Back to Normal? Assessing the Effects of the Federal Reserve's Quantitative Tightening*

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Abstract

We study the effects of the Federal Reserve's two Quantitative Tightening (QT) programs implemented over the last decade. We employ a high-frequency identification strategy to distinguish between conventional monetary policy shocks, Treasury borrowing announcement shocks, and balance-sheet unwinding. We analyse both QT operations and announcements. Our results show that QT operations, as long as they entail a decrease in the reserve supply, have a significant and persistent deflationary effect on interest rates and asset prices. A $1 trillion reduction in securities holdings by the Fed is associated with a 1.68 percentage point increase in 10-year Treasury yields. In contrast to operations, we find that QT announcements had limited effects on financial markets, except during the 2013 taper tantrum and select communications regarding QT II timing. While the contractionary impact of QT has so far been offset by changes in other components of the Fed's balance sheet that have kept the supply of reserves constant, our results suggest that balance sheet reductions entail, in principle, strong negative effects on financial markets. Therefore, although QT does not represent, in the policymakers' view, the primary tool for achieving price stability, it is still far from running quietly in the background of the monetary policy stance, and an appropriate balance sheet normalisation strategy must take these effects into account.

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1 Introduction

In response to the 2021-2022 inflationary surge, most global central banks have tightened monetary policy by raising interest rates and gradually shrinking their balance sheets. The return to conventional monetary policy has been relatively uniform across central banks, as interest rate hikes have been the predominant policy response in most advanced economies. In addition to abandoning the post-GFC zero interest rate policy, some central banks[1] have also started reducing the size of their balance sheets, thus partially offsetting the unconventional Quantitative Easing (QE) policies implemented after the Great Recession and in the wake of the 2020 pandemic crisis.

As interest rates rose again above the Effective Lower Bound (ELB), policymakers have explicitly regarded them as the main tool in the fight against inflation (Yellen, 2017; Schnabel, 2023b; Tenreyro, 2023), relegating Balance Sheet Policy (BSP) to a background role. While the reversal of Large-Scale Asset Purchases (LSAPs) is mostly targeted towards influencing the long-term supply of reserves, its implementation can be expected to also have a direct impact on the Treasury market and spillovers across different asset classes via portfolio rebalancing and the drain on reserve supply. Therefore, a rigorous assessment of the financial market effects of Quantitative Tightening (QT) is paramount to inform an appropriate balance sheet normalisation policy.

This paper takes an empirical stand on the financial market impact of both balance sheet reductions implemented by the Federal Reserve before (2017-2019) and after (2022-2025) the COVID-19 pandemic. We focus our analysis on the QT implemented in the United States for multiple reasons. First, the Fed was the only central bank to implement two full balance sheet reductions, the second of which was effectively terminated in the second half of 2025. This provides us with a longer time series and enables us to perform an *ex post* assessment of QT after the dust has settled. Second, the Fed has excelled in the clarity, transparency and consistency of its communications about BSP, thus representing an ideal case study for the effects of consistent policy actions when market participants are fully informed. Third, given the size of the US economy and of its financial sector, it is a priority to analyse the effects of the Fed's QT, also considering the high potential for international spillovers. Overall, the empirical conclusions and policy implications laid out in this paper can be extended and generalised to other advanced economies pursuing balance sheet normalisation policies.

Using a rich daily and weekly dataset comprising financial market indicators, Government debt, and Federal Reserve balance sheet items, we estimate impulse responses of asset prices, short- and long-run risk-free rates, and credit spreads to QT operations. We expand on the existing literature by employing a high-frequency identification strategy that disentangles BSP announcement shocks from conventional interest rate policy shocks. Moreover, by resorting to a recently developed identification strategy (Phillot, 2025), we explicitly account for changes in fiscal policy and their effects on the Treasury market during and after the pandemic. Finally, this paper broadens the current understanding of the workings of QT implementation by analysing its impact on a broad set of financial market indicators, including credit spreads and overall market liquidity.

Our results indicate that actual QT actions, as long as they effectively reduce the central bank's supply of reserves, have a strong, significant, and persistent effect on raising short- and long-run risk-free rates and increasing Treasury market volatility. We estimate that a 1-trillion reduction in the Fed's System Open Market Account (SOMA) holdings is associated with a 1.68 percentage point increase in the yield on 10-year Treasury securities over the medium term. We find that QT operations have similar deflationary effects on other asset prices. The shrinking of the balance sheet is associated with a fall in stock valuations, an increase in corporate spreads and Mortgage-Backed Security (MBS) yields and sizeable international spillovers, entailing a sharp Dollar appreciation and a fall in global bond prices. These effects critically

[1] The monetary authorities of Australia, Canada, the Euro Area, New Zealand, Sweden, the United Kingdom and the United States.

depend on the decrease in the reserve supply engendered by QT. On the other hand, a reduction in the Fed's Treasury holdings that is not matched by a commensurate decline in reserves fails to produce such disruptive consequences.

While we find strong effects from QT operations, our analysis of announcement effects reveals a more nuanced picture. Unlike the operational effects, QT announcements generally had minimal impact on asset prices, with notable exceptions being the 2013 taper tantrum and specific QT II communications regarding timing changes. Moreover, these findings are not robust to an event study analysis based on 30-minute windows centered around the relevant FOMC communication release.

The empirical findings on QT operations entail pervasive and far-reaching implications for BSP. A detailed study of the Fed's QT shows that shrinking holdings of Treasury securities and MBS on the asset side does not necessarily entail a symmetric reduction in the supply of reserves on the liability side. However, when the reduction in assets indeed diminishes the reserve supply, it also contributes to dragging down asset prices. This mechanism fundamentally works through portfolio rebalancing by economic agents: central bank reserves represent the most liquid and the least risky asset available in the economy. When their supply decreases, their relative price with respect to other assets increases.

Thus, a relatively higher supply of bonds and stocks with respect to reserves, all other things equal, implies a fall in the equilibrium price of the former. Alternatively, by assuming a monetary theory of the price level of financial assets, a fall in the supply of central bank money must imply a fall in the price level of financial assets. Taken at face value, these results suggest that it is not possible to reduce the supply of reserves without factoring in a proportional decrease in the price of riskier, less liquid financial assets, which could pose a threat to financial stability. Therefore, while there are many good theoretical reasons for reducing the central bank's balance sheet and the reserve, this becomes in practice a hard task, as it necessarily entails weathering a permanent tightening of financial conditions across the economy.

The remainder of this paper falls into five sections. Section 2 summarises the main stylised facts regarding the implementation of QT in the United States, as well as the recent developments in the literature on the implementation and the effects of central bank balance sheet reductions. Section 3 discusses the empirical methodology adopted in this paper. Section 4 displays and discusses the estimated effects of QT operations on money and capital markets, while Section 5 discusses the impact of BSP announcements on yields and prices of different financial assets. Finally, Section 6 concludes and discusses the policy implications of the findings.

2 Reversing Unconventional Balance Sheet Policies

2.1 Phases of QT

Over the last decade, the Federal Reserve has twice reduced its balance sheet. Figure 1 displays the evolution of the Federal Reserve's total assets and of the Federal Funds rate. A more detailed breakdown of the Fed's balance sheet by its main components is shown in Figure 2.

The first communication regarding a possible slowdown in the Fed's Treasury purchases under QE III occurred in late May 2013, amid widespread tensions in the bond and stock markets. In the aftermath of this event, also known as "taper tantrum", the Federal Open Market Committee (FOMC) had decided to hold the total level of assets on the Fed's balance sheet constant for about four years. As a result, the first QT operation was particularly cautious. The unwind episode began in 2017 and occurred amid broader monetary tightening. In September 2017, the Fed started decreasing its assets by reducing reinvestments of principal payments from maturing Treasuries and MBS/agency debt at a monthly pace of $6 billion and $4 billion, respectively. From the beginning of 2018, the monthly caps on reinvestments would be eventually raised in steps of $10 billion every quarter ($6 billion for Treasuries and $4 billion for agency

debt/MBS), until reaching maximum amounts of $30 billion per month for Treasury securities and $20 billion per month for agency debt and MBS by the end of the same year, for a combined total of $50 billion per month. However, as shown in Figure 1, this first unwinding episode lasted less than two years. While bond and equity markets did not react adversely to the reversal of the LSAPs by the Fed, sudden tensions in the interbank overnight market in end-September 2019 prompted a swift reaction from the monetary authority, with an injection of liquidity in money markets and the eventual suspension of the QT program (Figure 2).

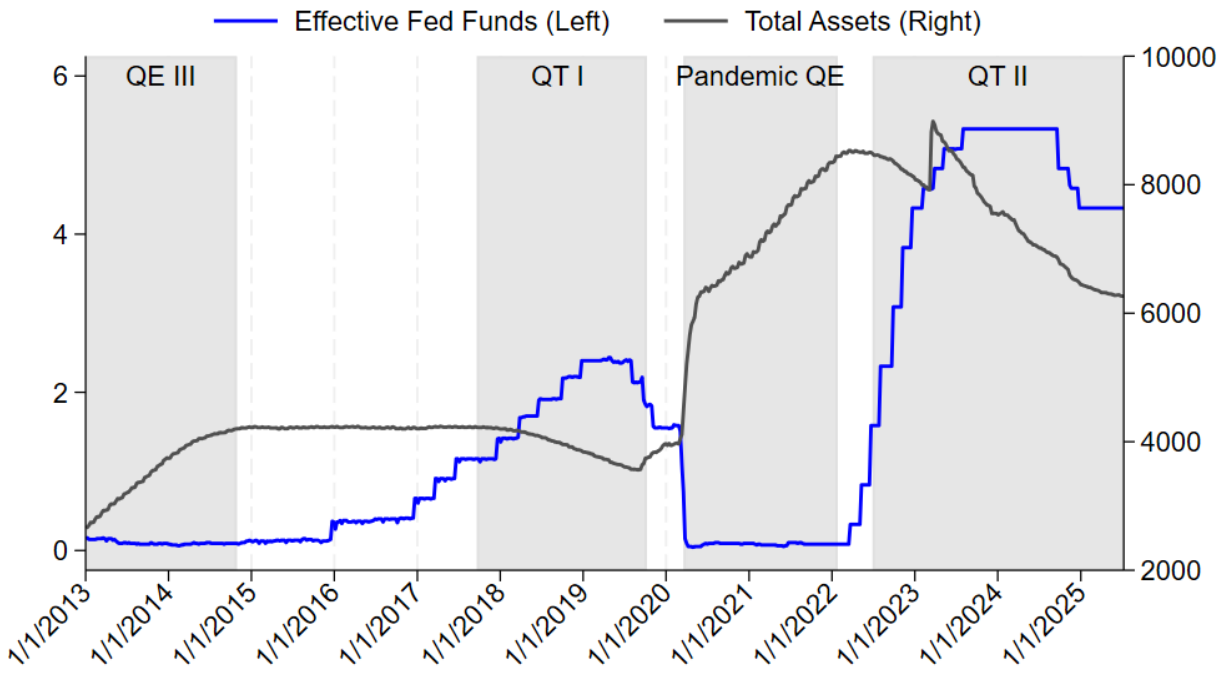

Figure 1. Effective Federal Funds rate and Federal Reserve total assets (USD billions). Source: Federal Reserve Board.

The unfolding of the global COVID-19 pandemic was met with a firm monetary response, with the return of the Federal Funds rate to the ELB and a resumption of LSAPs. A first emergency measure of outright purchases of $500 billion in Treasury securities and $200 billion in MBS and agency debt was deliberated in mid-March 2020. Subsequently, the Fed's balance sheet was further expanded by almost $3500 billion over the following two years. Only in November 2021 did the FOMC decide to taper the pandemic QE program. The subsequent balance sheet normalisation (QT II), deliberated in January 2022 and commenced in June 2022, was undertaken amid aggressive monetary tightening in response to the post-pandemic global inflationary surge. The second QT episode has been characterised by the firm decision to decrease Treasury holdings by $30 billion per month and, after three months, to raise such amount to $60 billion per month. In contrast, the initial decrease in MBS holdings was of $17.5 billion per month, to be raised to $35 billion per month after three months. The banking crisis unfolding in March 2023 did not prompt the FOMC to suspend the second QT episode; rather, it triggered a substantial liquidity intervention in the interbank market, with the unveiling of the Bank Term Funding Program (BTFP) to support depository institutions facing liquidity issues.

After one year of asset runoff, the FOMC decided to slow the pace of balance sheet unwinding. In May 2024, it was decided to lower the monthly redemption cap on Treasury securities from $60 billion to $25

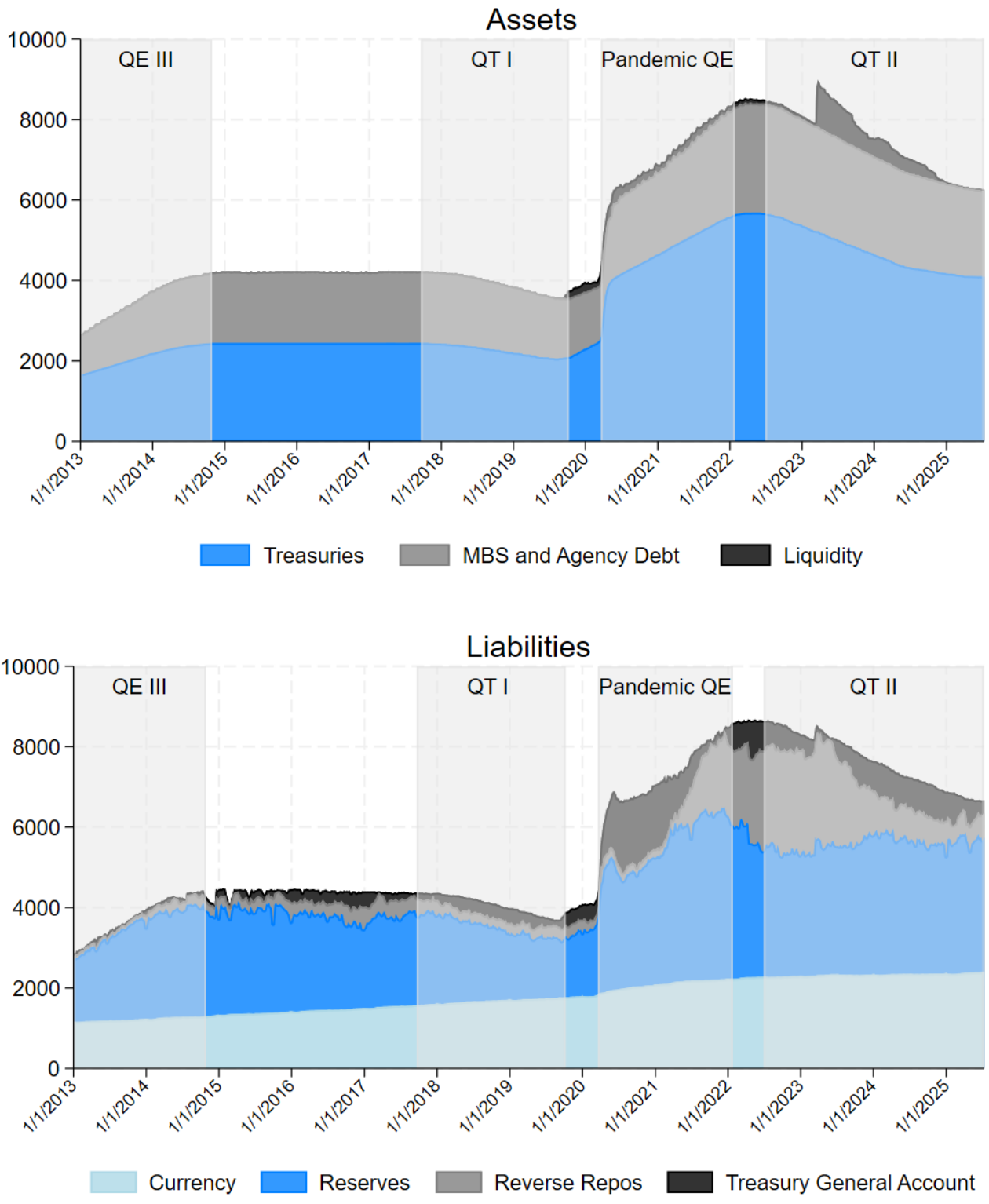

Figure 2. Selected assets and liabilities of the Federal Reserve's balance sheet (USD billions). Treasuries include Bills, Notes and Bonds held by the System of Open Market Accounts (SOMA). Liquidity includes repurchase agreements, rescue operations and targeted lending programs to the banking sector, including the Bank Term Funding Program (BTFP). Source: Federal Reserve Board.

billion, while leaving the monthly redemption cap on agency debt and Mortgage-Backed Securities (MBS) unaltered at $35 billion. Moreover, the cap on Treasuries was further lowered from $25 billion to $5 billion in April 2025. After its October 29th, 2025, meeting, the FOMC announced that it would conclude the reduction of its aggregate securities holdings on December 1, 2025, effectively ending quantitative tightening earlier than previously anticipated. Following this decision, maturing principal payments from agency MBS are now being reinvested into shorter-duration Treasury bills rather than being allowed to roll off.

The reinvestment of MBS proceeds into Treasuries reflects the Fed's longstanding preference to hold only Treasury securities for monetary policy purposes, gradually phasing out MBS holdings from the SOMA portfolio. This choice reflects the conviction, consistently stated in the Fed's communication (Federal Reserve, 2022), that the FOMC primarily aims to hold Treasury securities in the SOMA, thereby minimising the effect of Federal Reserve holdings on the allocation of credit across sectors of the economy. The balance sheet normalisation process can therefore be regarded as concluded as of December 2025.

2.2 Channels of Transmission

On the communication side, the transparency of the Fed's strategy allows one to clearly understand the purpose of BSP actions, thereby enabling identification of their expected *a priori* effects on financial markets. Since the FOMC set out the first long-term balance sheet normalisation plan in May 2014, the Fed's communication has always made it clear that the reduction in holdings of Treasuries was not a proper monetary policy tool intended to achieve the inflation and output gap targets:

"The Committee affirms that changing the target range for the federal funds rate is its primary means of adjusting the stance of monetary policy."

(Federal Reserve, 2014)

This key concept was further reasserted by Fed Chair Yellen during a FOMC press conference in June 2017, who explained that QT is not to be thought of as QE working in reverse. The FOMC's intention and expectation, as stated in press conferences and minutes, has been to carry out the unwinding of the balance sheet without having any significant impact on financial markets:

"[...] the plan is one that is consciously intended to avoid creating market strains and to allow the market to adjust to a very gradual and predictable plan. My hope and expectation is that when we decide to go forward with this plan, that there will be very little reaction to it, that it's clear how we intend to proceed, and that this is something that will just run quietly in the background over a number of years, leading to a reduction in the size of our balance sheet and in the outstanding stock of reserves."

(Yellen, 2017)

And the Fed's focus on conventional interest rate policy as the primary and only tool employed in the pursuit of price stability did not change, but was instead reiterated in the aftermath of the pandemic:

"[FOMC] participants reaffirmed that changes in the target range for the Federal Funds rate are the Committee's primary means for adjusting the stance of monetary policy."

(Federal Open Market Committee, 2022)

In light of the FOMC's communication strategy, it is clear that policymakers do not envisage QT as an unconventional restrictive policy that would work as a symmetric reverse of QE. While LSAPs represent an unconventional tool that operates when the policy rate hits the ELB or when financial markets are distressed, the unwinding of the balance sheet is instead viewed as a quiet background operation aimed at supporting the functioning of the primary conventional monetary policy tool, the Federal Funds rate. To analyse the channels through which QT can affect financial markets and the real economy, we first step back and review the channels of QE transmission, to discuss which are relevant to QT as well.

It is a consensus that the unconventional policy of QE mainly operates through three channels. Firstly, in the portfolio balance channel, Treasury purchases drive down yields across the whole term structure and reduce term premia (Bernanke et al., 2004, 2010). This effect can further be reinforced in the case of preferred-habitat[2] (Vayanos and Vila, 2021) because the non-substitutability of securities with different maturities causes a segmentation of the term structure (D'Amico and King, 2013). The operation of the portfolio balance channel has recently been further explored by Christensen and Krogstrup (2019), who show that asset purchases financed by central bank reserves trigger a bank portfolio rebalancing effect that adds further upward pressure on asset prices. Secondly, according to the signalling channel, LSAPs are a tool by which central banks can reinstate their commitment to achieving their macroeconomic targets, thereby signalling to market participants lower future rates than previously anticipated (Bernanke et al., 2004; Bauer and Rudebusch, 2014). Moreover, in the information channel, the decision to adopt unconventional policies may reveal new information to market participants about the state of the economy, thereby influencing agents' risk-taking behaviour. Finally, we have the liquidity channel, in which central bank purchases restore proper market functioning by decreasing liquidity premia (Joyce et al., 2010).

In addition to the channels mentioned above, Bernanke et al. (2004) proposes a channel in which the issuance of reserves enables the central bank to substitute seignorage for tax revenue, thereby relaxing the Government's consolidated resource constraint. A related argument is set forth by Reis (2017), who shows that in the presence of Government default risk, issuing nominally default-free reserves to purchase risky government bonds reduces risk premia. Overall, this aligns with the default risk channel discussed by Krishnamurthy and Vissing-Jorgensen (2011).

In the case of QT we can exclude with certainty the existence of a signalling channel, because the Fed, like most other central banks, made it clear in its communication that QT is not directly related to the commitment to price stability and thus cannot be regarded as a first measure of monetary policy "hawkishness", as this role belongs to the Fed Funds rate. On the other hand, the information channel can potentially operate. A high level of confidence among policymakers in the liquidity and stability of financial markets can be inferred from the decision to implement, and possibly expand, the unwinding of the balance sheet. This effect can invite markets to take on more risk, thereby boosting asset prices, reducing volatility, and compressing risk premia, including corporate credit spreads. The unwinding of the balance sheet is expected to reduce liquidity in financial markets, especially in the Treasury market. While this effect can certainly be expected, it is far from the Fed's financial stability mandate to cause a liquidity crisis or to impair the smooth functioning of financial markets. Hence, we argue that the liquidity channel does not apply to QT transmission: if the balance sheet unwind had caused market distress, as in September 2019, QT operations would have been suspended immediately.

In conclusion, the portfolio balance channel remains the principal means by which QT can affect financial markets and the only one that can potentially work symmetrically with QE. While the FOMC likely anticipates this effect, the increase in long-term interest rates is not envisaged as the key tool for achieving price stability, but rather as a secondary mechanism operating alongside policy rate tightening. Moreover, the Fed opted for a passive implementation of QT by ceasing reinvestments of maturing securities rather than engaging in actual Treasury sales. This decision has likely been taken to minimise the footprint of

[2]I.e., agents have a preference for a specific maturity over the whole spectrum.

QT operations on the yield curve. While the Fed gradually withdraws its demand from the Treasury and MBS market, it attempts not to distort the maturity structure of outstanding securities by actively selling its holdings.

Since policymakers' intentions, in practice, rely on conventional QE transmission channels only marginally for QT, the rationale for unwinding central bank balance sheets must be sought elsewhere. In the implementation of monetary policy, the balance sheet reduction is closely linked to the long-run supply of reserves (Schnabel, 2023a; Borio, 2023). Prior to the Global Financial Crisis (GFC), monetary policy was usually conducted in a scarce-reserve supply framework. Conventional monetary policy is conducted by setting a target range for the interest rate in the interbank market for reserves, and ensuring the interest rate remains within this target range by affecting the reserve supply (Lopez-Salido and Vissing-Jorgensen, 2023). With the policy rate stuck at the ELB and the implementation of LSAPs, monetary policy shifted to an ample supply of reserves (Afonso et al., 2020; Ihrig et al., 2020), where a constant, permanent excess supply of reserves in the interbank market made overnight liquidity conditions relatively inelastic to shifts in reserve supply. When the supply of reserves in the interbank market is limited, demand is binding. Thus, banks needing liquidity for daily operations borrow overnight from banks having excess reserves. This drives the spread between the overnight interbank rate and the central bank's target. On the contrary, with an ample supply, nearly all banks end up having excess reserves, and the overnight interbank spread disappears.[3] For this reason, as Borio (2023) aptly put it, an ample supply of reserves kills the interbank market.

With an ample supply, the only way to ensure that the central bank achieves its operational target - the level of the overnight interbank rate - is by paying interest on reserves held by banks via the Interest on Reserve Balances (IORB) and Overnight Reverse Repo (ONRRP) facilities. The efficiency of this mechanism, however, is suboptimal. For instance, excess reserve holdings are not evenly distributed across banks. The great majority of banks, mainly the most prominent institutions, indeed have abundant reserves. Conversely, a few, smaller institutions face tighter liquidity constraints. Thus, as shown by Fricke et al. (2023), paying interest on reserves increases the liquidity at the disposal of the majority of large reserve-holding banks. At the same time, only a few smaller institutions indeed feel the bind of the money squeeze. In this framework, the effectiveness of interest rate hikes in transmitting their contractionary impulse to the real economy, by curbing bank lending and ultimately aggregate demand, might be blunted.

Against this backdrop, the primary goal of QT is to shrink the supply of reserves, making the interbank overnight rate more responsive to monetary policy operations and thereby improving the transmission of interest rate hikes to the broader economy. It is therefore in light of long-run interbank reserve supply targeting that QT should be considered. Thus, as QT has been implemented with different goals compared to QE, the present empirical work is directed at evaluating the effects of QT through the lens of portfolio rebalancing and the supply of reserves in the interbank market.

