TBAC Presentation to Treasury

Recent events have suddenly and dramatically affected financial markets. Please comment on the evolution of liquidity conditions, both in Treasury market and broader financial markets. What are the primary factors currently driving interest rates, the shape of the yield curve, and relative demand for different maturities? Are these factors structural or temporary? How has the policy response affected liquidity conditions to date, and what other policy measures should be considered?

Executive summary

- Covid-19 brought about a "perfect storm" for financial markets. As the virus spread around the world in February and March, and economic activity began to fall, a large and urgent precautionary cash raise ensued, accompanied by aggressive deleveraging and risk reduction among investor portfolios.
- This resulted in both very high safe haven demand for Treasury bills and substantial liquidity demand evident in the large volume of selling of off-the-run nominal Treasury securities, Treasury Inflation-Protected Securities (TIPS), and Agency Mortgage-Backed Securities (MBS). The acute demand for dealer balance sheet capacity, when those balance sheets already maintained high levels of Treasury debt, also contributed to deteriorating market functioning across a range of securities. Altogether, these forces temporarily impaired the market for Treasury debt, historically the deepest, most liquid market in the world.
- The broad policy response monetary, fiscal, and regulatory has been substantial and has generally improved market functioning. In addition, the policy response has sought to cushion the economic blow and support eventual recovery.
- The challenge ahead for the Treasury securities market is to facilitate the large and rapidly rising deficit financing needs associated with the fiscal policy response to the virus-related economic disruption, and to do so without a decline in market functioning nor unduly high interest rates for Treasury debt. We review the historical sources of demand for US Treasury debt, using the 2008 to 2010 increase in issuance as an example for understanding the potential relative demand for Treasury debt issuance in the coming months.

The evolution of liquidity conditions in US Treasury and broader financial markets

US Primary Dealer holdings of Treasury securities

Average weekly Primary Dealer holdings increased significantly over the past two years and remained relatively elevated in early 2020. A variety of factors contributed to the rise in holdings including passage of the 2017 Tax Cuts and Jobs Act, the 2018 supplemental budget agreement, and the subsequent increase in net Treasury supply as a result of the Fed's redemptions in 2018. Changes in relative demand among investors may have also contributed to rising holdings, as well as Primary Dealer willingness to facilitate client demand for leverage.



Market functioning has periodically come under pressure since 2018

- The last two years have been punctuated by periodic episodes of impaired market functioning attributable to some related and some unrelated factors.
- Treasury futures market depth declined by 50% or more on several occasions over this period, partially influenced by Proprietary Trading Firms' (PTF) response to rising volatility.
- Spreads between on-the-run and off-the-run Treasury securities have abruptly widened several times and quarter-end funding pressures were evident with increased frequency through 2019, both likely related to dealer balance sheet capacity.
- February through April 2020 represented a severe episode of impaired market functioning with extreme observations of these factors and others such as bid-ask spread for Treasury debt.





Note: Measures the average of the amount bid and the amount offered in the top of book (best bid/offer) for the TY futures contract. Source: Goldman Sachs Group Inc, Goldman Sachs Global Investment Research; data as of 04/28/2020.

Spread between SOFR and IOER spiked



Source: New York Fed and Haver Analytics; data as of 04/27/2020

Source: JPMorgan Dataquery; data as of 04/27/2020

Covid-19 represented a "perfect storm" for financial markets

- Early 2020 market conditions were robust with the Fed's Treasury bill purchases stirring debate about reserve expansion, a healthy outlook for global growth, and broad financial asset prices appreciating in a low volatility environment.
- On January 23rd, the city of Wuhan, China was locked down, restricting travel. On the weekend of February 23rd, the outbreak in Italy demonstrated how rapidly the virus was spreading to other continents.
- As the Covid-19 outbreak spread across the United States, more states declared shelter-in-place orders, creating significant disruption to the everyday lives of millions.



Source: National Governors Association, University of Washington IMHE, and Goldman Sachs Global Investment Research. Data as of 04/15/2020. Note: It is a measure of the GDP-weighted share of the country that has shut schools, closed non-essential businesses, and issued stay-at-home orders Source: Goldman Sachs Global Investment Research, National Governors Association, University of Washington IMHE, and Google. Data as of 04/15/2020

The introduction of shelter-in-place policies motivated a large precautionary cash build

- Investors, businesses, and households raised cash amid substantial uncertainty as shelter-in-place policies were introduced.
- Rising financial market volatility led to aggressive (voluntary and involuntary) deleveraging by investors as volatility-based risk measures sharply increased. Margin requirements and repo lending conditions tightened significantly.
- Demand for overseas dollar funding rose substantially.



