Liquidity Facilities: Evidence from High-Frequency Identification*

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Abstract

This paper constructs a novel high-frequency liquidity news surprise to identify the effects of Federal Reserve liquidity facility announcements during the Global Financial Crisis and COVID-19 pandemic. Using local projections, we show that liquidity facility announcements substantially lower long-term Treasury yields, with a one percentage point expansionary surprise reducing 10-year yields by approximately 0.2 percentage points. This effect operates almost entirely through term premia rather than expected future short rates. Inconvenience yields on treasury securities fall substantially and primary dealer increase their relative holdings of Treasuries. Our findings demonstrate that liquidity facilities represent an effective tool which reduce risk premia during financial crises.

Keywords: Monetary policy shocks, Liquidity facilities, Term premia, Treasury markets
JEL Classification: E52, E58, G12, G23

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1 Introduction

During the COVID-19 pandemic, the Federal Reserve lowered interest rates to zero, launched quantitative easing, and announced a suite of emergency lending facilities targeting specific market segments. On March 17, 2020, the Fed introduced the Commercial Paper Funding Facility to backstop the commercial paper market, and later that day announced the Primary Dealer Credit Facility to provide direct funding to Treasury market intermediaries. These announcements occurred within hours of each other but addressed fundamentally different problems: conventional policy aimed to lower the path of short-term rates, while liquidity facilities aimed to alleviate funding market stress and intermediary balance sheet constraints.

A substantial literature has developed tools to measure the surprise component of conventional monetary policy announcements and trace their effects on financial markets and the economy (Kuttner, 2001; Gürkaynak et al., 2005; Nakamura and Steinsson, 2018; Bauer and Swanson, 2022). However, these measures capture only announcements about interest rate policy and large-scale asset purchases. Liquidity facilities—which constituted a major component of the Federal Reserve's crisis response during both the Global Financial Crisis and COVID-19—remain largely unstudied using high-frequency identification methods. This gap is consequential. If liquidity facilities work through different channels than conventional policy, ignoring them entirely could lead to misleading inferences about the effectiveness of central bank interventions during crises.

This paper addresses this gap by constructing a novel high-frequency surprise measure—the Liquidity News Surprise (LNS)—that captures the unexpected component of liquidity facility announcements. We collect high-frequency data on Eurodollar around 34 liquidity facility announcements during the GFC and COVID-19, including facilities such as the Primary Dealer Credit Facility, Commercial Paper Funding Facility, Term Asset-Backed Securities Loan Facility, and Money Market Mutual Fund Liquidity Facility. Following the established high-frequency identification approach, we compute the first principal component of futures price changes in narrow windows around these announcements, providing a measure of how much the announcements surprised markets.

Using local projections, we trace out the causal effects of liquidity facility announcements on Treasury yields, term premia, equity prices, and funding spreads. We compare these effects to those of conventional monetary policy announcements—both scheduled and unscheduled FOMC meetings where interest rate decisions were made—over the same sample period. This comparison reveals a striking difference in transmission mechanisms.

Our main finding is that liquidity facility announcements substantially lower long-term Treasury yields, with the effect operating almost entirely through term premia rather than expected future short rates. Following a percentage point expansionary liquidity surprise, the 10-year Treasury yield declines by approximately 0.2 percentage points on impact. Decomposing yields

using the model of Adrian et al. (2013), we find that the 10-year term premium falls by roughly 0.4 percentage points while the expected future short rate component shows no significant response. This stands in sharp contrast to conventional monetary policy announcements during the same period, which reduce yields but a substantially lower scale.

Why do liquidity facility announcements reduce term premia? We propose that these facilities work by alleviating balance sheet constraints on financial intermediaries, freeing up capacity for fixed-income arbitrage activities. In models of intermediary asset pricing (Vayanos and Vila, 2021; Kekre et al., 2022), risk-averse dealers arbitrage between preferred-habitat investors across the yield curve. When dealers face binding balance sheet constraints, they demand higher compensation for bearing duration risk, pushing up term premia. Policies that relax these constraints allow dealers to absorb more duration, thereby compressing term premia.

We provide three types of evidence for this mechanism. First, and most directly, we examine primary dealer Treasury holdings using weekly data from Klingler and Sundaresan (2023). Following liquidity facility announcements, primary dealer relative holdings of non-bill Treasuries increase sharply over the subsequent 4-10 weeks. This provides direct evidence that dealers expand their Treasury positions when liquidity facilities relax balance sheet constraints. Critically, conventional monetary policy announcements produce no such increase in dealer holdings—they remain flat or even decline—despite monetary policy also affecting Treasury yields. This stark contrast validates that the term premium compression we document operates specifically through the balance sheet capacity channel rather than through generic "Fed intervention" effects.

Second, we examine direct measures of dealer balance sheet costs using Treasury-OIS spreads, which capture the shadow costs of holding Treasuries (He et al., 2022). During the onset of the COVID-19 pandemic in March 2020, when regulatory leverage ratios and large Treasury supply shocks created binding balance sheet constraints, liquidity facility announcements significantly reduced 10-year Treasury-OIS spreads by approximately 0.3 to 0.4 percentage points. During the GFC, when flight-to-safety dynamics dominated, the facilities had smaller and less precisely estimated effects on Treasury-OIS spreads, though term premia still declined substantially. This context-dependent effectiveness suggests the facilities work most powerfully when addressing the specific constraints they were designed to alleviate.

Third, we examine responses of the Primary Dealer Equity Index (Kekre et al., 2022), which proxies for intermediary net worth. Following liquidity facility announcements, primary dealer equity rises by approximately 10 percent. The increase in dealer net worth occurring simultaneously with term premium declines is consistent with theoretical predictions, though the evidence is stronger during the GFC than during COVID-19, likely reflecting the evolving institutional structure of Treasury market intermediation.

To establish that these effects are specific to targeted liquidity facilities rather than any Federal Reserve crisis intervention, we compare responses across different types of announcements. Dis-

count window operations—which during the GFC included the Term Auction Facility—show minimal effects on Treasury yields, term premia, or intermediary equity, perhaps explaining why the Federal Reserve abandoned these tools in favor of targeted facilities during COVID-19. Central bank swap line announcements show some effects on short-term funding spreads but no consistent impact on long-term yields or term premia, consistent with their design to address cross-currency funding pressures rather than domestic intermediary balance sheet constraints (Kekre and Lenel, 2025)

Our findings make several contributions. First, we extend the high-frequency identification toolkit to a new dimension of central bank policy. The Liquidity News Surprise provides researchers with a measure to evaluate lender-of-last-resort interventions using the same empirical framework that has proven successful for studying conventional monetary policy. This is particularly valuable given the increasing frequency with which central banks deploy such facilities during crises.

Second, we provide empirical evidence on the determinants of term premia that speaks to recent theoretical developments in intermediary asset pricing. The strong reduction in term premia following announcements that relax intermediary constraints, coupled with direct evidence that these announcements reduce balance sheet costs, supports models in which dealer capacity is a key state variable governing risk premia (Vayanos and Vila, 2021; Kekre et al., 2022; He et al., 2022). Our finding that this channel varies in strength across crisis episodes—strongest when balance sheet constraints bind most tightly—provides further evidence for these mechanisms.

Third, we contribute to the literature evaluating specific Federal Reserve crisis facilities. Previous work has examined individual programs such as the Primary Dealer Credit Facility (Adrian et al., 2009; Martin and McLaughlin, 2021), Commercial Paper Funding Facility (Boyarchenko et al., 2022), and various other interventions during both crises. Our unified framework allows direct comparison of liquidity facilities with other policy tools and demonstrates their effectiveness in reducing term premia across multiple crisis episodes.

Finally, our results have important policy implications. Liquidity facilities represent an effective tool for addressing financial market dysfunction during crises, particularly when intermediary balance sheet constraints limit arbitrage capacity. The distinct transmission mechanism—working through term premia rather than expectations—indicates that liquidity facilities and conventional policy are complements rather than substitutes. An effective crisis response likely requires deploying both types of interventions in coordination.

Our paper relates to several strands of literature. The high-frequency identification approach builds on Kuttner (2001), who first suggested using Federal Funds futures to measure monetary policy shocks, and Gürkaynak et al. (2005), who documented that market participants perceive policy announcements as multi-dimensional. Subsequent work has used movements in the entire yield curve to study unconventional policy (Swanson, 2021; Rogers et al., 2014; Altavilla

et al., 2019). We add a new dimension—liquidity facilities—to this toolkit and demonstrate that these announcements have distinct effects from interest rate policy.

Our findings on term premia connect to Nakamura and Steinsson (2018), Hanson and Stein (2015), and Hanson et al. (2021), who show that monetary policy shocks significantly affect term premia. While their work focuses primarily on conventional policy and finds that expansionary shocks reduce term premia, they do not separately identify liquidity facility effects. Our contribution is to show that the term premium channel is particularly strong for liquidity facilities, which work by relaxing intermediary constraints rather than by affecting expectations about future policy rates.

The intermediary asset pricing mechanism builds on Vayanos and Vila (2021), who develop a model linking monetary policy to term premia through arbitrageur activity, and Kekre et al. (2022), who show that intermediary net worth determines the sign and magnitude of term premium responses. Our empirical evidence supports these theoretical predictions, particularly the finding that policies relaxing balance sheet constraints reduce term premia when intermediaries have positive-duration portfolios.

