.S. Treasury Futures			
	LSEG RTH	LSEG Quotes	LSEG Trades
D_t	2.32*** (0.35)	2.12*** (0.30)	1.40*** (0.28)
Currency FE	Yes	Yes	Yes
N	8622	8622	8622
R^2	0.09	0.08	0.04

Table B-IV
Alternative Bond Return Calculation

The table reports results to the regression:

$$\Delta p_{i,t}^* = \alpha_i + \gamma D_t + \varepsilon_{i,t},$$

where $\Delta p_{i,t}^*$ refers to 10-year bond returns of country i between days $t - 1$ and t (first column), $t - 1$ and $t + 1$ (second column), or $t - 1$ and $t + 2$ (third column). D_t denotes (log) price changes in 10-year U.S. Treasury futures over a 20-minute window, all measured around an auction on date t . Numbers in parentheses refer to Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

Global Bond Markets			
	$p_t^* - p_{t-1}^*$	$p_{t+1}^* - p_{t-1}^*$	$p_{t+2}^* - p_{t-1}^*$
D_t	5.83*** (1.30)	10.02*** (1.47)	10.32*** (1.68)
Currency FE	Yes	Yes	Yes
N	12204	12204	12204
R^2	0.02	0.02	0.02

Table B-V
Subsample Analysis - Excl. Global Financial Crisis

The table reports results to the following regressions:

$$\Delta s_{i,t} = \alpha_i + \beta D_t + \varepsilon_{i,t},$$

$$\Delta p_{i,t}^* = \alpha_i + \gamma D_t + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ refers to the returns of currency i in a small window around an auction on date t (first column), and $\Delta p_{i,t}^*$ refers to 10-year bond returns of country i between days $t - 1$ and $t + 1$ (second column). D_t refers to (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around an auction. The sub-columns “With Crisis” include the global financial crisis from 2007 to 2009 in the sample, whereas the sub-columns “W/O Crisis” exclude the global financial crisis from the sample. Numbers in parentheses refer to Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024, excluding the global financial crisis from 2007 to 2009.

	FX		Bonds	
	With Crisis	W/O Crisis	With Crisis	W/O Crisis
D_t	2.26*** (0.31)	2.69*** (0.33)	10.02*** (1.47)	11.21*** (1.60)
Currency FE	Yes	Yes	Yes	Yes
N	12555	11223	12204	10881
R^2	0.07	0.09	0.02	0.02

Table B-VI
Seasonality - End-of-Month Effects

The table reports results to the following regression:

$$\Delta s_{i,t} = \alpha_i + \beta D_t + \alpha_{EOM} \times \mathbb{1}^{EOM} + \beta^{EOM} D_t \times \mathbb{1}^{EOM} + \varepsilon_{i,t}$$

or

$$\Delta p_{i,t}^* = \alpha_i + \gamma D_t + \alpha_{EOM} \times \mathbb{1}^{EOM} + \gamma^{EOM} D_t \times \mathbb{1}^{EOM} + \varepsilon_{i,t},$$

where $\Delta s_{i,t}$ refers to the returns of currency i in a 20-minute window around an auction on date t (first column), and $\Delta p_{i,t}^*$ refers to 10-year bond returns of country i between days $t - 1$ and $t + 1$ (second column). D_t refers to (log) price changes in 10-year U.S. Treasury futures in a 20-minute window around an auction. $\mathbb{1}^{EOM}$ refers to an indicator variable, which equals 1 during the last 3 days of the month, and zero otherwise. Numbers in parentheses refer to Driscoll and Kraay (1998)-adjusted standard errors. ***, **, * refer to significance at the 1%, 5%, and 10% levels, respectively. The sample period is 2004-2024.

	FX		Bond	
	(1)	(2)	(3)	(4)
D_t	2.26*** (0.31)	2.08*** (0.37)	10.02*** (1.47)	9.66*** (1.60)
$\mathbb{1}^{EOM}$		0.11 (0.39)		0.37 (3.85)
$\mathbb{1}^{EOM} \times D_t$		0.82 (0.62)		1.59 (3.38)
Currency FE	Yes	Yes	Yes	Yes
N	12555	12555	12204	12204
R^2	0.07	0.07	0.02	0.02

Table B-VII
Summary Statistics: Bid-to-Cover Ratio and Allocation

This table reports summary statistics for demand measures based on the unexpected bid-to-cover ratio (Panel A) and for the unexpected share of the auctioned U.S. Treasury allocated to different investor types (Panel B). The unexpected bid-to-cover ratio and allocation share are the residuals from AR(3) processes of the bid-coverage ratio and allocation share. The investor group “Miscellaneous” includes banks, pension funds, individuals, System Open Market Account (Federal Reserve), and others. The sample period is 2004 to 2024.