Source: EPFR; data as of 04/15/2020

Higher margin requirements led to involuntary deleveraging





Source: Bloomberg; as of 04/27/2020. Used a stylized portfolio that consists of 60% S&P 500 and 40% Bloomberg Barclays US Aggregate index. Realized annualized volatility is calculated using daily total return over a 6M rolling window.



Treasury market functioning became impaired

- The widespread, heightened investor demand for cash resulted in acute demand for dealer balance sheet capacity, contributing to wider bid-ask spreads, on-the-run/off-the-run spreads, and declining market depth.
- Treasury market volumes expanded significantly, with heightened investor demand for Treasury bills coinciding with large selling of offthe-run nominal Treasuries and TIPS.
- The increasing number of market participants "teleworking" from remote locations may have contributed to impaired market functioning.



Treasury bid-ask spread at their widest since the crisis

Source: Michael Fleming and Francisco Ruela (NY Fed) calculations, based on data from BrokerTec; as of 04/17/2020



Note: Shows Primary Dealer Weekly Transaction Volume in bills, coupons, and TIPS. Source: New York Fed; data as of 04/22/2020.



Note: Measures the average of the amount bid and the amount offered in the top of book (best bid/offer) for the TY futures contract. Source: Goldman Sachs Group Inc, Goldman Sachs Global Investment Research; data as of 04/28/2020.

TY implied yield vol surged



Source: Bloomberg; data as of 04/28/2020

Risk premiums rose in many markets

- High quality short duration credit instruments declined in price as prime money market funds liquidated securities.
- · Agency mortgage spreads moved wider as levered mortgage sector investors reduced risk.
- Impaired Treasury market functioning contributed to rising risk premia in other securities that are priced based upon a spread to Treasury yields, or that use Treasury yields as the discount rate.
- The S&P 500 suffered the most rapid 35% decline in post war history (23 sessions) from a record high valuation on February 19th, triggering frequent circuit breaker market suspensions during this period.



Widening in corporate and agency MBS spreads



Source: Bloomberg; data as of 04/28/2020. IG spread shows the spread of Bloomberg Barclays US Aggregate Corporate Index, and HY spread shows the spread of Bloomberg Barclays US Corporate High Yield Index. MBS spread shows the spread of Bloomberg Barclays US MBS Index.



Source: Bloomberg and Bank of America; data as of 04/28/2020



Policy responses

Substantial, targeted, and coordinated policy response

- The Fed reduced short term interest rates to 0.0 0.25% on March 15th and indicated the Federal Open Market Committee (FOMC) expects to *"maintain this target range until it is confident that the economy has weathered recent events and is on track to achieve its maximum employment and price stability goals."*¹
- From mid-March through today, the Federal Reserve has directly purchased from dealers nearly \$2 trillion of Treasury securities and Agency MBS to improve market functioning.
- A number of new targeted funding facilities were introduced by the Fed in conjunction with the Treasury Department via the Federal Reserve's 13(3) authority. The breadth of actions was significant and specifically targeted to address funding stresses negatively impacting the provision of credit to real economy.
- In addition, the Fed announced multiple supervisory and regulatory adjustments in conjunction with other financial sector oversight agencies.
- Lastly, Congress delivered substantial fiscal policy support focused on providing relief for lost income to households and small to medium sized businesses.

Policy actions have improved market functioning and constructed a policy safety net that reduces tail risks for financial markets and the real economy

