Treasury Presentation to TBAC

Office of Debt Management

Fiscal Year 2022 Q3 Report

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Section I:
Executive Summary

Highlights of Treasury's August 2022 Quarterly Refunding Presentation to the Treasury Borrowing Advisory Committee (TBAC)

Receipts and Outlays through Q3 FY2022

- Through Q3 FY2022, receipts were $3.835 trillion, $779 billion (26%) higher than the same period last year. Withheld & FICA taxes were up $334 billion (17%) due to rising wages and employment, the required repayment by early January 2022 of 50% of the employer portion of the FICA taxes deferred under the CARES Act between March and December 2020, and the impact of the deferral lowering FY2021 FICA taxes received in October through December of 2020. Non-withheld and SECA taxes were $312 billion (42%) higher, buoyed by an exceptionally large final payment of 2021 tax liabilities in April that include elevated liabilities on realized capital gains as well as other factors. Gross corporate taxes were $41 billion (14%) higher due to higher corporate profits. Federal Reserve earnings were $24 billion (35%) higher. Miscellaneous and other social insurance was $19 billion (24%) higher due primarily to large Unemployment Trust Fund deposits. Customs duties were up $16 billion (25%) due to the recovery in international commerce. Gross excise taxes were $9 billion (17%) higher than last year with the largest difference stemming from highway excise taxes. Fiscal-year-to-date, receipts were 20.7% of GDP, compared to 18.2% for the same period last year.

- Through Q3 FY2022, outlays were $4.350 trillion, $944 billion (-18%) lower than the same period last year. Department of Treasury outlays were $447 billion (-32%) lower due to lower Economic Impact Payments and Covid relief payments of $702 billion, partially offset by tax credits increasing by $123 billion and higher interest on the public debt of $102 billion. Department of Labor outlays were $286 billion (-87%) lower due to the reduction in unemployment and expiration of expanded benefits attributable to the COVID-19 pandemic. Small Business Administration outlays were $303 billion (-93%) lower primarily due to the recognition of higher subsidy costs in FY2021 than in FY2022. Health and Human Services outlays were $106 billion (10%) higher mainly due to increases in Medicare and Medicaid. Social Security Administration outlays were $59 billion (7%) higher due to increases in the number of beneficiaries and in the average benefit amount. Department of Education outlays were $25 billion (20%) higher due to increased spending on emergency grants to the Education Stabilization Fund to support K-12 and postsecondary education. Other outlays were $95 billion (-24%) lower due to lower net outlays for the Federal Communications Commission Spectrum Auctions (-$77 billion). Fiscal-year-to-date, outlays were 23.5% of GDP, compared to 31.6% for the same period last year.

Projected Net Marketable Borrowing

- Treasury's Office of Fiscal Projections (OFP) currently forecasts a net privately-held marketable borrowing need of $444 billion for Q4 FY2022, with an end-of-September cash balance of $650 billion. For Q1 FY2023, OFP forecasts a net privately-held marketable borrowing need of $400 billion and end-of-December cash balance of $700 billion. These borrowing estimates are based upon current law and do not include any assumptions for the impact of additional legislation that may be passed.

Demand for Treasury Securities

- Bid-to-cover ratios for all securities were within historical ranges over the last quarter.
- Foreign demand remained stable.

Section II: Fiscal
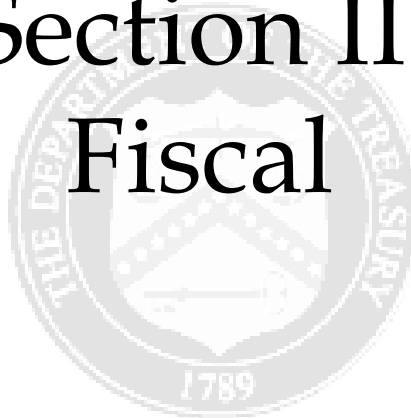
Quarterly Tax Receipts
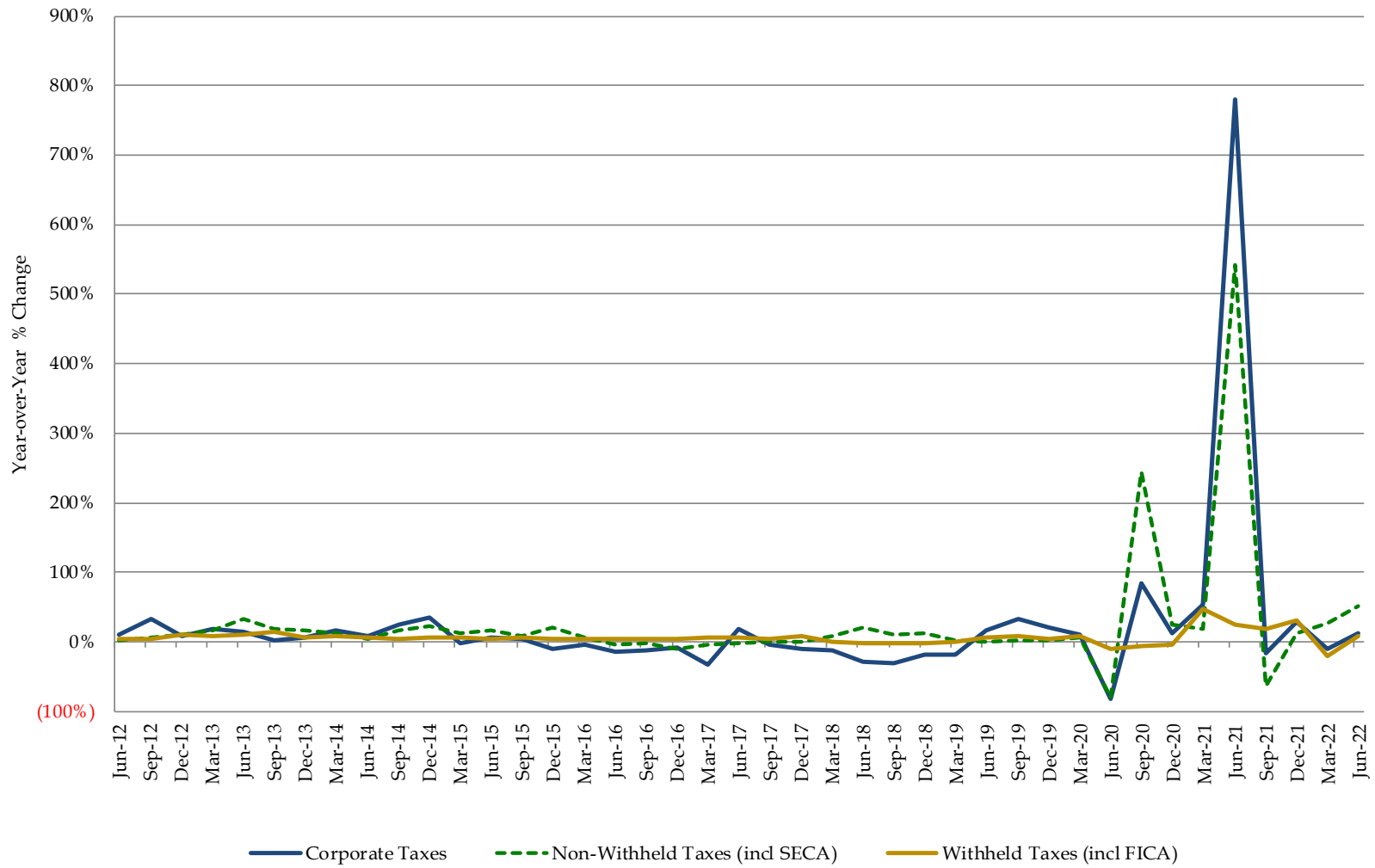
Quarterly tax receipts for Q4 FY2020 reflect the adjustment of April and June 2020 tax deadlines to July 15th, 2020.
Source: United States Department of the Treasury