Finally, our work relates to the extensive literature evaluating specific lender-of-last-resort facilities during the GFC and COVID-19. Studies have examined the Primary Dealer Credit Facility (Adrian et al., 2009; Martin and McLaughlin, 2021) & Term Securities Lending Facility (Fleming et al., 2010; Acharya et al., 2017; Carlson and Macchiavelli, 2020), Corporate Credit Facilities (Boyarchenko et al., 2022; Gilchrist et al., 2020), , Term Auction Facility (McAndrews et al., 2017), and central bank swap lines (Choi et al., 2021; Kekre and Lenel, 2025). We contribute to this literature by developing a unified surprise measure that allows systematic comparison of these facilities' effectiveness using high-frequency identification.

The remainder of this paper proceeds as follows. Section 2 describes the construction of the Liquidity News Surprise and presents summary statistics. Section 3 estimates the effects of liquidity facility announcements on Treasury markets and compares transmission mechanisms across announcement types and crisis episodes. Section 4 concludes.

2 Liquidity News Surprise

During financial crises, central banks deploy a range of policy tools beyond conventional interest rate adjustments. While the existing literature has extensively studied monetary policy surprises using high-frequency identification (Kuttner, 2001; Gürkaynak et al., 2005; Nakamura and Steinsson, 2018), these measures capture only one dimension of central bank interventions. Liquidity facilities—such as the Primary Dealer Credit Facility, Commercial Paper Funding Facility, and Term Asset-Backed Securities Loan Facility—represent distinct policy actions designed to address funding market dysfunction and intermediary distress. These facilities differ fundamentally from interest rate policy in their mechanism and target. While conventional

monetary policy operates through the intertemporal price of money, liquidity facilities directly address financial intermediary constraints by transforming illiquid assets into reserves and providing funding backstops. Given these distinct channels, we expect liquidity facility announcements to have different effects on financial markets, particularly on variables related to intermediary health and term premia.

To empirically distinguish these effects, we construct a novel high-frequency surprise measure—the Liquidity News Surprise (LNS)—that captures market expectations about liquidity facility announcements separately from conventional monetary policy surprises. We identify all Federal Reserve liquidity facility announcements during the Global Financial Crisis (GFC, 2007-2009) and COVID-19 pandemic (2020) using Federal Reserve press releases and Bloomberg timestamps. We classify announcements into three categories based on their primary mechanism: (i) **Liquidity Facilities**—direct interventions targeting specific market segments such as the Primary Dealer Credit Facility, Commercial Paper Funding Facility, Term Asset-Backed Securities Loan Facility, and Money Market Mutual Fund Liquidity Facility; (ii) **Discount Window**—adjustments to the discount rate spread and the Term Auction Facility; and (iii) **Central Bank Swaps**—dollar liquidity provision to foreign central banks. Table 1 provides the complete taxonomy.

Table 1: Classification of Federal Reserve Crisis Announcements

Category	Facilities and Programs
Liquidity Facilities	Term Securities Lending Facility, Primary Dealer Credit Facility, Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, Commercial Paper Funding Facility, Term Asset-Backed Securities Loan Facility, Agency MBS Purchase Program, Primary & Secondary Market Corporate Credit Facilities, Repo Operations
Discount Window	Discount rate adjustments, Term Auction Facility
Central Bank Swaps	Dollar swap line announcements and expansions

This table classifies Federal Reserve announcements during the GFC and COVID-19 pandemic. Our primary analysis focuses on Liquidity Facilities, which directly target specific market segments and intermediary balance sheets.

Our primary analysis focuses on Category 1 (Liquidity Facilities), as these announcements most directly address intermediary balance sheet constraints and market-specific funding pressures. We identify 22 such announcements during the GFC and 12 during COVID-19. For comparison, we also construct a Policy News Surprise (PNS) for conventional monetary policy announcements—both scheduled FOMC meetings and unscheduled rate decisions—following the approach in Nakamura and Steinsson (2018) and Bauer and Swanson (2022). This yields 29 policy announcements during the GFC and 8 during COVID-19. For the March 15 2020 announcement, no high-frequency data on Eurodollar futures is available. In the appendix, we show how a true high-frequency surprise can be imputed from the foreign exchange market.

We measure market surprises using high-frequency changes in interest rate futures around

announcement times. Specifically, we collect tick-by-tick trade data from the Times and Sales dataset from the Chicago Mercantile Exchange for Eurodollar futures (contracts 1-4). All surprise measures are calculated to have a 1-to-1 movement with the fourth quarter Eurodollar future. For each announcement, we calculate the change in futures prices (converted to yields) within a narrow window around the press release. We use a 60-minute window for standalone announcements. For regular FOMC announcements, we follow (Gürkaynak et al., 2005) and calculate 30-minute window but when a press conference follows the announcement, we extend the window by 85 minutes to capture the full information release (Altavilla et al., 2019).

The choice of Eurodollar futures warrants discussion. Eurodollar contracts reflect both expectations about the path of risk-free rates and credit spreads in the unsecured interbank lending market. For liquidity facility announcements, this is precisely the relevant measure: these facilities aim to reduce funding pressures while also signaling information about the expected path of monetary policy. Thus, movements in Eurodollar futures provide a comprehensive measure of how markets revalue short-term funding costs in response to liquidity interventions. We construct both the LNS and PNS as the first principal component of the high-frequency changes across the first four Eurodollar contracts. This approach, used by Gürkaynak et al. (2005), Nakamura and Steinsson (2018), and Bauer and Swanson (2022), aggregates information across the term structure.

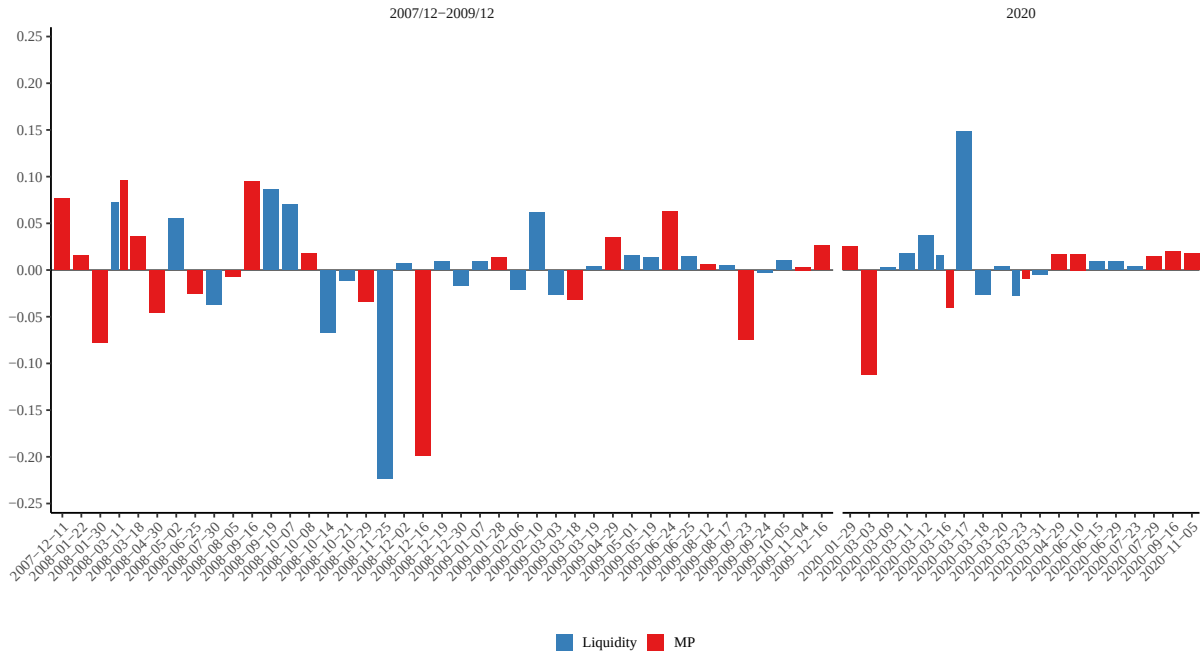
Figure 1 displays the LNS and PNS over our sample period. Both surprise measures exhibit substantial variation during both crisis episodes. The Figure reveals that liquidity facility announcements (blue bars) frequently occur on different dates than monetary policy announcements (red bars), suggesting these represent distinct policy interventions. Large liquidity surprises are visible during both the GFC (particularly in late 2008) and COVID-19 (March 2020).

Table 2 presents detailed summary statistics separately by announcement type and crisis period. Liquidity facility announcements generate surprises with mean of 0.01 and standard deviation of 0.07 during the GFC, and mean of 0.01 with standard deviation of 0.04 during COVID-19. The range of surprises is substantial: from -0.18 to 0.14 during the GFC and from -0.03 to 0.12 during COVID-19. For comparison, monetary policy announcements show similar dispersion, with standard deviations of 0.07 (GFC) and 0.04 (COVID-19). The similarity in magnitudes suggests that liquidity facility announcements were as unexpected—and potentially as economically important—as conventional policy decisions.

The distribution differs meaningfully across facility types. Discount window announcements during the GFC (N=20) show zero mean but substantial variation (SD=0.05). Central bank swap line announcements were infrequent during COVID-19 (N=2) but consistently expansionary (mean=-0.03). Notably, no discount window announcements occurred during COVID-19, indicating a shift in the Federal Reserve's crisis toolkit relative to the GFC.

Our identification strategy rests on the standard assumption in the high-frequency monetary

Figure 1: Liquidity News Surprise and Policy News Surprise



This figure plots the Liquidity News Surprise (blue bars) and Policy News Surprise (red bars) for all Federal Reserve announcements from December 2007 through December 2009 (GFC) and January through November 2020 (COVID-19). Surprises are measured as the first principal component of high-frequency changes in four Eurodollar futures contracts and the 2-year Treasury future in a narrow window around announcements. Both measures are expressed in percentage points.

