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US TREASURY LIQUIDITY DISRUPTIONS: A REVIEW

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0.1 Introduction

Liquidity, the ease with which an asset can be converted into ready cash without affecting its market price, has been an important aspect in financial transactions. Many important financial activities, such as collateralizing debt securities and forming portfolios with fluctuating redemption needs, require access to markets with high liquidity to function properly. The need to convert assets into cash is especially acute during time of financial distress. Various financial institutions often hold assets with high liquidity in anticipation of such crises and preventing "run on the bank" situations.

Chief among markets with high liquidity is the US Treasury securities market. With 23.2 Trillion USD outstanding assets as of April 2022, the US Treasury securities market form the bedrock of modern financial industry (SIFMA, 2022). One of the crucial features that places the UST securities market in such a central position is the high liquidity in the market. The reliance on UST securities based on its high liquidity became especially highlighted after the Global Financial Crisis. Prior to the Global Financial Crisis, AAA-rated private-label RMBS would likely have been considered highly liquid, but their liquidity deteriorated drastically during the crisis period (Board of Governors, 2023a). Regulators, including major central banks across the world, also began to emphasize the solvency of banks during time of distress, through regular exercise called "stress test." As a response, banks and other financial institutions shifted to hold more UST securities as their main highly liquid assets.

Recent experiences, however, may suggest major flaws in UST securities market that prevents it from satisfying such a role. "Flash events," during which market liquidity would rapidly disappear, have become more frequent in UST securities market since the Great Financial Crisis; more concerningly, the market's recovery from those events, in terms of available liquidity and trading volume, are disproportionately longer than the initial events themselves (Aronovich et al., 2021). Major liquidity crises, such as the Global Financial Crisis in 2008, Sovereign Debt Crisis in 2011, and the pandemic-triggered recession in 2020

are all moments when the UST securities market should have stood ready to fulfill its role in liquidity provision. Yet it has failed in performing this role due to liquidity shortages until major interventions by the Federal Reserves (Cheng et al., 2020). The dam seems to buckle when the flood is the greatest.

This article will review related literatures on the behaviors of UST securities, and agents who provide ready cash in the market (the liquidity providers), to highlight the development in evaluating and modeling the liquidity fluctuation in UST securities market. In section I, this article will present some stylized facts about the structure of UST securities market. In section II, a review on empirical and theoretical literatures on the behaviors of UST securities market liquidity provision is presented.

0.2 Background

The US Treasury markets are often described as having a two-tiered market structure. In the primary market, the US Department of Treasury conduct daily auctions of the US Treasury bonds directly to investors. In the secondary market, participants trade on US Treasury bonds previously issued. The focus of this article and related literatures is on the secondary market.

Unlike the primary market, the secondary market does not feature an officially recognized or regulated trading platform. The trading between dealers and professional traders, however, is increasingly conducted electronically and concentrates on a handful of platforms. As of 2017, about 90 percent of all interdealer trading by volume were conducted on two platforms, BrokerTec and eSpeed (Fleming et al., 2017). These platforms use the trading protocol called limit order book, commonly used on major stock and commodities exchanges. Limit order book as a trading protocol is also extensively studied in market microstructure literatures, theoretical works on market liquidity, which will be reviewed later. The price and volume data on UST securities are often sourced from the BrokerTec, which accounts

for over 60 percent of all transactions in the secondary market (Fleming et al., 2017).

UST securities are often considered highly liquid, due to the belief that large volumes of UST securities can be sold for ready cash in the secondary market quickly and with relatively small price impacts at any given time, especially time of distress (Longstaff, 2004; Krishnamurthy and Vissing-Jorgensen, 2012). Market participants, such as banks and funds, will have an elevated need for ready cash from debt obligations or client withdrawals during general financial distress. Further, regulatory measures and risk management tools, such as stress tests, often focus on the solvency of financial institutions during crisis scenarios. These concerns and constraints prompt financial institutions to seek highly liquid assets that can be converted to cash with minimal loss of paper value.

Despite the belief that UST securities are highly liquid, there are episodes of financial distress that may suggest otherwise. In March 2020, as the Federal Reserved announced rate cuts, the price volatility and trading volume increased dramatically. Further, there were persistent increase in trading friction in the form of widening bid-ask spread /citepFR20. Similar disruptions were also observed in during 2008, 2011, 2013, 2018, 2019, and 2021 /citepADM2021. These disruptions showed that the UST securities market may not be as highly liquid as otherwise expected.