| Operation | Announced | Implemented |
|---|-----------|-------------|
| Technical operations to aid market functioning: | | |
| Treasury purchases to include coupons | 13-Mar | 13-Mar |
| Treasury purchases: "at least \$500 billion" | 15-Mar | 16-Mar |
| MBS purchases: "at least… \$200 billion" | 15-Mar | 16-Mar |
| Treasury and MBS purchases: "in the amounts needed" | 23-Mar | 23-Mar |
| CMBS purchases | 23-Mar | 27-Mar |
| Facilities for liquidity: | | |
| Commercial Paper Funding Facility (CPFF) | 17-Mar | 14-Apr |
| Primary Dealer Credit Facility (PDCF) | 17-Mar | 20-Mar |
| Money Market Mutual Fund Liquidity Facility (MMLF) | 18-Mar | 23-Mar |
| Primary Market Corporate Credit Facility (PMCCF) | 23-Mar | |
| Secondary Market Corporate Credit Facility (SMCCF)* | 23-Mar | |
| Term Asset-Backed Securities Lending Facility (TALF) | 23-Mar | |
| Paycheck Protection Program Liquidity Facility (PPPLF) | 6-Apr | 16-Apr |
| Municipal Liquidity Facility (MLF) | 9-Apr | |
| Actions to support real economy: | | |
| Fed cut policy rate by 50bp to 1.0 – 1.25% | 3-Mar | 3-Mar |
| Fed cut rate by 100bp to the zero lower bound | 15-Mar | 15-Mar |
| Main Street Business Lending Program (MSNLF, MSELF) | 23-Mar | |
| Appraisal guidance for real estate transactions | 14-Apr | 17-Apr |
| Other actions: | | |
| Extending dollar swap lines | 15-Mar | 15-Mar |
| Encouraging use of Discount Window | 15-Mar | 15-Mar |
| FIMA repo facility | 31-Mar | 6-Apr |
| Temporary change to Supplementary Leverage Ratio Rule | 1-Apr | 1-Apr |
| Fiscal policy actions: | | |
| Coronavirus Preparedness and Response Supplemental Appropriations Act | | 6-Mar |
| Families First Coronavirus Response Act | | 18-Mar |
| Coronavirus Aid, Relief, and Economic Security Act (CARES Act) | | 27-Mar |
| Paycheck Protection Program and Health Care Enhancement Act | | 24-Apr |

- Treasury liquidity conditions have improved following the mid-March Fed announcements to cut rates to zero, expand Treasury purchases, and introduce the CPFF, MMLF, and PDCF. As of end of April, both Treasury bidask spread and estimated Treasury yield fitted error (an aggregate measure for dislocations in Treasury securities across the curve) have largely normalized. Treasury market depth has recovered about half of the decline relative to pre-Covid-19 levels.
- Stress in the commercial paper (CP) space took some time to calm. Upon the initial announcement of the CPFF on March 17th, CP-to-OIS spread continued to widen, but started to show signs of stabilization in late March, and has now reversed most of the widening. LIBOR-OIS spread started to tighten in April and has retraced roughly 2/3 of the March widening.
- March 23rd announcements for TALF, PMCCF, SMCCF, and expanding Treasury and MBS purchases "in the amounts needed" marked the widest observation in IG and HY corporate spreads. Since then, IG and HY corporate spreads have tightened and retraced roughly 60% and 50% of the widening respectively. MBS spreads reached the widest observation on March 19th and tightened meaningfully in the second half of March following substantial purchases by the Fed.

Treasury market functioning has improved



Note: Measures the average of the amount bid and the amount offered in the top of book (best bid/offer) for the TY futures contract. Source: Goldman Sachs Group Inc, Goldman Sachs Global Investment Research; data as of 04/28/2020.

Treasury trading volume back to normal levels \$bn - Primary dealer weekly transaction volume in Treasuries \$1200 Mar|23: "in the Mar 15: FOMC cuts target range 100 bps to amounts needed" 0.0 to 0.25% and Desk announces "at least for Tsy purchases \$1000 \$500 billion" of Tsy purchases Mar 17: CPFF and PDCF announced Mar 18: MMLF announced \$800 \$600 Apr 1: Temp \$400 change to SLR \$200 Mar-2020 Jan-2020 Feb-2020 Apr-2020

Note: Shows Primary Dealer Weekly Transaction Volume in bills, coupons, and TIPS. Source: New York Fed; data as of 04/22/2020.



Source: J.P. Morgan; data as of 04/27/2020. It's a measure of the aggregate yield error of all individual bonds relative to the par fitted curve constructed by J.P. Morgan.



1 month implied yield vol has fully recovered

Source: Bloomberg; data as of 04/28/2020

Other markets have also repaired by varying degrees



Source: Bloomberg, Federal Reserve Board and Haver Analytics; data as of 04/28/2020

Corporate and agency MBS spreads



Source: Bloomberg; data as of 04/28/2020. IG spread shows the spread of Bloomberg Barclays US Aggregate Corporate Index, and HY spread shows the spread of Bloomberg Barclays US Corporate High Yield Index. MBS spread shows the spread of Bloomberg Barclays US MBS Index.