Table 2: Summary Statistics: High-Frequency Surprises by Announcement Type

Type	Period	N	Mean	SD	Min	P25	Median	P75	Max
Panel A: Liquidity Facilities									
Liquidity	GFC	22	0.01	0.07	-0.18	-0.02	0.00	0.01	0.14
Liquidity	COVID-19	12	0.01	0.04	-0.03	0.00	0.01	0.02	0.12
Panel B: Other Facilities									
Discount	GFC	20	0.00	0.05	-0.11	-0.02	0.00	0.02	0.14
Discount	COVID-19	0	–	–	–	–	–	–	–
CB Swaps	GFC	13	0.00	0.06	-0.11	-0.03	-0.01	0.01	0.14
CB Swaps	COVID-19	2	-0.03	0.02	-0.04	-0.04	-0.03	-0.02	-0.02
Panel C: Monetary Policy									
FOMC	GFC	29	-0.01	0.07	-0.23	-0.04	0.00	0.03	0.11
FOMC	COVID-19	8	-0.01	0.04	-0.12	0.00	0.01	0.01	0.01

This table reports summary statistics for high-frequency surprises across different announcement types. Surprises are measured as the first principal component of changes in Eurodollar futures (contracts 1-4) and the 2-year Treasury future in narrow windows around announcements. All values are in percentage points. GFC covers December 2007-December 2009; COVID-19 covers January-November 2020.

policy literature: within narrow windows around policy announcements, movements in interest rate futures reflect only the new information released by the central bank (Kuttner, 2001; Gürkaynak et al., 2005; Nakamura and Steinsson, 2018; Camargos Jensen, 2025). This assumption requires that (i) no other relevant information arrives during the announcement window, and (ii) markets react immediately to the announcement. The validity of this assumption is

supported by several factors. First, we use narrow windows (60-85 minutes) that minimize contamination from other news. Second, we exclude announcements that coincide with other major economic releases. Third, high-frequency price movements around Federal Reserve announcements are typically orders of magnitude larger than normal intraday volatility. Given that we find similar volatility patterns for our Liquidity News Surprise these assumptions are likely satisfied.

In Section 3, we use these high-frequency surprises to trace out the causal effects of liquidity facility announcements on Treasury markets, term premia, and intermediary balance sheets using local projections.

3 The Impact of Liquidity Facility Announcements

We now turn to estimating the causal effects of liquidity facility announcements on financial markets. Our empirical strategy uses local projections (Jorda, 2005) to trace out the dynamic response of Treasury yields, term premia, equity prices, and funding spreads to the Liquidity News Surprise (LNS) and Policy News Surprise (PNS). The local projection specification is:

$$Y_{t+h} - Y_{t-1} = \alpha^h + \beta^h \text{LNS}_t + \epsilon_{t+h}, \quad h = 0, ..., 4 \tag{1}$$

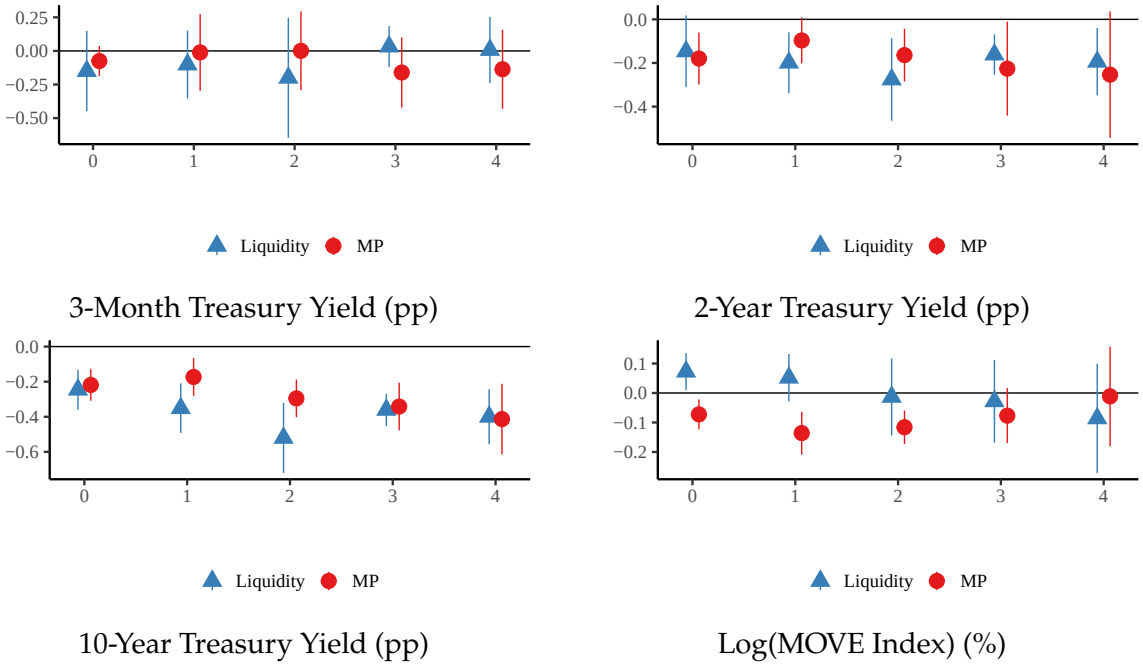
where Y_t is the outcome variable measured at daily frequency and LNS_t is our liquidity facility surprise. We estimate this specification separately for the LNS and PNS to compare transmission channels. The identifying assumption is standard in the high-frequency literature: $E(\text{LNS}_t \epsilon_{t+h} \mid Y_{t-j}, X_{j,t-k}) = 0$ (Stock and Watson, 2018). The inclusion of financial market controls helps address concerns that our surprises might partially capture time-varying risk premia or market stress.

We estimate equation (1) over the full sample from June 2007 to November 2020, which encompasses both the GFC and COVID-19 crisis periods. We focus on horizons $h = 0$ to $h = 4$ trading days to capture the immediate and short-term effects of announcements. All surprises are standardized across the full daily sample and then rescaled by the standard deviation of the surprise on the announcement days. Therefore, the coefficients can be interpreted as the response to a 1 percentage point increase in the fourth-quarter Eurodollar future on the announcement day.

Effects on Treasury Yields. Figure 2 presents the impulse response functions for Treasury yields across the maturity spectrum and for Treasury market volatility. The top panels show responses of 3-month and 2-year yields, while the bottom panels show 10-year yields and the log MOVE index (bond market implied volatility). Blue triangles denote responses to

liquidity facility announcements; red dots denote responses to conventional monetary policy announcements.

Figure 2: The Effect of Federal Reserve Announcements on Treasury Yields



This figure displays impulse response functions from local projections of Treasury yields and bond market volatility on announcement surprises. Blue triangles represent responses to liquidity facility announcements; red dots represent responses to monetary policy announcements. Surprises are standardized and scaled by the pooled standard deviation. Vertical bars show 90% confidence intervals. Sample: June 2007-November 2020.

Several patterns emerge. First, consistent with the existing literature on monetary policy surprises (Nakamura and Steinsson, 2018; Bauer and Swanson, 2022), an expansionary PNS significantly lowers Treasury yields at the 2-year and 10-year maturities. The impact effect is approximately -0.2 percentage points for both maturities, and the effect persists over subsequent trading days. The response of 3-month yields is more muted, around -0.1 percentage points, reflecting that most of the policy variation in our sample occurs through forward guidance rather than immediate rate changes.

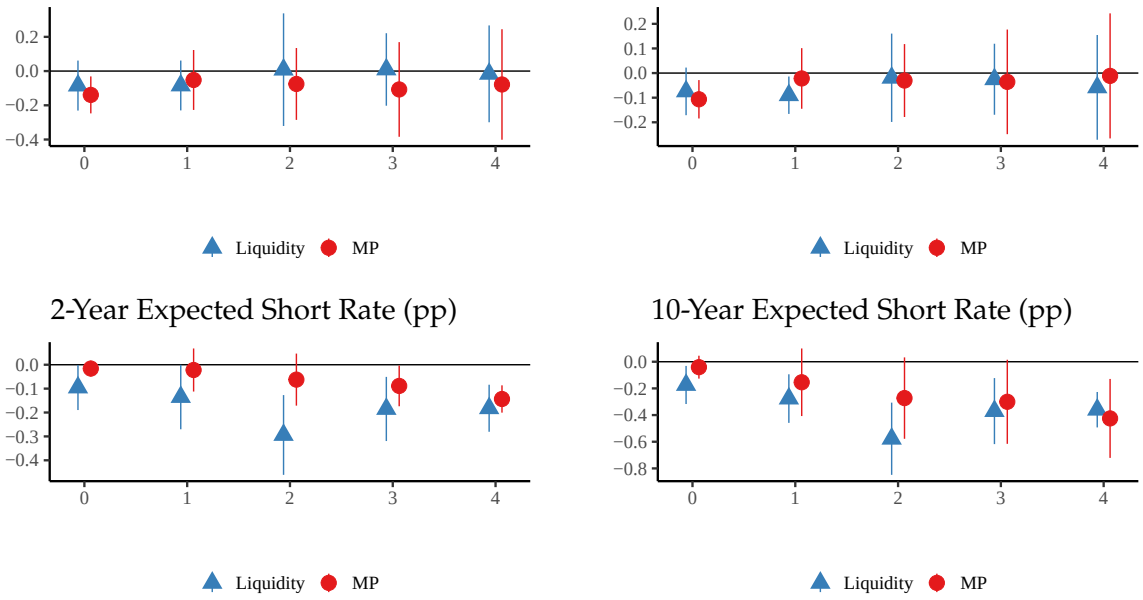
Second, and more novel, liquidity facility announcements also generate substantial declines in Treasury yields, but the pattern across maturities differs markedly. An expansionary LNS has essentially no effect on 3-month yields—the point estimates hover near zero with wide confidence intervals. In contrast, 2-year yields decline by approximately -0.2 percentage points on impact, and 10-year yields fall even more sharply, by roughly -0.25 percentage points on impact, deepening over subsequent days until a peak effect of -0.5 percentage points. This term structure of responses suggests that liquidity facilities affect longer-maturity bonds through channels distinct from conventional policy rate expectations.

