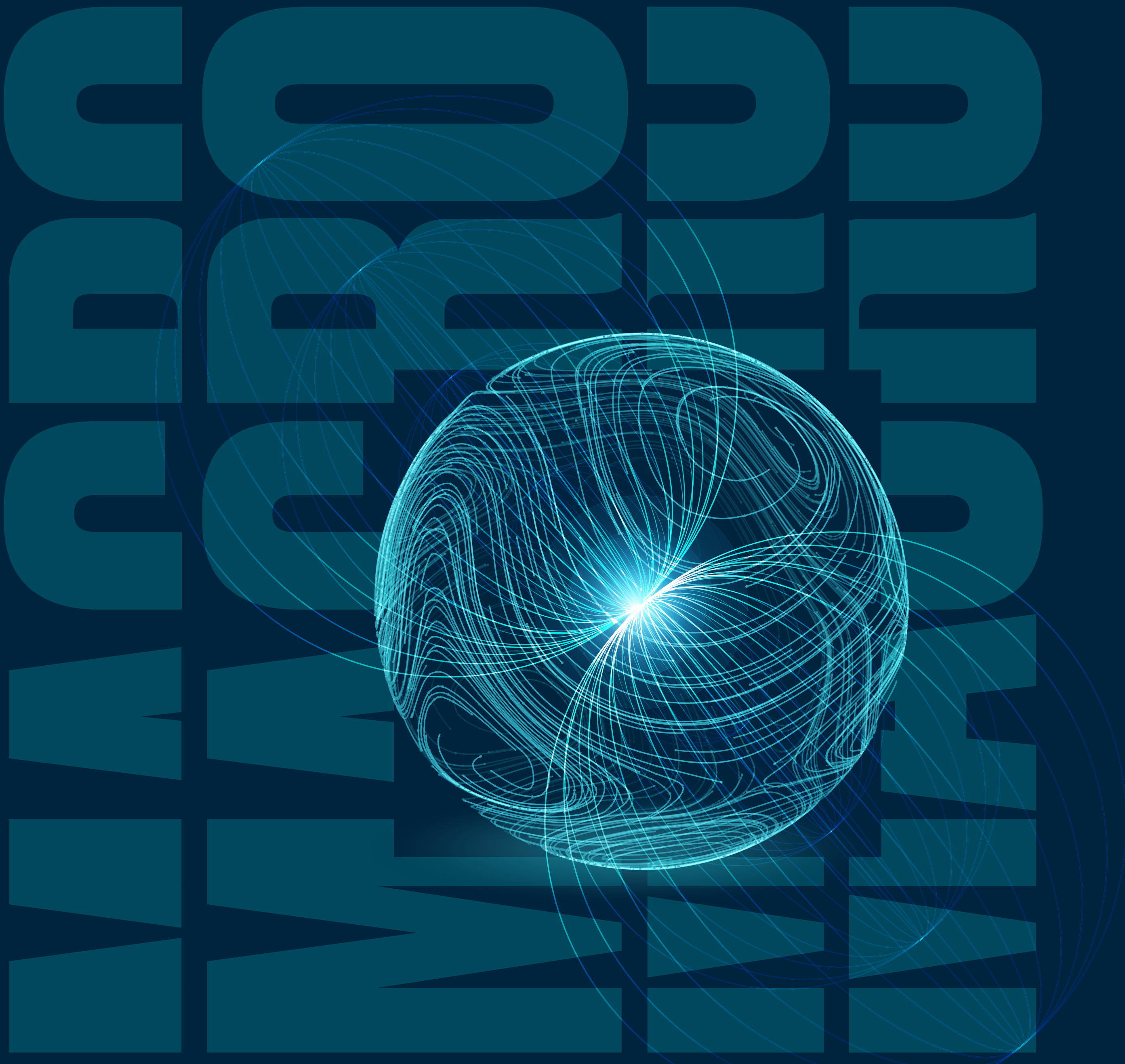
Navigating changes to

FIXED INCOME LIQUIDITY



Gbenro Odunaiya, CFA
SVP, Head of FIC Trading, Buy-Side Trading Solutions

Ernesto Ezequiel Perez
VP, Quant Modeling & Analytics, Buy-Side Trading Solutions

Theodore Bair Jr., CFA
SVP, Senior Investment Strategist, Mellon Investments Corporation

Bryan Steele
SVP, Senior Trader, Buy-Side Trading Solutions

INTRODUCTION

Liquidity of United States fixed income markets plays a central role in U.S. economic activity, the stability of the financial system and successful implementation of Federal Reserve (Fed) monetary policy.

Given its importance, it is essential for market participants to monitor liquidity changes closely. Over the past four years, BNY Buy-Side Trading Solutions and Mellon Investments have observed significant shifts in liquidity of U.S. fixed income markets. What caused these movements, and how can investors anticipate (and potentially benefit from) them? Having accurate and up-to-date data is essential in this regard.

This whitepaper examines recent liquidity trends and introduces a new proprietary liquidity metric developed by BNY's Buy-Side Trading Solutions[1] team. This unique metric was designed to provide a deeper understanding of liquidity trends based on insights derived from our trading data. These insights help to shape our understanding of the shifts in liquidity and their impact on U.S. fixed-income markets. And they can also be used to better understand rapid changes in the liquidity market.

Liquidity in the U.S. Fixed Income Market has been episodically turbulent since 2020:

- Market liquidity deteriorated in early 2020 as investors grappled with the economic uncertainty caused by the COVID-19 pandemic. During a 12-day period in March 2020, the Fed delivered 150 basis points of rate cuts, bringing the benchmark lending rate to near-zero. The rate cuts, coupled with the reintroduction and launch of several asset purchase programs aimed at restoring liquidity, allowed the Fed to successfully stabilize financial markets in the second half of 2020.
- In the period from 2021-2022, U.S. consumer spending momentum, global supply-chain shortages and the conflict in Ukraine contributed to a sharp surge in inflation. The rise in inflation led the Fed to rapidly increase interest rates, resulting in renewed deterioration of market liquidity.
- Although markets restabilized in early 2023, the U.S. regional banking crisis tested the resilience of liquidity once again with the largest bank failures since the 2008 financial crisis, as Silicon Valley Bank and Signature Bank collapsed.
- The Fed's quantitative tightening actions finally began paying off in late 2023, leading to a decline in inflation and improvement in market liquidity. However, uncertainty on the size of the Fed rate cuts has led to a slight decline in liquidity as 2024 draws to an end.

In the view of BNY's Buy-Side Trading Solutions and Mellon Investments teams, the rapidly changing underlying liquidity environment in the U.S. creates new opportunities in fixed income markets. Through the lens of BNY's Buy-Side Trading Solutions team, we examine the evolution of fixed income liquidity over the past five years. The team has analyzed liquidity based on an extensive trading dataset, covering the U.S. Treasury and Mortgage-Backed Security (MBS) markets.

Measuring Fixed Income Liquidity

In collaboration with Mellon, one of the world's largest index managers,[2] Buy-Side Trading Solutions executes a significant volume of fixed income trades daily and has unique insights into fixed income market liquidity thanks to its extensive proprietary database of trade metrics. The dataset used in this paper consists of approximately 500,000 quotes and 80 attributes per quote and covers the period from January 2019 to October 2024. It provides a snapshot of Treasury and MBS trades executed by Buy-Side Trading Solutions over the past five years.