2.3 Literature & Contribution

While the literature analysing the effects of LSAPs is extensive and well developed, relatively few studies have investigated the impact of balance sheet reductions. This reflects the limited historical sample of QT implementations: the only two tightening episodes in the last decade occurred very recently, and researchers are still working on a thorough and robust assessment. The present paper, therefore, builds on and expands these early attempts to provide a rigorous analysis of the financial market impacts of QT announcements and operations.

Among empirical studies on the effect of QT, most have focused on estimating the impact of central bank

[3] It can actually turn negative, in case not all banking institutions are able to deposit their excess reserves at a facility offered by the central bank.

communication. A first study of the Fed's QT I (2013-2019) program has been carried out by Smith and Valcarcel (2023). While the inquiry is restricted to the first tightening episode, the identification of a sufficient number of tightening events ensures the meaningfulness of the estimation. Following the use in the QE literature, the shocks are identified using a narrative approach (Neely and Fawley, 2013), by defining a dummy variable that takes the value of 1 on each day an announcement is made and 0 otherwise. As customary in the estimation of QE events, they regress the two-day change in the dependent variable (interest rates on Treasuries at various maturities, stock prices and other risk premia) centred on the announcement date on the announcement dummy. This approach is standard to capture the full effect of asset price adjustments (Hanson and Stein, 2015). The results by Smith and Valcarcel (2023) show that, in contrast to QE announcements, QT I statements by the Fed do not affect the dependent variables. On the other hand, they find that tapering announcements of QE in mid-2013 had a strong effect on raising Treasury interest rates, depressing asset prices, widening risk premia, and reducing market liquidity.

As a continuation of the 2023 contribution, Lu and Valcarcel (2024) perform the same regression analysis on a sample that also includes announcements related to the second QT episode (2022-2024). The key finding is that, in contrast to QT I, which did not significantly affect financial markets, announcements relative to QT II indeed seem to have a substantial impact on Treasury yields and asset prices. This result, however, is at odds with the findings of subsequent studies. Moreover, the methodology by Lu and Valcarcel (2024) is subject to two criticisms. Firstly, the authors' event study regresses the two-day change in yields on a dummy variable for the QT announcement day. However, no further controls are used in the baseline regression. Therefore, they cannot account for other confounding factors, such as monetary policy and inflation expectations, that might have affected yield changes during the same period. In addition, the authors select a non-standard set of announcement dates for the event study[4], which might bring a contamination of the announcement sample.

Another early contribution to this literature by Vaille (2023) performs the same analysis using the same narrative methodology but augments the regressions with macroeconomic surprises and Federal Funds futures as control variables. This effectively allows to partial out other monetary policy effects that are unrelated to the announcements of the reduction of the balance sheet. Moreover, Vaille (2023) restricts the analysis to a set of FOMC announcements, effectively reflecting future developments in BSP, thereby allowing the estimation of the pure effect of QT policy announcements. With this setup, they find no QT announcement effects during both QT I and QT II, whereas the contractionary impact of QE tapering announcements remains robust.

An alternative approach is taken by Lloyd and Ostry (2024), which resorts to the identification strategy proposed by Swanson (2021) to isolate the surprise components of QE (2008-2012) and QT I (2013-2019) announcements by the Fed. The methodology entails decomposing monetary policy surprises, measured from asset-price movements in 30-minute windows around FOMC announcements, into 3 distinct components: shocks to the level of the effective Federal Funds rate, forward guidance shocks to its expected path, and LSAP shocks to the Fed's balance sheet size. The authors proceed by using local projections to estimate the dynamic responses of 2-year and 10-year Treasury yields up to 50 days after the BSP announcement. They find that both have a contractionary effect on the 10-year maturity. They uncover an asymmetric impact on 2-year yields: QT shocks attain stronger effects by raising expectations of future rates. Thus, the authors find that QT announcements are actually carrying a signalling effect. However, the main issue with the approach adopted in the paper regards the identification strategy. In estimating QT surprises, all BSP events are treated equally, without distinguishing between tapering and tightening. In addition, the latter are not divided between events that actually communicate the magnitude of QT

[4]They include the FOMC statements of September 21st and November 22nd, 2022. These two statements, however, only contain conventional monetary policy decisions and release no new information regarding the implementation details of QT or the expected future path of the Fed's balance sheet. In fact, the doubling of the unwind caps on Treasury securities and MBS redemptions to take place in September had already been announced by the FOMC in January.

and announcements that simply state the Fed's commitment to tighten the balance sheet. Moreover, it is arguable whether the signalling effect of QT exists at all on narrative grounds, as official Fed communication seems to shut off this channel *a priori*. Hence, it is not straightforward whether this approach actually disentangles the signalling effect from the portfolio balance effect in QT surprises.

In another contribution, D'Amico and Seida (2024) estimate the unexpected component of LSAP and QT announcements by using Survey of Primary Dealers (SPD) data. Moreover, they exploit the operational details of each program implemented by the Fed to compute the local supply surprise effects for specific maturities. Their results show that both QE and QT I have a significant impact on Treasury yields over the sample 2009-2019. This result is interesting, as it indicates that BSP announcements continue to affect the policy rate even after the policy rate leaves the ELB. The authors attribute the finding to frictions, specifically liquidity constraints in the private sector's balance sheet. In light of these results, the lack of effect of QT announcements reported in the previous literature can be explained by the fact that financial markets may have anticipated BSP communications regarding the unwind.

Moving outside the U.S., Du et al. (2024) instead conduct a broader comparison of QT announcements across different central banks, estimating the impacts of all QT programs implemented by the central banks of the seven advanced economies over the last decade. They assess announcements using the standard narrative event-study approach employed by Vaille (2023), Smith and Valcarcel (2023) and Lu and Valcarcel (2024). Their findings highlight that QT announcements regarding the actual size of the balance sheet unwind affect financial markets. Conversely, announcements that merely discuss balance sheet reductions fail to have an impact. These results show some similarity with D'Amico and Seida (2024), underscoring how BSP announcements involving actual quantitative plans tend to influence financial markets. Taken together, the results from the two papers indicate that a policy aimed at directly affecting long-run interest rates works effectively both on and off the ELB, via the portfolio balance channel and preferred-habitat effects among market participants. This set of results cannot be interpreted as driven by a signalling effect, since the Fed clearly stated that BSP is not directly related to the monetary policy stance, but rather reflects the market's anticipation of the effects of QT operations.

Regarding the analysis of QT operations, to the best of our knowledge, there are only three contributions estimating the impact of the unwinding of the Fed's balance sheet on financial markets. The first two studies, employing very similar methodologies, are by Smith and Valcarcel (2023) and Lu and Valcarcel (2024). The former relates to the QT I (2017-2019); the latter, to the QT II (2022-2024) experience of the Fed. The authors run both a time-varying (TV) parameter SVAR (Primiceri, 2005) and a constant-parameter SVAR, in which the shocks are identified using Cholesky orthogonalisation. The authors order the variables in the TV-SVAR as follows: first, reserves; then the SOFR-IOR and Federal Funds-IOR spreads; and finally, the dependent variable, the asset price of interest. The last variable in the VAR ordering, which is therefore endogenous to the four shocks enumerated above, is the total amount of SOMA holdings. This identification strategy is based on the assumption that, with an ample supply of reserves, the monetary authority does not systematically intervene on the reserve supply to offset shocks to autonomous liquidity factors (Ihrig et al., 2020). Therefore, exogenous changes in the amount of reserves can be treated as stemming from the unwind of the Fed's balance sheet. While this approach is well-grounded in economic theory, it falls short on at least two aspects. Firstly, it does not control for conventional monetary policy shocks that can affect the dynamics of reserves in interbank markets. On similar grounds, the VAR does not include any other macroeconomic variable, such as economic surprises or Government borrowing, that can influence long-term yields. Therefore, it is not clear whether it is possible to attach a structural interpretation to the orthogonal shocks. Secondly, by assumption, the VAR specification neglects liquidity operations and other balance sheet components by the Fed (such as the ONRRP facility and the Treasury General Account) as factors directly affecting the reserve supply. Since other balance sheet items (as shown in Figure 2) have undergone substantial movements during the last QT phase, this approach is at least not viable to explore the post-pandemic QT experience.

The third empirical study on QT operations, Du et al. (2024), relies on a seven-country sample of advanced economies. However, it estimates the effects of QT operations by focussing only on asset price changes in the neighbourhood of the day QT operations actually started. For the US, the authors emphasise a difference between QT I and QT II: during the former episode, the decline in the reserve supply was more closely linked to changes in SOMA holdings, as outlined in the previous sections. During the latter, however, QT failed to reduce the supply of reserves due to liquidity interventions, Government spending, and a decline in overnight Reverse Repo balances. While this semi-descriptive evidence is insightful for comparing the two QT programs and QE, it cannot fully capture the dynamic effects of balance sheet reductions, nor can it assess their persistence.

The present paper, therefore, makes several contributions to the existing literature. We perform an estimation of the financial market effects of both QT implementations by the Fed. Our innovation lies in estimating the impact of QT operations while controlling for conventional interest rate shocks, fiscal policy announcement shocks, and the general macroeconomic outlook. In fact, while LSAPs are an unconventional monetary policy tool mainly employed when the policy rate reaches the ELB, shrinking central bank balance sheets occurs simultaneously with conventional monetary policy. Therefore, to isolate the pure effect of the BS normalisation on asset prices, we need to disentangle the impacts of unexpected changes in the Federal Funds rate.

Moreover, given the specific characteristics of the historical sample, we decide to employ two additional controls. In response to the COVID-19 pandemic, the U.S. Government enacted a bold fiscal stimulus financed by issuing debt securities and maintained a relatively loose fiscal stance during the post-pandemic recovery. The resulting significant shift in the supply of Treasury securities (Figure 3) is likely to have affected yields and broader asset prices. We therefore decide to control for this factor in our investigation of QT effects. In doing so, we are the first to explicitly control for the supply effects of Government borrowing shocks using the methodology recently developed by Phillot (2025). Our second set of controls relates to macroeconomic surprises and the general economic outlook. The period of the global pandemic was characterised by wild fluctuations in output growth, rapid inflation, and heightened policy uncertainty. While in normal times these background factors can have a relatively minor effect on asset prices, we argue that during the pandemic and its aftermath, such strong shifts in market expectations are potential confounders for identifying the impact of QT.

In addition, as mentioned in this section and the previous one, the supply of reserves since 2019 has been consistently influenced by the Fed's long-term loans to depository institutions and by Government borrowing and expenditure via the Treasury General Account (TGA). The evolving structure of the Fed's liabilities (Figure 2) implies that the two aforementioned factors must be accounted for when estimating the response of asset prices to a decrease in the Fed's SOMA holdings. We therefore explicitly include liquidity operations and the dynamics of the TGA and the ONRRP facility in our baseline model.

Our rich specification thus allows us to isolate the pure effect of QT operations on the Treasury market, on riskier assets and their international spillovers. We estimate impulse responses of selected asset prices to changes in SOMA holdings by the Fed during both QT I (2017-2019) and QT II (2022-2025) by using local projections (Jordà, 2005; Jordà and Taylor, 2025). This fully dynamic model permits assessing the delayed impact and the persistence of financial markets' reactions to the balance sheet unwind. The findings from our baseline specification are validated through various robustness checks, which show how the magnitude of the estimated effects is consistent across specifications. The estimation of these results provides a sound empirical basis for the policy considerations developed in the subsequent sections. Indeed, this paper also provides a rich and detailed policy discussion of the practical implications of balance sheet normalisation for both monetary and fiscal policy and debt sustainability, which represents a further advancement on the existing literature.

Finally, for empirical completeness and to allow comparability with other research on the topic, this paper

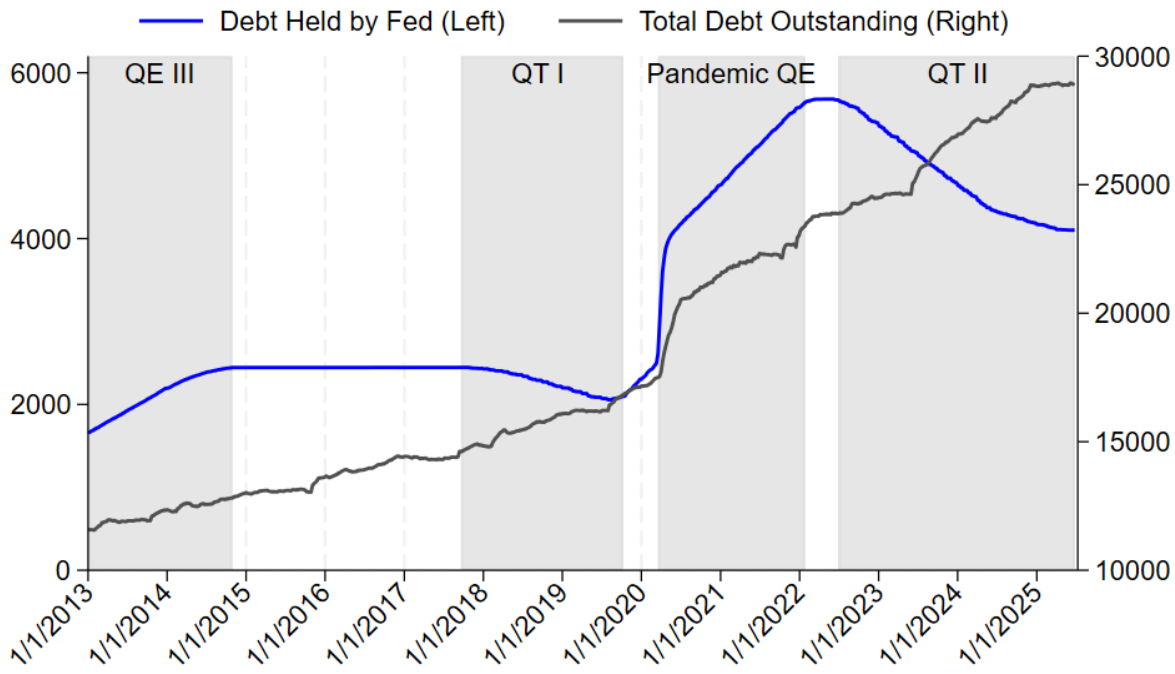

Figure 3. SOMA holdings of Government debt securities and total marketable Government debt securities outstanding (USD billions). Sources: Federal Reserve Board and US Treasury.

also estimates the effects of QE tapering and Fed QT announcements. Also, in this instance, we control for monetary and fiscal policy shocks that occurred simultaneously with QT operations, as well as changes in the macro outlook and liquidity operations by the Federal Reserve. The addition of this set of controls, which is partially shared with previous papers[5] ensures that all confounding factors are eliminated from the event study, hence enabling us to pick up the pure effects of QT. We validate the results from our baseline regression by running a battery of robustness checks. Among those, we conduct an event study of selected asset prices over a 30-minute window centered on the relevant QT announcement. We believe we are the first to perform an intraday event study analysis of QT in the literature.

3 Data & Methodology

3.1 Assessing QT Operations

We start by assessing the financial market impact of QT operations. There are various reasons for analysing the effects of the Fed's QT actions, besides policy communications, on the financial market. While efficient markets should quickly price in information about any policy announcement as soon as it is released, the presence of liquidity constraints allows the BSP to have an effect even when it is fully anticipated (D'Amico and King, 2013; Fratzscher et al., 2018). For instance, as argued by Smith and Valcarcel (2023), even largely anticipated events, such as Treasury auctions, can have a discrete effect on financial markets at the time of the event due to underlying frictions and slow-moving capital (Lou et al., 2013). Moreover, Jiang and Sun (2024) shows that portfolio rebalancing by investors during LSAP normalisations occurs at variable speeds. Therefore, financial markets take some time to adjust in the aftermath of QT actions.

[5]Such as Du et al. (2024) and Vaille (2023).

On these grounds, we investigate the liquidity effects on both money and capital markets arising from the reduction of the central bank's balance sheet. This research question has numerous and widespread ramifications that can enlighten and appropriately inform policy decisions. First and foremost, estimating the effect of QT actions on asset prices can help predict potential strain on financial stability. Monetary authorities can have a back-of-the-envelope estimation of how much pressure a given balance sheet reduction can put on fixed-income and stock markets. Thus, monetary authorities can incorporate these considerations into their baseline macro forecasts and stress-testing frameworks, thereby anticipating potential future liquidity interventions that might be needed. The estimates provided in this paper can ultimately guide policymakers in fine-tuning their balance sheet normalisation strategy and in setting realistic objectives. Finally, this guidance becomes particularly relevant in the current macroeconomic environment, where Government debt to GDP is high and growing, and sovereign risk is piling up as an additional threat to financial stability.

To estimate our empirical model, we use a weekly time series dataset from January 2013 to June 2025. This extended time frame for our analysis enables a comprehensive estimation of the magnitudes of both balance sheet unwinds performed by the Fed before and after the pandemic. Data on asset prices and bond yields have been retrieved from Datastream. The source of the daily nominal Broad Dollar Index is the Federal Reserve Board. Finally, all Bloomberg indexes have been retrieved from the Bloomberg terminal. Data on the Fed's balance sheet composition is available on the FOMC's website, whereas data on Government debt holdings and auctions are available on the Treasury's dataset website.

To disentangle the effects of BS normalisation from other shocks occurring simultaneously and that could confound our analysis, we account for conventional monetary policy decisions that occurred contemporaneously with the shrinking of the Federal Reserve's balance sheet. In fact, as argued in Section 2, QT is not designed to be an unconventional monetary policy working as a QE in reverse, but rather as a background operation targeting the long-run level of reserves in the interbank market. As QE is conceived as an unconventional monetary policy that is enacted at the ELB, that is, when the conventional tool - the policy rate - is no longer available, announcements and implementation of LSAPs by the Fed do not overlap by construction with changes in the Federal Funds rate. Conversely, as shown in Figure 1, the Fed has, on both occasions, shrunk its SOMA holdings of Treasuries and MBS while simultaneously conducting interest rate hikes and cuts.

To account for conventional monetary policy, we construct a daily time series of Federal Funds shocks using the methodology by Cochrane and Piazzesi (2002). We regress the change in the Federal Funds target range on the intraday change in the 3-Month LIBOR rate around the FOMC decision date. Since the LIBOR rate has been phased out since the end of 2021 (LeSueur, 2021), we replace it, starting in June 2021, with the newly introduced benchmark AMERIBOR rate from the American Financial Exchange (AFX). Overall, both unsecured money market rates serve as relevant instruments for identifying monetary policy shocks in the sample, as the Olea and Pflueger (2013) robust F-statistic rejects the null of weak instruments at the 5% significance level.

Additionally, we also control for Treasury borrowing surprises, which may constitute a relevant confounding factor for the present analysis. Indeed, in response to the COVID-19 pandemic, the US Government enacted a sizeable fiscal stimulus, primarily financed by issuing new debt (Figure 3). As news about the increase in Treasury supply caused by changes in Government borrowing can affect interest rates and asset prices, we control for them by employing the novel methodology developed by Phillot (2025). This approach relies on daily U.S. Treasury auction data, by instrumenting the net amount of debt securities offered at each auction with the intraday change in Treasury futures on the day the auction is announced. This methodology, therefore, yields a measure of the unexpected amount of debt securities supplied by the Treasury at each auction. Phillot (2025) finds that these shocks have a strong effect on financial markets, by shifting the yield curve upwards, raising stock prices and corporate bond yields. Given the potential overlap among fiscal announcement shocks, Fed BSP announcements, and the actual unwind of

the balance sheet, we argue that this set of shocks must be accounted for to recover the true effect of QT.

From the econometric point of view, we study the impact of the unwinding of the Fed's balance sheet by estimating impulse responses via direct projections (Jordà, 2005; Jordà and Taylor, 2025). We define QT operations as the net cumulative negative changes in SOMA holdings of Treasury securities, MBS and agency debt. The sample used for estimation consists of weekly time series of the Fed's balance sheet components. We use end-of-week stocks rather than weekly averages to avoid confounding lead-lag relations. Dependent variables, including asset prices and yields, as well as Treasury borrowing and Federal Funds shocks that come at a daily frequency, are therefore converted to weekly by averaging lagged observations starting on Wednesdays. Our baseline empirical specification takes the general form shown in Equation (1), where the dependent variable of interest y_t^j is regressed on the negative cumulative change in Treasury and MBS holdings $\Delta SOMA_t^-$:

$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h \Delta SOMA_t^- + \gamma' X_t + u_{t+h}, \qquad h \in \{1, 20\} \tag{1}$$

In the baseline model, the control variables are included in the matrix X_t. Besides QE operations (defined as the inverse of QT: the positive cumulative increase in SOMA holdings: $\Delta SOMA_t^+$) QT (tapering and tightening) and QE announcement dummies, and Federal Funds and Treasury borrowing shocks identified according to the methodology explained in the previous paragraph, this matrix X_t also contains the total amount of federal debt held by the public, weekly liquidity operations implemented by the Fed, Overnight Reverse Repurchase agreements (ONRRP)[6] and the TGA. The amount of Government debt holdings by the private sector is included to control for the shift in supply for Treasury securities issued during the pandemic, which may have decreased the liquidity of the Treasury market. The inclusion of outright loans by the Fed to depository institutions is intended to control for a confounding factor that increased the supply of reserves while QT was taking shape in the first half of 2023. A similar argument applies for the ONRRP balance and the TGA (Figure 2). This ensures that reductions in SOMA holdings are linked one-to-one to reductions in reserves. Finally, we add two control variables to our baseline specification to account for inflation expectations and the macroeconomic outlook. We use the CITIFX economic surprise index from Datastream and the Atlanta Fed's GDPNow nowcast for the current quarter.[7] To account for residual correlation, our IRF estimation employs Newey and West (1987) standard errors up to lag 3.

We estimate impulse responses up to a 20-week horizon. We group the dependent variables of the LP regressions into four categories.

- **Interbank Market**: total reserve balances and the spread between the Secured Overnight Financing Rate (SOFR) and the interest paid by the Fed on bank reserves (IOR).
- **Treasury Market**: yields on the 10-year Treasury note and on the 3-month Treasury bill and their spread, the Merryl Lynch Options Volatility Exchange (MOVE) index
- **Risky Assets**: S&P 500 stock market index, VIX, spread between the yield on Moody's seasoned Baa corporate bonds and the 10-year Treasury note, Bloomberg's yield-to-worst (YTW) on Mortgage-Backed Securities (MBS)
- **Other Assets**: Federal Reserve's Broad Dollar Index, Bloomberg's Global Bond Return index, Global Financial Stress, 30-year mortgage rate.

[6]The ONRRP facility, introduced in late 2013, allows non-bank money market institutions that do not have access to the Fed's Term Deposit Facility (TDF) to lend overnight their excess reserves (Afonso et al., 2022). This device ensures that the effective Federal Funds rate does not deviate significantly from its target.

[7]Since the GDPNow indicator is not released irregularly at a daily frequency, we interpolate it linearly to have a smooth weekly index.

The first group of dependent variables, comprising the total supply of central bank reserves and the SOFR-IOR spread, is intended to assess whether QT is indeed achieving its primary goal as stated in policymakers' official communication. Shrinking the balance sheet is intended to reduce the central bank's overall supply of reserves. This, in turn, is supposed to widen the interbank funding spread, thus making demand for overnight reserves more responsive. It is debatable whether this is meant as a return to a scarce-reserve system or simply a targeting of long-run reserve supply while remaining in an ample-reserve supply setting. We leave this technical discussion to policymakers. In the paper, we limit ourselves to assessing whether QT is indeed attaining its primary goal, as stated by central bankers.

The second group of dependent variables relates to the Treasury market and includes yields on 10-Year Treasury notes and 3-Month Treasury bills. The difference between these two yields is taken as a proxy for the term premium. Moreover, we estimate the impact on the MOVE index, measuring volatility in the Treasury market. All of these variables are meant to capture the direct effect of QT on the risk-free bond market and the yield curve. A negative shock in the demand for treasuries implies an expected increase in their yields. Moreover, a decrease in the reserve supply would shift the private sector's demand for risk-free bonds further down, thereby putting increased upward pressure on yields.

The third set of dependent variables regards risky assets. Thus, it includes the S&P 500 and its volatility (VIX), as well as the spread of BAA corporate bonds on 10-Year Treasuries, the MBS yield-to-worst and the interest rate on 30-year mortgages. QT is expected to have a deflationary effect on the price of riskier assets as well. The negative impact of the balance sheet unwind on stocks, MBS, corporate bonds, and bank credit could be higher than that on the Treasury market, assuming increased risk aversion among market participants during QT.

Finally, the last set proxies the international spillovers of QT, as well as on bank lending. It includes the Broad Dollar Index, the Global Financial Stress index and the Global Bond Return Index. Also in this case, balance sheet normalisation, by reducing the supply of reserves, is expected to induce an appreciation of the US Dollar, *ceteris paribus*. At the same time, the tightening of domestic financial conditions is likely to affect other countries as well, by decreasing global bond returns and potentially increasing global stress.

3.2 Assessing QT Announcements

Besides estimating the effect of QT implementation, which constitutes the core contribution of this paper, we also reassess the effects of announcements relative to BSP. While the impact of QT announcements has already been studied in various publications, for the sake of completeness, we re-estimate them in this paper. This exercise allows us to validate or contrast the findings of previous papers by estimating the effects of BSP communications using a robust methodology designed to ensure clear exogeneity in the event study analysis.