Third, these types of announcements have different effects on Treasury market uncertainty. The MOVE index—an implied volatility measure analogous to the VIX for bonds—declines by

roughly 8% in response to expansionary monetary policy surprise but increases significantly in response to a liquidity surprise.

Decomposing the Transmission Mechanism. To understand why liquidity facilities and conventional policy have different effects across the yield curve, we decompose Treasury yields into their expectation and term premium components using the model of Adrian et al. (2013). Figure 3 presents this decomposition for 2-year and 10-year yields.

Figure 3: The Effect of Federal Reserve Announcements on Yield Components



This figure displays impulse response functions decomposing Treasury yield responses into expected future short rates and term premia following Adrian et al. (2013). Blue triangles represent responses to liquidity facility announcements; red dots represent responses to monetary policy announcements. Vertical bars show 90% confidence intervals. Sample: June 2007-November 2020.

The decomposition reveals a striking pattern. For conventional monetary policy announcements, the decline in both 2-year and 10-year yields operates almost entirely through lower expected future short rates on impact. The 10-year expected average short rate falls by approximately -0.1 percentage points in response to an expansionary PNS, while the 10-year term premium shows no statistically significant response. However, over time the term premium becomes negative and reaches a level of around -0.4 percentage point This finding aligns with Hanson and Stein (2015) who show that monetary policy affects term premia.

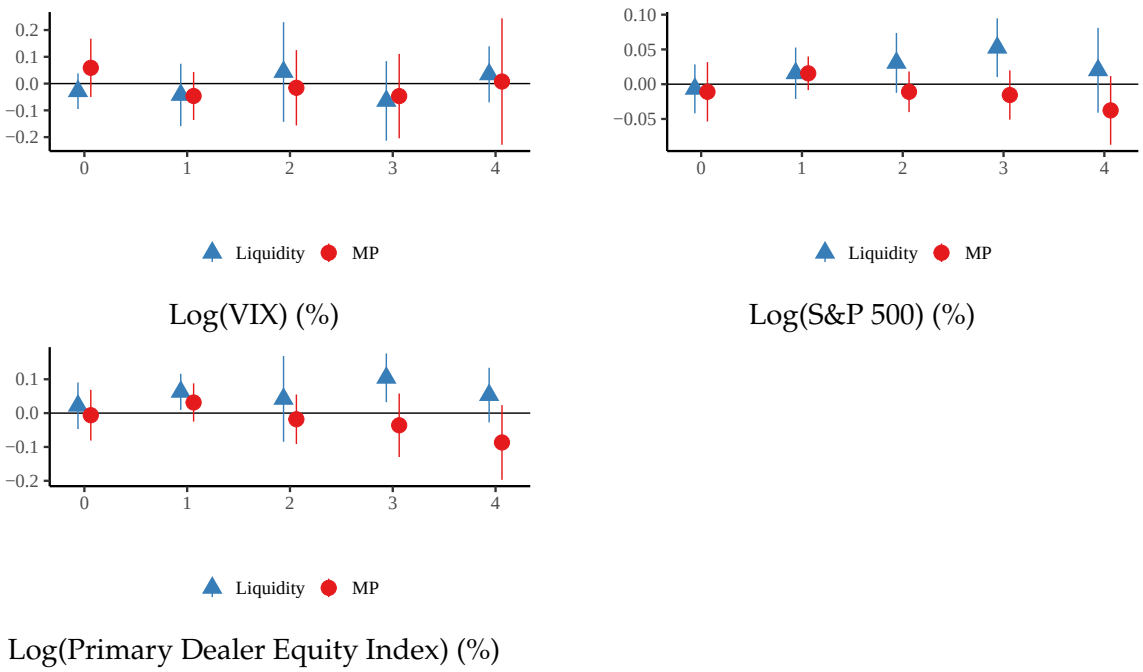
In sharp contrast, liquidity facility announcements work almost exclusively through term premia. Following an expansionary LNS, the 10-year term premium declines by roughly -0.2 percentage points on impact and remains depressed through subsequent days. Meanwhile, the expected future short rate component also reacts but at a smaller scale and only initially. This distinct transmission mechanism is economically sensible: liquidity facilities are designed to

alleviate funding market stress and intermediary balance sheet constraints rather than to signal future policy rates. The fact that they reduce term premia suggests they successfully ease the compensation investors require for bearing interest rate risk.

The Role of Financial Intermediaries. Why do liquidity facility announcements reduce term premia? Theoretical models of intermediary asset pricing offer a potential explanation. In the framework of Vayanos and Vila (2021), risk-averse intermediaries arbitrage between preferred-habitat investors across the yield curve. When these intermediaries face tighter constraints, they demand higher compensation for bearing duration risk, pushing up term premia. Kekre et al. (2022) extend this logic by showing that if intermediaries hold portfolios with positive duration, an unexpected easing of financial conditions increases their net worth, relaxing their constraints and allowing them to absorb more duration risk—thereby lowering term premia.

To test this mechanism, Figure 4 examines the response of equity prices, with particular focus on the Primary Dealer Equity Index constructed by Kekre et al. (2022). This index is the market-capitalization-weighted return on publicly traded primary dealers, the key intermediaries in Treasury and repo markets.

Figure 4: The Effect of Federal Reserve Announcements on Equity Markets



This figure displays impulse response functions for equity market variables. The Primary Dealer Equity Index is from Kekre et al. (2022). Blue triangles represent responses to liquidity facility announcements; red dots represent responses to monetary policy announcements. Vertical bars show 90% confidence intervals. Sample: June 2007-November 2020.

The results strongly support the intermediary channel. Following an expansionary liquidity facility announcement, the Primary Dealer Equity Index rises by approximately 10% after 4 trading day—a much larger response than the roughly 5% increase in the broad S&P 500. This

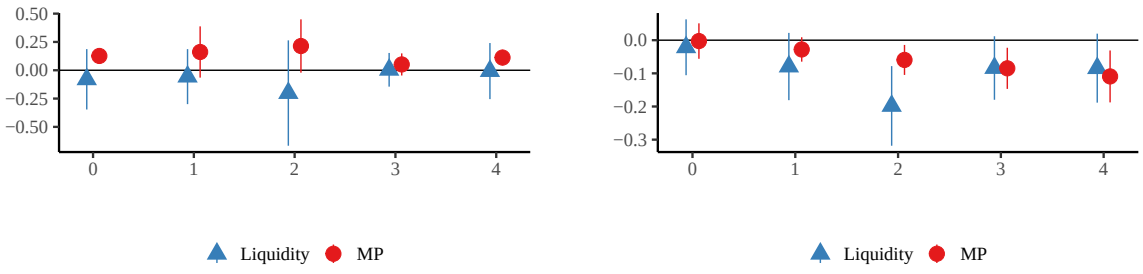
differential response indicates that primary dealers specifically benefit from liquidity facility announcements, consistent with the view that these facilities relax intermediary constraints.

In contrast, conventional monetary policy announcements show similar effects on the S&P 500 and VIX but no statistically significant differential effect on primary dealer equity. This reinforces that the two types of announcements work through distinct channels: monetary policy operates through expectations about the aggregate economy and policy path, while liquidity facilities directly target intermediary balance sheets.

Effects on Treasury Market Functioning. Beyond standard Treasury yields, we examine measures of market functioning and liquidity premia. Following He et al. (2022), we measure (in)convenience yields as the spread between Treasury yields and Overnight Index Swap (OIS) rates of comparable maturity. During the GFC, Treasury bonds exhibited a convenience yield (negative Treasury-OIS spreads) due to flight-to-safety dynamics and the special role of Treasuries as collateral (Krishnamurthy and Vissing-Jorgensen, 2012; Gorton, 2017). In contrast, during COVID-19, Treasury yields rose above OIS rates, creating an inconvenience yield as regulatory constraints made it costly for dealers to expand balance sheets in the face of large Treasury supply shocks (He et al., 2022).

Figure 5 shows that liquidity facility announcements significantly affect these (in)convenience yields. An expansionary LNS lowers the 10-year Treasury-OIS spread by approximately -0.2 percentage points after three trading days. Short-term Treasury-OIS spreads show no significant response, consistent with liquidity facilities primarily affecting intermediary capacity to hold duration rather than short-term funding conditions. Conventional monetary policy announcements increase short-term inconvenience yields, but lower inconvenience yields at similar scale to the liquidity surprise.

Figure 5: The Effect of Federal Reserve Announcements on Treasury Convenience Yields



3-Month Treasury-OIS Spread (pp) 10-Year Treasury-OIS Spread (pp)

This figure displays impulse response functions for Treasury-OIS spreads, which capture (in)convenience yields following He et al. (2022). Blue triangles represent responses to liquidity facility announcements; red dots represent responses to monetary policy announcements. Vertical bars show 90% confidence intervals. Sample: June 2007-November 2020.

This finding has an important economic interpretation. By reducing long-term inconvenience yields, the Federal Reserve's liquidity facilities successfully alleviated balance sheet pressures

on dealers, freeing up capacity for fixed-income arbitrage activities. This channel reinforces the term premium mechanism documented earlier: when dealers face lower shadow costs of holding Treasuries (lower inconvenience yields), they can provide more liquidity to the market and absorb more duration risk, thereby compressing term premia.