Monthly Receipt Levels
(12-Month Moving Average)
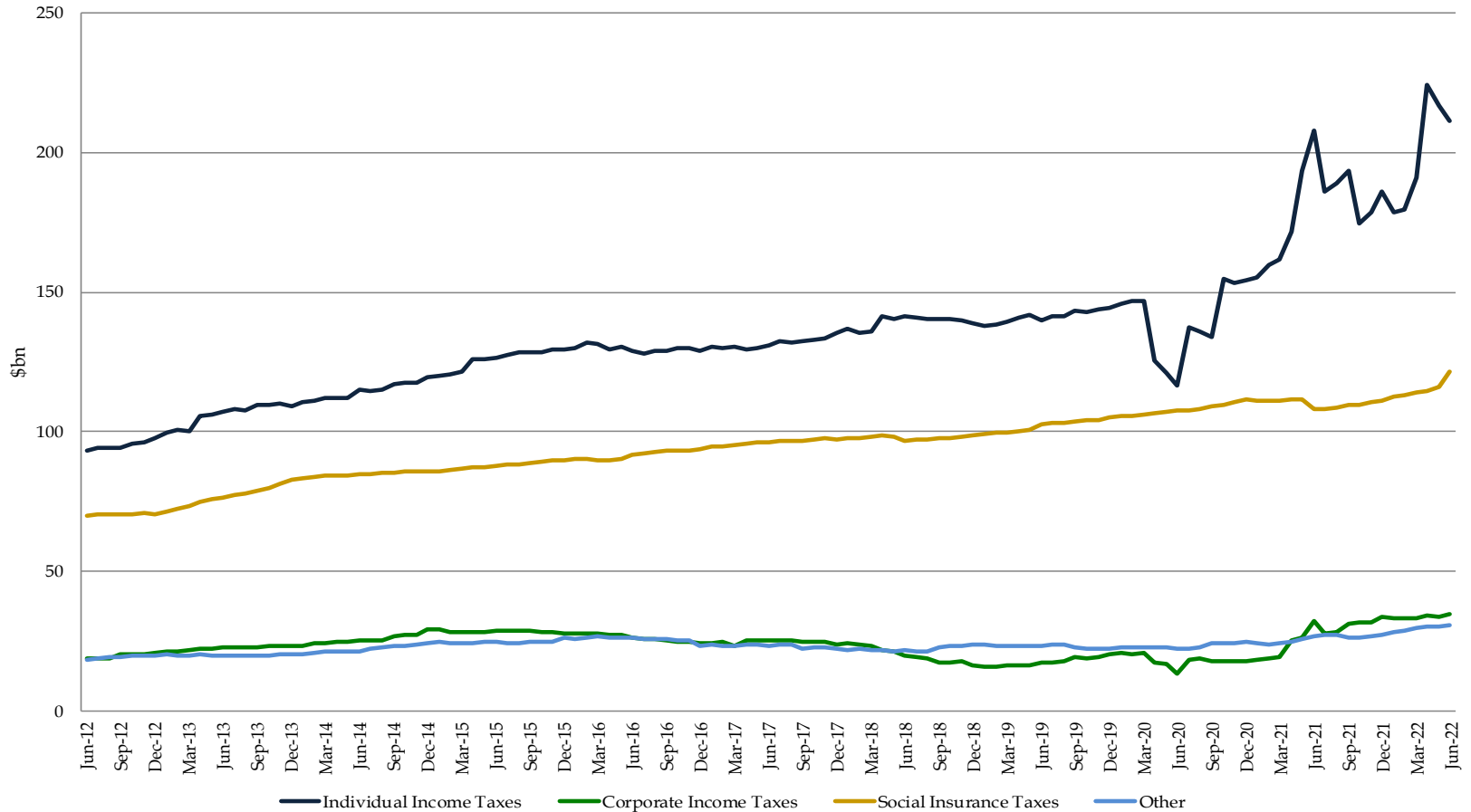
Quarterly tax receipts for Q4 FY2020 reflect the adjustment of April and June 2020 tax deadlines to July 15th, 2020. Individual Income Taxes include withheld and non-withheld. Social Insurance Taxes include FICA, SECA, RRTA, UTF deposits, FUTA and RUIA. Other includes excise taxes, estate and gift taxes, customs duties and miscellaneous receipts.
Source: United States Department of the Treasury

Largest Outlays

Source: United States Department of the Treasury

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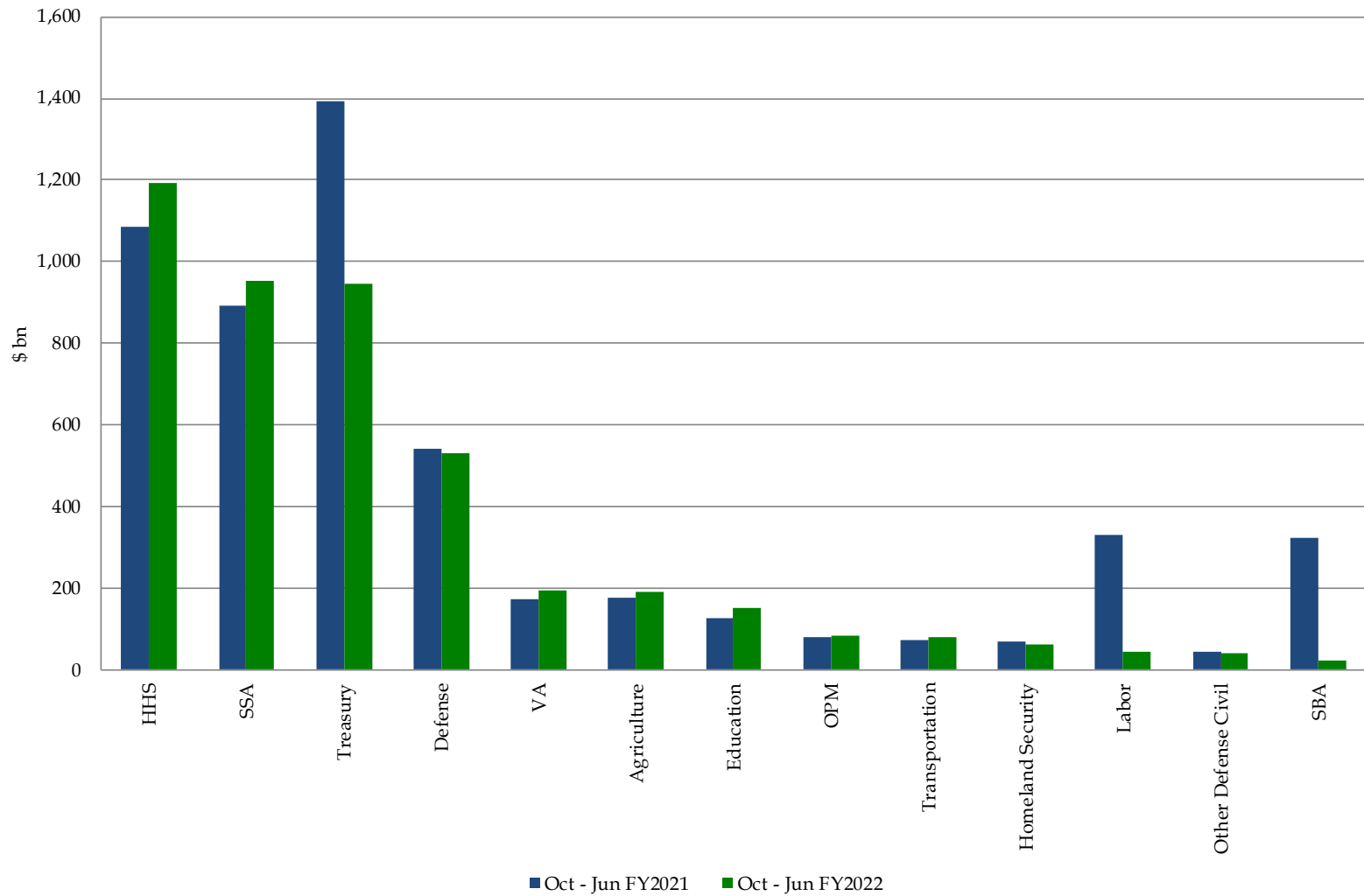
Treasury Net Nonmarketable Borrowing
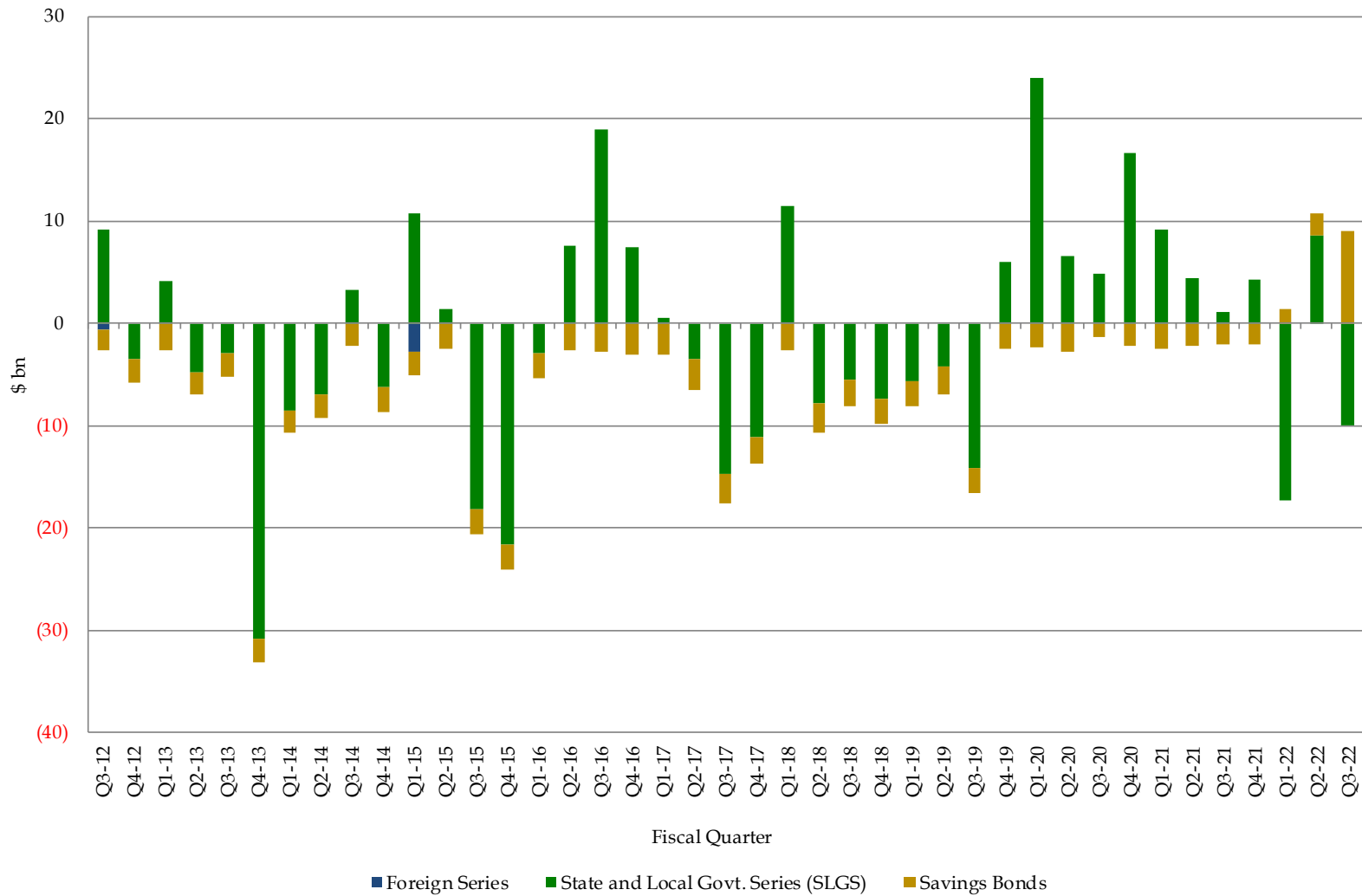
Source: United States Department of the Treasury