For the purpose of this analysis, we define liquidity as the ease with which securities transactions can be executed without causing a significant impact on price. Specifically, this paper considers four metrics using data from Treasury and MBS trades:

- **Best[3] Quotes:** A measure of brokers bidding/offering at the best price,
- **Quote Spread:** The difference between the best and worst quote for a given trade,
- **Time to Quote** The average time that elapses before dealers provide quotes after a trade request,
- **Missing Quotes:** The percentage of brokers not providing a quote.

These metrics are weighted to create a Liquidity Score for Treasury and MBS markets. Idiosyncratic variances have been removed by the application of a rolling average over time, which is used to create the final score as a linear combination of the four metrics.[4]

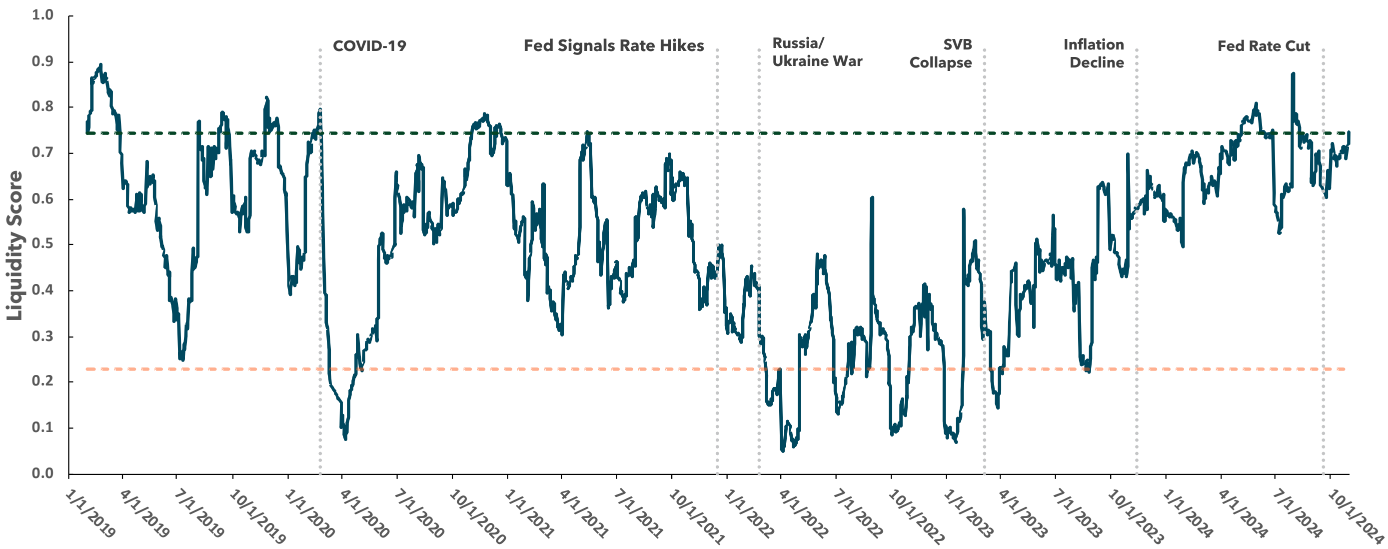
To create the Liquidity Score, Buy-Side Trading Solutions takes the following steps for each of the four metrics:

1. Calculate a daily rolling 30-day average.
2. Determine the percentile rank against the full dataset of that metric.
3. Create the Liquidity Score as an equal-weighted sum of the percentile ranks, with the score ranging from zero to one.

As shown in Exhibit A, liquidity has been volatile since 2019 due to market events. Most notable are the impact of COVID-19, the onset of the Fed's cycle of tightening, the conflict in Ukraine, the 2023 regional banking crisis in the U.S., the U.S. inflation decline and September 2024 Fed rate cuts.

EXHIBIT A: LIQUIDITY IN U.S. FIXED INCOME MARKETS

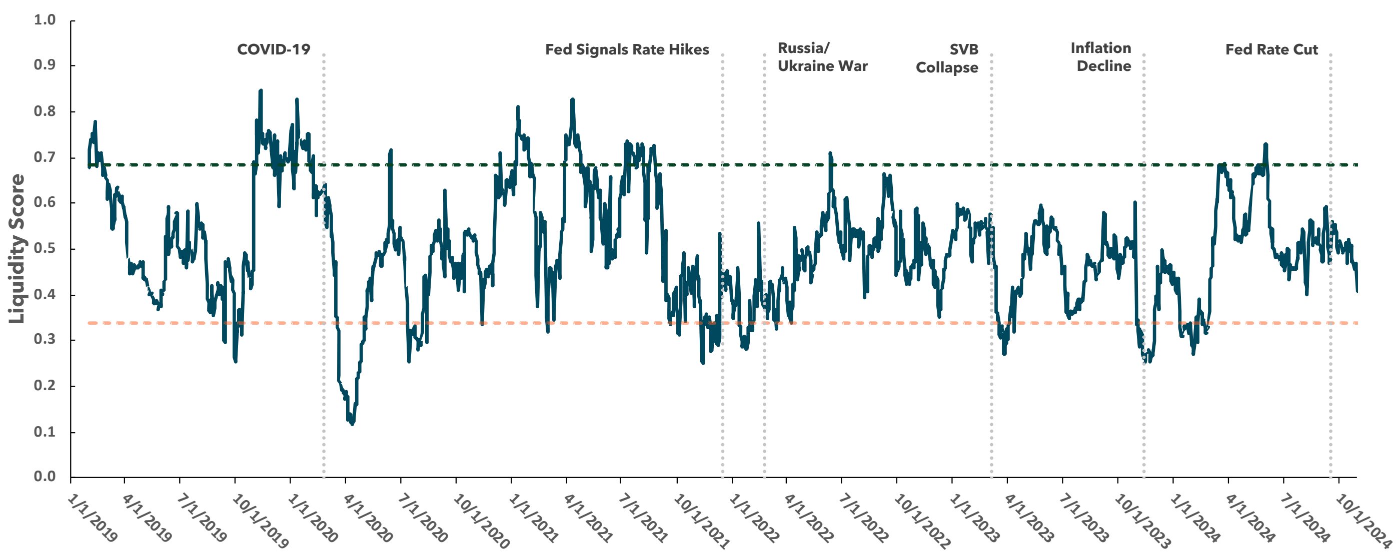
TRSY Liquidity Score



Source: Buy-Side Trading Solutions, as of October 31, 2024.

10th Percentile 90th Percentile

MBS Liquidity Score



Source: Buy-Side Trading Solutions, as of October 31, 2024.