Source: Bloomberg and Bank of America; data as of 04/28/2020



Source: Bloomberg; data as of 04/28/2020

Factors impacting the level of interest rates, the shape of the yield curve, and relative demand

US economic activity deteriorated sharply



Source: Department of Labor and Haver Analytics; data as of 04/30/2020

Consumer sentiment falling sharply



Source: University of Michigan, Bloomberg, and Haver Analytics; data as of April 2020



Source: Bureau of Labor Statistics and Haver Analytics; data as of March 2020

PMI points to significant disruption in economic activity



Source: IHS Markit and Haver Analytics; data as of April 2020

The economic outlook has been revised down significantly

The economy is expected to enter a recession

- Following the Covid-19 outbreak and subsequent actions to flatten the virus infection curve, large parts of economies around the world have shut down.
- Growth outlooks have been revised sharply lower. The Bloomberg median now expects a -26% Q/Q annualized decline in US real GDP in 2020 Q2.
- The median unemployment rate projection expects an increase to 12.8% in Q2, and is expected to remain relatively elevated at the end of next year.
- Inflation forecasts were revised down and the distribution of outlooks is skewed to the downside.
- The timing and pace of re-opening remain highly uncertain.





*SAAR: Seasonally Adjusted Annual Rate



GDP expected to contract meaningfully in Q2

Source: Haver Analytics and Bloomberg; latest data as of Q4 2019 for GDP growth and Core PCE inflation, and Q1 2020 for unemployment rate. The range of projections are based on forecasts submitted on Bloomberg, forecast ranges and medians are as of 04/28/2020.

Monetary policy expectations

- Market pricing and survey expectations reflect the Fed's current forward guidance combined with the downgraded economic outlook, which together indicate that an accommodative policy stance will remain necessary for an extended period of time.
- Market-based inflation expectations have declined with the growth outlook and term premium has remained low.



Source: Bloomberg; data as of 04/28/2020

Inflation expectations have declined



Source: Bloomberg; data as of 04/24/2020.

Survey expectations

From a Bloomberg survey* of economists:

| When will the FOMC lift | | | | | |
|--------------------------|--------------|--|--|--|--|
| the target federal funds | Percentage | | | | |
| range off the ZLB? | of responses | | | | |
| By end of 2020 | 3% | | | | |
| H1 2021 | 10% | | | | |
| H2 2021 | 13% | | | | |
| H1 2022 | 16% | | | | |
| H2 2022 | 6% | | | | |
| 2023 or later | 52% | | | | |

Source: Bloomberg; data as of 04/24/2020. *Note: A Bloomberg survey of 31 economists that was conducted from April 20 to April 23, 2020



Source: Bloomberg; data as of 04/28/2020. Note: Estimate for 10-year Treasury term premium is from the New York Fed based on methodology developed by New York Fed economists Tobias Adrian, Richard Crump, and Emanuel Moench (or "ACM"). 19

Treasury debt yields and curve slope

- The level of nominal yields is quite low by historical comparison and the slope of the nominal yield curve is relatively flat, in line with lower expectations for the path of policy rates, low inflation expectations and low term premium.
- US Treasury yields remain higher than other developed market rates but the differential has narrowed as German and Japanese sovereign bond yields have been relatively stable, already at very low or negative levels.



2020

2020

Treasury issuance is expected to rise following the fiscal response to Covid-19

- Given the severity of the shock to growth and income, Congress and the administration have delivered substantial fiscal policy support to cushion the economic blow and support recovery.
- The fiscal response points to the FY 2020 deficit nearly tripling relative to prior estimates, the Congressional Budget Office (CBO) projects \$3.7tn deficit in FY 2020 and \$2.1tn in FY 2021.
- With increased financing needs as implied by those deficit projections, Treasury issuance is expected to grow significantly over the months ahead.

| given recent policies | | | | | | | | |
|--|--------|--------|--|--|--|--|--|--|
| | | | | | | | | |
| Legislation: | FY2020 | FY2021 | | | | | | |
| CBO Deficit, prior projection ¹ | 1,073 | 1,002 | | | | | | |
| Families First Act ² | 135 | 57 | | | | | | |
| CARES Act ² | 1,606 | 450 | | | | | | |
| PPP & HCE Act ² | 435 | 43 | | | | | | |
| Lost revenue ³ | 475 | 550 | | | | | | |
| Subtotal | 3,723 | 2,101 | | | | | | |

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Notes: numbers are \$, in billions. FY ends Sept 30.