Cumulative Budget Deficits by Fiscal Year
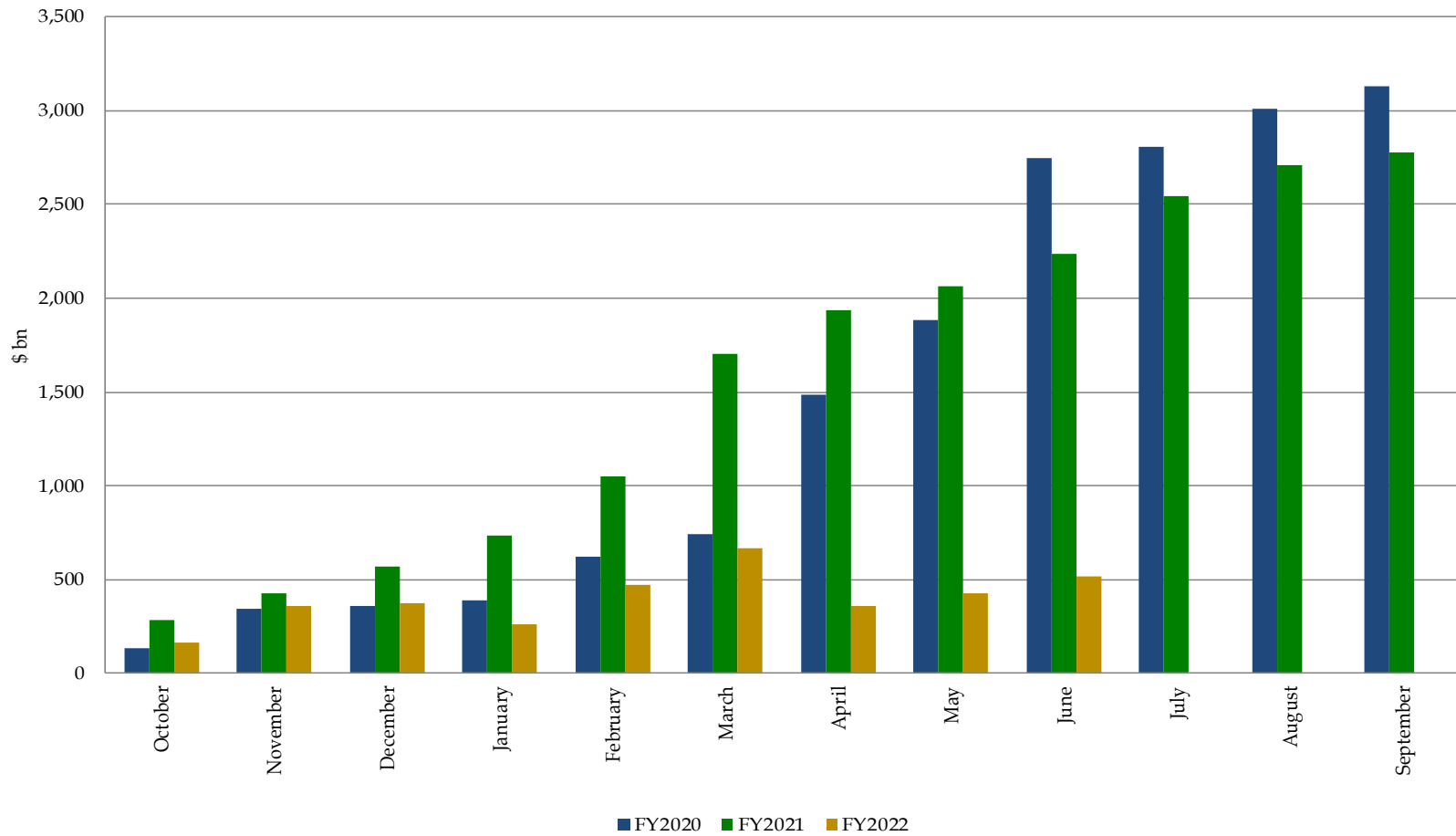
Source: United States Department of the Treasury

Privately-Held Net Marketable Borrowing Definition and Calculation Example

FY 2018 Actual Deficits and
Privately-Held Net Marketable Borrowing, in $ billions

	FY 2018 Actual
FY 2018 Deficit	779
FY 2018 + Change in Cash Balance	225
FY 2018 + Other Means of Financing (e.g. Direct Loans)	35
FY 2018 **= Total Net Marketable Borrowing**	1,039
FY 2018 + SOMA Redemption	156
FY 2018 **= Privately-Held Net Marketable Borrowing**	1,195

- Actual deficits are sourced from the Monthly Treasury Statement.
- Actual change in cash balance is sourced from the Daily Treasury Statement. Change in cash balance = cash balance of Sept 28, 2018 - cash balance of Sept 29, 2017
- Other Means of Financing include cash flows associated with federal credit programs, such as those related to student loans and loans to small businesses.
- Privately-Held Net Marketable Borrowing = Total Net Marketable Borrowing + SOMA Redemption
- SOMA redemption is the amount that the Federal Reserve redeems securities that Treasury has to replace with privately-held marketable borrowing. Actual SOMA redemptions amounts is from the Sources and Uses Reconciliation Table.
- Actual Privately-Held Net Marketable Borrowing is from the Sources and Uses Reconciliation Table.

FY 2022-2024 Deficits and Privately-Held Net Marketable Borrowing Estimates*, in $ billions

	Primary Dealer[1]			OFP[2]	OMB[3]	CBO[4]
	25th	Median	75th			
FY 2022 Deficit	800	916	1,000		1,415	1,036
FY 2023 Deficit	900	1,000	1,060		1,154	984
FY 2024 Deficit	900	965	1,083		1,200	1,056
FY 2022 Change in Cash Balance	435	435	485	435	535	350
FY 2023 Change in Cash Balance	-75	0	0		0	0
FY 2024 Change in Cash Balance	0	0	0		0	0
FY 2022 Total Net Marketable Borrowing				1,658	2,552	1,889
FY 2023 Total Net Marketable Borrowing					1,197	1,020
FY 2024 Total Net Marketable Borrowing					1,238	1,024
FY 2022 SOMA Redemption	150	150	180	150		
FY 2023 SOMA Redemption	720	720	720			
FY 2024 SOMA Redemption	113	405	590			
FY 2022 Privately-Held Net Marketable Borrowing	1,450**	1,700**	1,751**	1,808	2,602**	2,124**
FY 2023 Privately-Held Net Marketable Borrowing	1,450	1,620	1,825		1,917**	1,740**
FY 2024 Privately-Held Net Marketable Borrowing	1,032	1,300	1,632		1,643**	1,429**
Estimates as of:		Jul-22		Aug-22	Mar-22	May-22

[1] Estimates represent the medians/interquartile ranges from the primary dealer survey in July 2022.
[2] Treasury's Office of Fiscal Projections (OFP) borrowing estimates announced on August 1, 2022.
[3] OMB projections are using estimates are from Table S-1 of "Budget of The U.S. Government Fiscal Year 2023," March 2022.
[4] CBO projections are using estimates are from Table 1-1 of "The Budget and Economic Outlook: 2022 to 2032," May 2022.
*Privately-held marketable borrowing excludes rollovers (auction "add-ons") of Treasury securities held in the Federal Reserve System Open Market Account (SOMA) but includes financing required due to SOMA redemptions. Secondary market purchases of Treasury securities by SOMA do not directly change net privately-held marketable borrowing but, all else equal, when the securities mature and assuming the Fed does not redeem any maturing securities, would increase the amount of cash raised for a given privately-held auction size by increasing the SOMA "add-on" amount.
**Both OMB and CBO borrowing estimates are normalized to privately-held net borrowing after adding PD survey median SOMA redemption assumptions for FY22/23/24. In addition, all the PD, CBO and OMB's FY22 privately-held net borrowing estimates are normalized with OFP's FY22 ending cash balance of $650 billion.