Following the convention in the QE literature (Neely and Fawley, 2013; Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011), we identify Federal Reserve balance sheet Easing, Tapering, and Tightening announcements using a narrative approach. We define a dummy variable that equals 1 on announcement day and 0 otherwise. For completeness and to compare the magnitude of the effects of the 2013 "taper tantrum" with those of subsequent BSP announcements, our sample runs from January 2013 to June 2025. The narrative identification of announcements relating to the first tapering and QT experience (2013-2019) is reported in Table 1. Identified announcements relating to the pandemic QE experience, as well as to the subsequent tapering and balance sheet tightening (2022-2025), are reported in Table 2.[8] As customary practice when assessing unconventional monetary policy announcements (Rogers et al., 2014; Gagnon et al., 2011; Smith and Valcarcel, 2023), we regress the changes of our dependent variable

[8]These are the same dummy variables that are also included as controls in the local projection regression estimating the effects of QT operations.

Date	Event	Description
22/05/2013	Bernanke Speech	FOMC could slow down purchases
19/06/2013	Bernanke Speech	FOMC plans to taper purchases
18/12/2013	FOMC Statement	Tapering of MBS and long maturity Treasuries starts
21/05/2014	FOMC Minutes Released	Begin of long-term normalisation plan
09/07/2014	FOMC Minutes Released	Discussion of gradual asset reinvestments
15/07/2014	Yellen Speech	Further reductions in pace of asset purchases planned
20/08/2014	FOMC Minutes Released	Details on normalisation plan set out
17/09/2014	FOMC Statement	Policy normalization principles and plan released
29/10/2014	FOMC Statement	Treasury purchases ending that month
12/01/2017	Bernanke Speech	Discussion on balance sheet normalisation
05/04/2017	FOMC Minutes Released	Members agree on gradually reducing reinvestments
24/05/2017	FOMC Minutes Released	Details of phasing out reinvestments
14/06/2017	FOMC Statement	Balance sheet normalisation expected in the year
20/09/2017	FOMC Statement	Balance sheet normalisation starting in October
19/12/2018	Powell Speech	Asset runoff on automatic pilot
11/10/2019	FOMC Statement	End of Asset Runoff

Table 1. Pre-pandemic (2013-2019) tapering and tightening announcements by the Federal Reserve. Source: author's identification based on Smith and Valcarcel (2023), Lu and Valcarcel (2024), Vaille (2023) and Du et al. (2024).

Date	Event	Description
16/03/2020	FOMC Statement	Pandemic purchases of Treasuries and MBS start
23/03/2020	FOMC Statement	Broadening of Treasury and MBS purchase program
10/06/2020	FOMC Minutes Released	QE will continue at current pace
22/09/2021	FOMC Statement	First discussion of reducing Treasury purchases
03/11/2021	FOMC Statement	Initial tapering of pandemic QE
15/12/2021	FOMC Statement	Further tapering implemented
26/01/2022	FOMC Statement	Principles for Reducing the balance sheet released
16/02/2022	FOMC Minutes Released	Members show unanimous support for QT
16/03/2022	FOMC Statement	QT will be communicated at the next meeting
05/04/2022	Brainard Speech	QT could occur more rapidly than previously expected
06/04/2022	FOMC Minutes Released	Agreement on monthly caps on reinvestments
04/05/2022	FOMC Statement	QT schedule released
25/05/2022	FOMC Minutes Released	Follow up on QT plans details
10/04/2024	FOMC Minutes Released	QT tapering will start later than previously expected
01/05/2024	FOMC Statement	Start of QT tapering
22/05/2024	FOMC Minutes Released	Details on QT tapering released
19/02/2025	FOMC Minutes Released	QT expected to finish by mid-year
19/03/2025	FOMC Statement	Further QT tapering
21/03/2025	Waller Speech	QT still expected to continue
09/04/2025	FOMC Minutes Released	Updated details on QT tapering

Table 2. Post-pandemic (2020-2023) easing, tapering and tightening announcements by the Federal Reserve. Source: author's identification based on Lu and Valcarcel (2024), Vaille (2023) and Du et al. (2024).

of interest y_t on a two-day window centered on announcement day, i.e., $\Delta y_t \equiv y_{t+1} - y_{t-1}$. The baseline specification is displayed in Equation (2).

$$\begin{aligned}\Delta y_t =& \beta_1 TaperQE3_t + \beta_2 QT1_t + \beta_3 TaperQT1_t + \beta_4 QE4_t \\ &+ \beta_5 TaperQE4_t + \beta_6 QT2_t + \beta_7 TaperQT2_t + \gamma' X_t + u_t\end{aligned} \tag{2}$$

Where the $TaperQE3_t$ denotes the announcements relative to the tapering of the QE III program (2013); $QT1_t$ and $QT2_t$ relate to the announcements of the first (2017-2019) and second (2022-2025) balance sheet reductions; $QE4_t$ and $TaperQE4_t$, to the announcements on the implementation and the tapering of the pandemic QE program (2020-2021); and $TaperQT1_t$, $TaperQT2_t$, denote dummy variables for the announcements relating to the tapering of the pre-pandemic and post-pandemic balance sheet reductions.

Moreover, the vector γ contains a series of loadings estimating the effects of a series of control variables contained in the matrix X_t. This matrix includes the daily time series of Treasury borrowing announcement shocks and of Federal Funds shocks, both described in the previous section. Additionally, we control for global market risk aversion by also including the two-days lagged VIX and market liquidity conditions as measured by the (two days lagged) spread between the three-month T-bill and the three-month Overnight Swap Index rate (OIS), as employed by Fratzscher et al. (2018). Inflation expectations are proxied by adding the CITIFX economic surprise index. Finally, we also include 'day-of-week' dummy variables to capture seasonal effects and three event-specific dummy variables designed to capture extraordinary events that affected asset prices abnormally during the sample period.

The first of these dummies takes the value of 1 during the first week of March 2020 and 0 otherwise, to proxy for the financial panic that triggered a sell-off and a flight to quality during the early stages of the COVID-19 pandemic. The second dummy variable takes the value 1 in May 2023 and 0 otherwise. It is designed to proxy for uncertainty during the last phases of negotiations over raising the U.S. debt ceiling. It covers the period from the Treasury's enactment of temporary extraordinary measures (May 1st) to the resolution (June 1st), when the Senate passed the Fiscal Responsibilities Act. The last of our event-specific dummy variables controls for the five largest bank failures of 2023. [9] It takes the value of one on each day a bankruptcy was announced and the day before, and zero otherwise.

We are primarily concerned with examining the effect of BSP announcements on three sets of dependent variables:

- **Yield Curve**: the yields on the 3-month and 1-year Treasury bills, 3-year, 5-year and 10-year Treasury notes and 30-year bonds.
- **Bond Market**: the bid-ask spread on the price of 10-year Treasury notes, the ICE BofAML MOVE index (indicator of US Treasury market volatility), the Bloomberg Treasury market liquidity index (GVLQUSD),[10] Moody's Seasoned BAA spread over the 10-Year Treasury, Bloomberg MBS index average yield-to worst (LUMSYW), Bloomberg global bond total return index (LEGATRUU).
- **Stocks & Commodities**: the S&P 500 price index, the CBOE VIX (indicator of US equity market volatility), the Federal Reserve Board's measure of the Broad Dollar Index, Gold and Brent Spot Prices, and Bloomberg's global financial stress index (RFSITOTL).

The first set of indicators is chosen to gauge the effects of announcements on risk-free rates at various maturities. This allows us to assess the presence of preferred habitat and whether QT announcements affect

[9] Chronologically, Silvergate Bank (March 8th), Silicon Valley Bank (March 10th), Signature Bank (March 12th), Credit Suisse (March 19th) and First Republic Bank (May 1st).

[10] Defined as the average yield deviation relative to a fitted yield curve across US Treasuries with maturity beyond 1 year

specific, less liquid segments of the term structure. The second set relates to the liquidity and volatility of the Treasury bond market, as well as the yields of riskier fixed-income securities, such as investment-grade corporate bonds and MBS, which are directly affected by the shift in the supply of Government debt triggered by QT. The third set of dependent variables comprises a broad class of asset prices that are generally sensitive to monetary policy shocks (Rigobon and Sack, 2004; Bekaert et al., 2014): the general indicator of equity market valuations and its volatility, as well as gold and oil commodity prices. Moreover, it includes the US Dollar index and a global measure of financial stress to assess the international spillovers of BSP communications.

In addition to the aforementioned specification, our inquiry uses a second model that exploits the granularity of all the Fed's BSP communications identified in Table 1 and Table 2. We do so by regressing the asset price change y on every single announcement ANN_t^k, each of which is estimated with a different coefficient β_k. This specification also includes the same control variables adopted in the baseline equation (2).

$$\Delta y_t = \sum_{k=1}^{K} \beta_k ANN_t^k + \gamma' X_t + u_t \tag{3}$$

This regression aims to test the heterogeneous impacts of QT communications by examining whether each event is associated with specific effects in the relevant asset markets. Also, this individual event-study specification contains all the control variables enumerated in the baseline, aggregated model.

4 Effects QT Operations

4.1 Effects on Interbank Market

We now move on to discuss our estimates of the financial market impact of actual QT operations. As exposed in Section 2, the primary goal of QT rests in decreasing the reserve supply. This is therefore the first area of interest that we assess, by estimating the effect of QT operations on the total amount of bank reserves and on the spread between the Secured Overnight Financing Rate (SOFR) and the interest rate paid on reserves (IOR) by the Fed. The difference between the two rates is an indicator of the demand pressure in the interbank market (Smith and Valcarcel, 2023). As the shift from a scarce to an ample supply of reserves paradigm occurred, saturation of the interbank market led to a flattening of the demand curve for overnight reserves. To illustrate this stylised fact, we perform a back-of-the-envelope estimation of the liquidity effect in the interbank market along the lines of Lopez-Salido and Vissing-Jorgensen (2023). We perform a 208-observation window rolling regression of the simple model illustrated in Equation (4):

$$FF_t - IOR_t = \alpha + \beta \log(RES_t) + u_t \tag{4}$$

Where the overnight interbank funding spread, defined as the difference between the effective Federal Funds rate and the interest rate paid on reserves by the Fed, is regressed on a constant and on the log of reserves outstanding. The β coefficient represents the elasticity of demand for overnight reserves. We plot our estimate for β in blue in Figure 4. This shows an increase in absolute value while matching a decrease in the reserve supply. Historically, the estimated elasticity reached its all-time low at the same time as the reserve supply in mid-September 2019. This event corresponded to a liquidity crisis in the interbank market, which prompted the Fed to suspend QT I (Acharya et al., 2023). As the reserve supply reached a new local minimum in March 2023, simultaneously with the banking crisis, the estimated reserve elasticity also showed an inflection, after which it soared again with the latest increase in reserves, driven by the Fed's liquidity intervention with the implementation of the BTFP.

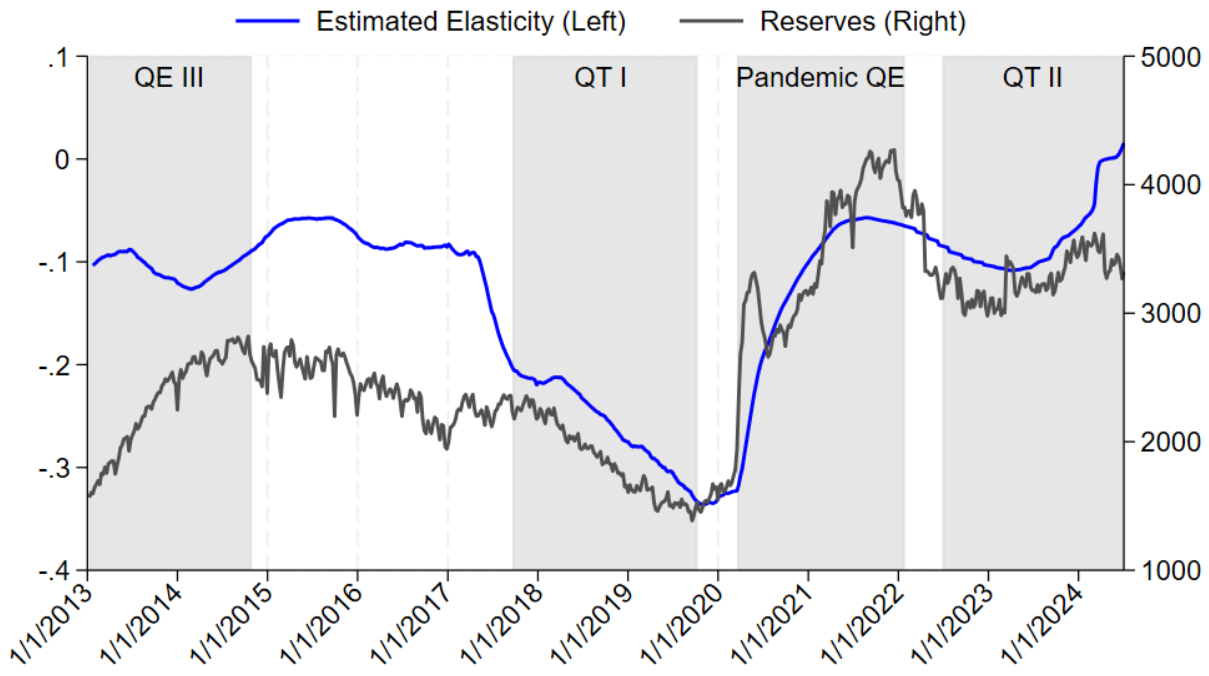

Figure 4. Estimated elasticity of demand for reserves in the interbank market and total reserves outstanding (USD billions). Sources: author's estimation and Federal Reserve Board.

Our first set of results, reported in Figure 5, is therefore concerned with the interbank market effects of the unwinding of the balance sheet. We show that a 1-trillion USD decrease in SOMA holdings of Treasuries and MBS attains an almost one-to-one reduction in the supply of reserves, which peaks at 0.97 trillion after about six weeks. As suggested by Figure 2 and Figure 4, QT was indeed successful in decreasing the actual supply of reserves, although this result was offset by liquidity operations, Government spending, and a decrease in the ONRRP balances, which injected reserves into the interbank market, thus leaving the overall reserve supply stationary.

Figure 5 also shows how, *ceteris paribus*, the drain on reserves brought about by QT operations does not put pressure on the interbank spread at short horizons, which remains insignificant from weeks 0 through 8. The spread turns significantly negative from weeks 9 through 11, with a trough of -0.12 percentage points at week 10. We interpret this result by considering a possible "kink" in the demand curve for reserves (Schnabel, 2023a), leading to two distinct regimes. In the first one, when the supply of reserves is abundant (i.e., in most of the sample period), marginal changes in reserves do not affect the SOFR-IOR spread. Conversely, when the reserve supply falls below a certain threshold, reserve demand bites, and changes in the reserve supply can influence the interbank market spread. Alternative nonlinear specifications[11] reported in Appendix A2 seem to support this hypothesis by showing that changes in SOMA holdings indeed have a significant tightening effect on the interbank market.

[11] Either by considering percentage variations in SOMA holdings from a benchmark or by restricting the definition of QT operations to the periods of actual unwinds.

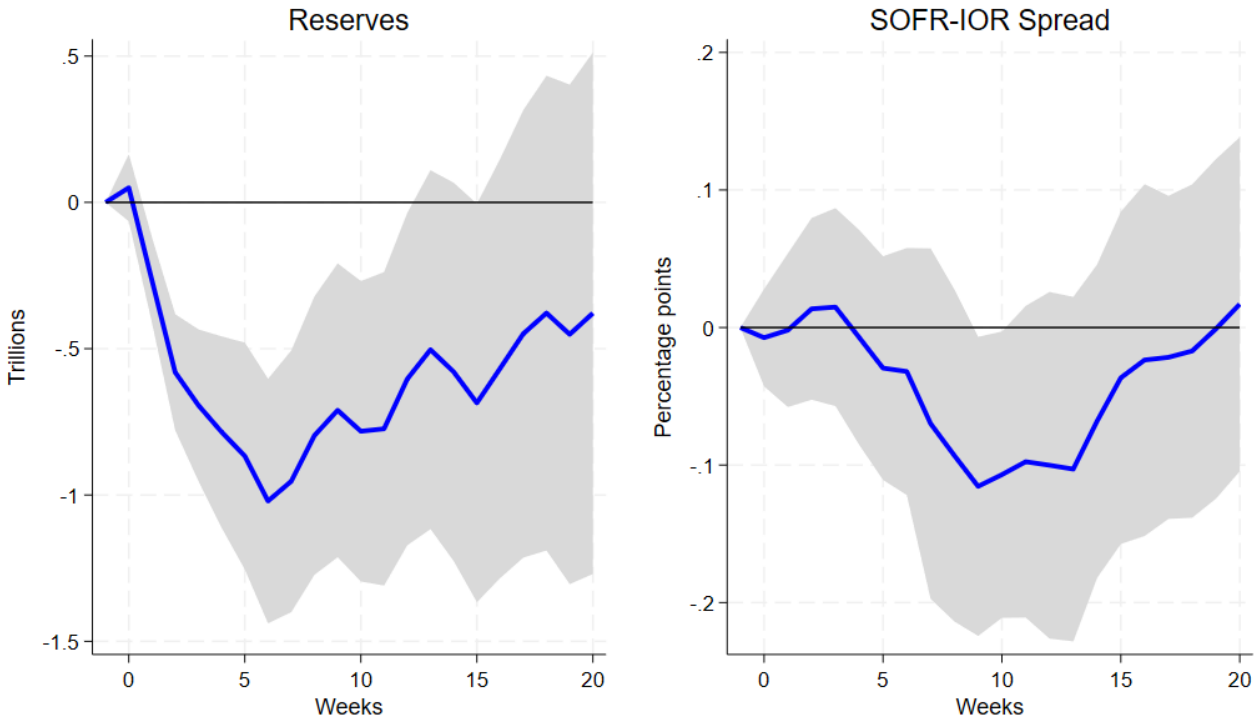

Figure 5. Money market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

4.2 Effects on Asset Prices

Having ascertained the expected functioning of QT on the interbank market for reserves, we proceed to show the results on how QT operations affect financial asset prices, spreads and premia. We recall that this can occur through two channels: the indirect effect, caused by a decrease in the reserve supply that triggers a rebalancing off other assets, and the direct effect, caused by a decrease in the Fed's demand for Treasury securities and MBS (Christensen and Krogstrup, 2019).

The responses of the Treasury market to QT operations are shown in Figure 6. We find that the asset runoff of the Fed's balance sheet has a sizeable and persistent effect on both short- and long-term interest rates. After ten weeks, a 1 trillion USD decrease in SOMA holdings raises the yield on 10-year Treasuries by 1.68 percentage points (90% CI: [0.55, 2.82]). As the US nominal GDP in 2022 amounted to approximately $25.5 trillion, this implies that a decrease in the balance sheet by 1% of GDP raises the long-run risk-free rate by approximately 43 basis points. It is worth stressing that this result concerns the estimated effect of a balance sheet unwind, which actually engenders a one-to-one, symmetric decrease in the stock of reserves. Since the reduction in SOMA holdings over the past few years has been matched by a shrinking of the TGA and ONRRP, rather than reserves, the actual effect on Treasury yields has likely been significantly smaller. The total asset runoff under QT II has amounted to $2.27 trillion; had this entailed a commensurate fall in reserves, 10-year yields would have risen by approximately 3.8 percentage points.

A 1-trillion decrease in the Fed's bond holdings causes a significant and persistent increase in Treasury volatility, peaking at 58.7 MOVE index points after 14 weeks. Our results further show that the effect of QT operations on 3-month Treasury yields is similar in magnitude to that on 10-year Treasuries for up to several months, and stronger thereafter, reaching 2.45 percentage points at week 20. This implies that QT operations do not raise the term premium but rather cause a parallel upward shift in the entire yield

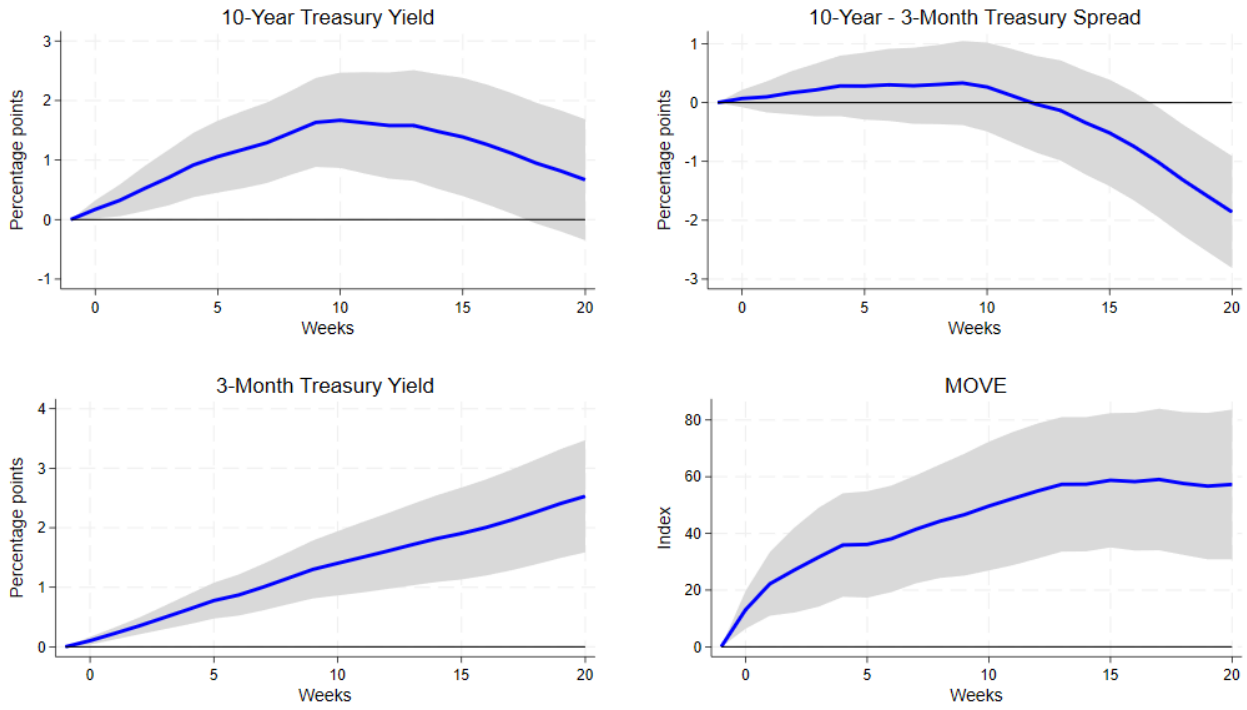

Figure 6. Treasury market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

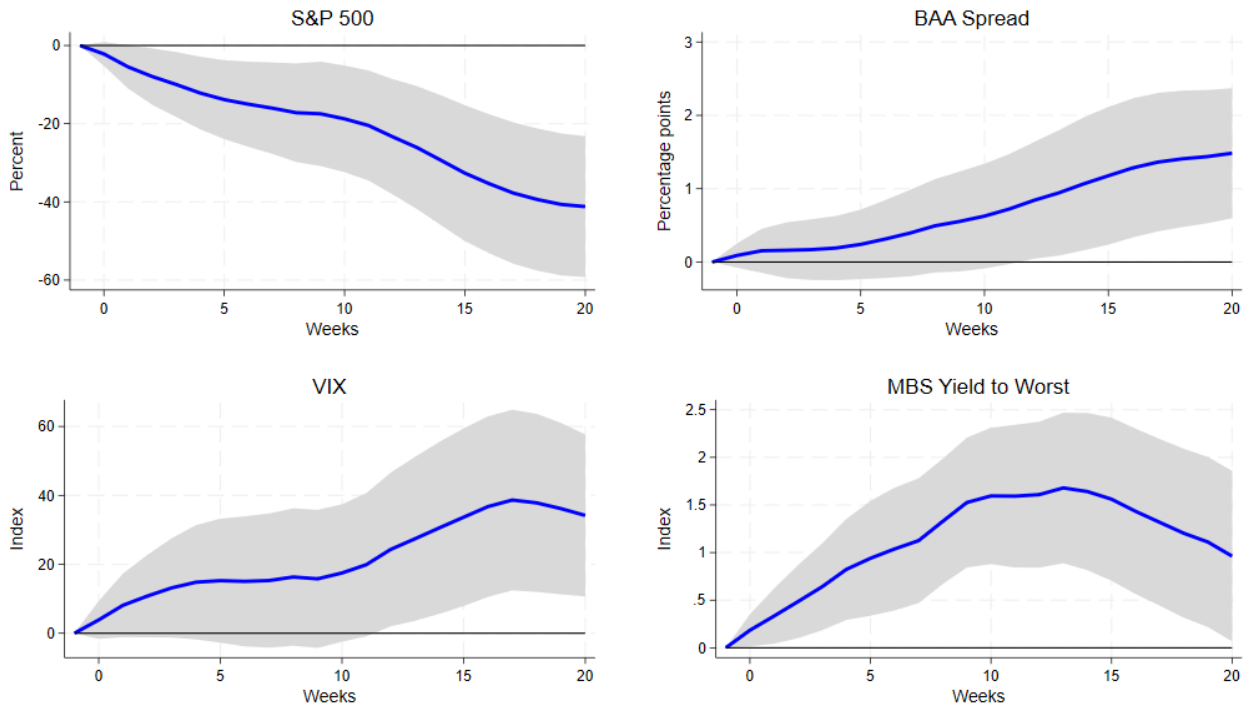

Figure 7. Stock market and corporate spreads: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