Sources: 1. CBO March 2020 budget update (prior to Covid-19 outbreak) 2. CBO scoring of FFA, CARES Act, PPP and Health Care Enhancement Act, and April 24 budget update (CBO56335) 3. Estimated based upon the April 24 budget update (CBO56335).



Source: Haver Analytics; data as of December 2019. Note: Treasury net supply computed as annual change in marketable Treasury securities held by the public

Identifying buyers of increased Treasury issuance

- Total Treasury debt outstanding grew by approximately \$14 trillion since 2008. Roughly 1/3 of that was absorbed by foreign investors with the
 remaining 2/3 absorbed by domestic investors. Over the past two years, foreign investors' demand has slowed and domestic investors took an
 increased share with households the largest source of recent demand.*
- The 2008-2010 period may provide helpful context as marketable Treasury debt outstanding nearly doubled in those three years (\$4.5tn to \$8.9tn). Foreign investors and domestic households together absorbed roughly 70% of the net issuance over those three years, 45% and 25% respectively. Money market funds along with brokers and dealers bought a meaningful amount of Treasuries in 2008 as issuance ramped higher, subsequently becoming net sellers in the following two years.
- Given the fiscal response to Covid-19, the FY2020 deficit projection has increased significantly, pointing to a large and rapid increase in Treasury net supply. We review each of these buyer bases in turn in an attempt to discern where the marginal demand may exist to absorb increased Treasury issuance.

Annual Treasury net purchase, breakdown by investor type

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Sum ('08 | to '19) | Sum (20 | 018&19) |
|---------------------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|----------|---------|---------|---------|
| Net purchase of Tsy | 56 | 282 | 423 | 403 | 347 | 219 | 271 | 1,302 | 1,506 | 1,645 | 1,138 | 1,181 | 858 | 736 | 724 | 843 | 447 | 1,411 | 1,177 | 12,968 | 100% | 2,588 | 100% |
| Foreign investors | 19 | 161 | 276 | 367 | 245 | 150 | 165 | 712 | 554 | 740 | 355 | 590 | 423 | 314 | 43 | (108) | 308 | 115 | 181 | 4,227 | 33% | 295 | 11% |
| Domestic investors | 36 | 119 | 147 | 37 | 102 | 69 | 105 | 591 | 951 | 905 | 782 | 591 | 434 | 422 | 682 | 951 | 139 | 1,296 | 996 | 8,740 | 67% | 2,292 | 89% |
| Household | (98) | (94) | (29) | (27) | (172) | (103) | (139) | 290 | 498 | 282 | (106) | 145 | (142) | (200) | 327 | 101 | (41) | 613 | 322 | 2,088 | 16% | 935 | 36% |
| Fed | 40 | 78 | 37 | 51 | 26 | 35 | (38) | (265) | 301 | 245 | 642 | 59 | 550 | 237 | (16) | (13) | (22) | (243) | 100 | 1,575 | 12% | (143) | -6% |
| State & local govt | 19 | 27 | 25 | 30 | 134 | 67 | 61 | (98) | 45 | 16 | (58) | 34 | 31 | 5 | 7 | 74 | (9) | (62) | (45) | (61) | 0% | (107) | -4% |
| Banks ¹ | (20) | 41 | 5 | (27) | (7) | 1 | 10 | (21) | 95 | 102 | (47) | 88 | (28) | 192 | 38 | 122 | (37) | 124 | 125 | 754 | 6% | 249 | 10% |
| Insurance ² | 1 | 47 | 5 | 20 | 15 | (4) | (58) | 14 | 52 | 24 | 16 | (2) | (8) | 21 | 6 | 32 | 33 | (21) | (15) | 151 | 1% | (36) | -1% |
| Pension ³ | 36 | 8 | 47 | 57 | 63 | 49 | 33 | 70 | 115 | 127 | 110 | 148 | 123 | 113 | 56 | 170 | 34 | 427 | 193 | 1,686 | 13% | 620 | 24% |
| Money mkt funds | 49 | 4 | (11) | (30) | (15) | (6) | 97 | 409 | (176) | (72) | 110 | 14 | 38 | (72) | 53 | 312 | (95) | 171 | 163 | 855 | 7% | 334 | 13% |
| Mutual funds & ETF ⁴ | (8) | 9 | 17 | 26 | 28 | 8 | 11 | 7 | 124 | 140 | 42 | 99 | (60) | 206 | 169 | 105 | 215 | 128 | 158 | 1,335 | 10% | 286 | 11% |
| Brokers & dealers | 15 | (28) | 55 | (73) | (14) | 4 | 98 | 212 | (116) | (14) | 66 | 67 | (72) | (92) | 16 | 36 | 22 | 139 | (73) | 192 | 1% | 66 | 3% |
| Other ⁵ | 2 | 27 | (5) | 10 | 43 | 20 | 29 | (29) | 14 | 55 | 8 | (59) | 2 | 11 | 25 | 11 | 39 | 21 | 68 | 166 | 1% | 89 | 3% |