Budget Surplus/Deficit*

Legend:
- OMB's (Mar 22) Surplus/Deficit (LHS)
- CBO's (May 22) Surplus/Deficit (LHS)
- PD Survey median estimates (Jul 22) (LHS)
- OMB's (Mar 22) Surplus/Deficit as a % of GDP (RHS)
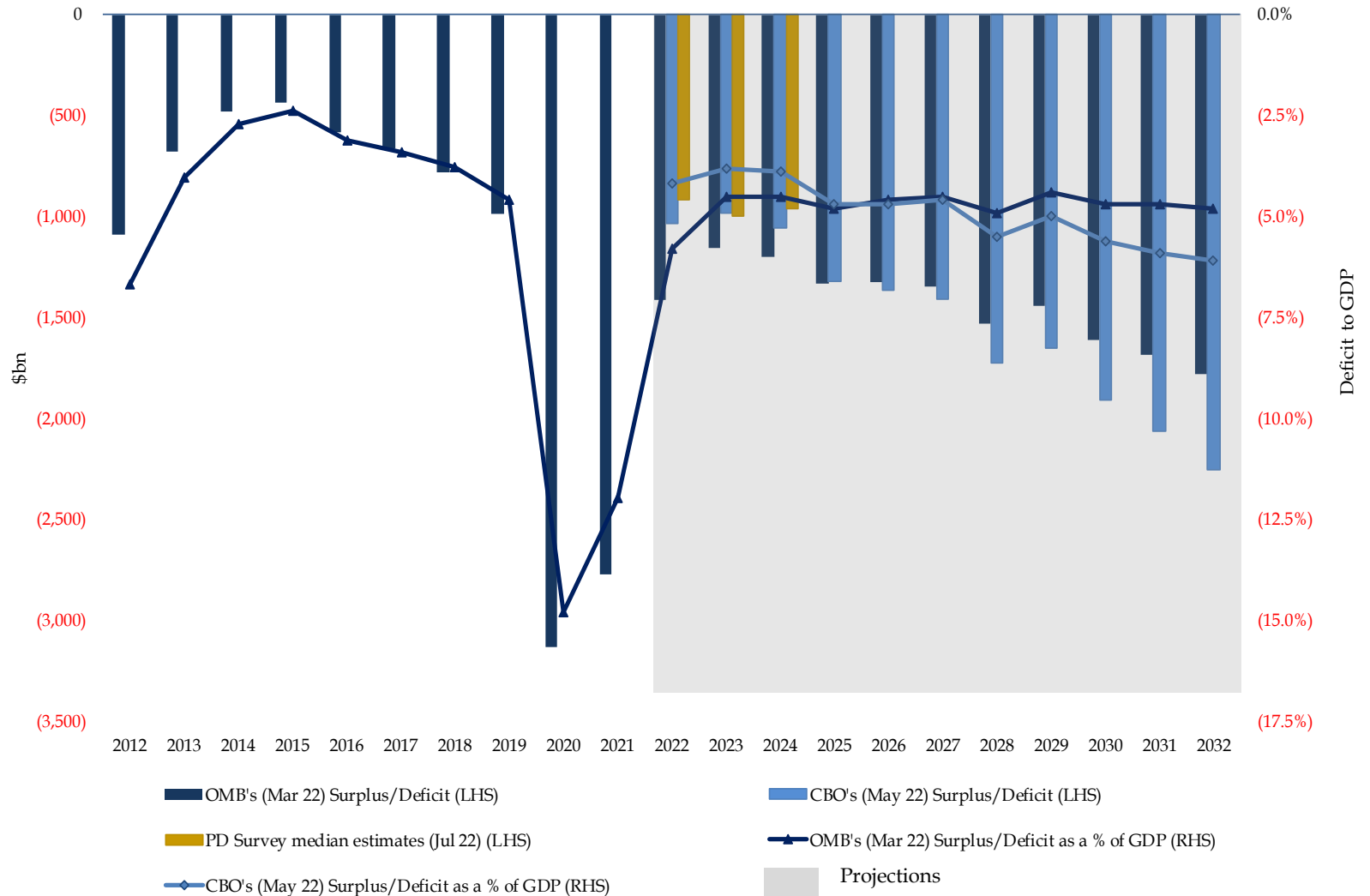- CBO's (May 22) Surplus/Deficit as a % of GDP (RHS)
- Projections

*OMB's projections are from OMB's Table S-1 of "Budget of The U.S. Government Fiscal Year 2023," March 2022.
CBO's deficit projections are using estimates from CBO's Table 1-1 of "The Budget and Economic Outlook: 2022 to 2032," May 2022.

Privately-Held Net Marketable Borrowing Outlook*
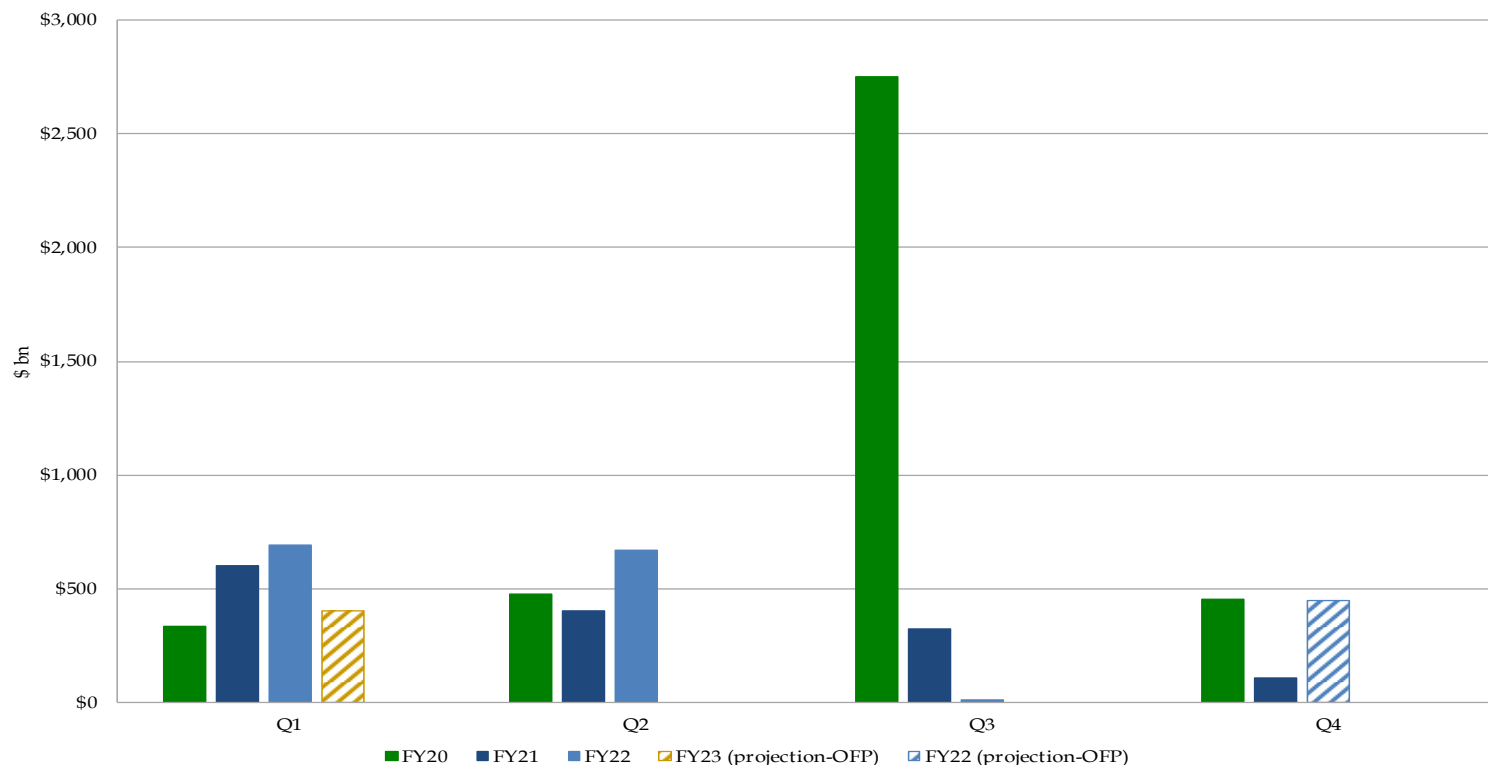
*Privately-held marketable borrowing excludes rollovers (auction "add-ons") of Treasury securities held in the Federal Reserve System Open Market Account (SOMA) but includes financing required due to SOMA redemptions. Secondary market purchases of Treasury securities by SOMA do not directly change net privately-held marketable borrowing but, all else equal, when the securities mature and assuming the Fed does not redeem any maturing securities, would increase the amount of cash raised for a given privately-held auction size by increasing the SOMA "add-on" amount. These borrowing estimates are based upon current law and do not include any assumptions for the impact of additional legislation that may be passed.

Section III: Financing

Assumptions for Financing Section (pages 17 to 21)

- Portfolio and SOMA holdings as of 06/30/2022.
- Estimates assume private announced issuance sizes and patterns remain constant for nominal coupons, TIPS, and FRNs given changes made before the August 2022 refunding, while using total bills outstanding of ~$3.52 trillion.
- The principal on the TIPS securities was accreted to each projection date based on market ZCIS levels as of 06/30/2022.
- No attempt was made to account for future financing needs.
- Privately-held net marketable borrowing excludes rollovers (auction "add-ons") of Treasury securities held in the Federal Reserve System Open Market Account (SOMA) but includes financing required due to SOMA redemptions. Secondary market purchases of Treasury securities by SOMA do not directly change net privately-held marketable borrowing but, all else equal, when the securities mature and assuming the Fed does not redeem any maturing securities, would increase the amount of cash raised for a given privately-held auction size by increasing the SOMA "add-on" amount.
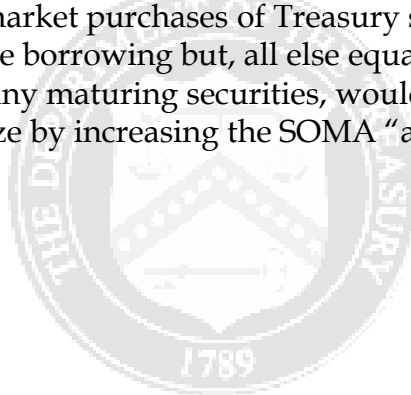
Sources of Privately-Held Financing in FY22 Q3

April - June 2022	
Net Bill Issuance	(405)
Net Coupon Issuance	412
Subtotal: Net Marketable Borrowing	7
Ending Cash Balance	782
Beginning Cash Balance	652
Subtotal: Change in Cash Balance	131
Net Implied Funding for FY 2022 Q3*	(124)

Security	April - June 2022 Bill Issuance			Fiscal Year-to-Date Bill Issuance		
	Gross	Maturing	Net	Gross	Maturing	Net
4-Week	455	485	(30)	1,375	1,305	70
8-Week	390	440	(50)	1,220	1,225	(5)
13-Week	627	774	(147)	2,100	2,139	(39)
26-Week	567	630	(63)	1,854	1,965	(111)
52-Week	102	102	(0)	340	340	(0)
CMBs						
17-Week	390	505	(115)	1,365	1,380	(15)
CMBs	0	0	0	675	765	(90)
Bill Subtotal	2,531	2,936	(405)	8,929	9,119	(190)

Security	April - June 2022 Coupon Issuance			Fiscal Year-to-Date Coupon Issuance		
	Gross	Maturing	Net	Gross	Maturing	Net
2-Year FRN	68	62	6	214	172	42
2-Year	141	111	30	471	305	166
3-Year	135	73	62	453	227	226
5-Year	144	78	66	480	235	245
7-Year	126	78	48	453	228	225
10-Year	103	23	80	323	91	232
20-Year	47	0	47	169	0	169
30-Year	61	0	61	197	9	188
5-Year TIPS	38	40	(2)	74	40	34
10-Year TIPS	14	0	14	58	40	18
30-Year TIPS	0	0	0	9	0	9
Coupon Subtotal	877	465	412	2,901	1,348	1,553

Total	3,408	3,401	7	11,830	10,467	1,363

*By adjusting the change in cash balance, Treasury arrives at the net implied funding number.