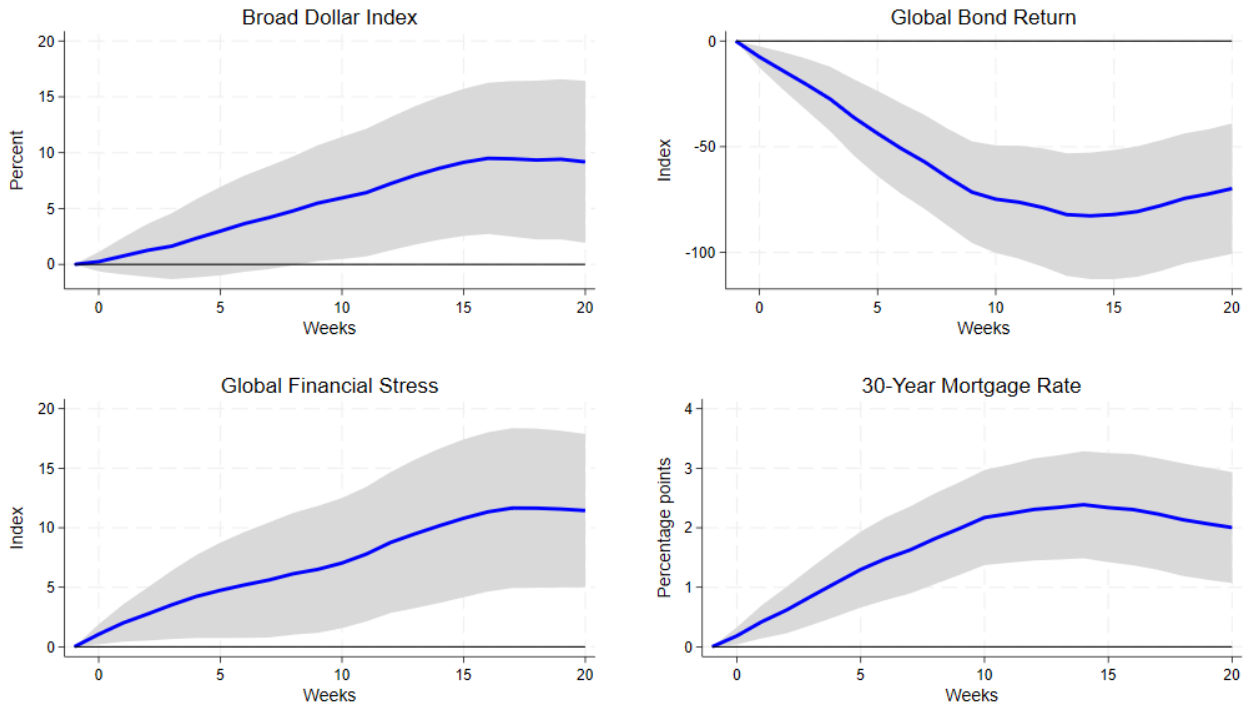

Figure 8. Other assets: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

curve, at least in the short term. This result may depend on the maturity structure of securities maturing off SOMA holdings, a shift in investor maturity preferences during balance sheet unwinds or a change in the maturity structure of debt issued by the Treasury. Interestingly, this finding closely aligns with the stylised facts noticed by Ramsden (2023) and Schnabel (2023b), who observe that QT implementation has been associated with negligible increases in term premia. As discussed by the authors, while the increased uncertainty on the policy outlook and the inflationary shocks might have brought an overall increase in global term premia, the steepening of the yield curves might have been partially counteracted by a moderate decline in the spread between the 10-year and the 3-month yields induced by the balance sheet runoff.

Figure 7 shows the effects of QT operations on selected risky assets. We uncover a significant contractionary effect across all risky assets, highlighting how the drain on reserves can indirectly affect a broad class of assets. A 1-trillion decrease in SOMA holdings causes the S&P 500 to fall by up to 41% after five months (week 20), with the effect significant at every horizon from week 1 onward. Just like the impact on bond prices, this estimated effect assumes a mirrored 1-trillion fall in reserves. The depressive effects on the stock market are complemented by a moderate but persistent increase in stock volatility (VIX), which peaks at 39.0 index points at week 17. QT operations are also found to affect the private credit market persistently. Shrinking the Fed's balance sheet by 1 trillion increases the spread between corporate BAA bonds and 10-year Treasuries by 1.53 percentage points at week 20, the MBS yield to worst by 1.68 percentage points at week 14, and the interest rate on 30-year mortgages by 2.48 percentage points at week 14 (Figure 8).

Figure 8 also reports the IRFs relative to the international spillovers to QT and its effect on bank lending. We find that a 1-trillion decrease in SOMA holdings is associated with a 9.4% appreciation in the Broad Dollar Index after 16 weeks, though this remains statistically marginal throughout the horizon. The

response of the Global Bond Return index is stronger and more rapid, with a trough of −95.2 index points at week 14 (90% CI: [−139.6, −50.7]), significant at every horizon. This suggests that the increase in the 10-Year U.S. Government bond yields, which can be regarded as the safe asset *par excellence* at the global level, has triggered a similar increase in the yields of non-U.S. securities, due to portfolio rebalancing. The resulting Dollar appreciation can be explained by inflows into U.S. assets driven by higher yields. We also document an increase in the global financial stress index, which peaks at 11.7 index points at week 17, caused by the downward pressure that portfolio rebalancing exerts on assets worldwide.

From these findings, it emerges that the unwinding of LSAPs in the United States has far-reaching implications for a broad class of assets. The Treasury and MBS markets are directly affected by the Federal Reserve's gradual withdrawal of demand for those assets. Additionally, the decrease in reserve supply directly affects banks' behaviour via portfolio rebalancing, thus depressing the stock market and tightening credit conditions for the private nonfinancial sector. From an international dimension, QT by the Fed has been associated with a strong contractionary effect on global bond yields, an appreciation of the US Dollar in effective terms and a rise in global financial stress.

4.3 Robustness Checks

As customary in the literature, to corroborate our findings, we run a series of robustness checks. These results are reported in full in Appendix A2. Firstly, we test for nonlinearity by estimating IRFs of asset prices to a decrease in the logarithm of SOMA holdings. This specification is designed to account for a multiplicative nonlinearity in the DGP. By taking logs, the IRFs can be interpreted as the response in the variable of interest to a 1% decrease in SOMA holdings. This implicitly assumes that the effects of QT can be stronger when the balance sheet of the central bank is smaller. The results from this log specifications are very similar in size and shape to our baseline model. The main difference relates to the estimated negative effect on the stock market, where the response results smaller in absolute value in the logarithmic model (a fall of about 10%, compared to the estimate of at least 20% in the baseline) during the first 10 weeks.

Secondly, we test an alternative definition of QT operations, where the those are defined as the level, rather than its first difference, of the overall SOMA holdings when QT is taking place, and zero otherwise. This alternative specification is meant to isolate the effect of change in bond holdings by the Fed only during periods when the balance sheet runoff is taking place, thereby shutting off all minor weekly asset adjustment operations occurring outside of QT periods. The main drawback associated with this definition of QT operations is that SOMA holdings now become a jump-wise defined variable, rather than a continuous one. Consequently, transitions between QT periods might potentially bias the estimated impact of balance sheet runoffs. With the awareness of this caveat, we can interpret the results of the robustness check. The main differences with respect to the baseline regard the effects of QT on long-term Treasury yields, their volatility (MOVE) and the overall effects on asset prices, which appear significantly smoothed. Some of these responses cease being significant and the magnitudes are 10 times smaller. At the same time, however, we also find that, in this specification, the reserve drain induced by QT is indeed successful in tightening the interbank market and raising the overnight SOFR-IOR spread. As mentioned in Section 4, we interpret this result as the nonlinear QT measure being able to drive the demand schedule for reserves past the "kink", into the scarce-reserve setting.

Thirdly, we employ the Weekly Economic Index (WEI) (Lewis et al., 2022) as a different proxy for the overall level of economic activity. This is a relevant test because alternative measurements of the business cycle imply different macroeconomic expectations by market participants, which in turn significantly affect asset prices. In this robustness check, the results show minimal amount of variation compared to our baseline LP regression. We only find a significant difference in the response of the Broad Dollar and in the Global Financial Stress Indexes. While still positive, the estimated appreciation of the US currency results weaker (about 3%, compared to the $\sim$ 9% baseline estimate) and is never significant. Also the effect on

Global Financial Stress in this alternative model appears barely significant and smaller in size.

Finally, we test for state-dependence by running a smooth-transition model[12] (Granger et al., 1993), to check whether the effect of QT changes when the Fed Funds rate approaches the ELB. This exercise can be insightful for policy, as it allows to uncover whether QT has more powerful effects when interest rates are high and thus bond markets can more easily come under pressure. Our results, when running the state-dependent model, show moderate evidence in favour of this hypothesis. We find that the IRFs are fairly symmetric across interest rate regimes. The main differences regard the effects on the VIX, the MOVE and Global Financial Stress, which are stronger when interest rates are higher. This suggests increased market volatility and potentially reduced liquidity when interest rates are higher.

Summing up the results obtained in this section, we can conclude that the core pattern of findings from our baseline LP model remains robust across alternative specifications.

5 Effects of QT Announcements

5.1 Baseline Results

Having ascertained the strong and significant effect of QT operations on asset prices, we may now turn to discussing the estimated announcement effect of the Fed's BSP communications. The results of our baseline specifications are displayed in Tables 3, 4 and 5. The event dummies are reported in the table in chronological order. Coefficient estimates for macroeconomic surprises, the GDP nowcast, the VIX, and the 3-month OIS spread have been omitted to ease table reading.[13]

Table 3 shows that the first set of tapering announcements had a significant contractionary impact on the Treasury market, by raising the yield on 5-year and 10-year notes and 30-year bonds by 7.8, 6.8 and 4.8 basis points, respectively. These findings are statistically significant at the 5% level. This finding primarily relates to the "taper tantrum" episode in May 2013, when Fed communications about a possible end to QE triggered widespread market tensions. Conversely, we find virtually no statistically significant effects across the board of subsequent announcements relating to the first QT I episode. These findings are closely aligned with previous studies on BSP communications.

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Tapering of QE III	0.004	0.004	0.040	0.078**	0.068**	0.048*
QT I	0.006	0.004	0.020	0.015	-0.002	-0.021
End of QT I	-0.009	0.020	0.104	0.105	0.096	0.069
Pandemic QE	-0.063***	-0.007	-0.017	-0.047	-0.075*	-0.115***
Tapering of Pandemic QE	0.003	0.008	-0.002	0.011	0.022	0.039
QT II	-0.025*	-0.003	0.014	0.022	0.050*	0.038
Tapering of QT II	0.016	0.038*	0.046*	0.049*	0.046*	0.046*
N	2807	2807	2807	2807	2807	2807
adj. R^2	0.272	0.118	0.046	0.034	0.030	0.028

Table 3. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[12] The empirical specification takes the form of $y_{t+h} - y_{t-1} = \alpha_h + F(z_t) \times (\beta_h^H \Delta SOMA_t^- + \gamma' X_t) + (1 - F(z_t)) \times (\beta_h^{ELB} \Delta SOMA_t^- + \gamma' X_t) + u_{t+h}$, where the logistic function $F(z_t) = \exp\{\theta z_z\}/1 + \exp\{\theta z_z\}$ is employed to induce a smooth transition between the high-interest-rate and the low-interest-rate states of the economy. Clearly, in our case, we use as state variable z_t the Z-score of the Federal Funds rate. We follow the calibration of Tenreyro and Thwaites (2016), in setting $\theta = 3$. In the figure reported in the Appendix, we compare the IRFs to QT in a high- and low-interest-rate environments defined by the parameters β_h^H and β_h^{ELB}, respectively.

[13] Full regression outputs are shown in Appendix A1.

Regarding the pandemic QE program, our results suggest that the Fed's emergency LSAP launched in mid-March 2023 was associated with a strong negative information effect. Its effects are those characteristic of a flight to quality, with a rebalancing towards risk-free assets. This causes a fall in Government bond yields across the term structure; the 6.3-basis-point fall in the 3-month yield and the 11.5-basis-point fall in the 30-year yield are statistically significant at the 1% level. Finally, Table 3 only shows a marginally significant 5-basis point increase in the yield on 10-year notes on BSP announcements relating to QT II. Conversely, the announcement of the end of QT had a marginally significant tightening effect - in the neighbourhood of 4.5 basis points - on the whole yield curve. This might be due to markets expecting a quicker unwind.

In Table 4, the Tapering announcements of QE III caused a marginally significant 4.5-point increase in the MOVE, as well as an increase in MBS yields by 7.3 basis points and a fall in the global return index by 2.4 points. Both effects are significant at the 5% level. This is consistent with the view of the "taper tantrum" as a repricing of long-term interest rates by financial markets, rather than a liquidity crisis in the Treasury market. Announcements relating to QT I register no significant effects, except for the tapering of QT I on the 10Y bid-ask spread, possibly relating to liquidity pressure during the 2019 repo crisis. On the other hand, the evidence on the pandemic QE announcements underscores the role of the flight to quality, with a decrease in Treasury volatility and liquidity, a compression of the bid-ask spread and a widening of the corporate spread. Finally, the last significant result of the table relates to a 3.2-basis-point decrease in the BAA-10Y spread during QT II announcements, driven by a modest increase in the 10-year Treasury yield. Other variables did not show a significant reaction during the second QT.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Tapering of QE III	4.532*	-0.002	0.041	-0.012	0.073**	-2.398**
QT I	0.057	0.021	-0.057	-0.011	0.008	-0.291
End of QT I	-1.351	0.288*	-0.068	-0.048	0.045	-0.833
Pandemic QE	-16.839***	-0.572***	-0.361***	0.065***	-0.477***	0.211
Tapering of Pandemic QE	-4.872	-0.116	-0.035	0.014	0.023	-0.353
QT II	2.515	0.057	0.021	-0.032**	0.038	-1.255
Tapering of QT II	0.129	-0.063	0.016	-0.005	0.042	-0.868
N	2740	2477	2854	2799	2837	3045
adj. R^2	0.088	0.017	0.027	0.074	0.050	0.018

Table 4. Bond market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

In Table 5, the tapering of QE III brings about a small but significant Dollar appreciation (0.4%) and a fall in gold prices (-1.4%), in line with the effects of an ordinary monetary squeeze. The first QT did not significantly affect any of the variables in the table. Once again, the pandemic flight to quality triggered a stock sell-off (-3.1%) and an increase in their volatility (11.5 points), a 1% Dollar and 2.6% gold appreciation, a 6.7% fall in oil prices and a significant increase in global financial stress. Conversely, it is noteworthy that QT II announcements did not significantly affect any of these assets and that the tapering of the last QT episode only moderately affected the stock market, possibly conveying some information effect.

Taking stock of this first set of results, we may summarise them as follows. Firstly, we confirm the existence of a significant contractionary effect of the first tapering episode, mostly associated with the "taper tantrum" of June 2013. Secondly, the first QT experience had no impact on financial markets, while the second QT only marginally raised the 10-year Government bond yields by 5 basis points. Thirdly, the pandemic QE was associated with a significant negative information effect, which increased agents' risk aversion and prompted a portfolio rebalancing toward risk-free assets, thereby lowering their yields.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Tapering of QE III	-0.004	0.043	0.004**	-0.014***	-0.010	0.174
QT I	-0.002	-0.029	-0.000	-0.006	-0.009	-0.018
End of QT I	0.008	-3.082	-0.004	-0.002	-0.008	-0.346
Pandemic QE	-0.031***	11.505***	0.009***	0.026***	-0.067**	0.811***
Tapering of Pandemic QE	0.012	-2.280*	-0.002	-0.001	0.003	-0.293
QT II	-0.001	0.932	0.001	0.000	0.002	0.038
Tapering of QT II	0.009*	-2.008**	-0.000	0.003	-0.009	-0.100
N	2845	2887	2787	3039	2914	2895
adj. R^2	0.011	0.062	0.004	0.011	0.015	0.066

Table 5. Stocks & Commodities: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2 Robustness Checks

To assess the robustness of our main findings on QT announcement episodes, we conduct a series of robustness checks. These are reported in Appendix A1. First, we run the regressions by omitting all the macroeconomic control variables. Second, we employ the weekly economic index developed by Lewis et al. (2022) rather than the CITIFX economic surprise index. Third, we run the baseline specification displayed in Tables 3, 4 and 5 using Newey and West (1987) standard errors. Finally, we also include, as an additional control, the overall level of outstanding Government debt securities[14] (see Figure 3). The rationale for this last control is that government debt rose considerably after the pandemic. As a consequence, QT announcements across different stocks of Government debt securities outstanding can be expected to have different effects. Overall, the underlying pattern of findings in this section does not change when robustness checks are applied.

5.3 Granular Effects of QT Announcements

We now delve deeper into the granularity of different BSP announcements. We assess the individual effect of each Fed announcement episode by regressing changes in asset prices and yields on a dummy for each announcement that occurred over the sample. We also include the same control variables as in the baseline specification. This new set of results is shown in Tables 6, 7, and 8, where each communication event is reported along with its date and the nature of the communication.

The results concerning the yield curve are reported in Table 6. The first element that emerges from this new regression is the stark effect of the remarks by Fed Chair Ben Bernanke about a tapering of QE on June 19th 2013, raising the long end of the term structure by 15 to 21 basis points. Conversely, other QT I announcements did not achieve significant movements in asset prices. Similarly, the tapering of the last LSAP was largely anticipated by markets and therefore entailed no significant consequences on asset prices. As already seen in Table 3, the 2020 QE implemented at the beginning of the pandemic crisis was associated with a significant downward movement in yields across both short- and long-maturity bonds.

Regarding QT II, we find that the announcement on January 26th, 2022, when the principles for the normalisation of the balance sheet were released, was associated with a significant 10-point increase in 1-year yields and a 16-point increase in 3-year yields. The remarks made by Governor Brainard on April 5th

[14]The total amount of Government debt outstanding can be classified into two broad categories: federal debt held by the public and intra-governmental holdings. The former stock can be further divided into SOMA holdings and debt held by the private sector. The latter quantity is the one employed as a control in this paper. The data comes from the US Treasury Debt to the Penny dataset.

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
22/05/2013	0.017	0.007	0.034	0.074	0.083	0.062
19/06/2013	0.006	0.016	0.144**	0.244***	0.212***	0.150**
18/12/2013	0.000	-0.002	0.053	0.112	0.091	0.029
21/05/2014	0.007	0.007	0.033	0.043	0.042	0.051
09/07/2014	-0.003	-0.003	-0.056	-0.037	-0.027	0.002
15/07/2014	-0.004	-0.003	0.030	0.030	0.000	-0.009
20/08/2014	-0.002	-0.003	0.054	0.053	0.013	-0.018
17/09/2014	0.006	-0.005	0.062	0.072	0.031	-0.000
29/10/2014	-0.005	0.005	0.072	0.052	0.021	-0.021
12/01/2017	0.006	-0.008	-0.000	0.002	0.016	0.031
05/04/2017	-0.002	0.019	-0.023	-0.013	-0.022	-0.003
24/05/2017	0.020	0.022	-0.029	-0.058	-0.038	-0.029
14/06/2017	0.021	-0.007	-0.018	-0.027	-0.047	-0.088
20/09/2017	0.001	0.003	0.041	0.051	0.032	-0.009
19/12/2018	0.010	0.009	0.017	0.006	-0.028	-0.052
11/10/2019	-0.009	0.020	0.104	0.105	0.096	0.069
16/03/2020	-0.106***	-0.096*	-0.040	-0.045	0.065	0.042
23/03/2020	-0.083**	0.066	0.017	-0.015	-0.104	-0.197***
10/06/2020	-0.004	0.012	-0.023	-0.075	-0.179**	-0.184***
22/09/2021	0.004	0.015	0.075	0.104	0.081	0.056
03/11/2021	-0.002	0.003	-0.024	-0.036	-0.018	0.011
15/12/2021	0.007	0.006	-0.057	-0.038	0.000	0.047
26/01/2022	0.015	0.104**	0.155**	0.104	0.031	-0.036
16/02/2022	-0.035	-0.055	-0.096	-0.087	-0.080	-0.066
16/03/2022	-0.066*	0.015	0.098	0.067	0.045	-0.001
05/04/2022	-0.001	0.053	0.051	0.132*	0.182**	0.141**
06/04/2022	0.022	0.005	-0.035	0.005	0.115	0.114*
04/05/2022	-0.092***	-0.095*	-0.037	0.002	0.081	0.117*
25/05/2022	-0.017	-0.049	-0.039	-0.068	-0.018	-0.003
10/04/2024	0.011	0.134***	0.244***	0.235***	0.196***	0.145**
01/05/2024	-0.003	-0.084*	-0.150**	-0.141*	-0.101	-0.061
22/05/2024	0.029	0.076	0.109	0.098	0.067	0.035
19/02/2025	0.021	-0.015	-0.045	-0.047	-0.041	-0.024
19/03/2025	0.014	-0.051	-0.067	-0.049	-0.043	-0.027
21/03/2025	0.002	0.058	0.080	0.080	0.100	0.112
09/04/2025	0.039	0.147***	0.150**	0.167**	0.139*	0.139**

Table 6. Yield curve: impact of all announcements relating to BSP. OLS standard errors not displayed. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
22/05/2013	9.665*	0.006	0.007	-0.037	0.105	-0.137
19/06/2013	16.484***	0.017	0.171	0.011	0.244***	-9.185***
18/12/2013	0.677	-0.077	0.029	-0.078*	0.073	-2.671
21/05/2014	-0.545	0.069	-0.071	0.023	0.014	-1.170
09/07/2014	1.808	-0.070	-0.048	0.024	-0.015	-0.215
15/07/2014	-0.605	0.050	0.164	-0.016	0.023	-0.986
20/08/2014	-0.560	-0.025	-0.112	-0.046	-0.005	-1.399
17/09/2014	-3.717	0.144	0.070	-0.017	0.023	-1.441
29/10/2014	-3.656	0.111	0.029	-0.039	0.013	-2.422
12/01/2017	2.354	-0.162	0.008	0.016	0.026	3.134
05/04/2017	4.874	0.146	-0.259**	0.014	0.000	-0.194
24/05/2017	-0.294	-0.006	0.001	0.024	-0.025	-0.208
14/06/2017	1.115	0.134	-0.086	-0.027	-0.005	0.147
20/09/2017	-0.388	0.041	-0.267**	-0.035	0.044	-1.891
19/12/2018	1.245	-0.181	0.110	0.016	0.004	1.699
11/10/2019	-1.362	0.289*	-0.068	-0.048	0.045	-0.836
16/03/2020	-26.678***	-0.546***	-0.491***	0.158***	-0.348***	-6.809***
23/03/2020	-20.419***	-1.004***	-0.679***	-0.072*	-0.906***	4.565**
10/06/2020	-4.482	-0.185	0.068	0.106**	-0.188**	2.867
22/09/2021	-0.435	-0.214	0.059	-0.025	0.083	-1.704
03/11/2021	-6.182	-0.064	-0.083	0.018	-0.009	0.339
15/12/2021	-8.154	-0.067	-0.080	0.049	-0.008	0.347
26/01/2022	3.266	-0.063	0.084	-0.058	0.062	-4.099*
16/02/2022	4.326	0.032	0.026	0.124***	-0.039	2.493
16/03/2022	-6.789	0.105	0.001	-0.198***	0.017	3.002
05/04/2022	17.080***	-0.070	-0.017	-0.040	0.175**	-5.810**
06/04/2022	8.079	-0.081	-0.005	0.010	0.078	-2.994
04/05/2022	-2.630	0.393**	0.090	0.036	0.030	-1.402
25/05/2022	-6.270	0.080	-0.035	-0.098**	-0.065	0.088
10/04/2024	11.729**	-0.092	0.006	-0.028	0.228***	-6.502***
01/05/2024	-6.494	-0.171	0.171	0.029	-0.152*	2.726
22/05/2024	1.921	-0.040	-0.134	-0.026	0.108	-2.944
19/02/2025	2.954	0.002	0.028	0.032	-0.050	0.605
19/03/2025	0.602	-0.051	0.115	0.009	-0.062	-0.120
21/03/2025	-1.649	-0.010	-0.002	0.001	0.108	-2.717
09/04/2025	-8.403	-0.070	-0.070	-0.048	0.111	2.932

Table 7. Bond market: impact of all announcements relating to BSP. OLS standard errors not displayed. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
22/05/2013	-0.012	0.476	0.003	0.011	-0.031	0.670**
19/06/2013	-0.040***	3.897*	0.017***	-0.069***	-0.027	0.825**
18/12/2013	0.015	-2.215	0.005	-0.033**	0.014	-0.419
21/05/2014	0.010	-1.241	0.000	-0.000	0.001	-0.193
09/07/2014	0.000	0.262	-0.000	0.013	-0.018	0.149
15/07/2014	0.001	-0.871	0.002	-0.006	-0.000	0.026
20/08/2014	0.005	-0.757	0.003	-0.014	0.002	-0.058
17/09/2014	0.006	-0.935	0.003	-0.008	-0.009	-0.211
29/10/2014	0.004	0.040	0.003	-0.024*	-0.004	-0.118
12/01/2017	-0.000	-0.348	-0.009**	0.005	0.009	-0.213
05/04/2017	-0.001	0.195	0.000	-0.003	0.008	0.081
24/05/2017	0.007	-1.054	-0.003	0.004	-0.022	-0.099
14/06/2017	-0.003	0.230	0.002	-0.009	-0.033	0.089
20/09/2017	-0.002	-0.930	0.003	-0.015	0.016	-0.087
19/12/2018	-0.033**	3.323	-0.003	0.007	-0.048	0.468
11/10/2019	0.008	-3.077	-0.004	-0.002	-0.008	-0.345
16/03/2020	-0.077***	21.662***	0.017***	-0.005	-0.132***	2.099***
23/03/2020	0.055***	-1.075	0.005	0.077***	-0.020	-1.108***
10/06/2020	-0.068***	13.673***	0.006	0.006	-0.050	1.406***
22/09/2021	0.020	-5.089**	-0.002	-0.019	0.034	-0.446
03/11/2021	0.011	-0.578	0.000	0.000	-0.040	-0.174
15/12/2021	0.006	-1.164	-0.004	0.016	0.014	-0.256
26/01/2022	-0.009	0.223	0.007	-0.029**	0.023	0.050
16/02/2022	-0.022	3.143	-0.002	0.023*	-0.030	0.259
16/03/2022	0.033**	-3.264	-0.010**	0.012	0.048	-0.899***
05/04/2022	-0.023	3.841	0.005	-0.003	-0.043	0.483
06/04/2022	-0.006	0.517	0.005	0.005	-0.081*	0.418
04/05/2022	-0.005	2.971	0.002	0.003	0.068	0.172
25/05/2022	0.029**	-1.109	0.001	-0.008	0.032	-0.245
10/04/2024	-0.002	-0.279	0.007	0.010	-0.006	0.043
01/05/2024	0.007	-1.090	-0.005	0.006	-0.039	-0.068
22/05/2024	-0.011	0.640	0.003	-0.040***	-0.029	0.043
19/02/2025	-0.004	0.206	-0.001	-0.001	0.007	0.152
19/03/2025	0.006	-1.647	0.004	0.002	0.011	-0.104
21/03/2025	0.016	-2.268	0.001	-0.012	0.009	-0.179
09/04/2025	0.052***	-9.596***	-0.013***	0.059***	-0.014	-0.579*

Table 8. Stocks & commodities: impact of all announcements relating to BSP. OLS standard errors not displayed. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

of the same year, speculating that QT would have started before than previously anticipated, significantly raised yields on 5-year, 10-year, and 30-year Treasury securities by 13, 18, and 14 basis points, respectively. On the other hand, the release of the actual QT schedule on May 4th, 2022, marginally steepened the curve by reducing the yield on 3-month bills by 9 basis points and raising the yield on 30-year bonds by 11 basis points. Other significant results concern the tapering of QT II: on April 10th, 2024, it was announced that the tapering would be delayed. This was revealed to be one of the most powerful BSP announcements, as it significantly pushed up the entire yield curve, except for the short end, by 15 to 25 basis points. The communication of the actual start of tapering, less than one month later, had the opposite effect: yields on 1-year, 3-year, and 5-year securities fell by 8 to 15 points. The last communication in our sample, on April 9th, 2025, once again shifted the whole yield curve upward when the FOMC minutes revealed a slower-than-expected QT tapering schedule.