0.3 Literature Review

The literatures are categorized into empirical works relating to the behaviors of UST securities liquidity provision, and theoretical works focusing on the behavior of liquidity provision in UST securities and beyond.

0.3.1 Empirical literatures

Empirical literatures suggest that the liquidity shortage triggered by different types of events are fundamentally different. For instance, Fleming and Remolona (2002) and Balduzzi et al.

(2001) show that while price and volume changes significantly and persistently around news announcements, the disruption to liquidity provision is much shorter-lived. These episodes of liquidity shortage often last no more than a single trading day.

Similarly, Munyan (2015) and Aldasoro et al. (2022) document disruptions at end-of-quarters. These papers found that UST securities and related markets often feature disruptions due to regulatory measures for banks, such as end-of-quarter stress tests and window dressing. However, the duration of liquidity shortage due to these regulations are also very short.

However, there are liquidity shortages, also similarly triggered by certain events, that last much longer. Aronovich et al. (2021) document the sizes and durations in liquidity provision downturns. They showed that recovery for liquidity provision in flash events often last several weeks, even months. Afonso et al. (2020); Avalos et al. (2019); Copeland et al. (2022); Correa et al. (2020) document similar disruptions in Treasury Repo market, which is heavily related with UST securities market due to trading strategies and participant compositions. The causes of such disruptions is heavily debated, but these papers point to the lack of reserves in depository institutions and increase in intermediation costs for dealers. These events may suggest a link between liquidity within loan markets, which provide capital for dealers and traders, and liquidity provision in secondary markets.

Major disruptions due to COVID19 also seem characteristically different from shorter disruptions. He et al. (2022); Vissing-Jorgensen (2021); Fleming and Ruela (2020) document the disruption in UST securities market in March 2020. Fleming and Ruela (2020) point out the increase price and volume volatility, as well as significant widening in bid-ask spreads. Vissing-Jorgensen (2021) demonstrate that the yield spike was driven by liquidity needs of mutual funds, foreign official agencies, and hedge funds that were unaffected by the March 15, 2020 Treasury-QE announcement. He et al. (2022) document large shifts in Treasury ownership and temporary accumulation of Treasury and reverse repo positions on dealer

balance sheets during this period. Their model link the shift in treasury yield with changes in repo markets, major sources of capital for hedge funds that actively participate in the UST securities market. Hedge funds' increasing participation in UST securities market, as well as their motivations to do so, are documented by Barth et al. (2023).

There does not seem to be empirical studies that systematically examine the different types of events that trigger liquidity shortages, and the lengths and sizes of their aftermaths. Further, the mechanism of recovery should be better documented and understood. Such studies may help us better categorize and understand the nature of liquidity events, and design models and policies around them.

In terms of measuring liquidity, Fleming (2001); Adrian et al. (2017); Nguyen et al. (2020) examine the different measures for liquidity within the UST securities market. In particular, Fleming (2001) find that bid-ask spreads and price impact coefficients are highly correlated with each other and with reported poor liquidity, while trading volume and frequency are only weakly correlated with other measures. Adrian et al. (2017) construct a new measure for liquidity within UST securities market. Nguyen et al. (2020) find that liquidity, volume, and volatility are highly persistent across time, and market dynamics change during the GFC.

Beyond UST securities market, Chordia et al. (2001) study the different aspects in measuring market liquidity in US equities market, including market spreads, depth, and trading activities, over the period 1988 to 1998. They find that liquidity plummets during market downturns and price volatilities, and short-term interest rate significantly impact the liquidity provision. These findings are similar to patterns in the UST securities market.

0.3.2 Theoretical Literatures

There are competing explanations to liquidity events. One such angle is through funding constraints for liquidity providers. De Long et al. (1990); Shleifer and Vishny (1997); Abreu

and Brunnermeier (2002) study the limit on arbitrage. They point out that rational agents may face asymmetric constraints on shorting, an important tool for inventory management for liquidity providers. These asymmetric limits on arbitrage may be due to asymmetric distribution of noise traders' beliefs and concentrated risk on arbitrageurs (De Long et al., 1990; Shleifer and Vishny, 1997), and synchronized actions from competing arbitrageurs Abreu and Brunnermeier (2002).