Sources of Privately-Held Financing in FY22 Q4

July - September 2022	
Assuming Constant Coupon Issuance Sizes*	
Treasury Announced Net Marketable Borrowing**	444
Net Coupon Issuance	340
Implied Change in Bills	104

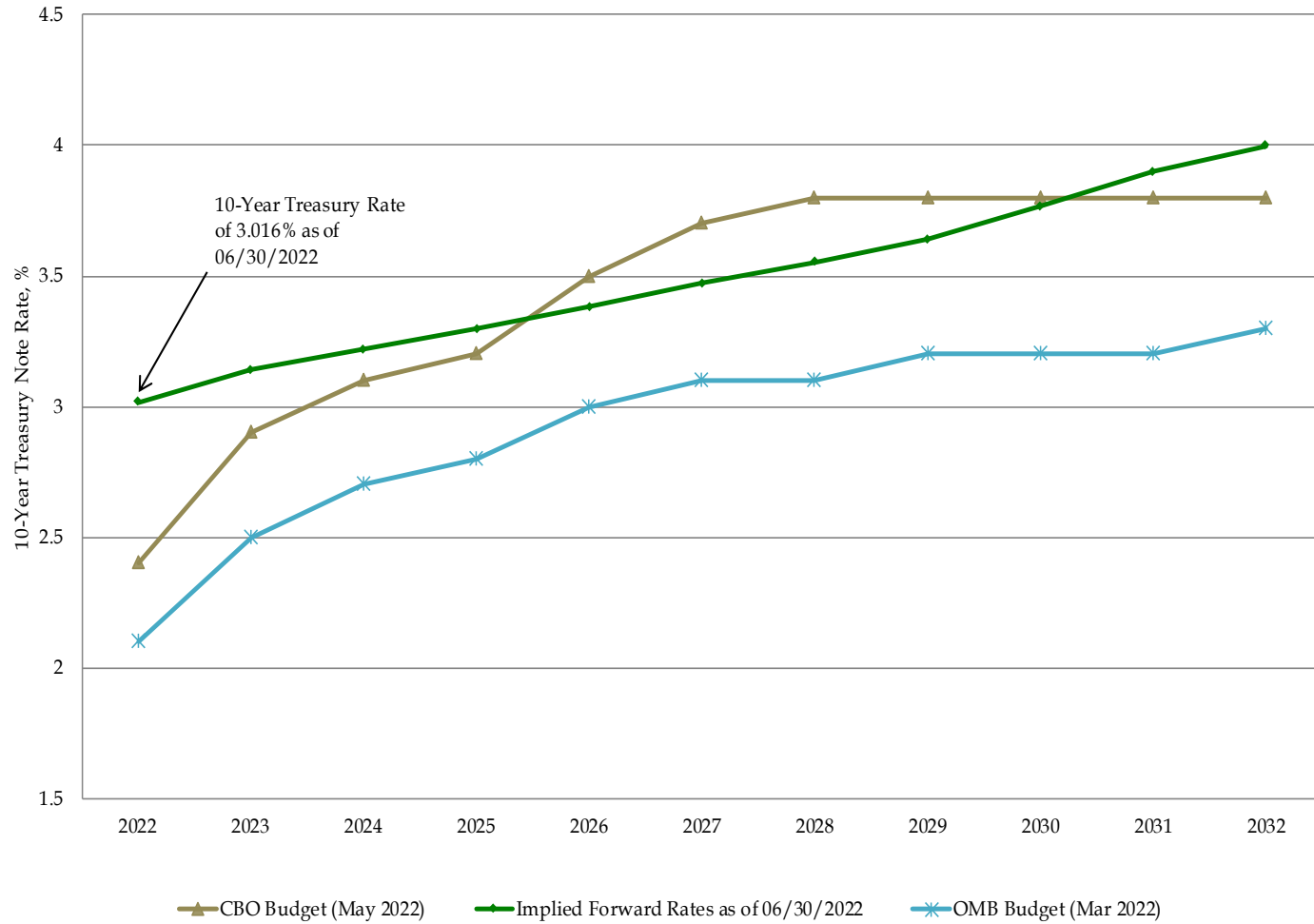| Security	July - September 2022 Coupon Issuance			Fiscal Year-to-Date Coupon Issuance		
	Gross	Maturing^	Net	Gross	Maturing	Net
2-Year FRN	68	68	0	282	240	42
2-Year	135	127	8	606	432	174
3-Year	129	83	46	582	311	271
5-Year	138	76	62	618	310	308
7-Year	114	73	41	567	301	266
10-Year	102	20	82	425	111	314
20-Year	45	0	45	214	0	214
30-Year	60	4	56	257	13	244
5-Year TIPS	0	0	0	74	40	34
10-Year TIPS	32	39	(7)	90	80	10
30-Year TIPS	8	0	8	17	0	17
Coupon Subtotal	831	491	340	3,732	1,838	1,894

* Keeping announced issuance sizes and patterns constant for nominal coupons, TIPS, and FRNs based on changes made before the August 2022 refunding.
** Assumes an end-of-September 2022 cash balance of $650 billion versus a beginning-of-July 2022 cash balance of $782 billion.
Financing Estimates released by the Treasury can be found here: http://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Pages/Latest.aspx
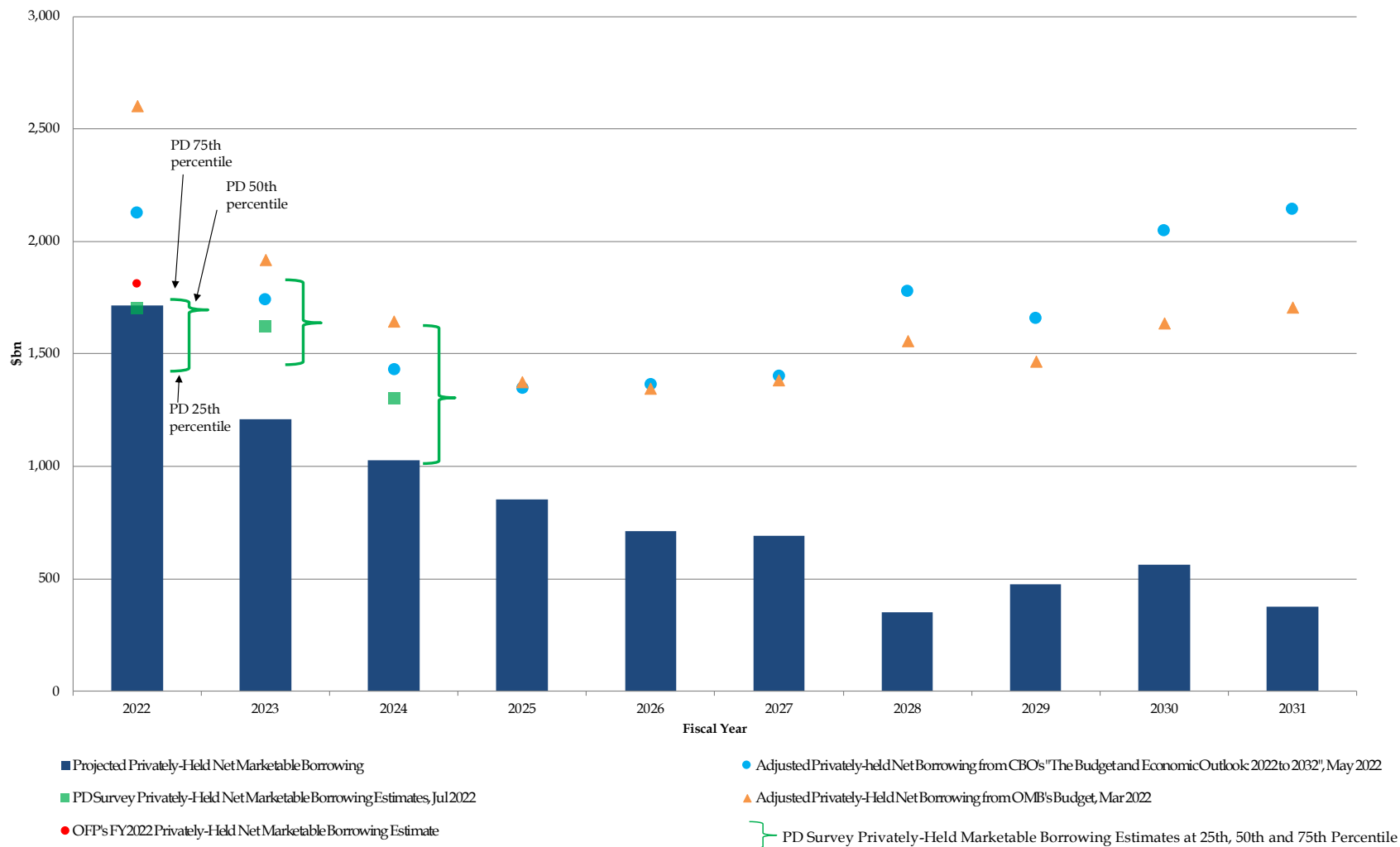^ Maturing amounts could change based on future Federal Reserve purchases.