In Table 7, we present the event study of BSP and its estimated effects on various indicators of the fixed-income markets. Once again, the "taper tantrum" on June 19th, 2023, pushed up the MOVE significantly by 16 points, MBS yields by 24 basis points and also had significant international spillovers on global bond returns. We do not find further noteworthy results concerning the first QT episode. By contrast, the findings on the pandemic QE do not provide further insight beyond the aggregated analysis shown in Table 4: the usual flight-to-quality mechanism applies. Finally, we discuss in more detail the results relative to QT II. We note that the January 26th, 2022 announcement of the balance sheet normalisation plan only marginally impacted the global bond return index, which fell by 4 points. The impact of Brainard's speech on April 5th, 2022, was more substantial, as it increased the MOVE by 17 points, the MBS yields by 17.5 basis points and decreased the global bond return index by 5 points. On the other hand, the release of the QT schedule on May 4th only widened the bid-ask spread on the 10-year note by 39 basis points. The last significant result of the table relates to the communication of delayed QT tapering, on April 10th, 2024, raising the MOVE by 11.8 points and the MBS yields by 23 basis points, while the global bond return index fell by 6.5 points.

The last panel of our event study focusses on the reaction of equity markets and commodities. In Table 8, the findings regarding the tapering of QE III, the implementation of QT I and of the 2020 QE reflect the market conditions described in the previous paragraph. The communications regarding the second balance sheet unwind did not result in significant movements in the relevant asset prices. The announcements on March 16th, 2022, and May 25th of the same year had a moderately expansionary effect on equities (about 3%). The fact that, on these dates, the Treasury and bond markets did not move significantly, however, suggests that these share price rallies could be more related to news specific to the stock market than to actual QT communication. In the end, our last significant finding in the table concerns the update on the operational details of QT tapering, released on April 9th, 2025. This had a strongly expansionary effect on shares, with shares rising by 5%, the VIX falling, the Dollar weakening by 1.3%, and gold prices surging by 6%. This result, combined with the steepening of the yield curve reported in Table 6, suggests that the last release of the QT tapering schedule might have had a positive information effect, fuelling market confidence and dissipating expectations of near-term monetary easing.

Zooming into the granularity of QT communications allows us to complement and expand on the current evidence presented in the early literature on QT announcement. Summing up, we find that the bulk of the financial market reaction to BSP is concentrated on four announcement dates: January 26th, 2022, April 5th, 2022, April 10th, 2024 and April 9th, 2025. Among these, the first three communications involved a direct repricing of market expectations over the timing of the unwind, whereas the last one entailed a revision of the schedule for ending the unwind. On the other hand, we do not find any effect from other Fed news releases.

As a final check on this finding, we run the identical event study for a few selected yields over a 30-minute window centered on the announcement release, using the dataset by Acosta et al. (2025). Arguably, this cleaner methodology could isolate any lingering confounders that our rich set of controls might not have

fully captured. To do this, we run the modified version of our specification in Equation (3):

$$\Delta y_t = \sum_{k=1}^{K} \beta_k ANN_t^k + \sum_{j=i}^{6} \gamma_j \Delta FF_t^j + u_t \tag{5}$$

In Equation (5), Δy_t denotes the change in the yield on the 30-minute window, where ΔFF_t^j denotes the change in the Federal Funds futures contract with maturity up to j months ahead during the same 30-minute window. Arguably, this component should remove the interest rate surprise associated with the conventional monetary policy decision, i.e., the rate hike, and leave the pure BSP effect. The results of this regression are reported in Appendix A1. None of the announcements in QT II are significant when using the 30-minute window event study. Instead, some announcements relative to QT I, occurring on September 17th, 2014, October 29th, 2014 and September 20th, 2017, all raise the yield on the 30-year bond by 55 to 70 basis points. These dates correspond to the release of the principles for the normalisation of the balance sheet, the announcement of the end of QE III, and the announcement of the beginning of QT I, respectively. This paints a relatively different picture than what emerges from the event study conducted on yield changes over a two-day window.

6 Conclusions

The evidence presented in this paper suggests that the implementation of QT has strong deflationary consequences on interest rates and asset prices. QT actions bring forth this effect through two channels. Firstly, the decrease in reinvestments of principal payments from maturing SOMA holdings implies a decline in demand for Treasury and MBS securities, thereby raising their yields across all maturities. Secondly, the shrinkage of SOMA holdings reduces the supply of reserves on the liability side of the Fed's balance sheet. The drain on reserves prompts a portfolio rebalancing away from riskier, less liquid assets such as stocks and corporate bonds, thereby causing their prices to fall. Overall, the latter channel significantly outweighs the former. These mechanisms affect a broad spectrum of financial assets, both in the domestic and foreign markets. In addition, the effect of QT on the Treasury market is potent, as it shifts the yield curve upward and causes persistent increases in Treasury volatility.

Although policymakers view QT as a secondary tool operating in the background, it actually has robust contractionary effects on asset prices and, potentially, the real economy. While these effects can likely be expected on prior grounds of economic theory, they show that QT ends up working at least partially as a QE in reverse, despite this not seeming to be part of policymakers' intentions or communication strategy.

Regarding announcement effects, our findings suggest that QT communications operate differently from QT operations. While markets clearly anticipated some aspects of balance sheet normalisation, the muted response to most announcements, combined with the strong operational effects, indicates that the actual implementation of QT, rather than its communication, drives financial market impacts. This finding has important implications for central bank communication strategies.

Against this backdrop, now that the Fed's QT ends in November 2025, we can take stock of the situation. The unwinding of the Fed's Treasury purchases over the last couple of years has not destabilised markets, as the drain in reserves brought about by the reduction in SOMA holdings has been offset by opposite movements in other components of the Fed's balance sheet. In fact, as shown in Figure 2, liquidity operations initiated in March 2023 with the BTFP have led to an expansion in the Fed's assets that has temporarily offset the reduction in SOMA holdings. On the liability side, the lion's share has been accounted for by a shrinkage in overnight money market borrowing through the ONRRP facility. Moreover, a surge in Government net spending that has depleted the TGA has increased the reserve supply, *ceteris*

paribus. Thus, the overall reserve supply during the balance sheet unwind period has remained broadly stationary, while we have rather witnessed a shift in the composition of the Fed's balance sheet.

This paper has hence brought to light three major conclusions regarding the Fed's BSP. First, the central bank's unconventional policy has direct control over its balance sheet assets, but only indirect control over its liabilities. A decrease in holdings of Treasury securities need not entail a symmetric reduction in reserves: other items on the liability side can adjust, so that the reserve supply remains unaltered. Second, interbank reserves cannot be reduced without inducing a parallel deflationary effect on the bond and equity markets, which can, in principle, constitute a threat to financial stability if sustained over a long period. Therefore, taken at face value, a permanent reduction in the stock of central bank reserves, which is the ultimate goal of QT, remains a challenging policy objective. While a reduction of the reserve supply remains desirable, at least in theory (Borio, 2023; Fricke et al., 2023), its practical achievement remains difficult.

All in all, the results in this paper complement those of Acharya et al. (2023), who also show that maturity and liquidity transformation activities by banks make it harder to reduce the supply of reserves after prolonged expansions of the central bank's balance sheet. Taken at face value, the emerging evidence suggests that LSAPs might be irreversible overall: a sizeable expansion in the supply of reserves triggers a fundamental shift in the balance sheet composition of the banking system. It permanently drives asset prices upward, and any subsequent shrinkage of reserves cannot be achieved without a commensurate negative effect on money and capital markets. In the end, QT has so far mostly had the effect of "paint drying", but, as Du et al. (2024) aptly states, when the drain on reserves starts biting, QT could potentially evolve into "watching water boil".

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A1 Appendix I - Robustness Checks: QT Announcements

A1.1 Full Regression Outputs

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Tapering of QE III	0.004	0.004	0.040	0.078**	0.068**	0.048*
	(0.014)	(0.021)	(0.029)	(0.031)	(0.030)	(0.028)
QT I	0.006	0.004	0.020	0.015	-0.002	-0.021
	(0.012)	(0.017)	(0.024)	(0.025)	(0.024)	(0.023)
End of QT I	-0.009	0.020	0.104	0.105	0.096	0.069
	(0.034)	(0.051)	(0.071)	(0.075)	(0.072)	(0.069)
Pandemic QE	-0.063***	-0.007	-0.017	-0.047	-0.075*	-0.115***
	(0.020)	(0.030)	(0.042)	(0.044)	(0.043)	(0.040)
Tapering of Pandemic QE	0.003	0.008	-0.002	0.011	0.022	0.039
	(0.020)	(0.029)	(0.041)	(0.043)	(0.042)	(0.040)
QT II	-0.025*	-0.003	0.014	0.022	0.050*	0.038
	(0.013)	(0.019)	(0.027)	(0.028)	(0.028)	(0.026)
Tapering of QT II	0.016	0.038*	0.046*	0.049*	0.046*	0.046*
	(0.013)	(0.019)	(0.027)	(0.028)	(0.027)	(0.026)
FF SHOCKS	0.046	0.003	0.026	0.012	0.044	0.078
	(0.032)	(0.048)	(0.067)	(0.070)	(0.068)	(0.065)
TR SHOCKS	-0.007	0.067	0.127**	0.111*	0.102*	0.106*
	(0.029)	(0.042)	(0.059)	(0.062)	(0.060)	(0.057)
CITIFX	0.000	0.000	0.000	0.000*	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
VIX	0.000***	0.000**	0.000	0.000	0.000	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	0.091***	0.068***	0.043***	0.037***	0.028**	0.025**
	(0.006)	(0.009)	(0.013)	(0.013)	(0.013)	(0.012)
MON	-0.002	0.005	-0.002	-0.001	0.002	0.006
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
TUE	-0.023***	-0.002	-0.009**	-0.008*	-0.004	-0.000
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
WED	-0.025***	-0.013***	-0.013***	-0.012**	-0.008*	-0.002
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
THU	-0.021***	-0.005	-0.005	-0.005	-0.005	-0.004
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
SVB	-0.038***	-0.191***	-0.193***	-0.170***	-0.116***	-0.050**
	(0.011)	(0.016)	(0.023)	(0.024)	(0.023)	(0.022)
COVID	-0.282***	-0.219***	-0.160***	-0.151***	-0.175***	-0.178***
	(0.012)	(0.018)	(0.025)	(0.027)	(0.026)	(0.025)
CEIL	0.038***	0.064***	0.059***	0.050***	0.038**	0.026*
	(0.008)	(0.011)	(0.016)	(0.017)	(0.016)	(0.015)
Constant	0.006***	-0.003	0.006	0.004	-0.001	-0.008*
	(0.002)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)
N	2807	2807	2807	2807	2807	2807
adj. R^2	0.272	0.118	0.046	0.034	0.030	0.028

Table 9. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Tapering of QE III	4.532*	-0.002	0.041	-0.012	0.073**	-2.398**
	(2.318)	(0.066)	(0.048)	(0.017)	(0.033)	(0.935)
QT I	0.057	0.021	-0.057	-0.011	0.008	-0.291
	(1.900)	(0.054)	(0.039)	(0.014)	(0.027)	(0.766)
End of QT I	-1.351	0.288*	-0.068	-0.048	0.045	-0.833
	(5.657)	(0.162)	(0.116)	(0.042)	(0.080)	(2.283)
Pandemic QE	-16.839***	-0.572***	-0.361***	0.065***	-0.477***	0.211
	(3.331)	(0.095)	(0.068)	(0.025)	(0.047)	(1.342)
Tapering of Pandemic QE	-4.872	-0.116	-0.035	0.014	0.023	-0.353
	(3.275)	(0.094)	(0.067)	(0.024)	(0.046)	(1.321)
QT II	2.515	0.057	0.021	-0.032**	0.038	-1.255
	(2.158)	(0.062)	(0.044)	(0.016)	(0.030)	(0.870)
Tapering of QT II	0.129	-0.063	0.016	-0.005	0.042	-0.868
	(2.150)	(0.062)	(0.044)	(0.016)	(0.030)	(0.867)
FF SHOCKS	0.796	-0.118	0.015	0.027	0.053	-1.905
	(5.345)	(0.171)	(0.110)	(0.040)	(0.072)	(2.047)
TR SHOCKS	-10.765**	-0.210	-0.022	-0.041	0.082	-0.430
	(4.765)	(0.144)	(0.097)	(0.035)	(0.066)	(1.867)
CITIFX	-0.001	0.000	-0.000	-0.000	0.000	-0.001
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
VIX	-0.067***	0.001**	-0.001**	0.001***	0.000	-0.016**
	(0.016)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)
OIS	-0.763	-0.002	0.012	0.001	0.021	-1.222***
	(1.022)	(0.030)	(0.021)	(0.008)	(0.014)	(0.394)
MON	0.318	-0.014	-0.020***	0.000	0.003	0.018
	(0.341)	(0.010)	(0.007)	(0.003)	(0.005)	(0.129)
TUE	-2.280***	-0.003	-0.006	0.001	-0.007	0.111
	(0.350)	(0.011)	(0.007)	(0.003)	(0.005)	(0.130)
WED	-2.602***	-0.005	-0.029***	0.002	-0.010**	0.226*
	(0.354)	(0.011)	(0.007)	(0.003)	(0.005)	(0.135)
THU	-1.950***	0.005	-0.015**	0.000	-0.005	0.144
	(0.357)	(0.011)	(0.007)	(0.003)	(0.005)	(0.136)
SVB	13.802***	0.028	0.094**	0.102***	-0.112***	2.575***
	(1.809)	(0.052)	(0.037)	(0.014)	(0.026)	(0.729)
COVID	14.555***	-0.156***	0.214***	0.166***	-0.126***	4.657***
	(2.021)	(0.058)	(0.041)	(0.015)	(0.028)	(0.815)
CEIL	-0.565	-0.014	-0.027	-0.006	0.035**	-1.009**
	(1.259)	(0.038)	(0.026)	(0.009)	(0.018)	(0.485)
Constant	2.299***	-0.014	0.027***	-0.013***	0.003	0.260*
	(0.381)	(0.011)	(0.008)	(0.003)	(0.005)	(0.144)
N	2740	2477	2854	2799	2837	3045
adj. R^2	0.088	0.017	0.027	0.074	0.050	0.018

Table 10. Bond market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Tapering of QE III	-0.004	0.043	0.004**	-0.014***	-0.010	0.174
	(0.006)	(0.976)	(0.002)	(0.005)	(0.019)	(0.138)
QT I	-0.002	-0.029	-0.000	-0.006	-0.009	-0.018
	(0.005)	(0.800)	(0.001)	(0.004)	(0.016)	(0.113)
End of QT I	0.008	-3.082	-0.004	-0.002	-0.008	-0.346
	(0.014)	(2.382)	(0.004)	(0.013)	(0.047)	(0.336)
Pandemic QE	-0.031***	11.505***	0.009***	0.026***	-0.067**	0.811***
	(0.009)	(1.402)	(0.003)	(0.008)	(0.028)	(0.198)
Tapering of Pandemic QE	0.012	-2.280*	-0.002	-0.001	0.003	-0.293
	(0.008)	(1.379)	(0.003)	(0.008)	(0.027)	(0.195)
QT II	-0.001	0.932	0.001	0.000	0.002	0.038
	(0.006)	(0.908)	(0.002)	(0.005)	(0.018)	(0.128)
Tapering of QT II	0.009*	-2.008**	-0.000	0.003	-0.009	-0.100
	(0.005)	(0.905)	(0.002)	(0.005)	(0.018)	(0.128)
FF SHOCKS	-0.017	1.303	0.002	0.003	0.021	0.298
	(0.013)	(2.135)	(0.004)	(0.012)	(0.042)	(0.302)
TR SHOCKS	0.014	0.069	-0.005	-0.020*	0.027	-0.148
	(0.012)	(1.980)	(0.004)	(0.011)	(0.039)	(0.279)
CITIFX	-0.000	0.002**	0.000	-0.000	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
VIX	0.000***	-0.069***	-0.000	0.000**	-0.000	-0.005***
	(0.000)	(0.007)	(0.000)	(0.000)	(0.000)	(0.001)
OIS	-0.004*	-0.066	0.001	-0.006***	-0.006	0.040
	(0.003)	(0.416)	(0.001)	(0.002)	(0.008)	(0.059)
MON	0.000	0.107	-0.000	-0.001	-0.001	-0.034*
	(0.001)	(0.139)	(0.000)	(0.001)	(0.003)	(0.020)
TUE	0.001	-0.395***	-0.000*	0.000	0.002	-0.080***
	(0.001)	(0.141)	(0.000)	(0.001)	(0.003)	(0.020)
WED	0.000	-0.156	-0.001*	0.000	0.005*	-0.037*
	(0.001)	(0.145)	(0.000)	(0.001)	(0.003)	(0.020)
THU	0.001	-0.300**	-0.000	0.001	0.005	-0.033
	(0.001)	(0.146)	(0.000)	(0.001)	(0.003)	(0.021)
SVB	-0.008*	1.595**	0.001	0.014***	-0.045***	0.539***
	(0.005)	(0.761)	(0.001)	(0.004)	(0.017)	(0.107)
COVID	-0.023***	5.421***	0.000	0.002	-0.102***	1.454***
	(0.005)	(0.851)	(0.002)	(0.005)	(0.017)	(0.120)
CEIL	0.001	-0.144	0.001	-0.004	0.000	-0.042
	(0.003)	(0.506)	(0.001)	(0.003)	(0.011)	(0.071)
Constant	-0.001	1.332***	0.001*	-0.001	0.001	0.117***
	(0.001)	(0.156)	(0.000)	(0.001)	(0.003)	(0.022)
N	2845	2887	2787	3039	2914	2895
adj. R^2	0.011	0.062	0.004	0.011	0.015	0.066

Table 11. Stocks & commodities: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A1.2 30-Minutes Window Changes

	3M	5Y	10Y	30Y	SP500	DXY
22/05/2013	0.002	0.009	0.007	0.005	-0.604	0.116
19/06/2013	0.004	0.159***	0.119***	0.059***	-0.607	1.035***
18/12/2013	-0.005	-0.010	0.014	0.016	1.638**	0.336
21/05/2014	0.007	0.006	0.008	0.004	0.097	-0.026
09/07/2014	-0.000	-0.002	-0.008	-0.012	0.140	-0.018
20/08/2014	0.001	0.040	0.020	0.011	-0.156	0.199
17/09/2014	0.002	0.050	0.047	0.038*	0.294	0.556**
29/10/2014	-0.002	0.050	0.021	-0.003	-0.120	0.679***
05/04/2017	0.011	0.012	0.015	0.016	-0.138	0.002
24/05/2017	0.005	-0.007	-0.008	-0.007	0.102	-0.023
14/06/2017	-0.003	0.028	0.021	0.008	0.231	0.415
20/09/2017	0.006	0.031	0.022	0.004	0.319	0.691**
19/12/2018	-0.009	-0.047	-0.058*	-0.050**	-2.109***	0.263
23/03/2020	0.012	-0.055	-0.090***	-0.104***	-0.152	-0.916***
10/06/2020	0.000	-0.037	-0.035	-0.001	0.132	-0.285
22/09/2021	0.006	0.034	0.012	-0.008	0.342	0.159
03/11/2021	0.005	-0.000	0.028	0.057***	0.533	-0.107
26/01/2022	-0.004	0.012	0.016	0.026	-1.044	-0.144
16/02/2022	0.001	0.003	-0.004	0.003	0.036	0.077
16/03/2022	0.006	-0.013	-0.026	-0.035	0.819	-0.509*
06/04/2022	-0.002	-0.003	0.008	0.014	-0.118	-0.123
04/05/2022	0.005	0.036	0.032	0.020	0.870	0.382
25/05/2022	0.005	0.008	0.001	-0.004	0.140	-0.002
10/04/2024	-0.004	0.000	-0.001	-0.003	0.452	-0.071
01/05/2024	0.008	-0.018	-0.004	0.011	0.591	0.012
22/05/2024	0.007	0.012	0.011	0.006	-0.174	0.070
FF1	0.025	1.142***	0.995***	0.281	30.478***	-1.437
FF2	0.338***	-0.736*	-0.607*	-0.192	-18.237***	2.241
FF3	0.706***	-0.417	-0.160	0.308	-10.870	-3.627
FF4	-0.548***	0.320	0.091	-0.480	29.218**	0.382
FF5	0.417**	-0.567	-0.336	0.021	-18.731	0.157
FF6	-0.041	1.567***	0.964***	0.408*	-8.349	8.667***
_cons	-0.003***	-0.007**	-0.005*	-0.003	-0.010	-0.020
N	200	200	200	200	200	198
adj. R^2	0.709	0.445	0.333	0.245	0.275	0.498

Table 12. Impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors not displayed. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A1.3 Newey-West Standard Errors