Comparing Crises: GFC versus COVID-19. Given the different nature of financial stress during the GFC and COVID-19, we examine whether the transmission of liquidity facility announcements differed across episodes. Figure 6 re-estimates our baseline specifications separately for the GFC period (December 2007-December 2009) and the COVID-19 period (January-November 2020).

The core findings are remarkably consistent across crises. In both episodes, liquidity facility announcements substantially lower 10-year Treasury yields, primarily through reductions in term premia rather than expected short rates. During COVID-19, the effects are somewhat larger in magnitude—10-year yields fall by roughly -0.6 to -0.8 percentage points compared to -0.4 percentage points during the GFC—but the transmission mechanism remains the same.

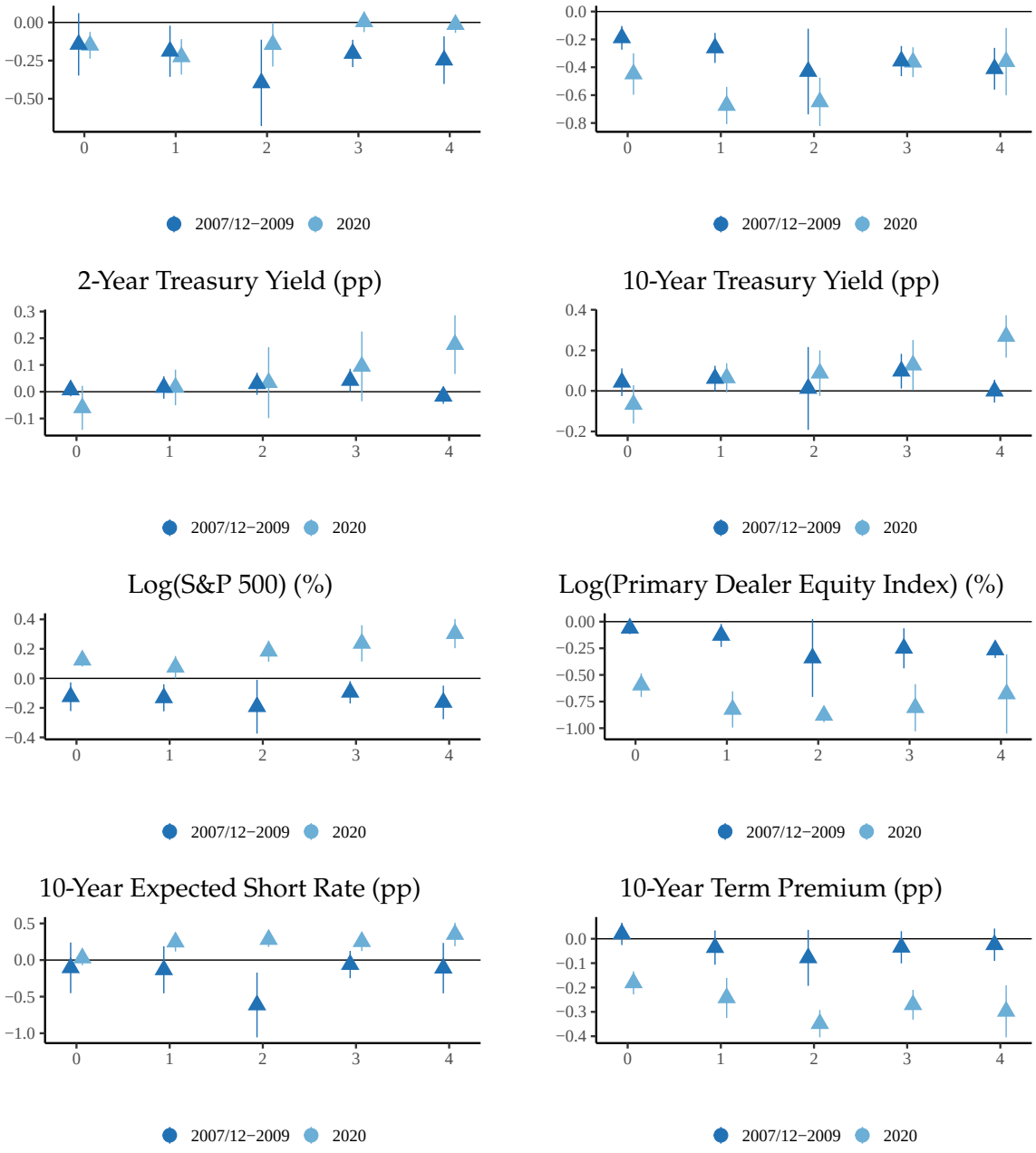
The the Primary Dealer Equity Index response is positive and significant during both sample periods. During the GFC, primary dealer equity rises following liquidity facility announcements, consistent with our earlier full-sample results. During COVID-19, the point estimates show a similar increase.

The effects on Treasury-OIS spreads are only present during COVID-19. The 10-year Treasury-OIS spread falls by approximately -0.3 percentage points following an expansionary LNS during COVID-19, compared to smaller and insignificant effects during the GFC. This is consistent with the different nature of Treasury market stress: during COVID-19, inconvenience yields arose from dealer balance sheet constraints binding in the face of massive Treasury supply, whereas during the GFC, convenience yields reflected flight-to-safety demand. The Federal Reserve's liquidity facilities were particularly effective at alleviating the balance sheet constraints that characterized COVID-19, directly reducing the shadow costs of intermediation.

Comparison with Other Crisis-Era Facilities. The Federal Reserve deployed multiple types of interventions during the crises beyond our core liquidity facilities. To ensure our results are not confounded by these other policies, Figure 7 compares the effects of liquidity facilities with those of discount window operations and central bank swap line announcements.

Discount window announcements—which during the GFC included both changes to the discount rate spread and the Term Auction Facility—show minimal effects on Treasury yields, term premia, or intermediary equity. Point estimates are generally close to zero with wide confidence intervals. The one statistically significant effect is a slight increase in the 10-year Treasury-OIS spread, suggesting that discount window operations may have marginally increased convenience yields during the flight-to-safety dynamics of the GFC. The limited effectiveness of

Figure 6: The Effect of Liquidity Facility Announcements Across Crisis Episodes

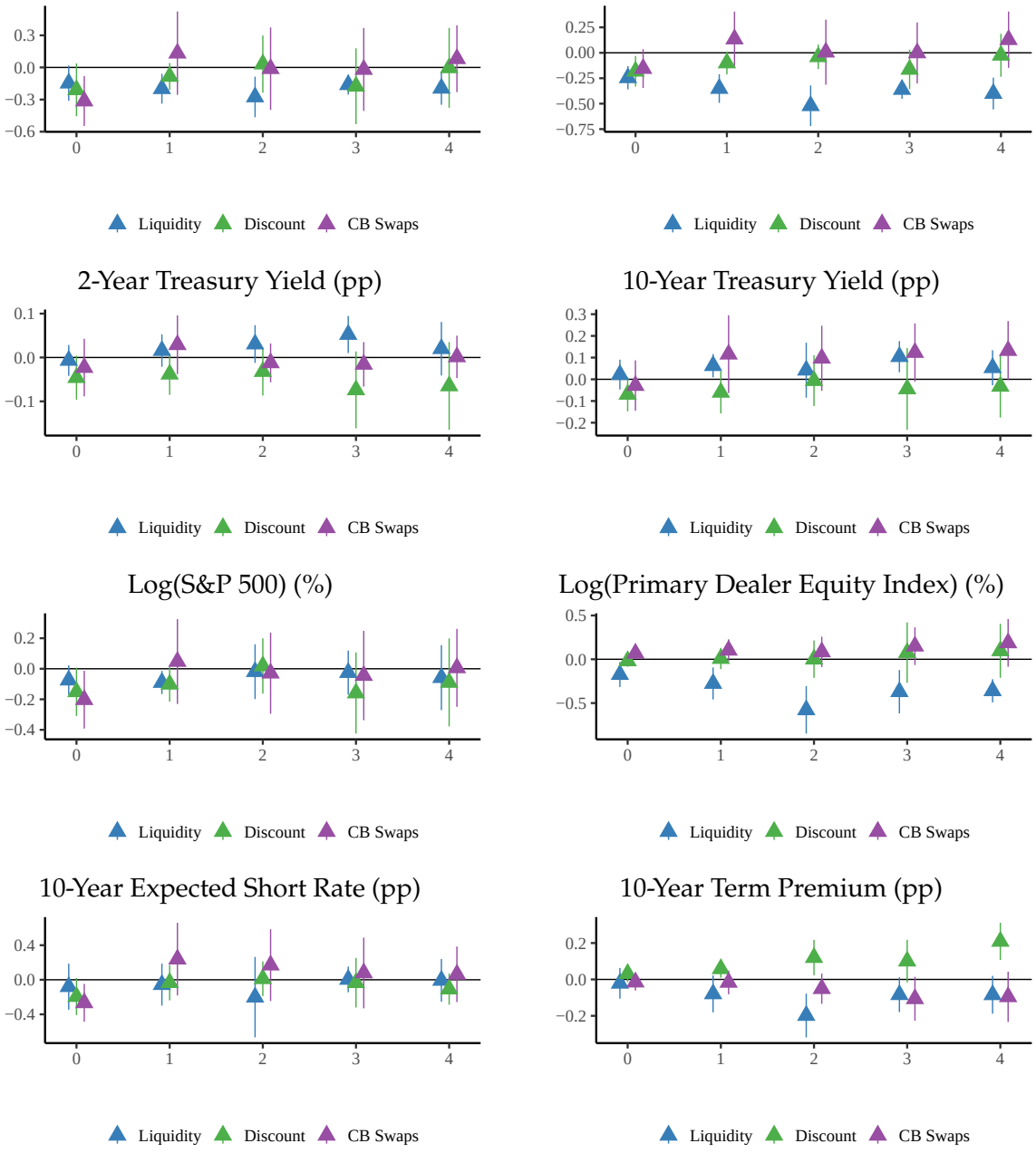


This figure displays impulse response functions estimated separately for the GFC (dark blue) and COVID-19 (light blue) periods. Vertical bars show 90% confidence intervals. All surprises are standardized within sample and then scaled by the pooled standard deviation for comparability.

discount window operations likely reflects stigma associated with borrowing from the discount window (Armantier et al., 2015), which may have prevented these facilities from meaningfully relaxing intermediary constraints. Tellingly, the Federal Reserve did not rely on discount window operations during COVID-19, instead moving directly to the targeted liquidity facilities that we show to be more effective.