Interest Rate Assumptions: 10-Year Treasury Note

10-Year Treasury Rate of 3.016% as of 06/30/2022

Legend: CBO Budget (May 2022) — Implied Forward Rates as of 06/30/2022 — OMB Budget (Mar 2022)

Projected Privately-Held Net Marketable Borrowing
Assuming Private Coupon Issuance & Total Bills Outstanding Remain Constant as of 06/30/2022*

Legend:
- ■ Projected Privately-Held Net Marketable Borrowing
- ● Adjusted Privately-held Net Borrowing from CBO's "The Budget and Economic Outlook: 2022 to 2032", May 2022
- ■ PD Survey Privately-Held Net Marketable Borrowing Estimates, Jul 2022
- ▲ Adjusted Privately-Held Net Borrowing from OMB's Budget, Mar 2022
- ● OFP's FY2022 Privately-Held Net Marketable Borrowing Estimate
- PD Survey Privately-Held Marketable Borrowing Estimates at 25th, 50th and 75th Percentile

*Treasury's latest primary dealer survey median/interquartile range estimates can be found on page 12. OMB's borrowing projections are from Table S-1 of "Budget of the U.S. Government Fiscal Year 2023," March 2022. CBO's borrowing projections are using estimates from Table 1 of CBO's "The Budget and Economic Outlook: 2022 to 2032," May 2022. Both OMB and CBO borrowing estimates are normalized to privately-held net borrowing after adding PD survey median SOMA redemption assumptions for FY22/23/24. FY2022 net borrowing estimates from PD, OMB and CBO are normalized with OFP's FY22 ending cash balance of $650 billion (details can be found on page 12).

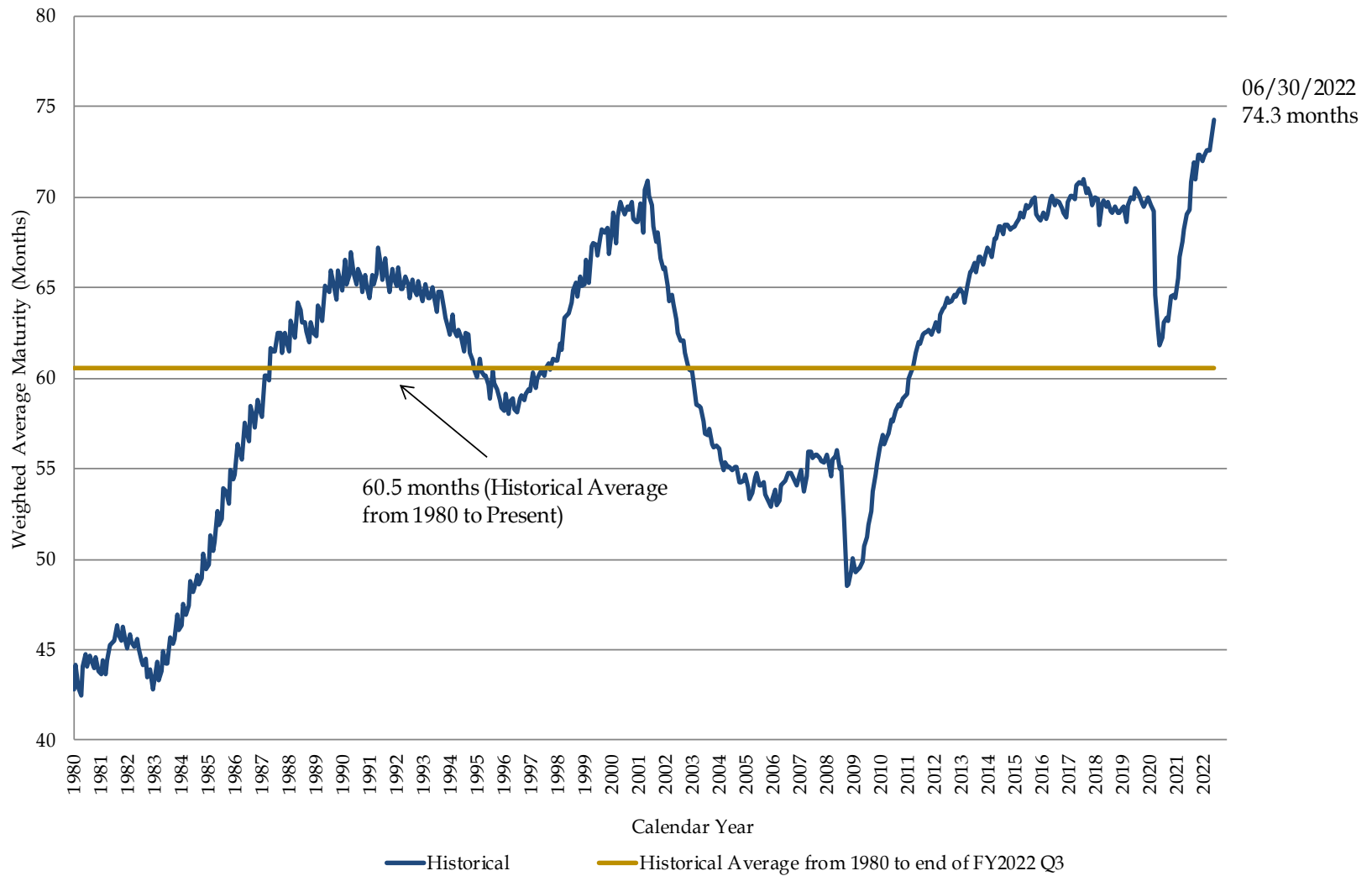# Federal Reserve SOMA Treasury Holdings Maturity Profile as of 6/30/2022
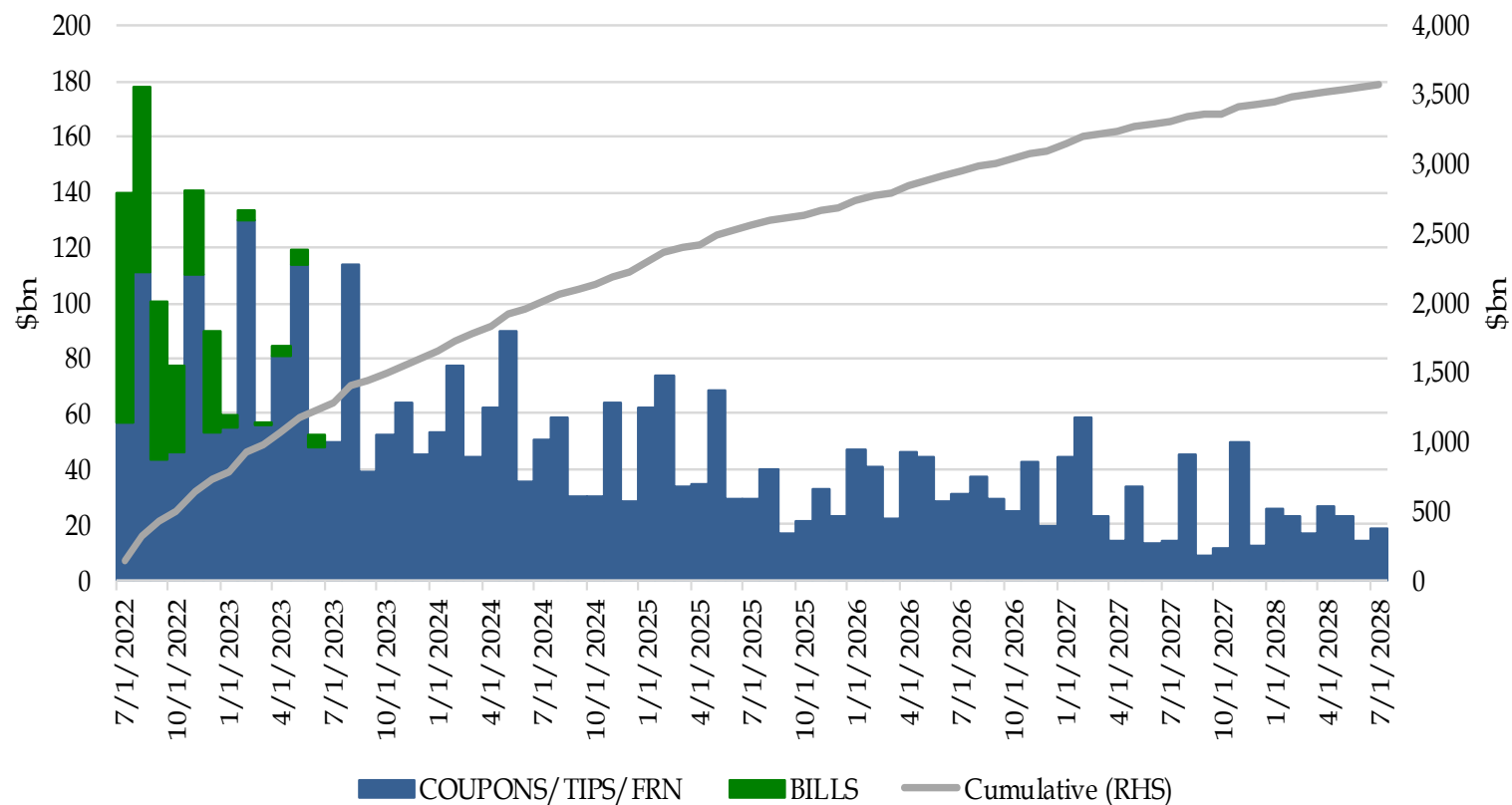
The figures do not include any assumptions for Federal Reserve balance sheet normalization.