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Pandemic QE	-0.061***	-0.007	-0.021	-0.051**	-0.078	-0.116**
	(0.023)	(0.034)	(0.020)	(0.022)	(0.053)	(0.049)
QT I	0.006*	0.005	0.022*	0.019	0.002	-0.017
	(0.004)	(0.004)	(0.013)	(0.014)	(0.010)	(0.011)
QT II	-0.021	-0.001	0.015	0.025	0.055	0.043
	(0.016)	(0.024)	(0.031)	(0.028)	(0.036)	(0.035)
Tapering of QE III	0.000	0.001	0.004	0.016	0.010	0.019
	(0.004)	(0.004)	(0.019)	(0.018)	(0.018)	(0.017)
Tapering of Pandemic QE	0.004	0.010**	0.000	0.014	0.025	0.042***
	(0.003)	(0.004)	(0.033)	(0.038)	(0.025)	(0.012)
End of QT I	-0.010***	0.021***	0.106***	0.106***	0.097***	0.070***
	(0.002)	(0.003)	(0.005)	(0.005)	(0.005)	(0.004)
Tapering of QT II	0.024***	0.060*	0.080	0.083	0.066	0.056
	(0.006)	(0.035)	(0.053)	(0.051)	(0.043)	(0.035)
FF SHOCKS	0.060*	-0.000	0.010	-0.002	0.018	0.036
	(0.036)	(0.026)	(0.033)	(0.047)	(0.075)	(0.095)
TR SHOCKS	-0.015	0.064	0.118*	0.104	0.094	0.087
	(0.025)	(0.047)	(0.072)	(0.073)	(0.069)	(0.068)
L2.CITIFX	-0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
VIX	0.000	0.000	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	0.094***	0.080***	0.050**	0.036	0.019	0.013
	(0.017)	(0.022)	(0.025)	(0.025)	(0.023)	(0.020)
MON	-0.003	0.007**	-0.001	0.001	0.005	0.009*
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)
TUE	-0.026***	-0.001	-0.008	-0.008	-0.005	-0.001
	(0.003)	(0.005)	(0.006)	(0.007)	(0.007)	(0.006)
WED	-0.027***	-0.014***	-0.014**	-0.013**	-0.010	-0.004
	(0.003)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
THU	-0.023***	-0.005	-0.005	-0.004	-0.005	-0.004
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)
SVB	-0.050	-0.220***	-0.203***	-0.174***	-0.119***	-0.051***
	(0.045)	(0.075)	(0.052)	(0.043)	(0.029)	(0.017)
COVID	-0.280***	-0.218***	-0.160***	-0.151***	-0.175***	-0.177***
	(0.032)	(0.040)	(0.031)	(0.027)	(0.018)	(0.049)
CEIL	0.022*	0.057***	0.056**	0.045***	0.040***	0.032***
	(0.011)	(0.017)	(0.022)	(0.016)	(0.012)	(0.010)
Constant	0.009*	-0.004	0.002	0.001	-0.003	-0.009
	(0.005)	(0.006)	(0.007)	(0.007)	(0.008)	(0.009)
N	2002	2002	2002	2002	2002	2002
adj. R^2						

Table 13. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. Newey-West standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Pandemic QE	-16.640***	-0.578***	-0.357*	0.064	-0.479***	0.415
	(5.943)	(0.203)	(0.185)	(0.055)	(0.154)	(1.851)
QT I	0.146	0.026	-0.060	-0.011	0.010	-0.447
	(0.858)	(0.040)	(0.044)	(0.009)	(0.008)	(0.584)
QT II	2.422	0.058	0.019	-0.033	0.041	-1.386
	(3.491)	(0.063)	(0.022)	(0.036)	(0.033)	(1.313)
Tapering of QE III	0.276	0.018	0.013	0.011	0.009	-0.934***
	(0.557)	(0.031)	(0.052)	(0.009)	(0.009)	(0.257)
Tapering of Pandemic QE	-4.821**	-0.117***	-0.035	0.012	0.025	-0.473
	(1.981)	(0.041)	(0.039)	(0.018)	(0.025)	(0.579)
End of QT I	-1.755***	0.295***	-0.062***	-0.049***	0.047***	-0.888***
	(0.359)	(0.008)	(0.007)	(0.003)	(0.005)	(0.133)
Tapering of QT II	2.004	-0.048***	-0.009	-0.012	0.069	-1.336
	(2.837)	(0.017)	(0.040)	(0.014)	(0.050)	(1.504)
FF SHOCKS	7.229**	-0.097	0.035	0.018	0.035	-1.816
	(3.575)	(0.115)	(0.050)	(0.015)	(0.065)	(2.583)
TR SHOCKS	-13.125***	-0.324**	-0.004	-0.083*	0.085	0.521
	(4.498)	(0.158)	(0.097)	(0.046)	(0.068)	(2.291)
L2.CITIFX	0.000	-0.000	-0.000	-0.000	0.000	-0.001
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
VIX	-0.070**	0.001**	-0.001	0.001	0.000	-0.022
	(0.033)	(0.001)	(0.001)	(0.001)	(0.001)	(0.025)
OIS	0.066	-0.003	0.036	0.006	0.019	-1.101
	(1.852)	(0.029)	(0.030)	(0.015)	(0.028)	(0.800)
MON	-0.019	-0.006	-0.018**	-0.001	0.005	-0.091
	(0.358)	(0.011)	(0.008)	(0.002)	(0.006)	(0.135)
TUE	-2.954***	0.006	-0.006	-0.001	-0.007	0.032
	(0.502)	(0.014)	(0.011)	(0.003)	(0.008)	(0.185)
WED	-3.190***	-0.003	-0.025*	0.000	-0.010	0.316*
	(0.504)	(0.013)	(0.013)	(0.003)	(0.008)	(0.181)
THU	-2.347***	-0.000	-0.006	-0.002	-0.004	0.058
	(0.416)	(0.012)	(0.007)	(0.002)	(0.006)	(0.142)
SVB	15.799***	-0.001	0.097***	0.110***	-0.110***	2.634***
	(3.543)	(0.084)	(0.025)	(0.020)	(0.025)	(0.990)
COVID	14.495**	-0.153***	0.216***	0.166***	-0.125***	4.720***
	(5.672)	(0.056)	(0.070)	(0.043)	(0.039)	(0.624)
CEIL	-2.021	-0.037*	-0.016	-0.002	0.040***	-1.256***
	(1.437)	(0.022)	(0.012)	(0.011)	(0.012)	(0.448)
Constant	2.788***	-0.024	0.024	-0.012	-0.000	0.427
	(0.728)	(0.016)	(0.017)	(0.014)	(0.015)	(0.453)
N	2002	2002	2002	2002	2002	2002
adj. R^2						

Table 14. Bond market: impact of QE, Tapering I & II, QT I & II announcements. Newey-West standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Pandemic QE	-0.031	11.320***	0.009***	0.026	-0.064**	0.773
	(0.030)	(4.344)	(0.002)	(0.017)	(0.031)	(0.649)
QT I	-0.002	0.083	0.000	-0.007**	-0.012	-0.016
	(0.004)	(0.446)	(0.001)	(0.003)	(0.007)	(0.068)
QT II	-0.001	0.844	0.001	0.000	0.002	0.017
	(0.008)	(0.907)	(0.002)	(0.006)	(0.023)	(0.191)
Tapering of QE III	0.004	-0.561	0.001**	0.001	-0.008	-0.003
	(0.003)	(0.351)	(0.000)	(0.003)	(0.005)	(0.090)
Tapering of Pandemic QE	0.013***	-2.263**	-0.002**	-0.002	0.002	-0.305***
	(0.003)	(1.139)	(0.001)	(0.008)	(0.018)	(0.066)
End of QT I	0.008***	-3.091***	-0.004***	-0.001**	-0.008***	-0.357***
	(0.001)	(0.166)	(0.000)	(0.001)	(0.003)	(0.027)
Tapering of QT II	0.008	-2.088	0.000	0.005	-0.009	-0.096
	(0.010)	(1.723)	(0.003)	(0.014)	(0.008)	(0.123)
FF SHOCKS	-0.023*	2.122	0.003	-0.022***	-0.003	0.468**
	(0.014)	(1.623)	(0.003)	(0.006)	(0.029)	(0.211)
TR SHOCKS	0.025*	-1.421	-0.009**	-0.009	0.071**	-0.395
	(0.013)	(2.073)	(0.005)	(0.011)	(0.033)	(0.244)
VIX	0.000	-0.066***	0.000	0.000	-0.000	-0.004
	(0.000)	(0.018)	(0.000)	(0.000)	(0.001)	(0.004)
L2.CITIFX	-0.000	0.003**	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	-0.004	-0.134	0.002	-0.007**	-0.009	0.050
	(0.005)	(0.636)	(0.001)	(0.003)	(0.015)	(0.114)
MON	-0.000	0.197	-0.000	-0.000	-0.002	-0.033
	(0.001)	(0.150)	(0.000)	(0.001)	(0.004)	(0.023)
TUE	0.001	-0.365	-0.000	0.001	0.003	-0.097***
	(0.001)	(0.227)	(0.000)	(0.001)	(0.003)	(0.032)
WED	0.000	-0.200	-0.001**	0.001	0.007**	-0.042
	(0.001)	(0.200)	(0.000)	(0.001)	(0.004)	(0.028)
THU	-0.000	-0.235	-0.000	0.001	0.007**	-0.038*
	(0.001)	(0.170)	(0.000)	(0.001)	(0.003)	(0.022)
SVB	-0.008	1.788***	0.002*	0.014***	-0.045***	0.625***
	(0.005)	(0.603)	(0.001)	(0.004)	(0.012)	(0.114)
COVID	-0.023*	5.332***	0.000	0.002	-0.101**	1.435***
	(0.012)	(1.854)	(0.002)	(0.007)	(0.048)	(0.468)
CEIL	0.000	-0.141	0.000	-0.005**	0.002	-0.067
	(0.002)	(0.337)	(0.001)	(0.002)	(0.004)	(0.050)
Constant	-0.001	1.267***	0.000	-0.001	0.003	0.113*
	(0.002)	(0.336)	(0.001)	(0.002)	(0.009)	(0.065)
N	2002	2002	2002	2002	2002	2002
adj. R^2						

Table 15. Stocks & commodities: Treasury market: impact of QE, Tapering I & II, QT I & II announcements. Newey-West standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A1.4 Control: Government Debt

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Pandemic QE	-0.053***	-0.001	-0.014	-0.044	-0.073*	-0.113***
	(0.020)	(0.030)	(0.042)	(0.044)	(0.043)	(0.041)
QT I	0.008	0.005	0.021	0.016	-0.001	-0.020
	(0.011)	(0.017)	(0.024)	(0.025)	(0.024)	(0.023)
QT II	-0.027**	-0.005	0.012	0.021	0.050*	0.037
	(0.013)	(0.020)	(0.027)	(0.029)	(0.028)	(0.026)
Tapering of QE III	0.007	0.006	0.042	0.079***	0.069**	0.049*
	(0.014)	(0.021)	(0.029)	(0.031)	(0.030)	(0.028)
Tapering of Pandemic QE	0.001	0.007	-0.002	0.010	0.021	0.038
	(0.020)	(0.030)	(0.041)	(0.043)	(0.042)	(0.040)
End of QT I	-0.007	0.022	0.106	0.106	0.097	0.070
	(0.034)	(0.051)	(0.071)	(0.075)	(0.072)	(0.069)
Tapering of QT II	0.010	0.034*	0.043	0.047	0.043	0.044*
	(0.013)	(0.020)	(0.027)	(0.029)	(0.028)	(0.026)
FF SHOCKS	0.050	0.002	0.024	0.010	0.043	0.078
	(0.032)	(0.048)	(0.067)	(0.071)	(0.068)	(0.065)
TR SHOCKS	-0.008	0.068	0.129**	0.114*	0.103*	0.106*
	(0.029)	(0.043)	(0.060)	(0.063)	(0.061)	(0.058)
L2.CITIFX	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
VIX	0.000*	0.000	0.000	0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	0.097***	0.075***	0.047***	0.039***	0.029**	0.024*
	(0.007)	(0.010)	(0.014)	(0.014)	(0.014)	(0.013)
MON	-0.004*	0.005*	-0.001	-0.000	0.003	0.006
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
TUE	-0.023***	-0.002	-0.009**	-0.008*	-0.004	-0.000
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
WED	-0.025***	-0.013***	-0.013***	-0.012**	-0.008*	-0.002
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
THU	-0.021***	-0.004	-0.004	-0.005	-0.005	-0.004
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
SVB	-0.039***	-0.194***	-0.196***	-0.172***	-0.118***	-0.052**
	(0.011)	(0.016)	(0.023)	(0.024)	(0.023)	(0.022)
COVID	-0.276***	-0.215***	-0.157***	-0.149***	-0.173***	-0.176***
	(0.012)	(0.018)	(0.025)	(0.027)	(0.026)	(0.025)
CEIL	0.026***	0.067***	0.068***	0.057***	0.044***	0.029*
	(0.008)	(0.012)	(0.016)	(0.017)	(0.017)	(0.016)
DEBT	0.000***	0.000**	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.004	-0.011**	0.000	-0.000	-0.004	-0.011*
	(0.003)	(0.005)	(0.006)	(0.007)	(0.006)	(0.006)
N	2699	2699	2699	2699	2699	2699
adj. R^2	0.274	0.121	0.048	0.035	0.031	0.028

Table 16. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Pandemic QE	-16.387***	-0.580***	-0.354***	0.060**	-0.475***	0.203
	(3.367)	(0.096)	(0.069)	(0.025)	(0.047)	(1.351)
QT I	0.111	0.020	-0.055	-0.011	0.008	-0.292
	(1.915)	(0.055)	(0.039)	(0.014)	(0.027)	(0.769)
QT II	2.536	0.060	0.018	-0.030*	0.037	-1.279
	(2.177)	(0.062)	(0.045)	(0.016)	(0.031)	(0.874)
Tapering of QE III	4.599**	-0.005	0.045	-0.014	0.075**	-2.392**
	(2.338)	(0.067)	(0.048)	(0.017)	(0.033)	(0.939)
Tapering of Pandemic QE	-4.933	-0.114	-0.037	0.015	0.022	-0.357
	(3.301)	(0.094)	(0.068)	(0.025)	(0.047)	(1.326)
End of QT I	-1.294	0.285*	-0.065	-0.050	0.046	-0.827
	(5.700)	(0.163)	(0.118)	(0.043)	(0.080)	(2.290)
Tapering of QT II	-0.030	-0.057	0.012	-0.002	0.039	-0.864
	(2.173)	(0.062)	(0.045)	(0.016)	(0.031)	(0.873)
FF SHOCKS	0.849	-0.119	0.015	0.027	0.052	-1.878
	(5.386)	(0.172)	(0.111)	(0.040)	(0.072)	(2.053)
TR SHOCKS	-10.802**	-0.226	-0.029	-0.045	0.080	-0.458
	(4.815)	(0.145)	(0.099)	(0.036)	(0.067)	(1.878)
L2.CITIFX	-0.001	0.000	-0.000	-0.000	0.000	-0.001
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
VIX	-0.075***	0.001***	-0.001**	0.001***	0.000	-0.017**
	(0.017)	(0.001)	(0.000)	(0.000)	(0.000)	(0.007)
OIS	-1.004	-0.013	0.028	-0.003	0.021	-1.104***
	(1.100)	(0.033)	(0.023)	(0.008)	(0.015)	(0.421)
MON	0.136	-0.017	-0.020***	-0.000	0.004	0.041
	(0.355)	(0.011)	(0.007)	(0.003)	(0.005)	(0.134)
TUE	-2.244***	-0.003	-0.005	0.001	-0.007	0.109
	(0.354)	(0.011)	(0.007)	(0.003)	(0.005)	(0.131)
WED	-2.552***	-0.006	-0.029***	0.002	-0.010*	0.223
	(0.359)	(0.011)	(0.007)	(0.003)	(0.005)	(0.136)
THU	-1.922***	0.003	-0.016**	-0.000	-0.005	0.137
	(0.364)	(0.011)	(0.007)	(0.003)	(0.005)	(0.138)
SVB	13.745***	0.031	0.091**	0.104***	-0.114***	2.588***
	(1.826)	(0.052)	(0.038)	(0.014)	(0.026)	(0.733)
COVID	14.758***	-0.160***	0.218***	0.163***	-0.123***	4.636***
	(2.041)	(0.058)	(0.042)	(0.015)	(0.029)	(0.820)
CEIL	-0.399	-0.008	-0.030	-0.007	0.043**	-1.221**
	(1.304)	(0.039)	(0.027)	(0.010)	(0.018)	(0.499)
DEBT	0.000	-0.000	0.000	-0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.104***	-0.003	0.017*	-0.008**	-0.001	0.247
	(0.511)	(0.015)	(0.010)	(0.004)	(0.007)	(0.193)
N	2635	2382	2747	2691	2729	2937
adj. R^2	0.085	0.017	0.028	0.077	0.051	0.018

Table 17. Bond market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Pandemic QE	-0.032***	11.873***	0.009***	0.026***	-0.066**	0.831***
	(0.009)	(1.416)	(0.003)	(0.008)	(0.028)	(0.200)
QT I	-0.002	0.050	-0.000	-0.006	-0.009	-0.013
	(0.005)	(0.806)	(0.002)	(0.004)	(0.016)	(0.114)
QT II	-0.000	0.804	0.001	-0.000	0.001	0.027
	(0.006)	(0.916)	(0.002)	(0.005)	(0.018)	(0.130)
Tapering of QE III	-0.004	0.190	0.004**	-0.013**	-0.009	0.185
	(0.006)	(0.984)	(0.002)	(0.005)	(0.019)	(0.139)
Tapering of Pandemic QE	0.013	-2.338*	-0.002	-0.001	0.002	-0.298
	(0.008)	(1.389)	(0.003)	(0.008)	(0.028)	(0.197)
End of QT I	0.008	-2.989	-0.004	-0.001	-0.007	-0.340
	(0.015)	(2.398)	(0.004)	(0.013)	(0.048)	(0.340)
Tapering of QT II	0.010*	-2.213**	-0.000	0.003	-0.011	-0.116
	(0.006)	(0.914)	(0.002)	(0.005)	(0.018)	(0.129)
FF SHOCKS	-0.017	1.373	0.002	0.003	0.021	0.302
	(0.013)	(2.150)	(0.004)	(0.012)	(0.043)	(0.304)
TR SHOCKS	0.015	-0.116	-0.005	-0.019*	0.031	-0.158
	(0.012)	(2.000)	(0.004)	(0.011)	(0.039)	(0.282)
VIX	0.000***	-0.076***	-0.000	0.000	-0.000	-0.006***
	(0.000)	(0.007)	(0.000)	(0.000)	(0.000)	(0.001)
L2.CITIFX	-0.000	0.002**	-0.000	-0.000	-0.000	0.000*
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	-0.006**	0.312	0.001	-0.004*	-0.004	0.067
	(0.003)	(0.447)	(0.001)	(0.002)	(0.009)	(0.063)
MON	0.001	0.053	-0.000	-0.001	-0.000	-0.038*
	(0.001)	(0.145)	(0.000)	(0.001)	(0.003)	(0.021)
TUE	0.001	-0.389***	-0.000	0.000	0.002	-0.081***
	(0.001)	(0.143)	(0.000)	(0.001)	(0.003)	(0.020)
WED	0.000	-0.162	-0.001*	0.000	0.005*	-0.036*
	(0.001)	(0.146)	(0.000)	(0.001)	(0.003)	(0.021)
THU	0.001	-0.312**	-0.000	0.001	0.005*	-0.034
	(0.001)	(0.149)	(0.000)	(0.001)	(0.003)	(0.021)
SVB	-0.008*	1.479*	0.001	0.014***	-0.046***	0.531***
	(0.005)	(0.767)	(0.001)	(0.004)	(0.017)	(0.109)
COVID	-0.024***	5.636***	0.000	0.002	-0.102***	1.467***
	(0.005)	(0.859)	(0.002)	(0.005)	(0.017)	(0.122)
CEIL	0.001	-0.214	0.001	-0.005	0.001	-0.050
	(0.003)	(0.522)	(0.001)	(0.003)	(0.011)	(0.074)
DEBT	-0.000	0.000***	-0.000	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.000	0.929***	0.001*	-0.002**	-0.003	0.086***
	(0.001)	(0.209)	(0.000)	(0.001)	(0.004)	(0.030)
N	2739	2779	2683	2931	2812	2789
adj. R^2	0.012	0.065	0.004	0.012	0.015	0.067

Table 18. Stocks & commodities: Treasury market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A1.5 No Macroeconomic Controls

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Pandemic QE	-0.052**	0.004	-0.015	-0.042	-0.061	-0.091**
	(0.023)	(0.031)	(0.041)	(0.044)	(0.042)	(0.040)
QT I	0.001	-0.001	0.017	0.013	-0.005	-0.022
	(0.013)	(0.018)	(0.024)	(0.025)	(0.024)	(0.023)
QT II	-0.017	0.002	0.014	0.023	0.053*	0.045*
	(0.015)	(0.020)	(0.027)	(0.029)	(0.028)	(0.026)
Tapering of QE III	-0.006	-0.004	0.035	0.073**	0.064**	0.045
	(0.016)	(0.022)	(0.029)	(0.031)	(0.030)	(0.028)
Tapering of Pandemic QE	-0.006	-0.002	-0.012	0.002	0.015	0.035
	(0.023)	(0.031)	(0.041)	(0.044)	(0.042)	(0.040)
End of QT I	-0.002	0.018	0.108	0.108	0.099	0.069
	(0.040)	(0.053)	(0.072)	(0.075)	(0.073)	(0.069)
Tapering of QT II	0.003	0.025	0.037	0.041	0.040	0.043
	(0.015)	(0.020)	(0.027)	(0.029)	(0.028)	(0.026)
Constant	0.002***	0.002**	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	2989	2989	2989	2989	2989	2989
adj. R^2	-0.000	-0.002	-0.000	0.002	0.002	0.003

Table 19. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Pandemic QE	-19.044***	-0.530***	-0.399***	0.087***	-0.468***	-0.366
	(3.407)	(0.093)	(0.066)	(0.025)	(0.046)	(1.324)
QT I	-1.124	0.015	-0.067*	-0.013	0.004	-0.200
	(1.969)	(0.054)	(0.038)	(0.014)	(0.027)	(0.765)
QT II	0.541	0.070	0.006	-0.025	0.037	-1.499*
	(2.232)	(0.061)	(0.044)	(0.016)	(0.030)	(0.868)
Tapering of QE III	3.377	-0.009	0.033	-0.015	0.068**	-2.255**
	(2.410)	(0.066)	(0.047)	(0.018)	(0.033)	(0.937)
Tapering of Pandemic QE	-6.184*	-0.108	-0.051	0.017	0.015	-0.265
	(3.407)	(0.093)	(0.066)	(0.025)	(0.046)	(1.324)
End of QT I	-0.222	0.293*	-0.056	-0.050	0.048	-0.855
	(5.899)	(0.161)	(0.115)	(0.043)	(0.080)	(2.293)
Tapering of QT II	-0.953	-0.057	0.003	-0.003	0.035	-0.723
	(2.232)	(0.061)	(0.044)	(0.016)	(0.030)	(0.868)
Constant	-0.056	0.004	0.002	-0.000	0.002	0.031
	(0.110)	(0.003)	(0.002)	(0.001)	(0.001)	(0.041)
N	2915	2640	3034	2981	3021	3233
adj. R^2	0.010	0.012	0.011	0.004	0.033	0.001

Table 20. Bond market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Pandemic QE	-0.026***	8.981***	0.009***	0.028***	-0.072***	0.596***
	(0.008)	(1.391)	(0.003)	(0.008)	(0.027)	(0.198)
QT I	-0.003	0.181	-0.000	-0.007	-0.006	-0.004
	(0.005)	(0.804)	(0.001)	(0.004)	(0.016)	(0.114)
QT II	-0.001	0.237	0.001	0.000	0.003	-0.015
	(0.005)	(0.911)	(0.002)	(0.005)	(0.018)	(0.130)
Tapering of QE III	-0.004	0.234	0.004**	-0.014***	-0.007	0.178
	(0.006)	(0.984)	(0.002)	(0.005)	(0.019)	(0.140)
Tapering of Pandemic QE	0.012	-2.543*	-0.002	-0.000	0.005	-0.315
	(0.008)	(1.391)	(0.003)	(0.008)	(0.027)	(0.198)
End of QT I	0.009	-2.996	-0.004	-0.001	-0.009	-0.325
	(0.014)	(2.409)	(0.004)	(0.013)	(0.047)	(0.343)
Tapering of QT II	0.010*	-2.232**	-0.001	0.004	-0.006	-0.122
	(0.005)	(0.911)	(0.002)	(0.005)	(0.018)	(0.130)
Constant	0.001***	-0.004	0.000	0.000*	-0.000	0.000
	(0.000)	(0.044)	(0.000)	(0.000)	(0.001)	(0.006)
N	3023	3071	2965	3227	3068	3078
adj. R^2	0.003	0.015	0.004	0.005	0.000	0.003

Table 21. Stocks & commodities: Treasury market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A1.6 LMS - Weekly Economic Index