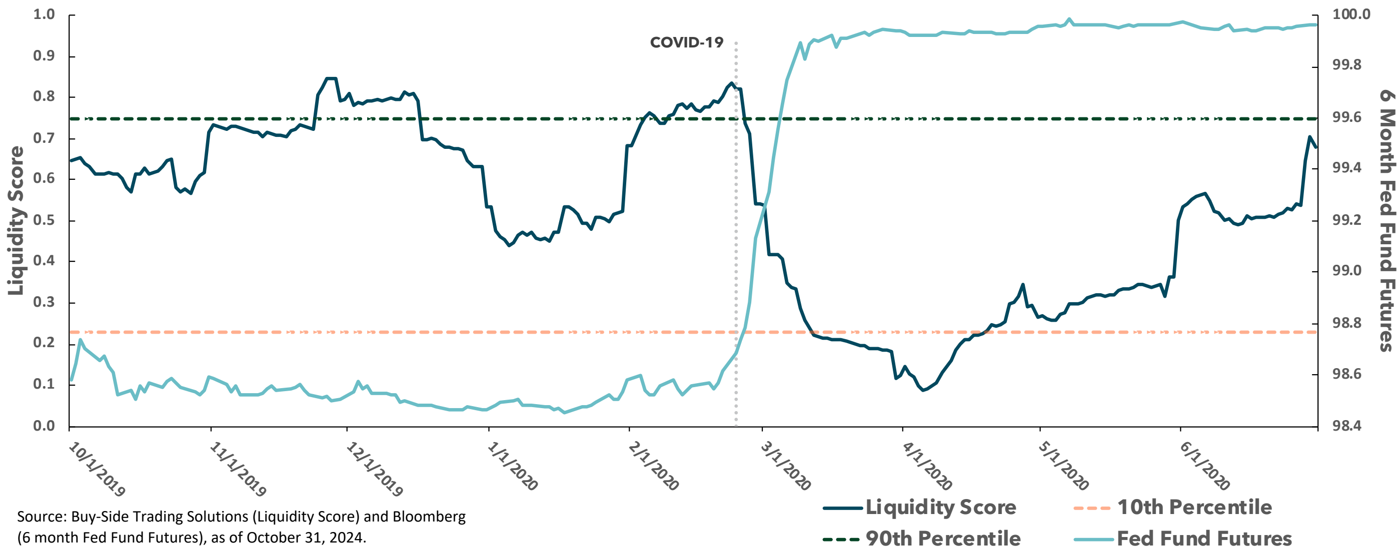
10th Percentile 90th Percentile

Uncertainty caused by the COVID-19 pandemic jolted global financial markets in early 2020. As a result, sentiment fell precipitously and liquidity in U.S. fixed income markets plummeted. The impact of these events is reflected in our Liquidity Scores, which bottomed out during the initial phase of the pandemic (Exhibit B). Liquidity Scores reached their nadir in early April 2020.

The sudden deterioration of liquidity prompted the Fed to act by purchasing Treasurys and MBS and cutting rates to near-zero in an emergency session held on March 15, 2020. These aggressive actions by the Fed halted the decline in liquidity toward the end of March and eventually led to improved liquidity conditions from April 2020 until the end of 2021.

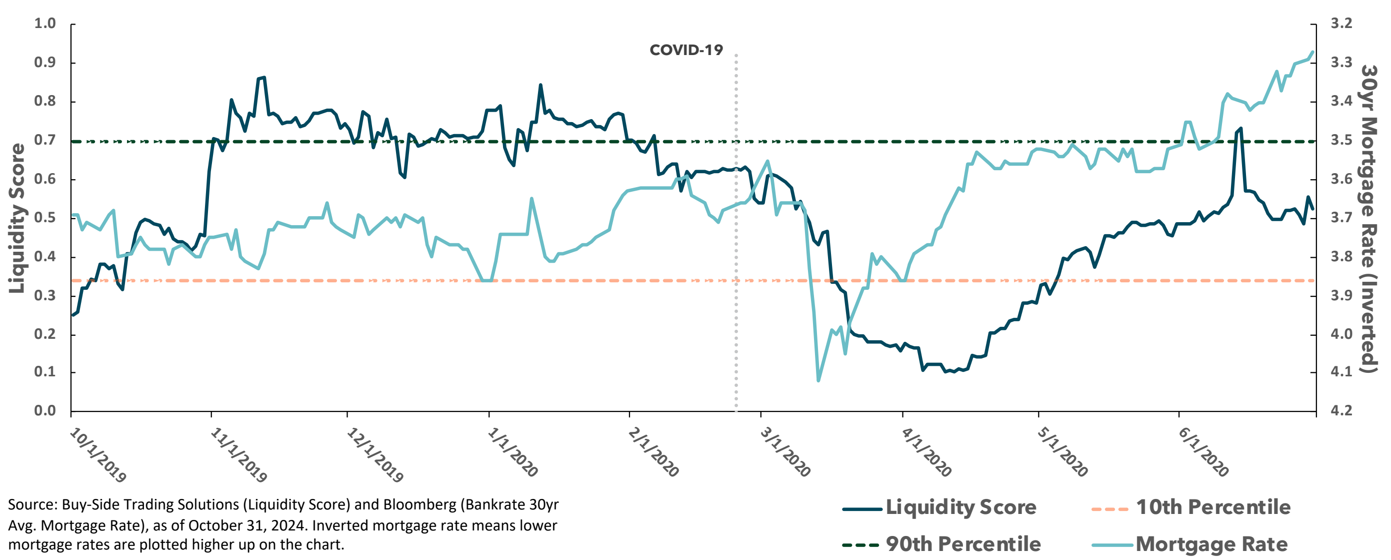
EXHIBIT B:
IMPACT OF COVID-19 GLOBAL PANDEMIC ON LIQUIDITY SCORES

TRSY Liquidity—COVID-19



Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (6 month Fed Fund Futures), as of October 31, 2024.

MBS Liquidity—COVID-19



Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (Bankrate 30yr Avg. Mortgage Rate), as of October 31, 2024. Inverted mortgage rate means lower mortgage rates are plotted higher up on the chart.

In December 2021, the Fed recognized the possible threat of sustained inflation, caused in part by increased U.S. consumer spending on goods and pandemic-driven supply chain shortages. As a result, the Fed indicated it would end the pandemic-era bond purchases in March 2022 and signaled the potential for three rate hikes in 2022.

Barely two months later, a conflict in Ukraine led to further deterioration of the inflation outlook. In response, rate-hike expectations rose rapidly and by the end of March 2022, the market had priced in seven hikes by September of the same year. This sharp increase in rate-hike expectations quickly led to a significant decline in Treasury market liquidity, which is evidenced by the Liquidity Score nearing its pandemic-era lows (Exhibit C).

EXHIBIT C:
RATE-TIGHTENING CYCLE AND RUSSIA-UKRAINE WAR

Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (6 month Fed Fund Futures), as of October 31, 2024.