Section IV:
Portfolio Metrics

Historical Weighted Average Maturity of Marketable Debt Outstanding

06/30/2022
74.3 months

60.5 months (Historical Average from 1980 to Present)

Weighted Average Maturity (Months)

Calendar Year

Historical — Historical Average from 1980 to end of FY2022 Q3

Bills, TIPS & FRNs Outstanding as a Percent of Marketable Debt Outstanding

Private Bills Holdings as a Percentage of Total Private Holdings

06/30/22
$3,198 bn

06/30/22
18%
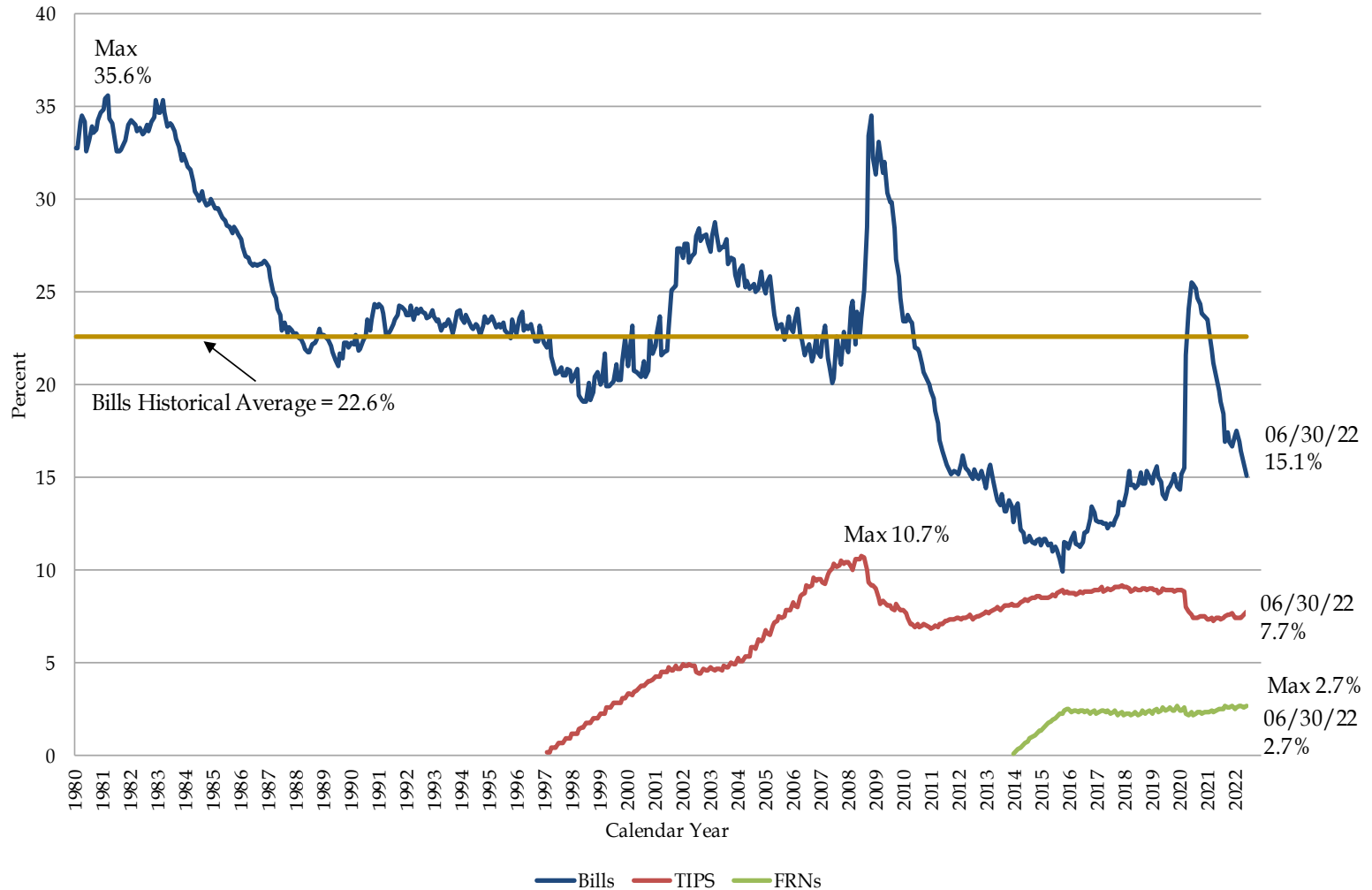
Private Bills Holdings — Private Bills Holdings as a Percentage of Total Private Holdings (RHS)
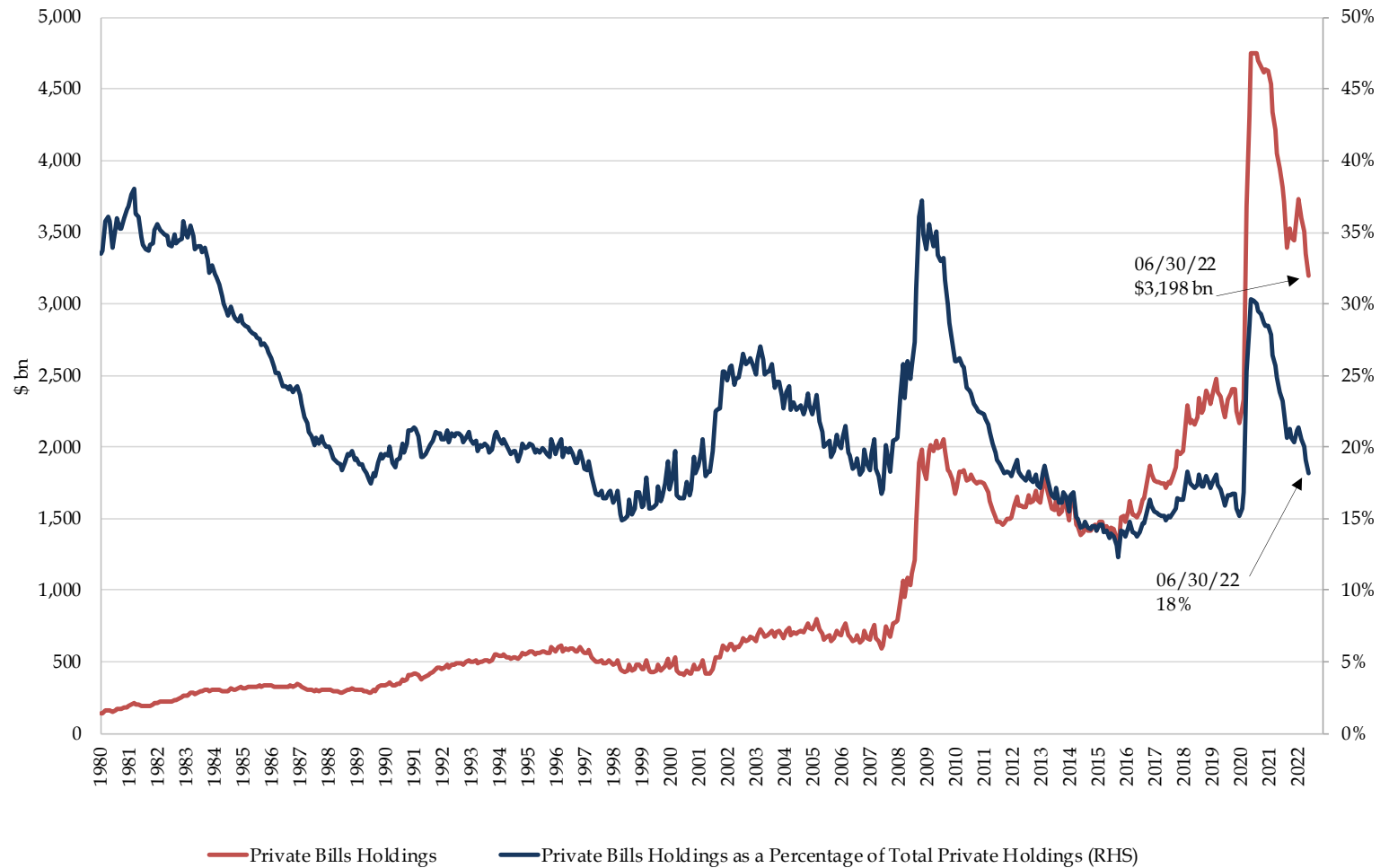
Treasury Maturity Profile History