	3M Tr.	1Y Tr.	3Y Tr.	5Y Tr.	10Y Tr.	30Y Tr.
Pandemic QE	-0.064***	-0.007	-0.018	-0.048	-0.076*	-0.115***
	(0.020)	(0.030)	(0.041)	(0.044)	(0.042)	(0.040)
QT I	0.006	0.004	0.020	0.016	-0.002	-0.021
	(0.011)	(0.017)	(0.024)	(0.025)	(0.024)	(0.023)
QT II	-0.025*	-0.005	0.011	0.021	0.051*	0.039
	(0.013)	(0.019)	(0.027)	(0.028)	(0.028)	(0.026)
Tapering of QE III	0.004	0.004	0.040	0.078**	0.067**	0.048*
	(0.014)	(0.021)	(0.029)	(0.030)	(0.030)	(0.028)
Tapering of Pandemic QE	0.002	0.005	-0.006	0.008	0.021	0.039
	(0.020)	(0.029)	(0.041)	(0.043)	(0.042)	(0.040)
End of QT I	-0.009	0.020	0.104	0.105	0.096	0.069
	(0.034)	(0.051)	(0.070)	(0.074)	(0.072)	(0.069)
Tapering of QT II	0.016	0.037*	0.045*	0.048*	0.045	0.045*
	(0.013)	(0.019)	(0.027)	(0.028)	(0.027)	(0.026)
FF SHOCKS	0.047	0.004	0.028	0.014	0.046	0.080
	(0.032)	(0.048)	(0.066)	(0.070)	(0.068)	(0.065)
TR SHOCKS	-0.007	0.066	0.124**	0.109*	0.100*	0.105*
	(0.029)	(0.042)	(0.059)	(0.062)	(0.060)	(0.057)
Weekly Economic Index	0.000	0.001*	0.001	0.001	0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
VIX	0.000***	0.000***	0.000	0.000	0.000*	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OIS	0.089***	0.063***	0.035***	0.030**	0.023*	0.022*
	(0.006)	(0.009)	(0.013)	(0.013)	(0.013)	(0.012)
MON	-0.002	0.005*	-0.002	-0.001	0.002	0.005
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
TUE	-0.023***	-0.002	-0.009**	-0.008*	-0.004	-0.000
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
WED	-0.025***	-0.013***	-0.013***	-0.011**	-0.008*	-0.002
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
THU	-0.021***	-0.005	-0.005	-0.005	-0.005	-0.004
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
SVB	-0.037***	-0.190***	-0.192***	-0.168***	-0.114***	-0.049**
	(0.011)	(0.016)	(0.022)	(0.024)	(0.023)	(0.022)
COVID	-0.282***	-0.219***	-0.160***	-0.151***	-0.174***	-0.177***
	(0.012)	(0.018)	(0.025)	(0.027)	(0.026)	(0.025)
CEIL	0.038***	0.064***	0.059***	0.050***	0.037**	0.025*
	(0.008)	(0.011)	(0.016)	(0.017)	(0.016)	(0.015)
Constant	0.006**	-0.007*	0.002	0.002	-0.001	-0.008
	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)
N	2821	2821	2821	2821	2821	2821
adj. R^2	0.272	0.119	0.046	0.033	0.029	0.027

Table 22. Yield curve: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	MOVE	10Y Bid-Ask	Tr. Liquidity	BAA-10Y	MBS	Global Bond
Pandemic QE	-16.856***	-0.573***	-0.362***	0.064***	-0.478***	0.254
	(3.329)	(0.095)	(0.068)	(0.025)	(0.047)	(1.337)
QT I	0.061	0.021	-0.056	-0.010	0.008	-0.305
	(1.898)	(0.054)	(0.039)	(0.014)	(0.027)	(0.763)
QT II	2.524	0.051	0.020	-0.039**	0.037	-1.038
	(2.162)	(0.062)	(0.044)	(0.016)	(0.030)	(0.869)
Tapering of QE III	4.538*	-0.003	0.042	-0.012	0.073**	-2.403***
	(2.316)	(0.066)	(0.047)	(0.017)	(0.033)	(0.932)
Tapering of Pandemic QE	-4.841	-0.124	-0.036	0.005	0.020	-0.034
	(3.279)	(0.094)	(0.067)	(0.024)	(0.046)	(1.319)
End of QT I	-1.334	0.288*	-0.067	-0.048	0.045	-0.841
	(5.654)	(0.162)	(0.116)	(0.042)	(0.080)	(2.275)
Tapering of QT II	0.146	-0.065	0.017	-0.006	0.040	-0.796
	(2.148)	(0.061)	(0.044)	(0.016)	(0.030)	(0.864)
FF SHOCKS	0.787	-0.115	0.014	0.026	0.055	-1.955
	(5.341)	(0.170)	(0.109)	(0.040)	(0.071)	(2.039)
TR SHOCKS	-10.908**	-0.211	-0.026	-0.044	0.080	-0.374
	(4.761)	(0.143)	(0.097)	(0.035)	(0.066)	(1.859)
Weekly Economic Index	-0.006	0.002	0.001	0.002***	0.001	-0.073***
	(0.050)	(0.002)	(0.001)	(0.000)	(0.001)	(0.020)
VIX	-0.068***	0.001***	-0.001*	0.001***	0.000	-0.024***
	(0.017)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)
OIS	-0.704	-0.010	0.013	-0.006	0.015	-0.861**
	(1.023)	(0.030)	(0.021)	(0.008)	(0.014)	(0.392)
MON	0.338	-0.015	-0.020***	-0.000	0.003	0.006
	(0.339)	(0.010)	(0.007)	(0.002)	(0.005)	(0.128)
TUE	-2.262***	-0.003	-0.005	0.001	-0.007	0.104
	(0.349)	(0.011)	(0.007)	(0.003)	(0.005)	(0.129)
WED	-2.582***	-0.005	-0.029***	0.002	-0.010**	0.215
	(0.353)	(0.011)	(0.007)	(0.003)	(0.005)	(0.134)
THU	-1.953***	0.005	-0.015**	0.000	-0.005	0.143
	(0.356)	(0.011)	(0.007)	(0.003)	(0.005)	(0.135)
SVB	13.779***	0.029	0.093**	0.103***	-0.111***	2.502***
	(1.807)	(0.052)	(0.037)	(0.013)	(0.025)	(0.726)
COVID	14.538***	-0.158***	0.212***	0.163***	-0.125***	4.719***
	(2.020)	(0.058)	(0.041)	(0.015)	(0.028)	(0.812)
CEIL	-0.557	-0.014	-0.026	-0.005	0.034*	-1.027**
	(1.258)	(0.038)	(0.026)	(0.009)	(0.018)	(0.483)
Constant	2.304***	-0.020	0.024***	-0.021***	0.000	0.546***
	(0.425)	(0.013)	(0.009)	(0.003)	(0.006)	(0.162)
N	2754	2488	2867	2813	2851	3059
adj. R^2	0.088	0.017	0.027	0.085	0.049	0.022

Table 23. Bond market: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	S&P 500	VIX	Dollar	Gold	Brent	Global Stress
Pandemic QE	-0.031***	11.498***	0.009***	0.026***	-0.067**	0.806***
	(0.008)	(1.400)	(0.003)	(0.008)	(0.028)	(0.197)
QT I	-0.002	-0.030	-0.000	-0.006	-0.009	-0.016
	(0.005)	(0.799)	(0.001)	(0.004)	(0.016)	(0.113)
QT II	-0.000	0.977	0.001	0.000	0.006	0.010
	(0.006)	(0.909)	(0.002)	(0.005)	(0.018)	(0.128)
Tapering of QE III	-0.004	0.029	0.004**	-0.014***	-0.010	0.175
	(0.006)	(0.975)	(0.002)	(0.005)	(0.019)	(0.137)
Tapering of Pandemic QE	0.013	-2.275*	-0.003	-0.001	0.008	-0.335*
	(0.008)	(1.380)	(0.003)	(0.008)	(0.027)	(0.194)
End of QT I	0.008	-3.096	-0.004	-0.002	-0.008	-0.346
	(0.014)	(2.379)	(0.004)	(0.013)	(0.047)	(0.335)
Tapering of QT II	0.009*	-2.044**	-0.001	0.003	-0.008	-0.110
	(0.005)	(0.904)	(0.002)	(0.005)	(0.018)	(0.127)
FF SHOCKS	-0.017	1.367	0.002	0.003	0.020	0.306
	(0.013)	(2.133)	(0.004)	(0.012)	(0.042)	(0.301)
TR SHOCKS	0.015	0.050	-0.005	-0.019*	0.028	-0.160
	(0.012)	(1.978)	(0.004)	(0.011)	(0.039)	(0.278)
VIX	0.000**	-0.067***	-0.000	0.000*	-0.000*	-0.004***
	(0.000)	(0.007)	(0.000)	(0.000)	(0.000)	(0.001)
Weekly Economic Index	-0.000	-0.009	0.000**	0.000	-0.001***	0.010***
	(0.000)	(0.021)	(0.000)	(0.000)	(0.000)	(0.003)
OIS	-0.004	-0.198	0.001	-0.006**	-0.001	-0.008
	(0.003)	(0.415)	(0.001)	(0.002)	(0.008)	(0.058)
MON	0.000	0.104	0.000	-0.001	-0.001	-0.034*
	(0.001)	(0.139)	(0.000)	(0.001)	(0.003)	(0.020)
TUE	0.001	-0.400***	-0.000	0.000	0.002	-0.080***
	(0.001)	(0.141)	(0.000)	(0.001)	(0.003)	(0.020)
WED	0.000	-0.165	-0.001*	0.000	0.005*	-0.037*
	(0.001)	(0.144)	(0.000)	(0.001)	(0.003)	(0.020)
THU	0.001	-0.309**	-0.000	0.001	0.005	-0.034*
	(0.001)	(0.146)	(0.000)	(0.001)	(0.003)	(0.020)
SVB	-0.009*	1.643**	0.001	0.014***	-0.046***	0.550***
	(0.005)	(0.760)	(0.001)	(0.004)	(0.017)	(0.107)
COVID	-0.023***	5.488***	0.000	0.002	-0.101***	1.447***
	(0.005)	(0.850)	(0.002)	(0.005)	(0.017)	(0.120)
CEIL	0.001	-0.169	0.001	-0.004	0.000	-0.040
	(0.003)	(0.506)	(0.001)	(0.003)	(0.011)	(0.071)
Constant	-0.000	1.355***	0.000	-0.001	0.005	0.080***
	(0.001)	(0.175)	(0.000)	(0.001)	(0.003)	(0.025)
N	2858	2901	2800	3053	2922	2909
adj. R^2	0.012	0.061	0.006	0.011	0.017	0.068

Table 24. Stocks & commodities: impact of QE, Tapering I & II, QT I & II announcements. OLS standard errors in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A2 Appendix II - Robustness Checks: QT Operations

A2.1 Logarithms

Figure 9. Money market: impulse responses to a 1% decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

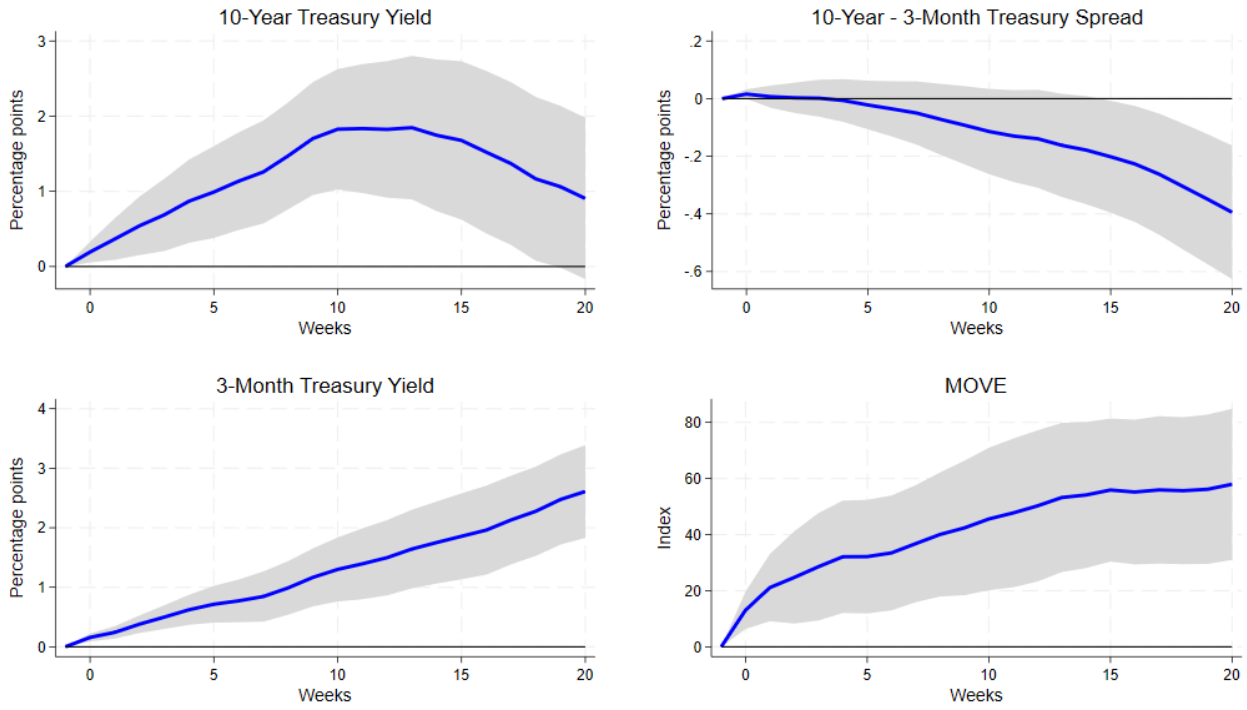

Figure 10. Treasury market: impulse responses to a 1% decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

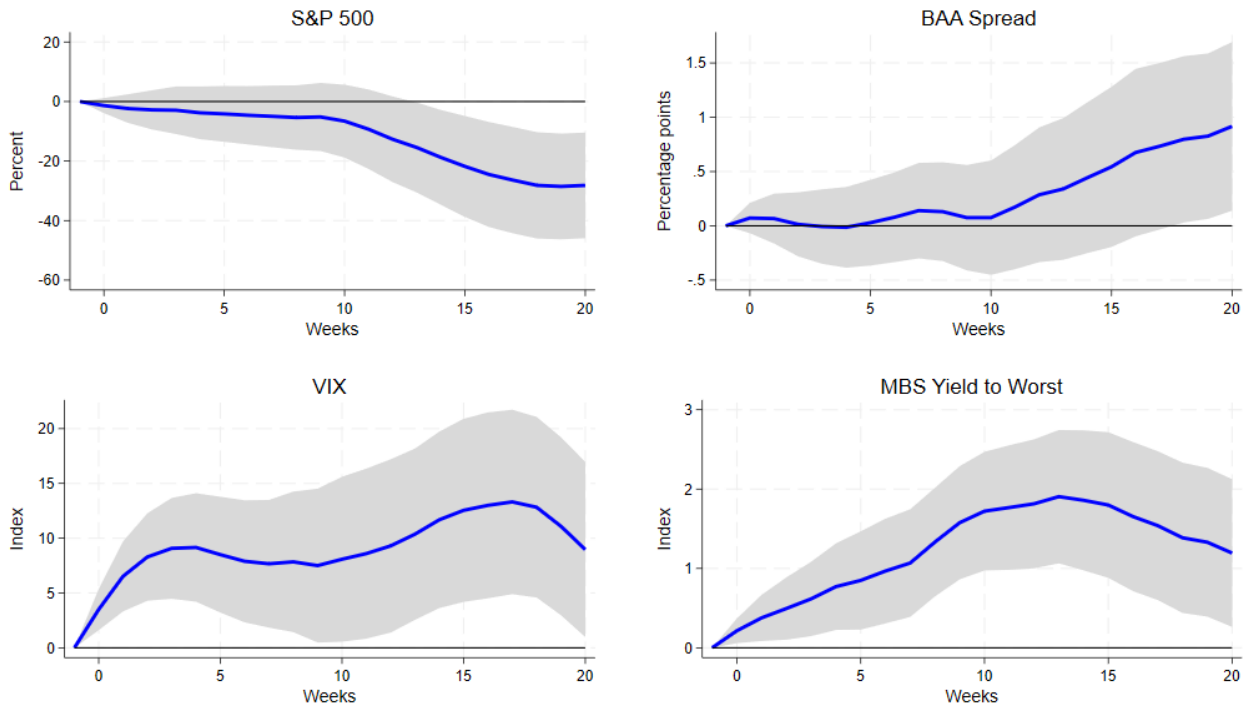

Figure 11. Other assets I: impulse responses to a 1% decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

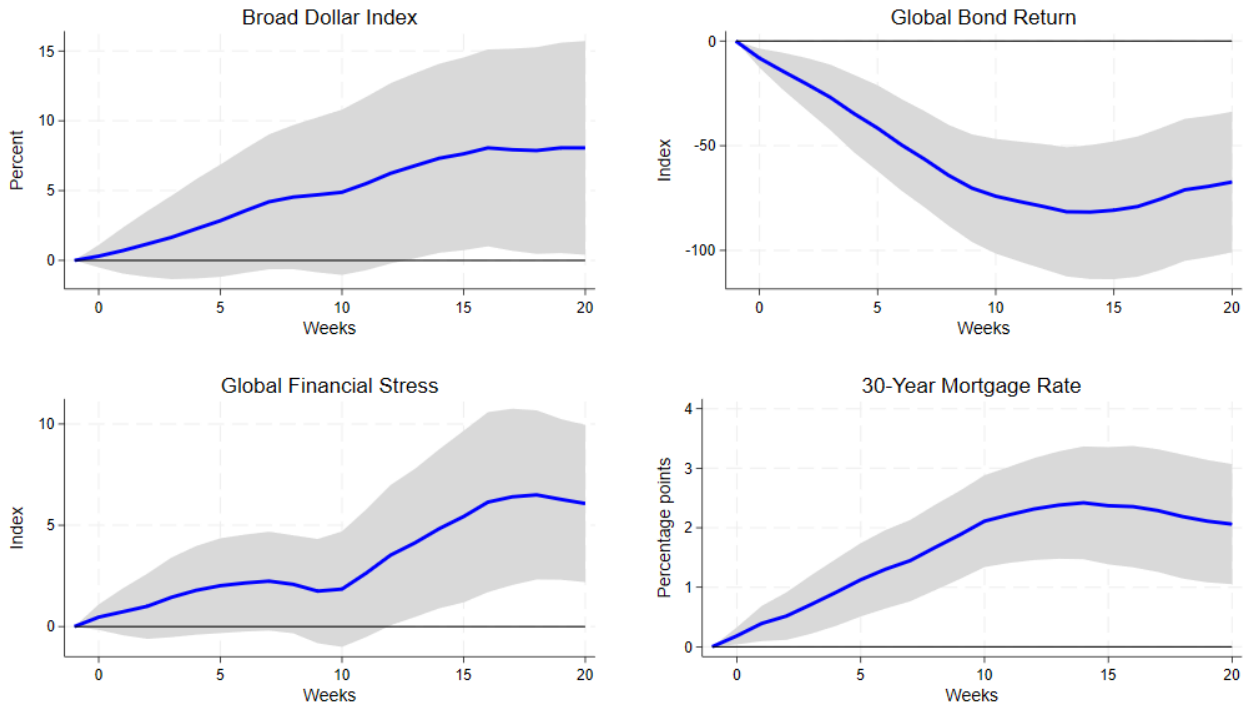

Figure 12. Other assets II: impulse responses to a 1% decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