Aggregated from the Fed's Z.1 Flows of Funds transaction data (F.210 table):

Market levels for reference (annual average)

| 2Y Tsy yield (avg, %) | 3.8 | 2.6 | 1.6 | 2.4 | 3.8 | 4.8 | 4.4 | 2.0 | 0.9 | 0.7 | 0.4 | 0.3 | 0.3 | 0.4 | 0.7 | 0.8 | 1.4 | 2.5 | 2.0 |
|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 10Y Tsy yield (avg, %) | 5.0 | 4.6 | 4.0 | 4.3 | 4.3 | 4.8 | 4.6 | 3.6 | 3.2 | 3.2 | 2.8 | 1.8 | 2.3 | 2.5 | 2.1 | 1.8 | 2.3 | 2.9 | 2.1 |
| 2s10s Tsy curve (avg, br | 120 | 199 | 237 | 190 | 44 | -2 | 27 | 165 | 230 | 250 | 232 | 151 | 203 | 208 | 145 | 100 | 93 | 38 | 16 |

Source: Flows of Funds transaction data in F.210 table. Note: 1) Sum of U.S.-chartered depository institutions, foreign banking offices in US, banks in US-affiliated areas, and credit unions. 2) Sum of property-casualty insurance companies and life insurance companies. 3) Sum of private pension funds, state and local govt retirement funds, and federal govt retirement funds. 4) Sum of mutual funds, closeend funds, and exchange-traded funds. 5) Includes nonfinancial corporate business, nonfinancial noncorporate business, government-sponsored enterprises, ABS issuers, and holding companies. *Over the past two years pension was the 2nd largest source of demand but roughly 2/3 of the pension purchase was by Federal govt retirement funds which primarily hold non-marketable Treasury securities.

Foreign Investors

- · Foreign official demand has remained relatively stable in recent years, following a period of strong growth in the years after the financial crisis.
- Foreign private investor demand has been steady despite minimal FX-hedged yield pickup from Treasury securities. Of note, demand for intermediate to longer maturity US credit products has been reasonably robust.
- Foreign holdings of Treasury coupon securities are concentrated in front-end and belly maturities, with over 60% of the holdings maturing within 5 years.
- Foreign investors (official and private) would need to substantially increase the recent pace of purchases to replicate their share of purchases from the 2008-10 experience.



Maturity structure of foreign-held Treasury coupon securities



Source: TIC data; maturity structure as of June 2019

FX-hedged yield pickup of 10y Treasuries



Source: Bloomberg; data as of 04/28/2020

Brokers and Dealers

- Brokers and dealers are historically the initial absorption mechanism for unexpected increases in Treasury issuance.
- Brokers and dealers purchased roughly 15% of Treasury issuance in 2008, a substantial increase in share of purchases relative to their historical average. Their holdings declined in 2009-2010 as securities matured or were intermediated to other investors.
- The Fed's purchases of roughly \$1.5 trillion Treasury securities since mid-March have created a substantial net negative supply of Treasury coupon securities net of Fed purchases.
- Recent Treasury bill supply has been robust, generating a significant positive net supply of Treasury bills net of Fed purchases. As a result, dealer holdings of Treasury bills have increased sharply.