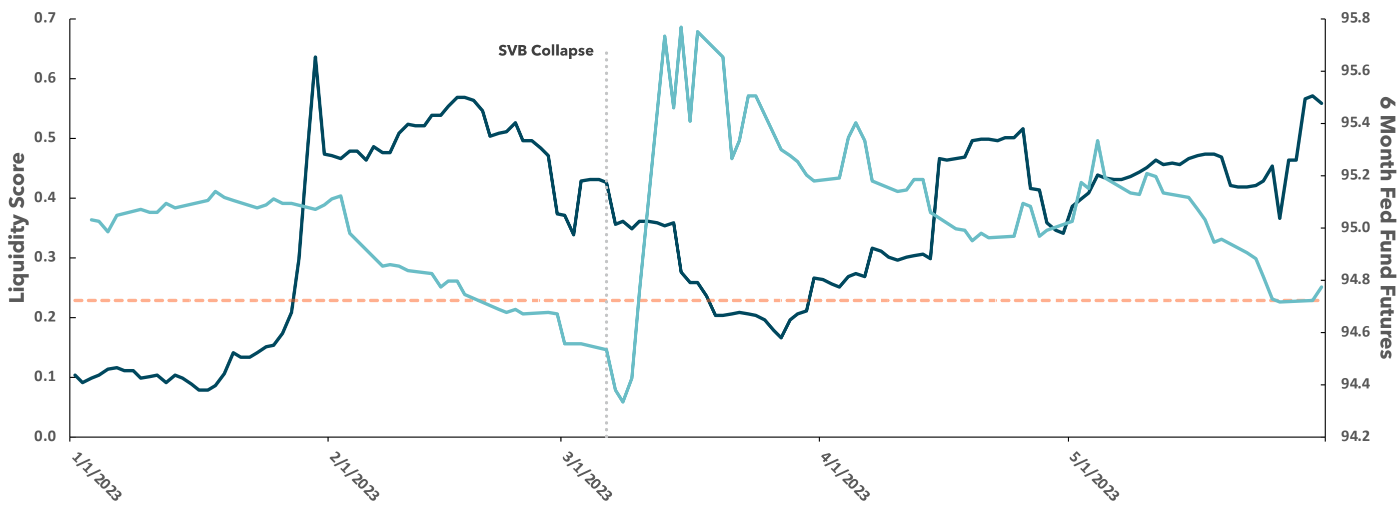
Liquidity improved at the beginning of 2023 as dealer balance sheets returned to normal levels following seasonal year-end pressures. Inflation also appeared to trend lower, restoring a sense of calm. However, an unexpectedly high January payroll number led to a sharp increase in Treasury yields and another reevaluation of market liquidity.

March 2023 saw a new shock to the markets, driven by concerns about sizable unrealized losses held on the balance sheets of regional U.S. banks. These fears triggered a heavy outflow of deposits from several banks, ultimately forcing Silicon Valley Bank and Signature Bank into insolvency. In Europe, Credit Suisse faced a similar loss of investor confidence and was taken over by UBS at the behest of Swiss regulators, exacerbating fears regarding the stability of the global financial system.

These banking concerns resulted in liquidity falling to five-year lows as measured by the Liquidity Score. Fortunately, the banking crisis remained contained to the subset of regional banks, and market participants soon focused on hopes of a soft landing in the economy, leading to improved liquidity (Exhibit D).

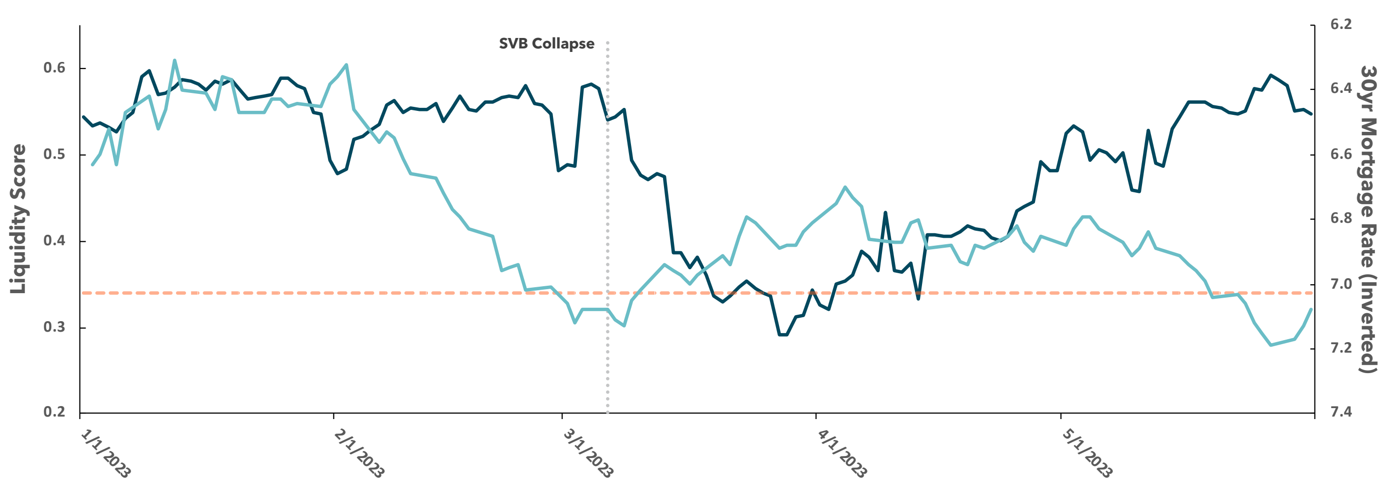
EXHIBIT D:
2023 U.S. BANKING CRISIS

TRSY Liquidity–Banking Crisis



Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (6 month Fed Fund Futures), as of October 31, 2024.

MBS Liquidity–Banking Crisis



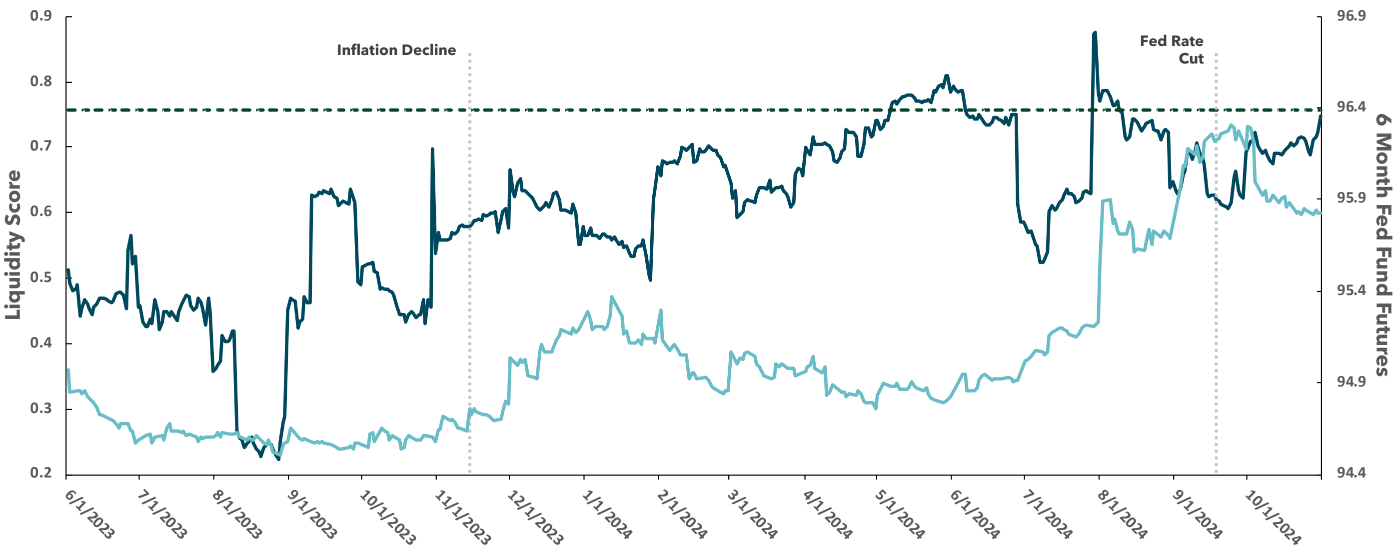
Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (Bankrate 30yr Avg. Mortgage Rate), as of October 31, 2024. Inverted mortgage rate means lower mortgage rates are plotted higher up on the chart.

As the inflation outlook improved and the market priced in several rate cuts ahead, Treasury and MBS liquidity improved to close out 2023. MBS liquidity had initially fallen in early November 2023 as it became more difficult to source some of the lower-coupon bonds. However, in line with the widespread rally and a 1% decline in mortgage rates, MBS liquidity improved sharply to end 2023.