A2.2 QT Operations: Alternative Definition

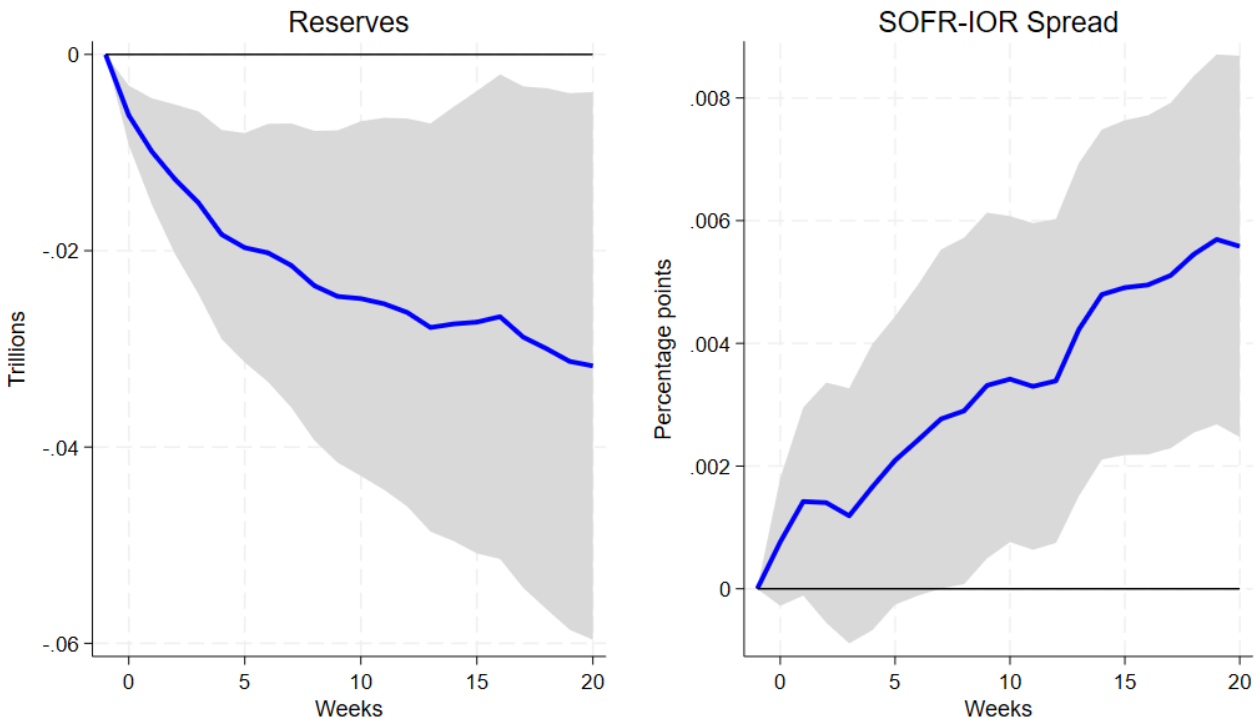

Figure 13. Money market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

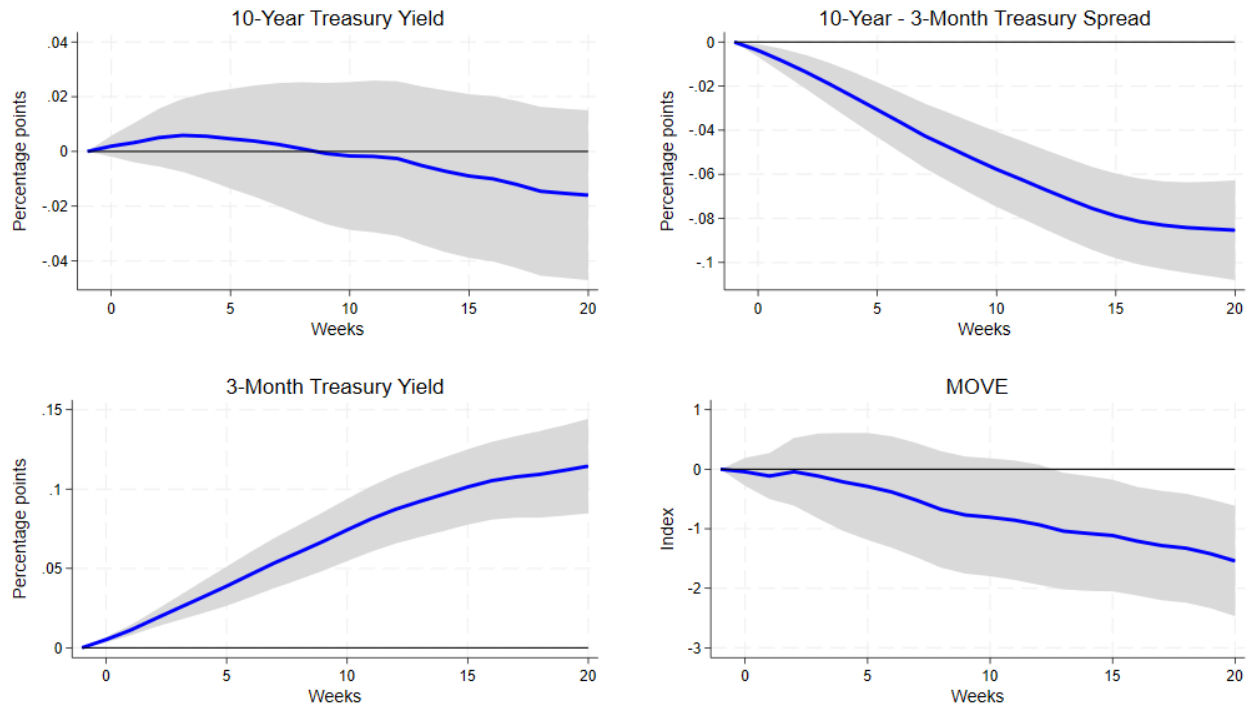

Figure 14. Treasury market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

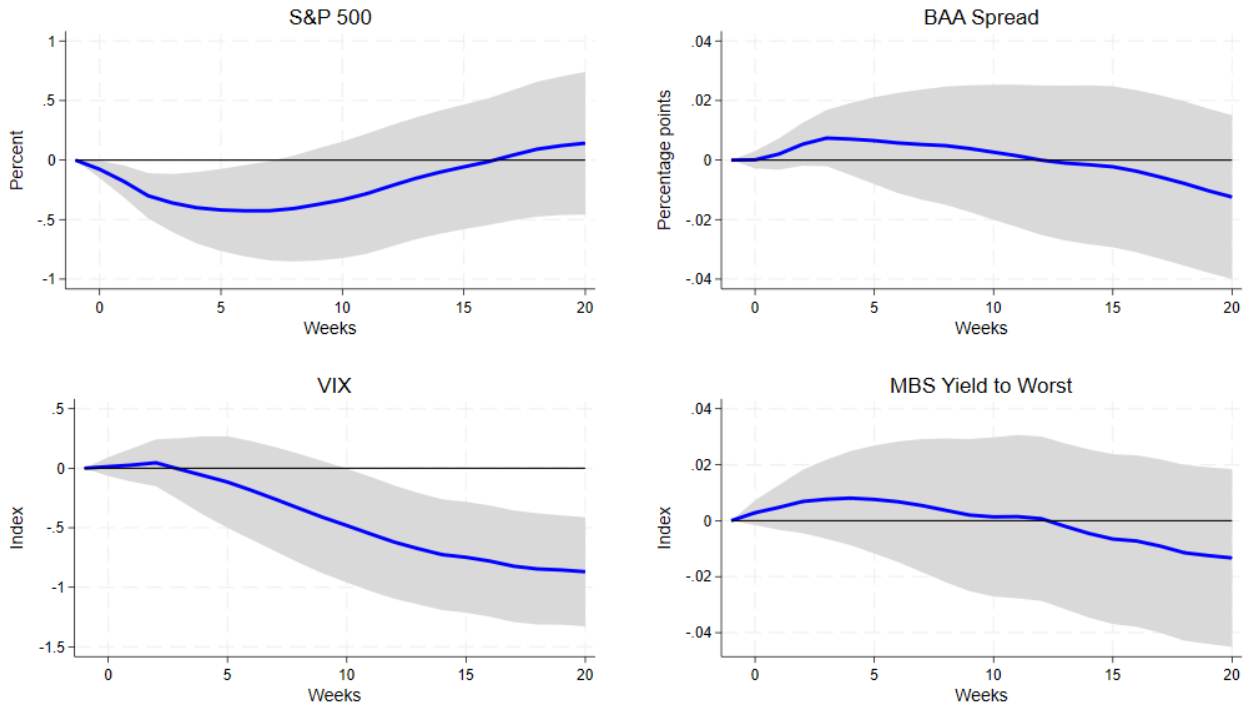

Figure 15. Other assets I: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

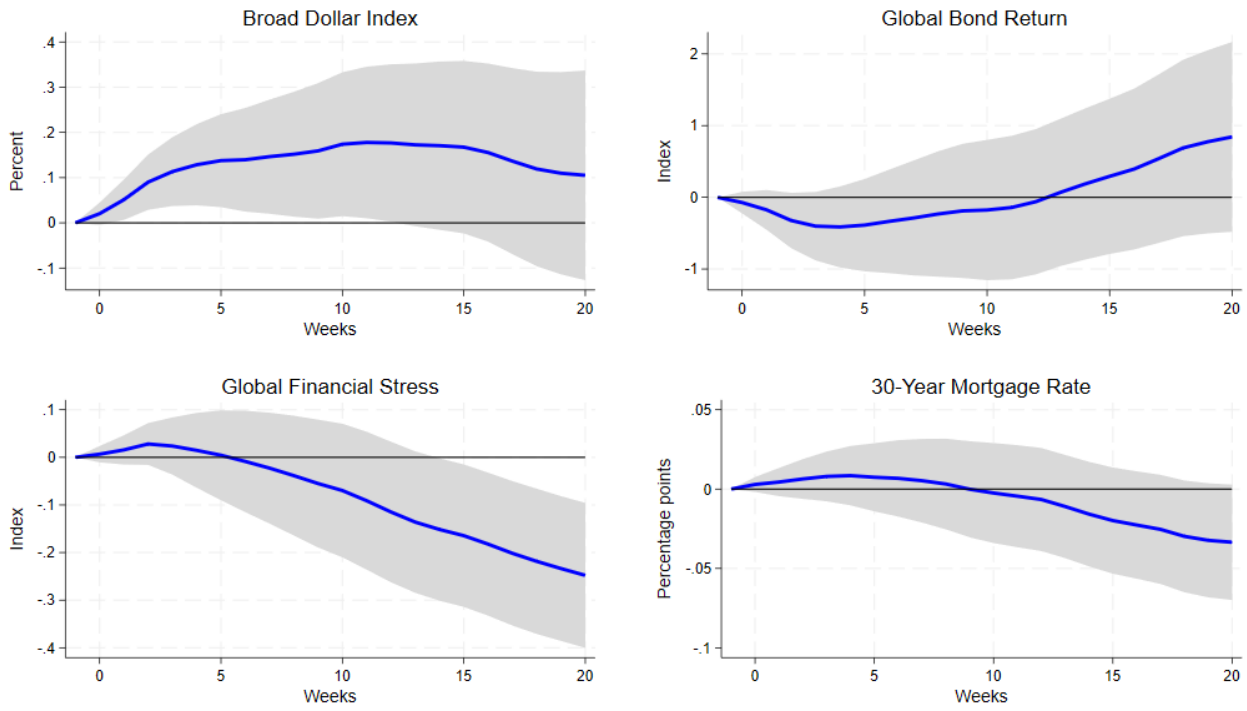

Figure 16. Other assets I: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

A2.3 LMS - Weekly Economic Index

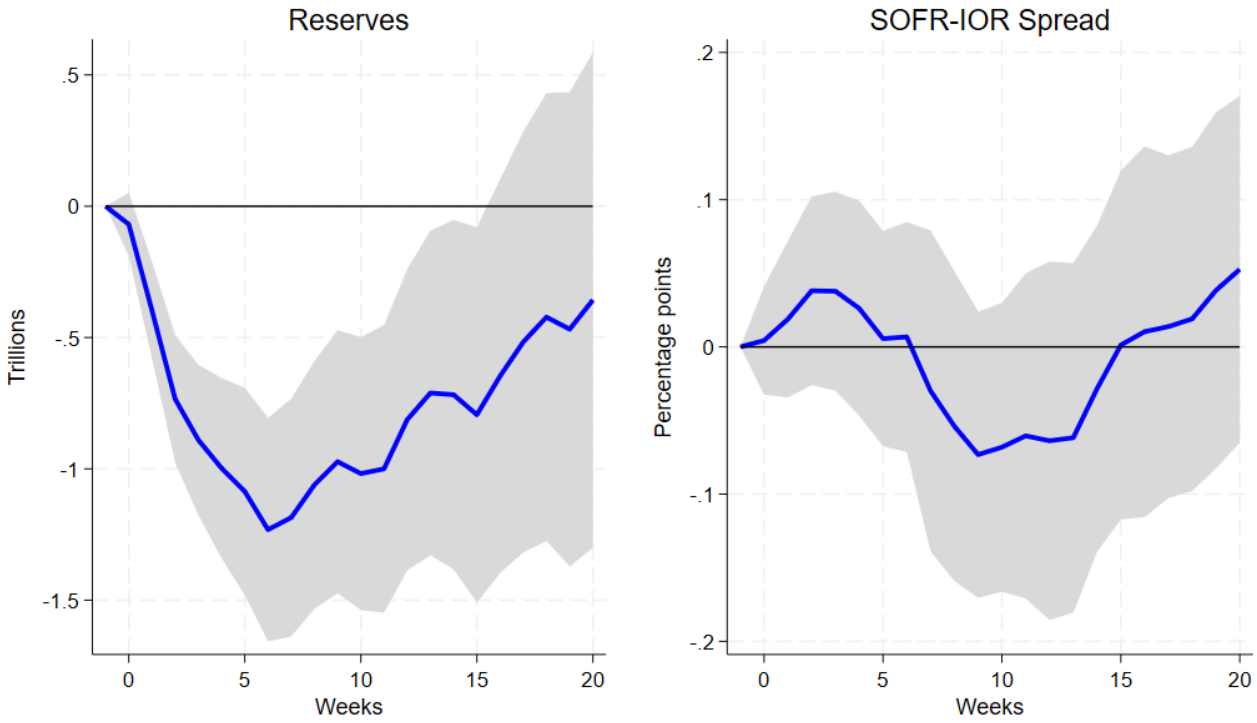

Figure 17. Money market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

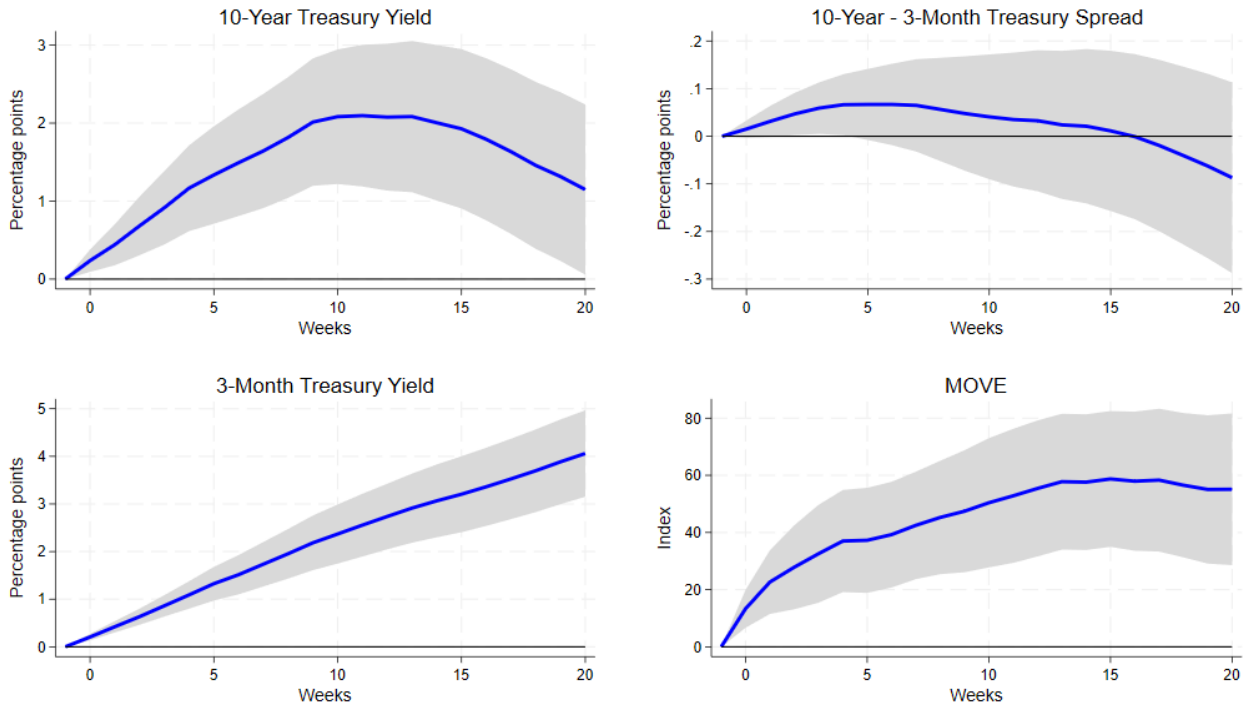

Figure 18. Treasury market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

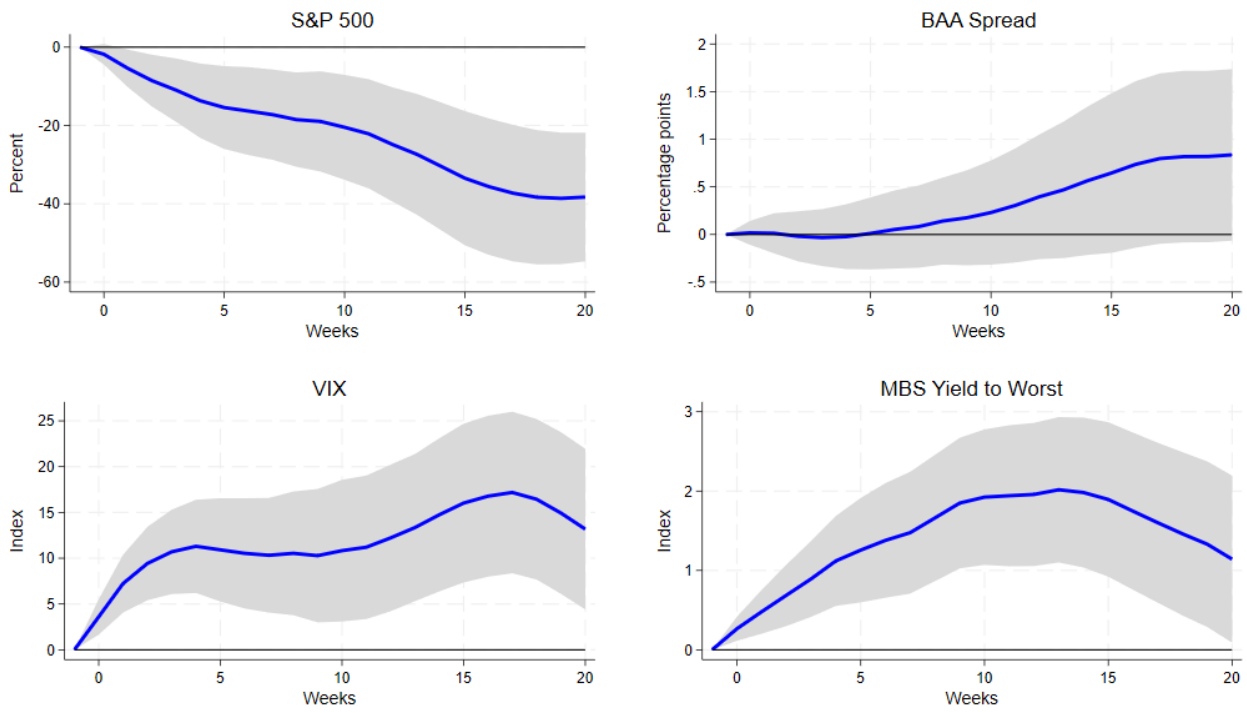

Figure 19. Other assets I: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

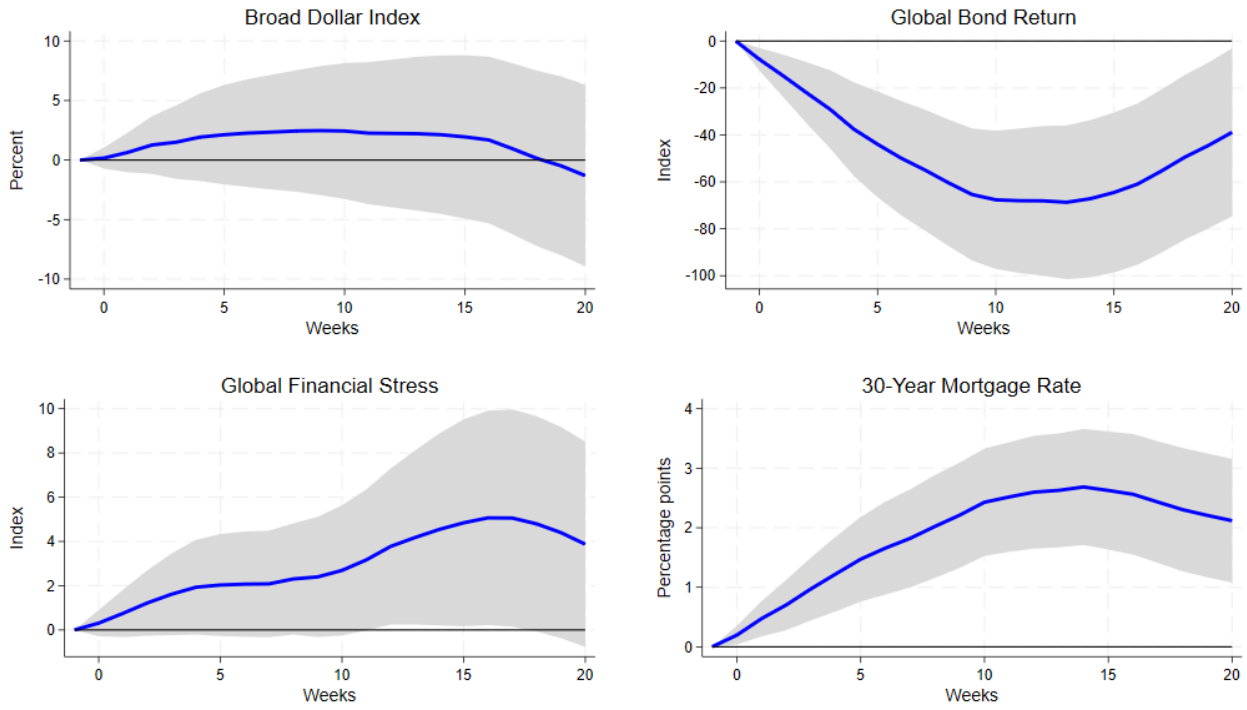

Figure 20. Other assets II: impulse responses to a 1-trillion decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

A2.4 State Dependence (STLP)

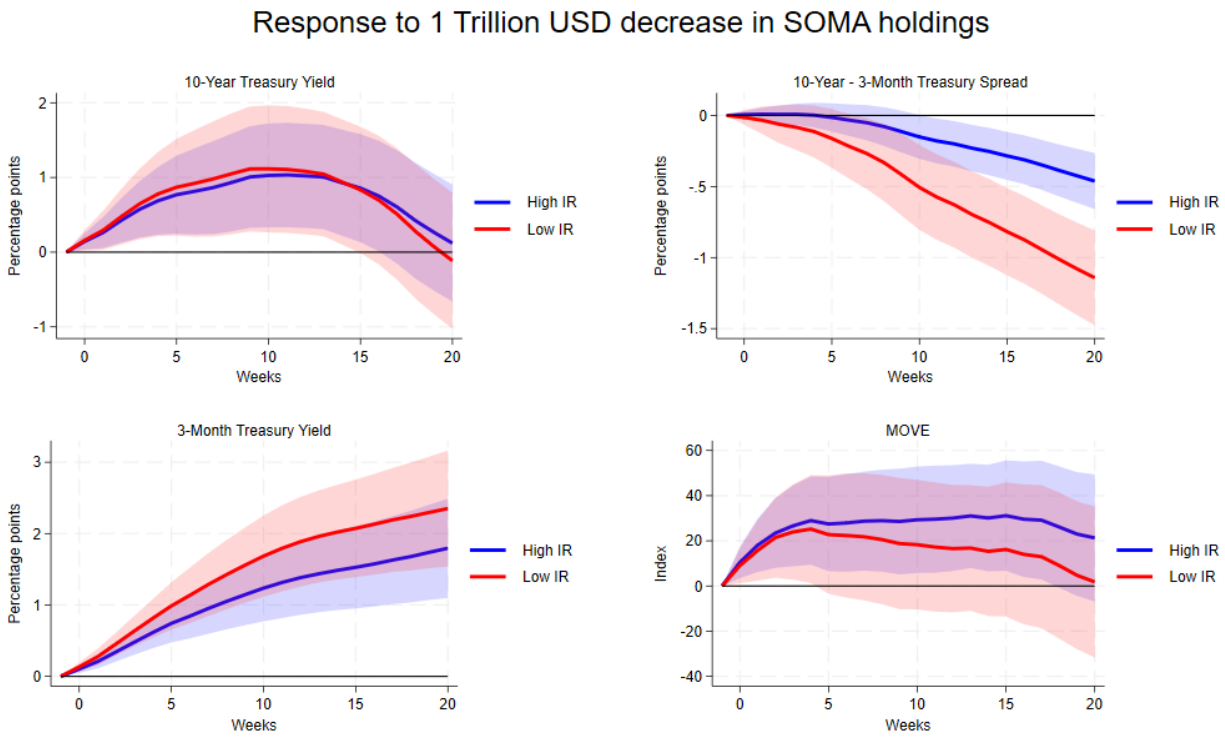

Figure 21. Treasury market: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

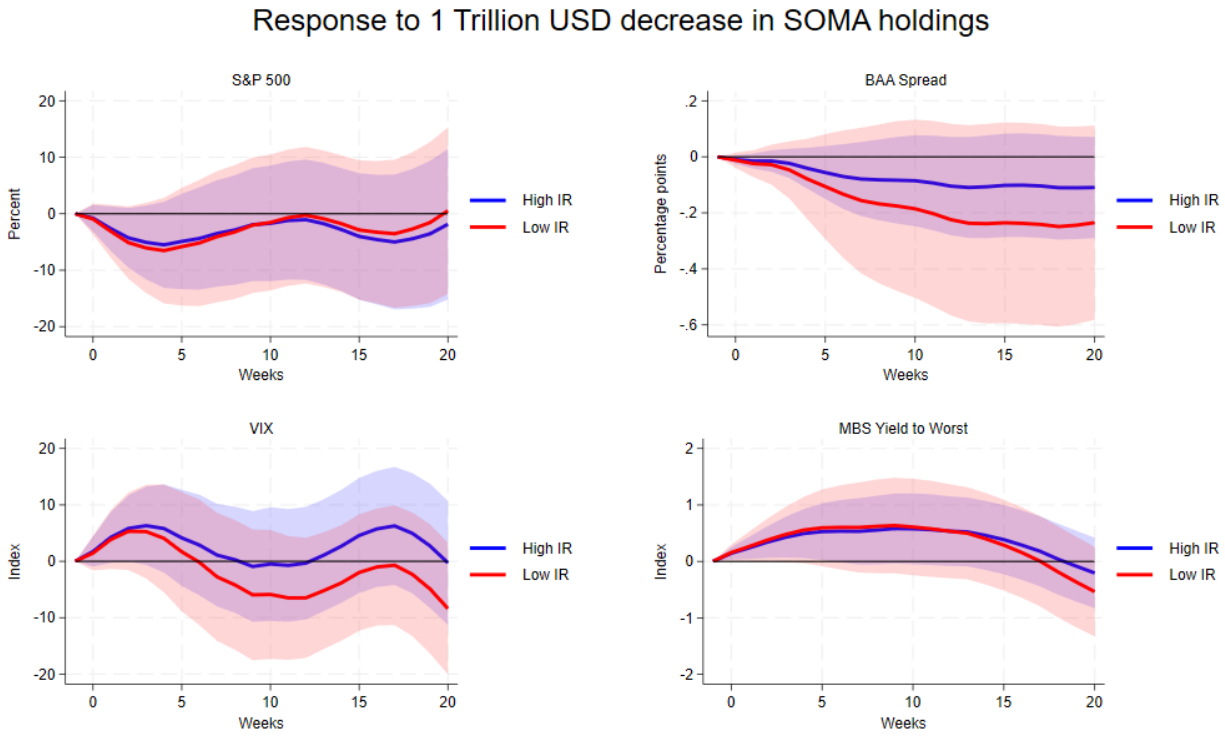

Figure 22. Other assets: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.

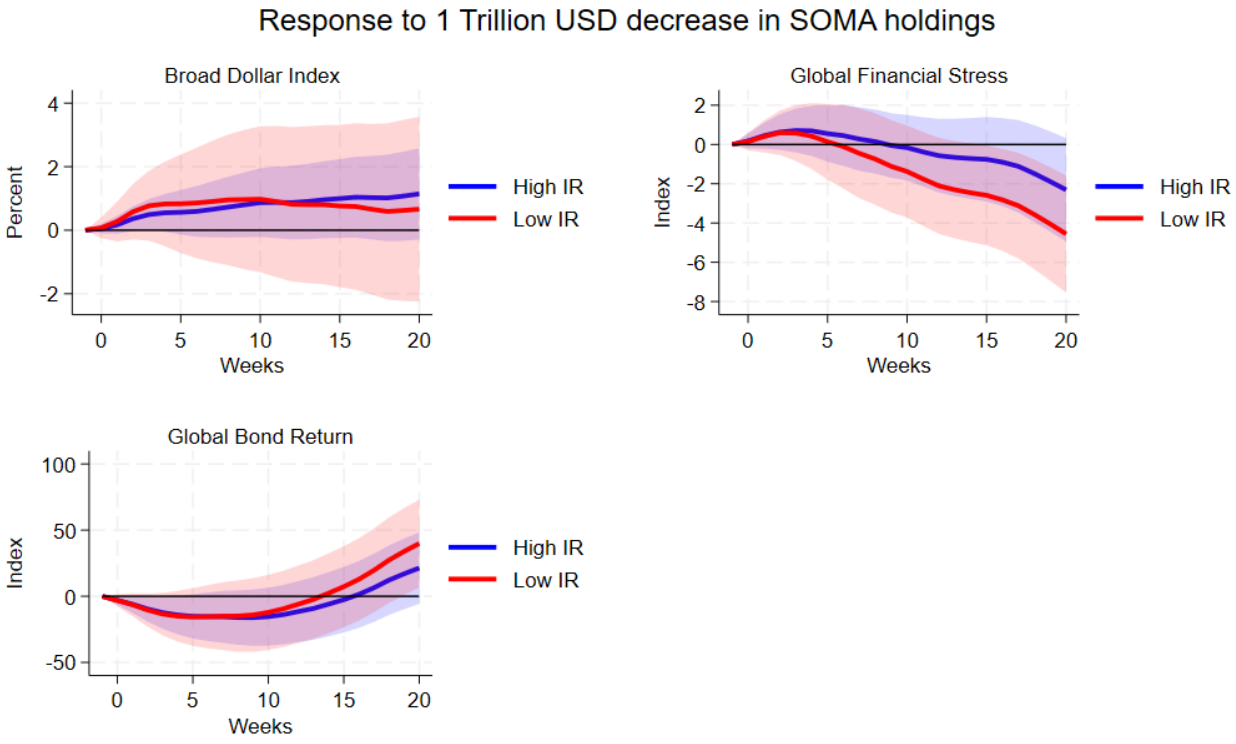

Figure 23. Other assets: impulse responses to a 1-trillion USD decrease in SOMA holdings. 90% Newey and West (1987) confidence bands displayed.