Central bank swap line announcements show qualitatively similar effects to the liquidity sur-

Figure 7: Comparison of Different Federal Reserve Crisis Interventions



This figure compares responses to liquidity facilities (blue triangles), discount window operations (green squares), and central bank swap lines (purple diamonds). Vertical bars show 90% confidence intervals. Sample: June 2007-November 2020.

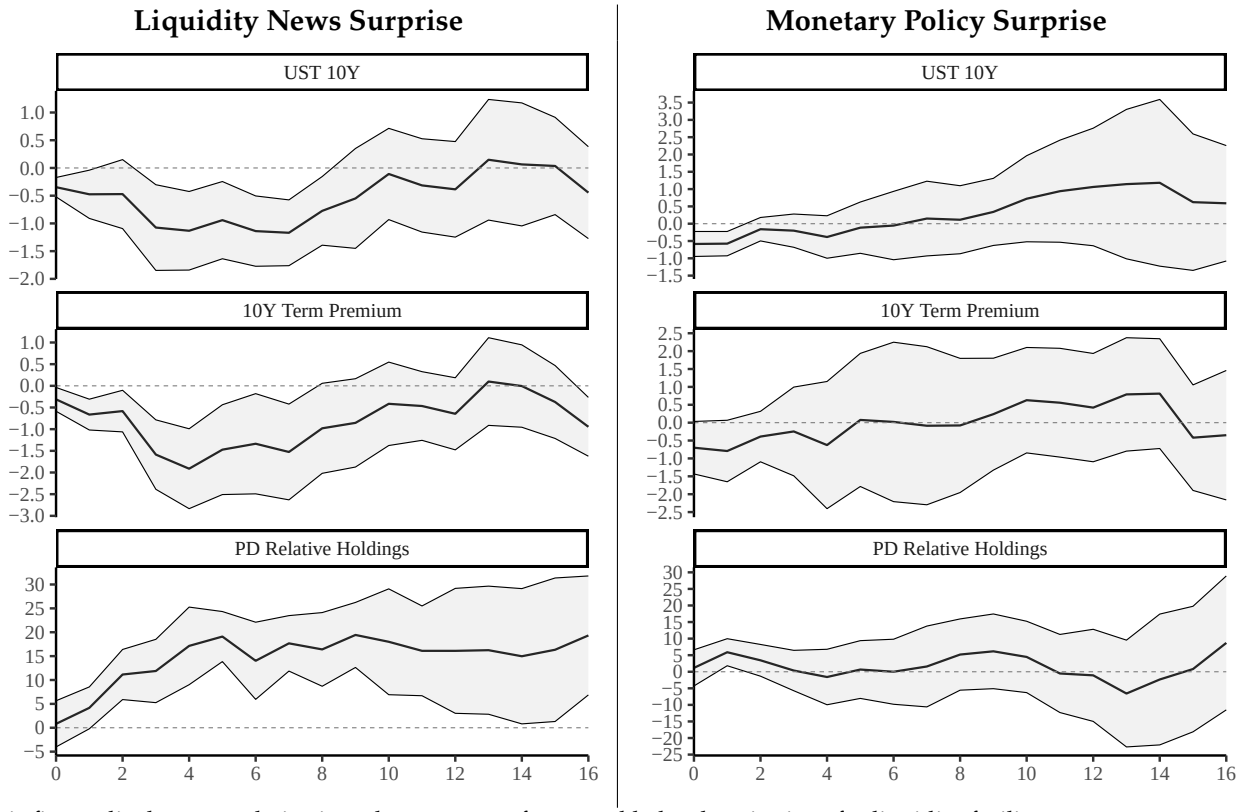
prises. The small sample set of announcements however precludes us from drawing insights on the statistical and economic relevance of these estimates.

These comparisons reinforce that our main findings are specific to liquidity facilities designed to directly support financial intermediary balance sheets and market-specific funding. The term premium effects we document are not a generic response to any Federal Reserve crisis intervention, but rather reflect the particular channel through which facilities like the PDCF, CPFF,

and TALF operate—by relaxing intermediary constraints and reducing the costs of providing liquidity to Treasury markets.

Primary Dealer Holdings To provide direct evidence for distinct transmission mechanisms, Figure 8 examines how relative primary dealer non-bill Treasury holdings respond to liquidity facility versus conventional monetary policy announcements using weekly data from Klingler and Sundaresan (2023).

Figure 8: Primary Dealer Treasury Holdings and Term Premia - Weekly Event Study



This figure displays cumulative impulse responses from weekly local projections for liquidity facility announcements (left column) and conventional monetary policy announcements (right column). The dependent variables are the 10-year Treasury yield (top), 10-year term premium from Adrian et al. (2013) (middle), and primary dealer relative holdings of non-bill Treasuries from Klingler and Sundaresan (2023) (bottom). The surprise measures aggregate all announcements of each type within each week. Shaded areas represent 90% confidence intervals. Sample: June 2007-November 2020, weekly frequency.

It shows the response of the weekly 10Y Treasury, and 10Y Term Premia as well as the primary dealer holdings. The coefficients are rescaled in a similar fashion as before, such that the results can be interpreted as a 1pp increase in the surprise in the week with an announcement.

The contrast is striking. Following liquidity facility announcements (left panels), primary dealer relative holdings of non-bill Treasuries increase sharply, rising by up to approximately 20% within 4-10 weeks. This expansion in dealer positions occurs simultaneously with the persistent compression in term premia documented in our daily analysis. To put this effect into perspective, it is relative to a weekly decline in the 10Y Treasury yield of 1 percentage point. Therefore, relative to a 10 bp increase on impact in the 10-year Treasury yields, expansionary

liquidity surprises lead to 5% increase in relative dealer holding after 5 weeks.

In sharp contrast, conventional monetary policy announcements (right panels) produce no increase in dealer holdings. The point estimates remain close to zero throughout. These findings provide compelling validation for our proposed mechanism. Liquidity facilities reduce term premia by relaxing intermediary constraints, enabling dealers to absorb more duration. Conventional monetary policy operates through a different channel—affecting expectations about future short rates—and does not require (or induce) dealer balance sheet expansion. The fact that only liquidity facilities generate increases in dealer holdings, and only liquidity facilities produce persistent term premium compression, supports models in which intermediary balance sheet capacity is a key determinant of risk premia(Vayanos and Vila, 2021; Kekre et al., 2022).

4 Conclusion

During financial crises, central banks deploy a range of policy interventions beyond conventional interest rate adjustments. This paper introduces a novel high-frequency measure—the Liquidity News Surprise—to quantify the unexpected component of announcements about liquidity facilities such as the Primary Dealer Credit Facility, Commercial Paper Funding Facility, and Term Asset-Backed Securities Loan Facility. Using data from the Global Financial Crisis and COVID-19 pandemic, we trace out the causal effects of these announcements on Treasury markets and compare their transmission mechanism to that of conventional monetary policy.

Our main finding is that liquidity facility announcements substantially lower long-term Treasury yields, with the effect operating almost entirely through term premia rather than expected future short rates. This stands in sharp contrast to conventional monetary policy announcements during the same period, which primarily affect yields through lower expected future short rates, consistent with the prominent role of forward guidance and quantitative easing signaling channels.

The distinct transmission mechanism of liquidity facilities reflects their design and purpose. These facilities are intended to alleviate funding market stress and relax balance sheet constraints on financial intermediaries rather than to signal future policy rates. Our evidence suggests they succeed in this objective. Direct measures of dealer balance sheet costs—Treasury-OIS spreads—show significant reductions following liquidity facility announcements during COVID-19, precisely when regulatory constraints and large Treasury supply shocks created binding balance sheet constraints on dealers. During the Global Financial Crisis, when flight-to-safety dynamics created different market conditions, Treasury-OIS spreads respond less to liquidity announcements, though term premia still decline substantially. This context-dependent effectiveness indicates that liquidity facilities work most powerfully when addressing the specific problem they were designed to solve: intermediary balance sheet constraints limiting

arbitrage capacity.

Our findings have important policy implications. Liquidity facilities represent an effective tool for central banks facing financial crises characterized by intermediary stress and market dysfunction. The facilities successfully reduced term premia and alleviated balance sheet pressures during both the GFC and COVID-19, demonstrating their effectiveness across different types of crises. Importantly, this effectiveness appears specific to targeted liquidity facilities. Discount window operations, which suffered from stigma issues, showed minimal effects on Treasury markets, perhaps explaining why the Federal Reserve abandoned them in favor of targeted facilities during COVID-19.