2024 started off with increased interest-rate volatility triggering yet another decline in MBS liquidity. In the second quarter, the relative stability in interest rates led to a sharp improvement in both MBS and Treasury liquidity with the latter closing out July 2024 at five-year highs. Cooling economic data and uncertainty around the size of the Fed's rate cut in September 2024 led to a reversal in both liquidity metrics. Since the rate cut, MBS liquidity has worsened further as mortgage rates have risen.

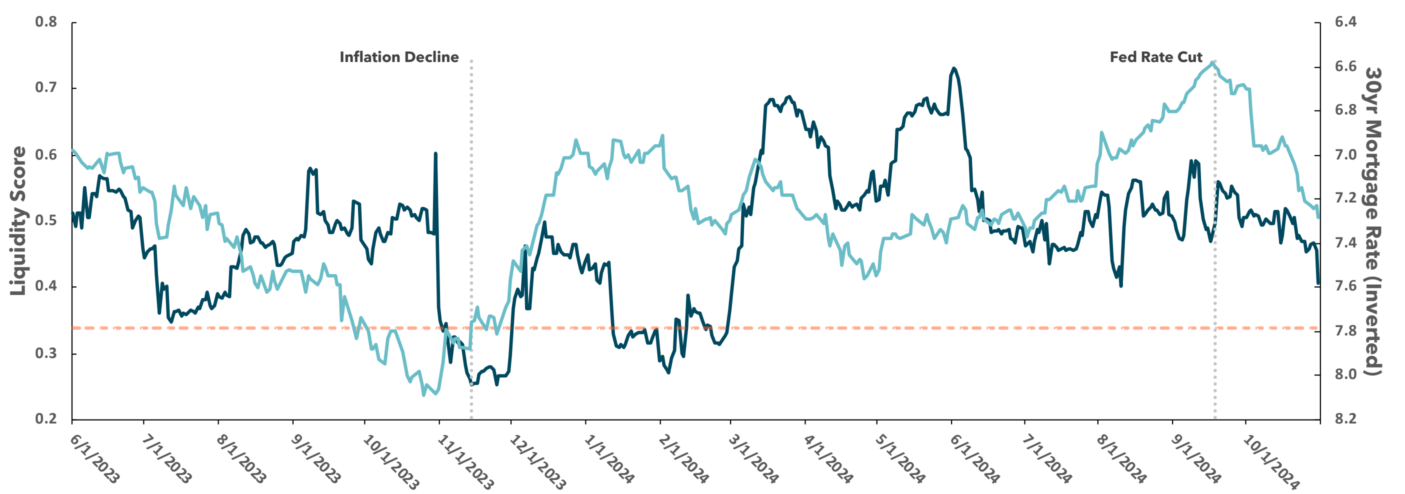
EXHIBIT E:
DECLINING INFLATION AND FED RATE CUT

TRSY Liquidity–Inflation Decline and Fed Rate Cut



Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (6 month Fed Fund Futures), as of October 31, 2024.

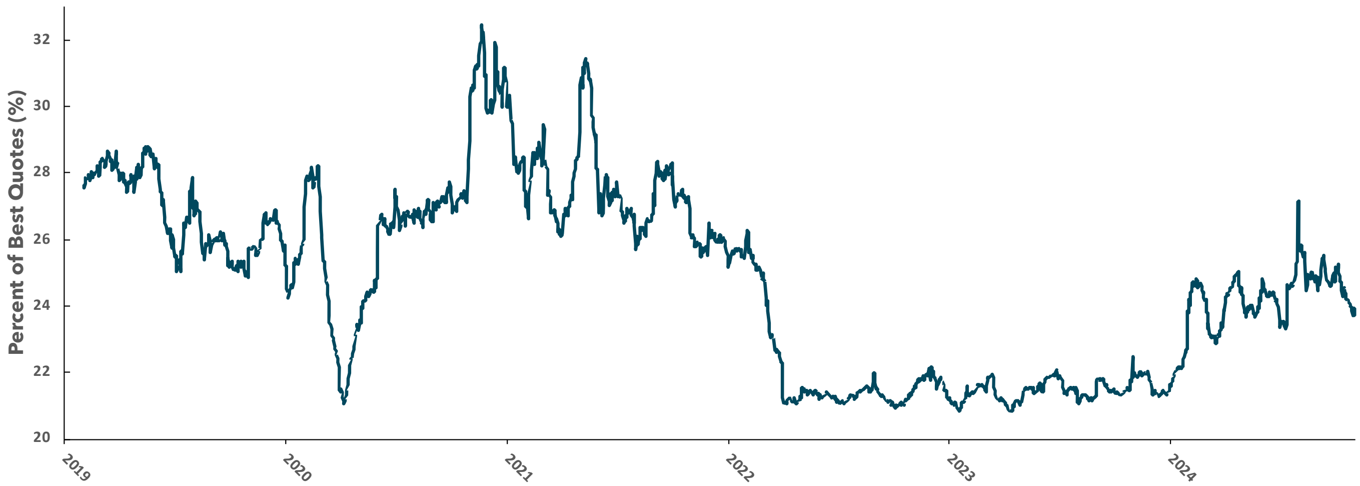
MBS Liquidity–Inflation Decline and Fed Rate Cut



Source: Buy-Side Trading Solutions (Liquidity Score) and Bloomberg (Bankrate 30yr Avg. Mortgage Rate), as of October 31, 2024. Inverted mortgage rate means lower mortgage rates are plotted higher up on the chart.

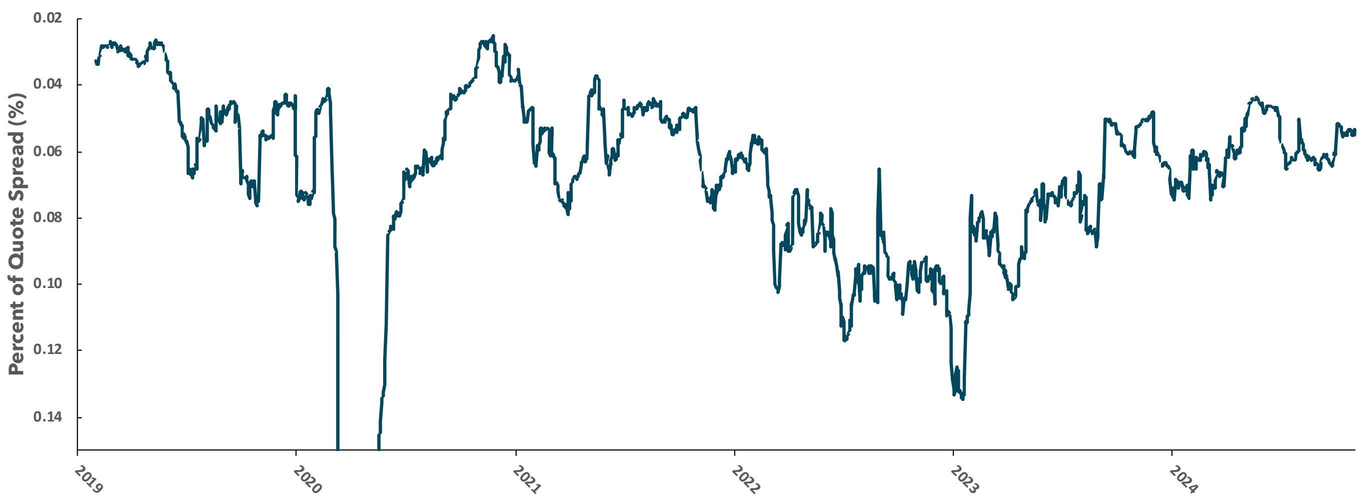
EXHIBIT F:
U.S. TREASURY LIQUIDITY BY METRIC

TRSY Best Quotes (69514 samples)



As shown above, the percentage of quotes that were at the best market price worsened significantly at the start of the COVID-19 pandemic but rebounded significantly following the Fed's intervention. This metric remained stable in 2021 but deteriorated substantially as inflation reached multidecade highs in early 2022. It remained in this state through 2023 and has improved in 2024.