Source: Haver Analytics and Federal Reserve. April 2020 supply estimate from Morgan Stanley

Source: New York Fed and Bloomberg; data as of April 2020

Domestic Banks

- In 2008 to 2010, banks played a modest role in absorbing the increase in Treasury issuance. However, during the 1940's "Wartime Finance" era, banks played an important role in absorbing Treasury debt issuance, and holdings rose to over 50% of insured commercial bank assets, even while the Treasury and the Fed cooperated to cap Treasury yields.
- More recently, Treasury holdings have represented a small share of bank assets. As the Fed's recent open market operations (OMO) and lending efforts have added substantial reserves to the banking system, the composition of bank assets has changed meaningfully. Conditional upon leverage constraints and the yield spread to funding costs, banks represent a potential source of demand for Treasury bills and shorter maturity Treasury debt.
- The Fed temporarily exempted Treasuries and reserves from its supplementary leverage ratio (SLR) rule on April 1st, saying, "restrictions that accompany this balance sheet growth may constrain the firms' ability to continue to serve as financial intermediaries and to provide credit to households and businesses. The change to the supplementary leverage ratio will mitigate the effects of those restrictions and better enable firms to support the economy."



Source: Federal Deposit Insurance Corporation and Haver Analytics; data as of 08/29/2019



Note: Cash assets includes vault cash, cash items in process of collection, balances due from depository institutions, and balances due from Federal Reserve Banks. Source: Federal Reserve Board and Haver Analytics; data as of 04/24/2020

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Domestic Corporate Pensions

- Demographic trends point to continued steady demand for intermediate to longer maturity Treasuries from defined contribution plans.
- The de-risking trend among domestic defined benefit corporate pension plans seems likely to continue. The majority of those plans are actively executing or considering a de-risking glide-path that increases the fixed income allocation. The Treasury allocation is typically concentrated in longer maturities.
- Pension plans' recent share of purchases has increased, and that demand can be less price sensitive conditional upon other factors.



Source: Milliman 2019 Corporate Pension Funding Study

Domestic Households

- Households represented a large source of demand for Treasury issuance in the 2008-2010 period although nominal and real interest rates were significantly higher during that time.
- Price appreciation potential has declined as a consequence of lower rates, unless Treasuries trade with negative yields.
- The probability of a negative annual mark-to-market return in the US Treasury Aggregate Bond index is again above 40%, similar to the post-GFC period of aggressive monetary policy forward guidance. Household demand stalled during the 2011-2014 period.
- The stock-bond correlation remains negative, but hedge effectiveness of Treasuries declines as price appreciation potential is reduced.



Estimated probability of mark-to-market loss over one year



Source: Bloomberg, data as of 4/22/2020. Computed assuming a normal distribution with the index's yield-to-maturity (currently 0.5%) as mean, and long-term annualized volatility of the index's daily price return (4.6% annualized vol) as standard deviation.

Price return potential calculation

| | Estimated price return if yield goes to zero | | | | | | | |
|---------|--|------------------|--|--|--|--|--|--|
| | As of 4/28/2020 | As of 06/30/2009 | | | | | | |
| 2y Tsy | 0% | 2% | | | | | | |
| 5y Tsy | 2% | 13% | | | | | | |
| 10y Tsy | 6% | 34% | | | | | | |
| 30y Tsy | 33% | 109% | | | | | | |
| Tsy Agg | 4% | 14% | | | | | | |

Source: Bloomberg, JPMorgan Dataquery; Price return estimate is calculated using the modified duration and convexity for on-the-run Treasuries and the Bloomberg Barclays US Aggregate Treasury Index.



Source: Bloomberg; data as of 4/24/2020

Domestic Investment Funds

- For US fixed income mutual funds and ETFs that are benchmarked to various aggregate bond indices, the weight of Treasuries in the benchmark plays an important role in their Treasury allocation. The share of Treasuries in US Aggregate Bond index has been increasing over the past few years, and may increase further with rising Treasury issuance.*
- The pace of bond fund inflows has been robust for a decade, a significant source of demand for intermediate maturities.
 Investment funds will need to maintain their share of purchases at current valuations to replicate the 2008-2010 experience.