Panel A: Bid-to-Cover Ratio - Disaggregated by Bidder Type								
	Mean	Std	Min	P25	P50	P75	Max	N
Bid-Coverage Ratio	0.01	0.27	-1.17	-0.15	-0.00	0.15	1.87	1392
Direct Bidders	0.00	0.07	-0.37	-0.03	-0.00	0.03	0.51	1392
Indirect Bidders	0.01	0.13	-0.74	-0.07	0.00	0.08	0.58	1392
Primary Dealers	0.00	0.21	-1.52	-0.09	0.00	0.09	1.78	1392
Panel B: Allocation - Disaggregated by Investor Group								
	Mean	Std	Min	P25	P50	P75	Max	N
Broker-Dealers	0.49	9.99	-40.32	-5.22	-0.06	5.49	73.64	1392
Investment Funds	0.40	8.94	-61.35	-5.16	0.12	5.89	32.40	1392
Foreign Investors	0.80	7.14	-35.54	-2.86	0.85	4.58	38.10	1392
Miscellaneous	1.19	6.77	-26.11	-0.55	0.38	2.41	35.90	1392

References

- Acharya, V. V. and Laarits, T. (2023). When Do Treasuries Earn the Convenience Yield?—A Hedging Perspective. *NBER Working Paper*, w31863.
- Albagli, E., Ceballos, L., Claro, S., and Romero, D. (2024). UIP deviations: Insights from event studies. *Journal of International Economics*, 148:103877.
- Andersen, T. G., Bollerslev, T., Diebold, F. X., and Vega, C. (2003). Micro effects of macro announcements: Real-time price discovery in foreign exchange. *American Economic Review*, 93(1):38–62.
- Antolin-Diaz, J. (2025). How did government bonds become safe? *MIT Sloan Working Paper*, 7314-24.
- Bank for International Settlements (2022). OTC foreign exchange and interest rate derivatives markets through the prism of the Triennial Survey. *BIS Quarterly Review*, December 2022.
- Bank for International Settlements (2025). International finance through the lens of BIS statistics: bond markets, domestic and international. *BIS Quarterly Review*, September 2025.
- Bauer, M. D. and Neely, C. J. (2014). International channels of the Fed’s unconventional monetary policy. *Journal of International Money and Finance*, 44:24–46.
- Chaudhary, M., Zhiyu, F. J., and Zhou, H. (2025). Anatomy of the treasury market: Who moves yields?
- Cieslak, A. and Schrimpf, A. (2019). Non-monetary news in central bank communication. *Journal of International Economics*, 118:293–315.
- Dedola, L., Georgiadis, G., Gräb, J., and Mehl, A. (2021). Does a big bazooka matter? Quantitative easing policies and exchange rates. *Journal of Monetary Economics*, 117:489–506.
- Driscoll, J. C. and Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80:549–560.
- Eren, E., Schrimpf, A., and Xia, F. D. (2023). The demand for government debt. *BIS Working Papers*, No 1105.

- Ferrari, M., Kearns, J., and Schrimpf, A. (2021). Monetary policy’s rising FX impact in the era of ultra-low rates. *Journal of Banking and Finance*, 129:106142.
- Fry, R. and Pagan, A. (2011). Sign restrictions in structural vector autoregressions: A critical review. *Journal of Economic Literature*, 49(4):938–960.
- Gourinchas, P.-O., Ray, W., and Vayanos, D. (2025). A preferred-habitat model of term premia, exchange rates, and monetary policy spillovers. *American Economic Review*, forthcoming.
- 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.
- Gürkaynak, R. S., Sack, B., and Swanson, E. (2005). Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking*, 1(1).
- Hanson, S. G. and Stein, J. C. (2015). Monetary policy and long-term real rates. *Journal of Financial Economics*, 115(3):429–448.
- Hu, G. X., Jin, Z., and Pan, J. (2025). The Stock-Bond Correlation: A Tale of Two Days in the U.S. Treasury Bond Market. *Working Paper*, available at SSRN 5533913.
- Jansen, K. A., Li, W., and Schmid, L. (2025). Granular treasury demand with arbitrageurs. *USC Marshall School of Business Research Paper*, available at SSRN 4940397.
- Jarociński, M. and Karadi, P. (2020). Deconstructing monetary policy surprises—the role of information shocks. *American Economic Journal: Macroeconomics*, 12(2):1–43.
- 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.
- Jiang, Z., Richmond, R. J., and Zhang, T. (2025). Understanding the Strength of the Dollar. *Journal of Financial Economics*, 168:104052.
- Koijen, R. S. J. and Yogo, M. (2019). A demand system approach to asset pricing. *Journal of Political Economy*, 127(4):1475–1515.

- Newey, W. K. and West, K. D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3):703–708.
- Phillot, M. (2025). Us Treasury Auctions: A High-Frequency Identification of Supply Shocks. *American Economic Journal: Macroeconomics*, 17(1):245–273.
- Ray, W., Droste, M., and Gorodnichenko, Y. (2024). Unbundling quantitative easing: Taking a cue from treasury auctions. *Journal of Political Economy*, 132(9):3115–3172.
- Rubio-Ramírez, J. F., Waggoner, D. F., and Zha, T. (2010). Structural vector autoregressions: Theory of identification and algorithms for inference. *Review of Economic Studies*, 77(2):665 – 696.
- Somogyi, F., Wallen, J., and Xu, L. (2025). Treasury auctions and long-term bond yields. *Working Paper*, available at SSRN 5025427.
- Zou, D. (2024). Bond demand and the yield-exchange rate nexus: Risk premium vs. convenience yield. *Working Paper*.