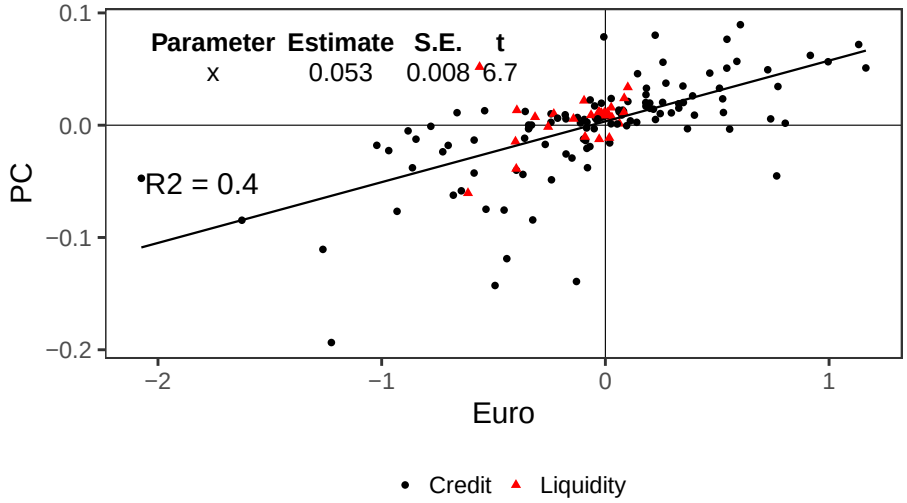
Our analysis also reveals important heterogeneity in how facilities work across different crisis episodes. During COVID-19, when dealer balance sheets were constrained by regulatory leverage ratios and large Treasury supply shocks, liquidity facilities had particularly strong effects on Treasury-OIS spreads, directly reducing the shadow costs of intermediation. This suggests that the design of crisis facilities should be tailored to the specific nature of market dysfunction. Facilities that directly address binding constraints—whether balance sheet capacity, funding costs, or market liquidity—are likely to be most effective.

In conclusion, this paper demonstrates that liquidity facility announcements during financial crises have substantial and economically meaningful effects on Treasury markets. The development of high-frequency surprise measures for liquidity facilities opens new avenues for research on the effectiveness and transmission of lender-of-last-resort policies, complementing the extensive literature on conventional monetary policy.

A Appendix

A.1 Measuring Surprises In FX Markets

Figure A.9: Change in Policy News Surprise vs. the USDEUR exchange rate around FOMC announcements



	AUD	CHF	EUR	JPY
Dep. Var: PNS	0.038***	0.057***	0.053***	0.052***
	(0.007)	(0.008)	(0.008)	(0.010)
Num.Obs.	146	146	148	146
R2	0.352	0.406	0.395	0.322

Figure displays the changes in the Conventional Monetary Policy factor against log change in the Euro expressed as as units of foreign currency per USD in a 30 minute window around FOMC announcements. In case, a press conference is held the window is extended. The black dots denote scheduled & unscheduled FOMC announcements while the red triangles mark events where the Federal Reserve enacted liquidity & lender-of-last-resort policies.

Unfortunately, high-frequency identification of monetary policy surprises with interest rate futures is not possible on all relevant dates of central bank communication. A few key dates occur outside the trading hours of the Chicago Mercantile Exchange. Therefore, we propose to use exchange rates to measure the implied change in the Policy News Surprise.

During the height of uncertainty about the Covid pandemic, the FOMC announced a 1pp interest rate cut, asset purchases of $500 billion and swap lines with central banks at other major advanced economies on Sunday 5 p.m. ET March 15, 2020. This represented an unprecedented policy intervention. It is, however, impossible to measure the PNS in a high-frequency window in interest rate futures as those are only trading every week from Sunday 6 p.m. to Friday 5 p.m. ET. The PNS could therefore only be measured over a window of 49 hours and would likely contain other news affecting interest rate expectations which are revealed over the course of the weekend. In contrast, with trading sessions spanning around the globe, currency markets are open longer. In particular, according to the Australian Foreign Exchange Committee the Sydney session typically opens at 5a.m. AEDT or 2p.m. ET (AFEC (2022)). This allows us to measure the news solely conveyed by the FOMC announcement in the exchange rate movements and

hence to proxy for the missing PNS.

This method is motivated by evidence of the close co-movement between interest rates and exchange rates during announcement times (Faust et al., 2007; Gürkaynak et al., 2020; Swanson, 2021). Consistent with previous work, our empirical results suggest that the US dollar (USD) tends to depreciate against the Euro (EUR) during an FOMC meeting announcing a monetary policy expansion in our sample from 2007 to 2020. Vice versa, the USD tends to appreciate against the Euro during FOMC meetings announcing a monetary policy contraction.

This pattern is shown graphically in Figure A.9 where we plot changes in the PNS factor against the movement in EUR expressed as units of EUR per USD measured in a tight window around the policy announcement. The co-movement between U.S. interest rates and the EURUSD exchange rate is quantitatively strong with a coefficient that is highly statistically significant. The exchange rate alone can explain up to 41 % of the total variation in the PNS factor during announcement windows. We make use of this strong co-movement between exchange rates and Treasury futures around FOMC announcements to impute the value of the PNS on 15/03/2020.

To motivate this methodology, Figure A.11 displays intra-day exchange rate movements on 15/03/2020. The US Dollar depreciates against major international currencies after the press release of the FOMC and remained so during the Press Conference conducted with FOMC chair Jerome Powell.[1]

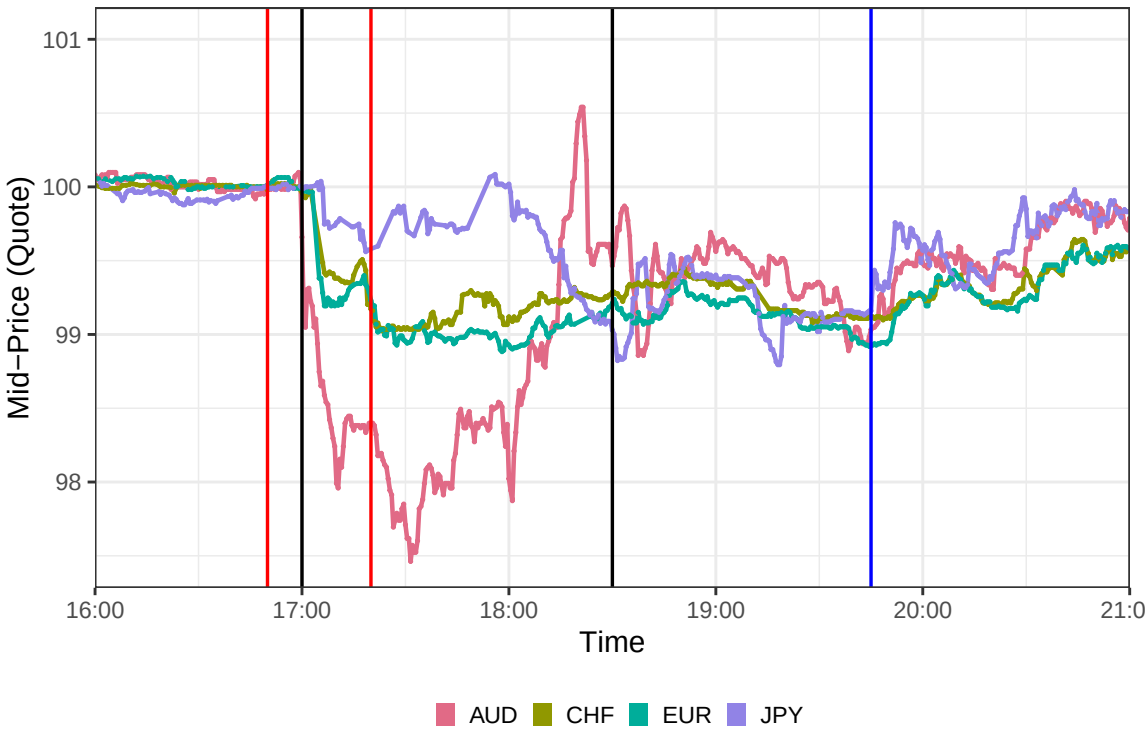
A large depreciation is associated with a strong negative surprise in the PNS, suggesting markets priced in that interest rates are about to remain lower for the foreseeable future in the US. In particular, the Euro depreciates by -0.86% against the US dollar from 10 minutes prior to the press release at 5pm until 75 minutes after the press conference at 6:30PM. In A.9, we document that a 1% depreciation in the Euro implies a 5bp increase in the 2Y Treasury Future. Therefore, the change in PNS implied by the 1% Euro appreciation on March 15, 2020, is -5bps. [2] This pattern is not unique to the Euro: the Australian dollar (AUD), Swiss Franc (CHF) and the Japanese yen (JPY) also exhibit this strong co-movement with the PNS factor.

The same approach can be used to shed more light on key announcements during the GFC. On Sunday March 16, 2008, 15:45 ET the FOMC met to discuss an emergency lending of $30 billion dollars to help JP. Morgan fund the acquisition of Bear Stearns. At the same time, it deliberated the decision to introduce the first Primary Dealer Credit Facility which broadened discount window access to investment banks. At 17:45 ET the lending facility to JP. Morgan as well as the Primary Dealer Credit Facility were announced to the public. Upon the arrival of the news, the USD depreciates sharply against the EUR by around 0.3%. A similar calculation as outlined above implies a drop in the PNS by around 2bp.

[1]There is a slight appreciation of all exchange rates when President Donald Trump comments on the FOMC decision at 17:15pm at the Press Briefing of the Coronavirus Task Force. However, these movements are small compared to the change in the 15 minutes prior, making significant confounding unlikely.