Cumulative Flows into Bond and Equity Funds 2,000 bn Equity funds Bond funds 1,500 bn 1,000 bn 500 bn 0 br 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 Weekly flows into bond funds (\$bn) 40 bn 20 bn and a state of the s 0 bn -20 bn -40 bn -60 bn -80 bn -100 bn -120 bn

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Source: Bloomberg, data as of 04/28/2020

Source: EPFR, data as of 04/15/2020

*Note: weight is based on the amount of outstanding Treasuries (excluding Fed's holdings) with maturity >= 1 year

Flows into bond and equity funds

Money Market Funds

- As of Q4 2019, 28% of assets held by money market funds were Treasury securities (17% in Treasury bills and 11% in Treasury front-end coupon securities).
- Money market funds have seen large inflows in the past two months, in part a result of the precautionary cash build. The three-month Treasury bill yield followed expectations for the policy rate lower, and traded negative in late March amid increased demand.
- Looking back at the 2008-2010 experience, money market funds saw strong inflows in the financial crisis, and they absorbed a meaningful share of the increase in Treasury bills outstanding in 2008. In 2009-2010 they experienced outflows as bill yields remained near zero.
- One notable development in recent years is that as a result of the money market fund reform, there has been a shift from prime money market funds to government money market funds, suggesting that an increased share of inflows will be invested in Treasuries.



Source: ICI, Bloomberg; data as of 04/29/2020

*Note: Based on Flows of Funds holdings data as of Q4 2019.

The Federal Reserve

- The Fed has committed to maintain market functioning and support the recovery to full employment and target inflation.
- The Fed demonstrated the elastic nature of its balance sheet throughout the 2008-2014 period, maintaining a relatively large share of Treasury purchases to reinforce accommodative financial conditions.
- Since mid-March, the Fed has once again demonstrated this elasticity by purchasing roughly \$1.5 trillion Treasury securities and close to \$600 billion MBS. The pace of Treasury purchase has gradually slowed from \$75 billion/day (\$375 billion/week) to \$8 billion/day (\$40 billion/week*). Nonetheless, the recent pace of OMO's significantly exceeds the pace of Treasury purchases seen in LSAP/ QE programs over the past decade.

Fed's Treasury holdings increased sharply in recent weeks



Source: Federal Reserve Board and Haver Analytics; data as of 04/30/2020 *Note: based on New York Fed's announcement on 05/01/2020

Recent purchase pace compared to prior QEs

| | | | Total purch | ased (\$ bn) |
|-----|---|----------------------|----------------|--------------|
| | | | Tsy securities | Agency MBS |
| QE1 | | Dec 2008 to Mar 2010 | \$300 | \$1,250 |
| QE2 | | Nov 2010 to Jun 2011 | \$600 | |
| QE3 | | Sep 2012 to Oct 2014 | \$790 | \$823 |
| OMO |) | Mar 13, 2020 to Now | \$1,469 | \$594 |



Source for table: Federal Reserve Bank of New York; data as of 04/28/2020 Source for graph: Federal Reserve Board and Haver Analytics; data as of 04/23/2020

Conclusions

- > Q1 2020 witnessed a "perfect storm" with respect to market functioning as the Covid-19 virus spread around the world. Real economic activity collapsed in many countries, and substantial uncertainty exists with respect to the timing and pace of recovery.
- An urgent precautionary cash build led to acute demand for dealer balance sheet capacity, contributing along with other factors to an eventual impairment of Treasury market functioning.
- The broad policy response monetary, fiscal and regulatory has been substantial, targeted and coordinated. Actions taken have improved market functioning and reduced tail risks for financial markets and the economy.
- Treasury borrowing needs are now rising rapidly as a consequence of the fiscal policy response. CBO projects deficits of \$3.7 trillion and \$2.1 trillion in FY 2020 and 2021 respectively.
- > The challenge ahead is to establish a regime that allows large deficit financing needs to be met without a decline in market functioning nor unduly high interest rates for Treasury debt. A review of the 2008-2010 period may be instructive as outstanding Treasury debt doubled during this time.
- > Questions for consideration:
 - Will foreign investors maintain their share of Treasuries outstanding as issuance grows in the future?
 - What additional facilities or regulatory changes may be necessary to support primary dealers absorbing Treasury issuance similar to the 2008 observation?
 - Are there regulatory adjustments that could encourage domestic banks to hold more Treasuries without crowding out lending activities?
 - Could potential changes in market structure improve the durability of liquidity provision across the range of Treasury securities during periods of elevated volatility?
 - Will the outlook for growth and inflation improve such that nominal interest rates move higher without negatively impacting financial conditions, thereby attracting increased demand for Treasuries among more price sensitive domestic buyers?