TRSY Quote Spread (Inverted, 69514 samples)

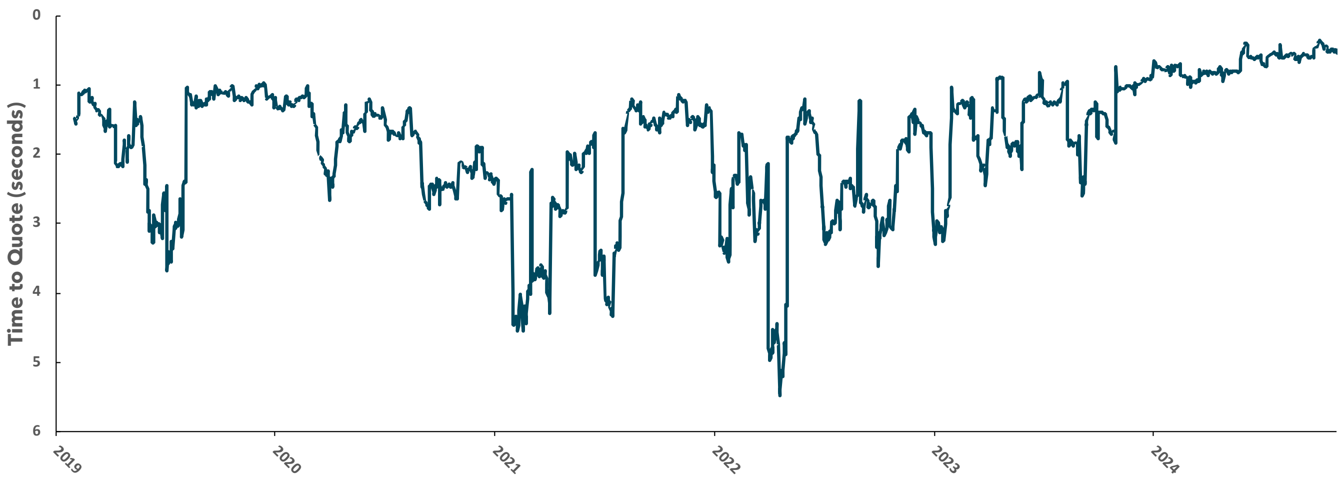


During the pandemic, the spread between the best and worst price quotes widened due to the extreme levels of uncertainty. Quote spreads improved dramatically in 2021 but then gradually levelled off into 2022. Spreads improved briefly at the start of 2023 and despite worsening in March 2023 due to the banking crisis, they are on an upward trend.

Source: Buy-Side Trading Solutions, as of October 31, 2024. Inverted Percent Quote Spread, Time to Quote and Percent Missing Quotes means lower numbers are plotted higher up in the chart to reflect inverse relationship with liquidity (e.g., longer time to quote implies less liquidity). The different sample sizes are based on the metric.

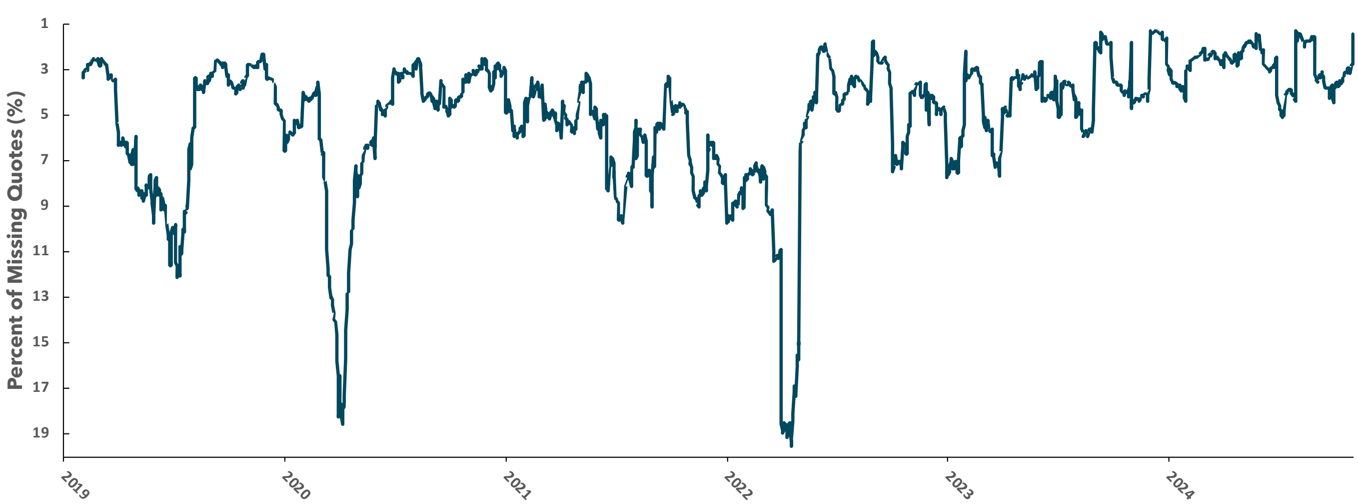
EXHIBIT F: U.S. TREASURY LIQUIDITY BY METRIC

TRSY Time to Quote (Inverted, 327497 samples)



In early 2020, brokers took longer to quote, as uncertainty impacted their risk appetites. The response times improved as the Fed intervened directly in the markets, but early 2021 saw another uptick in broker quote times. The largest spike occurred in 2022 as algorithmic pricing was apparently turned off in response to perceived market liquidity deterioration. Since then, brokers have quoted faster and are currently quoting at the fastest pace in the last five years.