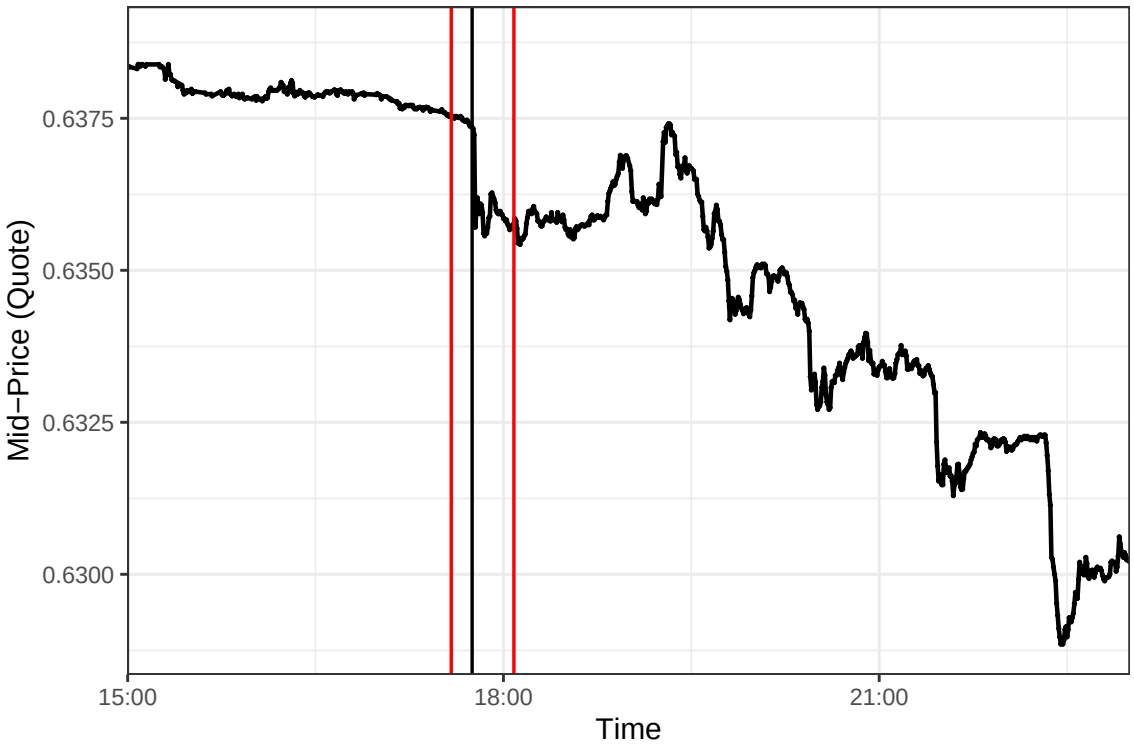
[2]The window is slightly longer as the press conference was only held 90 minutes after the press release.

Figure A.10: Movements in exchange rates on around the unscheduled FOMC announcement on 15/03/2020



This figure displays the movements in exchange rates around the FOMC announcement on 15/03/2020 at 17:00 EDT/ 22:00 UTC. The x-axis is in EDT. The exchange rates are normalized to their level at 16:50. The black lines indicate the press release at 17:00 EDT and the press conference call at 18:30 EDT. The red lines mark the boundaries of the press release window. The blue line indicates the right boundary of the press conference window.

Figure A.11: Movements in the USDEUR exchange rate on 16/03/2008



This figure displays the movements in exchange rates around the Press Release on 16/03/2008 at 17:45 EDT/ 22:45 UTC. The x-axis is in EDT. The red lines mark the boundaries of the press release window.

References

Acharya, Viral V, Michael J Fleming, Warren B Hrung, and Asani Sarkar (2017) "Dealer financial conditions and lender-of-last-resort facilities," *Journal of Financial Economics*, 123 (1), 81–107.

Adrian, Tobias, Christopher R Burke, and James McAndrews (2009) "The federal reserve's primary dealer credit facility," *Current issues in economics and finance*, 15 (4).

Adrian, Tobias, Richard Crump, and Emanuel Mönch (2013) "Pricing the Term Structure with Linear Regressions," *Journal of Financial Economics*, 110 (1), 110–138.

AFEC (2022) "Australian Foreign Exchange Committee Q&A 2022," `https://afxc.rba.gov.au/qa/`, Last accessed on: 2022-10-11.

Altavilla, Carlo, Luca Brugnolini, Refet Guerkaynak, Roberto Motto, and Guiseppe Ragusa (2019) "Measuring Euro Area Monetary Policy," *Journal of Monetary Economics*, 108, 162–179.

Armantier, Olivier, Eric Ghysels, Asani Sarkar, and Jeffrey Shrader (2015) "Discount window stigma during the 2007–2008 financial crisis," *Journal of Financial Economics*, 118 (2), 317–335.

Bauer, Michael D and Eric T Swanson (2022) "A reassessment of monetary policy surprises and high-frequency identification," Working Paper.

Boyarchenko, Nina, Anna Kovner, and Or Shachar (2022) "It's what you say and what you buy: A holistic evaluation of the corporate credit facilities," *Journal of Financial Economics*, 144 (3), 695–731.

Camargos Jensen, Jonas (2025) "Trading Volume and Monetary Policy Surprises," Unpublished Working Paper.

Carlson, Mark and Marco Macchiavelli (2020) "Emergency loans and collateral upgrades: How broker-dealers used federal reserve credit during the 2008 financial crisis," *Journal of Financial Economics*, 137 (3), 701–722.

Choi, Mark, Linda Goldberg, Robert Lerman, and Fabiola Ravazzolo (2021) "COVID Response: The Fed's Central Bank Swap Lines and FIMA Repo Facility," *Federal Reserve Bank of New York Staff Reports*.

Faust, Jon, John Rogers, Shing-Yi Wang, and Jonathan Wright (2007) "The High-Frequency Response of Exchange Rates and Interest Rates to Macroeconomic Announcements," *Journal of Monetary Economics*, 54:4, 1051:1068.

Fleming, Michael J, Warren B Hrung, and Frank M Keane (2010) "Repo market effects of the term securities lending facility," *American Economic Review*, 100 (2), 591–596.

Gilchrist, Simon, Bin Wei, Vivian Z Yue, and Egon Zakrajšek (2020) "The Fed takes on corporate credit risk: An analysis of the efficacy of the SMCCF,"Technical report, National Bureau of Economic Research.

Gorton, Gary (2017) "The history and economics of safe assets," *Annual Review of Economics*, 9, 547–586.

Gürkaynak, Refet, Hakan Kara, Burcin Kisacikoglu, and Sang Lee (2020) "Monetary Policy Surprises and Exchange Rate Behavior," *CESInfo working paper*.

Gürkaynak, Refet, B. Sack, and E.T. Swanson (2005) "Do actions speak louder than words? The response of asset prices to monetary policy actions and statements," *International Journal of Central Banking*, 1, 55–93.

Hanson, Samuel G, David O Lucca, and Jonathan H Wright (2021) "Rate-amplifying demand and the excess sensitivity of long-term rates," *The Quarterly Journal of Economics*, 136 (3), 1719–1781.

Hanson, Samuel G and Jeremy C Stein (2015) "Monetary policy and long-term real rates," *Journal of Financial Economics*, 115 (3), 429–448.

He, Zhiguo, Stefan Nagel, and Zhaogang Song (2022) "Treasury inconvenience yields during the COVID-19 crisis," *Journal of Financial Economics*, 143:1, 57–79.

Jorda, Oscar (2005) "Estimation and Inference of Impulse Responses by Local Projections ," *The American Economic Review*, 95:1, 161–182.

Kekre, Rohan and Moritz Lenel (2025) "The High-Frequency Effects of Dollar Swap Lines," *American Economic Review: Insights*, 7 (1), 107–123.

Kekre, Rohan, Moritz Lenel, and Federico Mainardi (2022) "Monetary Policy, Segmentation, and the Term Structure."

Klingler, Sven and Suresh Sundaresan (2023) "Diminishing Treasury convenience premiums: Effects of dealers' excess demand and balance sheet constraints," *Journal of Monetary Economics*, 135, 55–69.

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

Kuttner, Kenneth N (2001) "Monetary policy surprises and interest rates: Evidence from the Fed funds futures market," *Journal of Monetary Economics*, 47 (3), 523–544.

Martin, Antoine and Susan McLaughlin (2021) "COVID Response: The Primary Dealer Credit Facility," *FRB of New York Staff Report* (981).

McAndrews, James, Asani Sarkar, and Zhenyu Wang (2017) "The effect of the term auction facility on the London interbank offered rate," *Journal of Banking & Finance*, 83, 135–152.

Nakamura, Emi and Jón Steinsson (2018) "High-frequency identification of monetary non-neutrality: the information effect," *The Quarterly Journal of Economics*, 133 (3), 1283–1330.

Rogers, John H, Chiara Scotti, and Jonathan H Wright (2014) "Evaluating asset-market effects of unconventional monetary policy: a multi-country review," *Economic Policy*, 29 (80), 749–799.

Stock, James H and Mark W Watson (2018) "Identification and estimation of dynamic causal effects in macroeconomics using external instruments," *The Economic Journal*, 128 (610), 917–948.

Swanson, Eric T (2021) "Measuring the effects of federal reserve forward guidance and asset purchases on financial markets," *Journal of Monetary Economics*, 118, 32–53.

Vayanos, Dimitri and Jean-Luc Vila (2021) "A preferred-habitat model of the term structure of interest rates," *Econometrica*, 89 (1), 77–112.