As empirical literatures point out, hedge funds are now a major segment in liquidity provision in UST securities market. At the same time, hedge funds often use leverage and face capital constraints. Hence, capital constraints can be important in explaining abnormal liquidity provision behaviors.

Capital constraints faced by firms in general, or funding liquidity constraints, is studied in corporate finance (Shleifer and Vishny, 1992; Holmström and Tirole, 1998, 2001; Diamond and Dybvig, 1983). This strand of literature focus on the interaction between lenders and borrowers. In particular, Shleifer and Vishny (1992) examines the private cost of leverage due to the possibility of fire sales, and Diamond and Dybvig (1983) shows that creditors to the same debtor may form competition in demanding repayment or deposit, leading to bank runs for the debtor. Funding and collateral constraints are also studied in macroeconomic literatures, such as Bernanke and Gertler (1989); Kiyotaki and Moore (1997); Geanakoplos (1997, 2003).

Modifying the assumption of well-capitalized dealers, Attari et al. (2005) study the strategic behavior of lending to distressed arbitrageurs, and find that arbitrageurs in distress may face increased borrowing costs and even forced liquidations. Bernardo and Welch (2004); Morris and Shin (2004) provide bank-run style models, in which asset holders may find it optimal to liquidate before an expected run occurs, thus triggering the run itself. Brunnermeier and Pedersen (2009) further examines the behaviors for and interactions between liquidity providers and their creditors, linking market liquidity supply shortage with funding

liquidity constraints.

While the funding constraint aspect is well-developed, it does not help in explaining the heterogeneity of such bank-run style events. These are often symmetric in that liquidity shortage and recovery are similar mechanically. But the recovery period seems characteristically different from the flash events themselves (although this statement itself should also be empirically tested). Further, liquidity events have varying lengths and impacts. Such heterogeneity does not seem to be well-understood and modeled by bank-run style models.

Market design may provide yet another angle for deficiencies in liquidity shortage events. Classical literatures in market microstructure, such as Stoll (1978); Ho and Stoll (1983); Kyle (1985); Glosten and Milgrom (1985); Grossmand and Miller (1988), study the actions and outcomes under limit order book, the trading protocol prominently used in most equities exchanges. They attribute trading friction and costs to inventory and execution costs (Stoll, 1978; Ho and Stoll, 1981; Grossmand and Miller, 1988), and competition from informed demand (Kyle, 1985; Glosten and Milgrom, 1985). Budish et al. (2015) point out that the inherent flaws in limit book order market design causes front-running and hence competition in transaction speed rather than cheaper liquidity provision. The specific trading protocols and market design in UST securities market also seem to require further documentation and studies. Prominent electronic exchanges for UST securities, such as BrokerTec and eTrade, use limit order book trading protocols similar to equities exchanges. This may indicate that results from traditional market microstructure, which primarily study limit order book protocols, can be applied to understand UST securities liquidity provision.

There is also a strand of literature that focus on the specific institutional arrangement around the UST securities market. d'Avernas et al. (2024) link fluctuations in UST securities market with central bank balance sheet and repo lending in a dynamic asset pricing model. They show that as lenders face reserve constraints with the central banks and expecting policy interventions, they may reduce their lending, leading to rising yields and funding constraints

for liquidity providers within the UST securities market. d'Avernas and Vandeweyer (2022) point to regulations requiring real-time settlements and changes in reserve requirements as source for disruptions in treasury yields. These factors further restrict bank lending in the repo market, an important source of funding for liquidity providers and shadow banks such as hedge funds.

0.4 Research Proposal

There does not seem to be empirical studies that systematically examine the different types of events that trigger liquidity shortages, and the lengths and sizes of their aftermaths. Further, the mechanism of recovery should be better documented and understood. Such studies may help us better categorize and understand the nature of liquidity events, and design models and policies around them.

On the other hand, theoretical literatures explain liquidity events in many different angles, including through funding constraints for liquidity providers, through deficiencies in market design , and through the specific institutional interaction between UST markets and Repo markets. They all explain the same phenomena, but with different causes and policy implications. There does not seem to be theoretical literatures that connects and delineates the effects of these different factors on the liquidity shortage event. Which factors contribute more to the severities and durations of liquidity shortage? Is UST market liquidity shortage fundamentally different from liquidity crises in other markets? How are market participants actually impacted by such liquidity shortages? Do they strategically plan around such events? These all may be directions for future research and readings.

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