TRSY Missing Quotes (Inverted, 67091 samples)

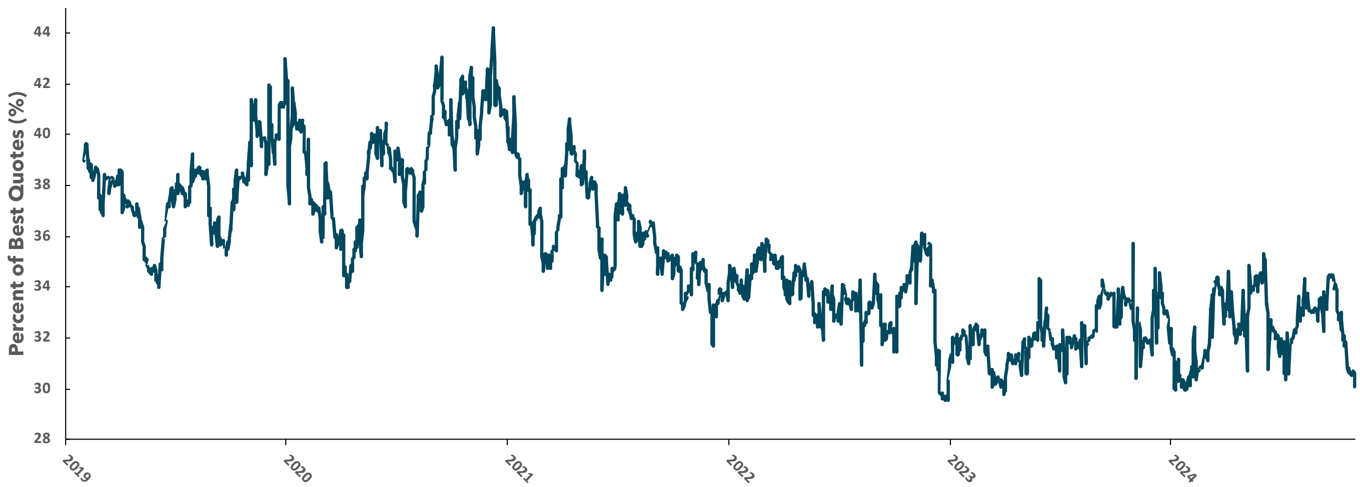


As expected, approximately 19% of brokers stopped pricing orders in the earlier pandemic months. This improved in the latter half of 2020 but declined again in 2021. In 2022, there was a renewed rise in the number of missing quotes compared to 2020, before brokers priced more consistently again in the latter half of 2022. It has remained at good levels since then.

Source: Buy-Side Trading Solutions, as of October 31, 2024. Inverted Percent Quote Spread, Time to Quote and Percent Missing Quotes means lower numbers are plotted higher up in the chart to reflect inverse relationship with liquidity (e.g., longer time to quote implies less liquidity). The different sample sizes are based on the metric.

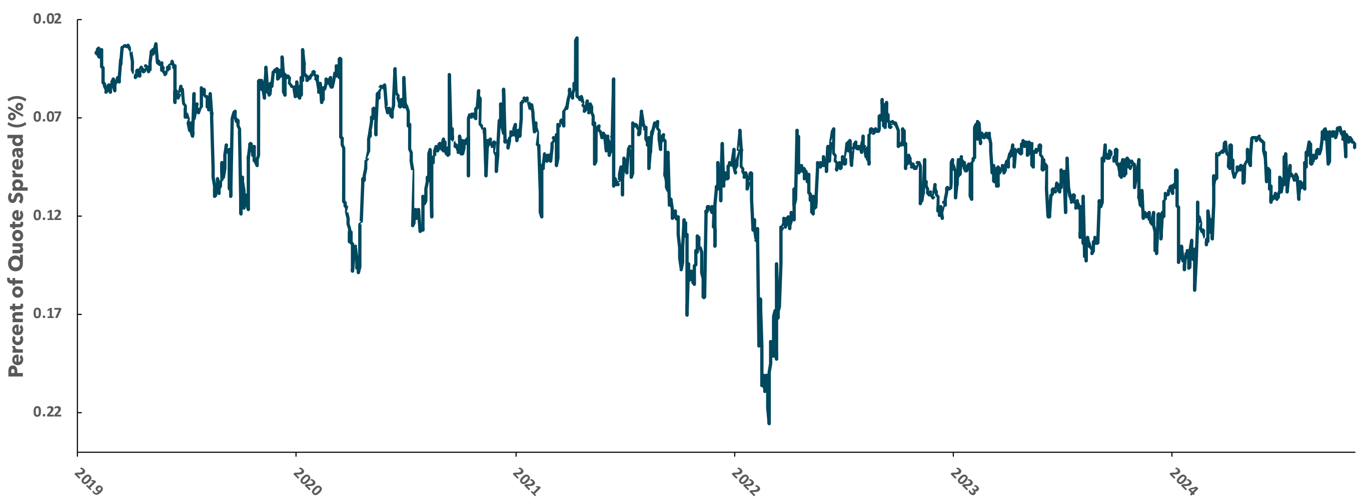
EXHIBIT G:
U.S. MORTGAGE LIQUIDITY BY METRIC

MBS Best Quotes (18296 samples)



During the COVID-19 pandemic, there was a decline (back to 2019 lows) in the number of brokers offering the best prices in the MBS space. However, that drop was small in comparison to what has happened since 2021. From 2021 to 2024, the percentage of brokers offering the best quotes has fallen consistently to new four-year lows as spreads have widened and liquidity has worsened in the MBS space.

MBS Quote Spread (Inverted, 18296 samples)

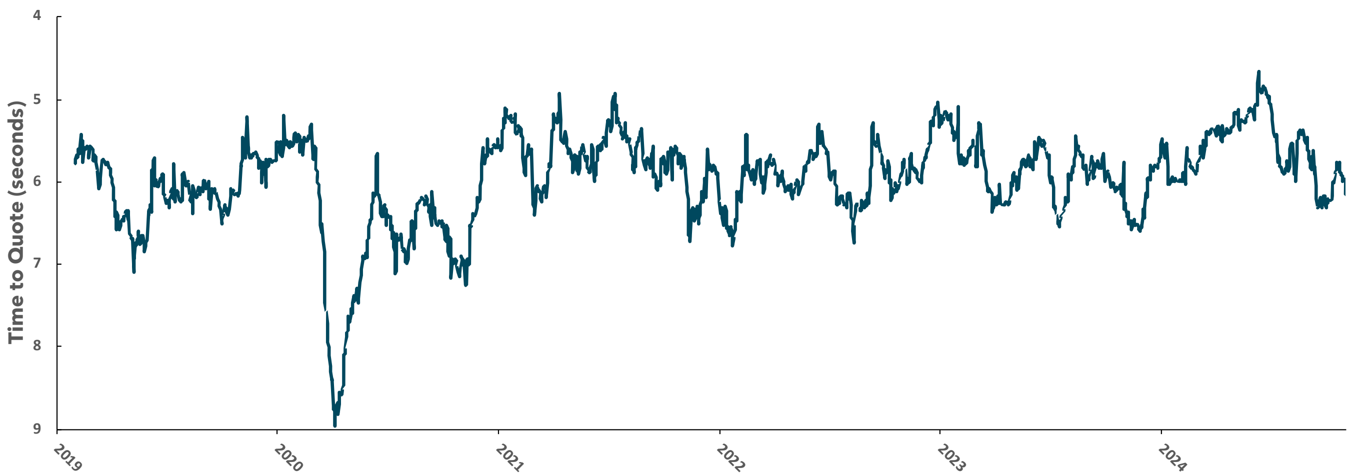


Spreads widened in 2020 and the difference between the best and worst quotes dropped. Conditions improved in the latter half of 2021 and early 2022. However, like the Best Quotes metric, in 2022 levels worsened, spreads widened and there was more volatility in the MBS markets as liquidity conditions bottomed just ahead of the first Fed rate hike in March 2022. Since then, spreads have greatly improved and are on an upward trend.

Source: Buy-Side Trading Solutions, as of October 31, 2024. Inverted Percent Quote Spread, Time to Quote and Percent Missing Quotes means lower numbers are plotted higher up in the chart to reflect inverse relationship with liquidity (e.g., longer time to quote implies less liquidity). The different sample sizes are based on the metric.

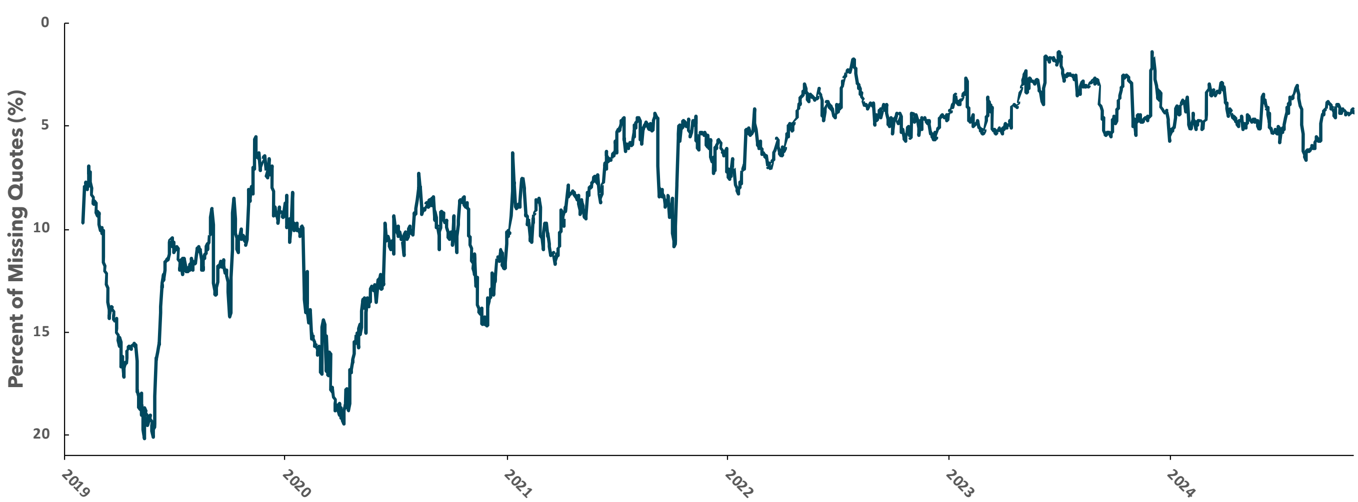
EXHIBIT G:
U.S. MORTGAGE LIQUIDITY BY METRIC

MBS Time to Quote (Inverted, 66807 samples)



The pandemic saw most brokers take much longer time to price trades. Since then, we have observed an increase in algorithmic pricing in the MBS markets and improved Time to Quote. However, when the market is volatile, brokers turn the pricing algorithms off and take longer to price.

MBS Missing Quotes (Inverted, 17844 samples)



During the pandemic, about one in five brokers stopped offering pricing to our trade requests. Since then, we've seen constant improvement in the number of brokers responding, thus giving a sense of improving liquidity. However, while the increased usage of algorithmic pricing of MBS resulted in more brokers quoting, they have widened the bid-ask spreads when liquidity is worse. As such, more illiquid periods (like in 2022) have shown better response rates but worse pricing.

Source: Buy-Side Trading Solutions, as of October 31, 2024. Inverted Percent Quote Spread, Time to Quote and Percent Missing Quotes means lower numbers are plotted higher up in the chart to reflect inverse relationship with liquidity (e.g., longer time to quote implies less liquidity). The different sample sizes are based on the metric.

Gbenro Odunaiya, CFA

SVP, Head of FIC Trading

Gbenro is the head of FIC Trading for xBK. His primary responsibilities are trading the Foreign Exchange (FX) flow for some BNY Investment Managers, providing market color on the FX markets and establishing strong relationships with our FX brokers to ensure best execution. He is also the backup fixed income trader for xBK.

Prior to joining xBK, Gbenro was at State Street Global Markets on the FX desk. At State Street, Gbenro was a market maker on the G10 and Latin American desks specializing in spots, forwards and nondeliverable forwards. He also had experience on the electronic FX trading desk, providing appropriate pricing to State Street's Foreign Exchange clients. He was previously a commodity trading tech analyst at Goldman Sachs, where he worked with the traders and quants to build commodity trading systems and algorithms.

Gbenro earned an M.S. in computational finance from Carnegie Mellon University and a B.S. in electrical and computer engineering from Illinois Institute of Technology. He holds the CFA® designation and is a member of the CFA Institute and CFA Society Boston.

Theodore Bair Jr., CFA

SVP, Senior Investment Strategist

Ted is a senior investment strategist, responsible for articulating the firm's index strategies to clients, prospective clients and consultants to help grow and retain Mellon's index business. He works closely with sales and client service staff worldwide to guide the messaging and positioning of index strategies and to develop product solutions for client portfolios.

Previously, Ted oversaw attribution and risk analytics for Mellon's Active Fixed Income division. Prior to that, Ted held roles of increasing responsibility in fixed income trading and portfolio management for Mellon Bond Associates, followed by roles as a senior portfolio manager and investment strategist for Standish Asset Management and Cash Investment Strategies. Ted has been in the investment industry since 1995.

Ted earned an MBA in finance from the University of Pittsburgh and a B.A. in finance from Westminster College. He holds the CFA® designation and is a member of the CFA Institute and CFA Society of Pittsburgh.

Ernesto Ezequiel Perez

VP, Quant Modeling & Analytics

Ernesto serves as vice president, Quant Modeling & Analytics at BNY. He is focused on development and implementation of innovative solutions for trade cost analysis and optimal execution strategies using computational and statistical modeling techniques across various asset classes.

Ernesto holds an M.S. in financial mathematics from Johns Hopkins University and a B.S. in electrical engineering and computer science from University of California at Berkeley.

Bryan Steele

SVP, Senior Trader

Bryan is a senior trader for xBK. He is primarily responsible for trading fixed income. Prior to his current role, he was a Senior Trader at Standish Mellon Asset Management responsible for ABS, CMBS, CLO and non-agency RMBS securities. Bryan originally joined BNY in 2007 and returned in 2013 after spending three years on the sellside as a Director/Institutional Fixed Income Sales. His previous roles at BNY includes head of Trading, Short Duration and Index Strategies for BNY Cash Investment Strategies (CIS) and Fixed Income Research Manager for Mellon Bank's Global Securities Lending Group.

Bryan has an MBA from Carnegie Mellon University, a B.A. from Muhlenberg College and has been in the industry since 2004.

REFERENCES:

[1] Employees of Buy-Side Trading Solutions at BNY, acting as dual officers of Mellon Investments Corporation.

[2] Mellon Investments Corporation (MIC) is a registered investment adviser and subsidiary of The Bank of New York Mellon Corporation. MIC is composed of two divisions; Mellon, which specializes in index management, and Dreyfus, which specializes in cash management and short duration strategies. Securities are offered through BNY Mellon Securities Corporation, a registered broker-dealer and affiliate of MIC. Where applicable, assets include discretionary and non-discretionary assets, and assets managed by investment personnel acting in their capacity as officers of affiliated entities.

[3] "Best" in "best quotes" and "best price" means the most competitive pricing received based on Buy-Side Trading Solutions' side of the trade. If Buy-Side Trading Solutions is buying, "best" means the lowest quote. If selling, "best" means the highest quote.

[4] Data uses an average and is based on trades that Buy-Side Trading Solutions completed.

[5] The 6 Month Fed Fund Futures contract tracks the market expectation of where the Fed Fund rates would be in six months. For more information, visit **https://www.cmegroup.com/markets/interest-rates/stirs/30-day-federal-fund.html**

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