06/30/22
51%

06/30/22
28%

Calendar Year

—— Percent Maturing <=1 Year   —— Percent Maturing <= 3 Years
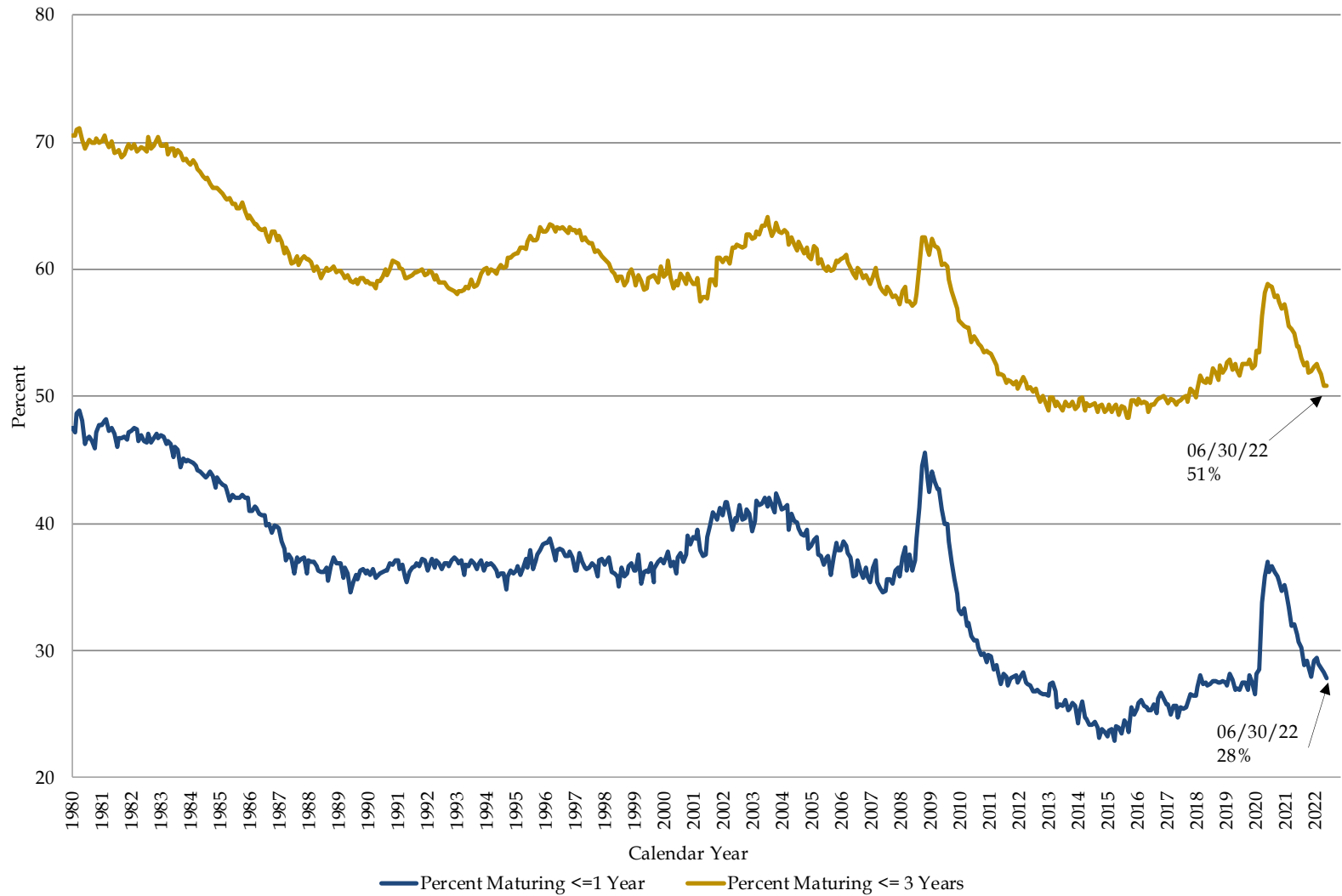
Section V: Demand
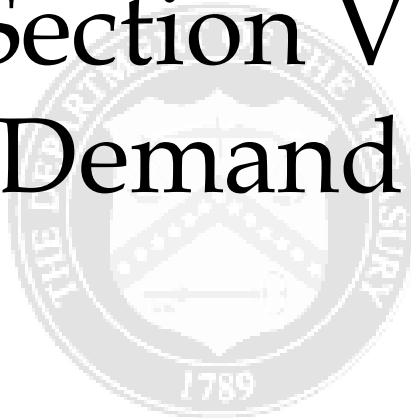
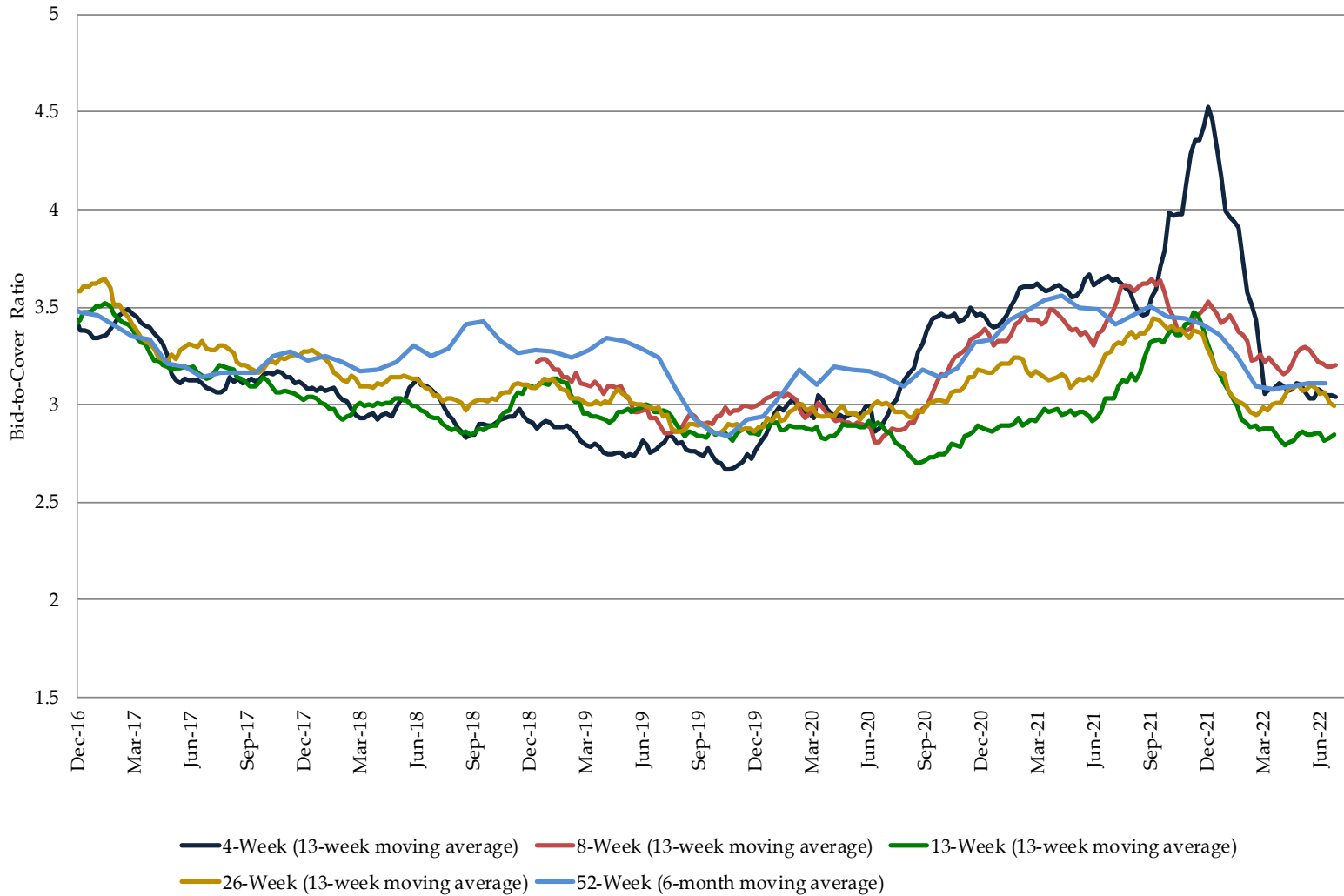## Summary Statistics for Fiscal Year 2022 Q3 Auctions

Security Type	Term	Stop Out Rate (%)*	Bid-to-Cover Ratio*	Competitive Awards ($bn)	% Primary Dealer*	% Direct*	% Indirect*	Non-Competitive Awards ($bn)	SOMA "Add-Ons" ($bn)	10-Year Equivalent ($bn)**
Bill	4-Week	0.73	3.04	442.48	49.12	2.83	48.05	12.53	44.29	4.38
Bill	8-Week	0.96	3.20	383.34	48.65	3.57	47.78	6.67	37.96	7.50
Bill	13-Week	1.10	2.83	610.19	45.30	5.45	49.26	16.82	84.50	20.22
Bill	26-Week	1.61	3.01	550.13	41.91	2.76	55.33	16.87	76.47	36.52
Bill	52-Week	2.33	3.19	99.48	37.54	5.48	56.98	2.52	13.52	13.17
CMB	17-Week	1.40	3.36	386.34	43.95	2.98	53.08	3.66	-	14.49
Coupon	2-Year	2.73	2.62	138.37	16.99	22.91	60.10	2.63	17.24	35.40
Coupon	3-Year	2.82	2.51	133.85	24.66	19.68	55.66	1.15	45.05	58.93
Coupon	5-Year	2.93	2.38	143.47	19.08	19.73	61.19	0.53	17.60	86.52
Coupon	7-Year	2.98	2.53	125.94	13.07	18.66	68.27	0.06	15.47	102.85
Coupon	10-Year	2.90	2.44	102.92	15.64	18.19	66.18	0.08	35.24	137.26
Coupon	20-Year	3.28	2.63	46.97	11.36	17.18	71.47	0.03	5.84	90.12
Coupon	30-Year	3.00	2.34	60.98	14.54	17.45	68.01	0.02	21.28	189.49
TIPS	5-Year	(0.01)	2.67	37.73	6.64	6.53	86.82	0.27	1.38	22.15
TIPS	10-Year	0.23	2.24	13.97	17.85	11.42	70.73	0.03	2.10	17.86
FRN	2-Year	(0.03)	3.06	67.84	33.12	11.07	55.81	0.16	3.33	0.07

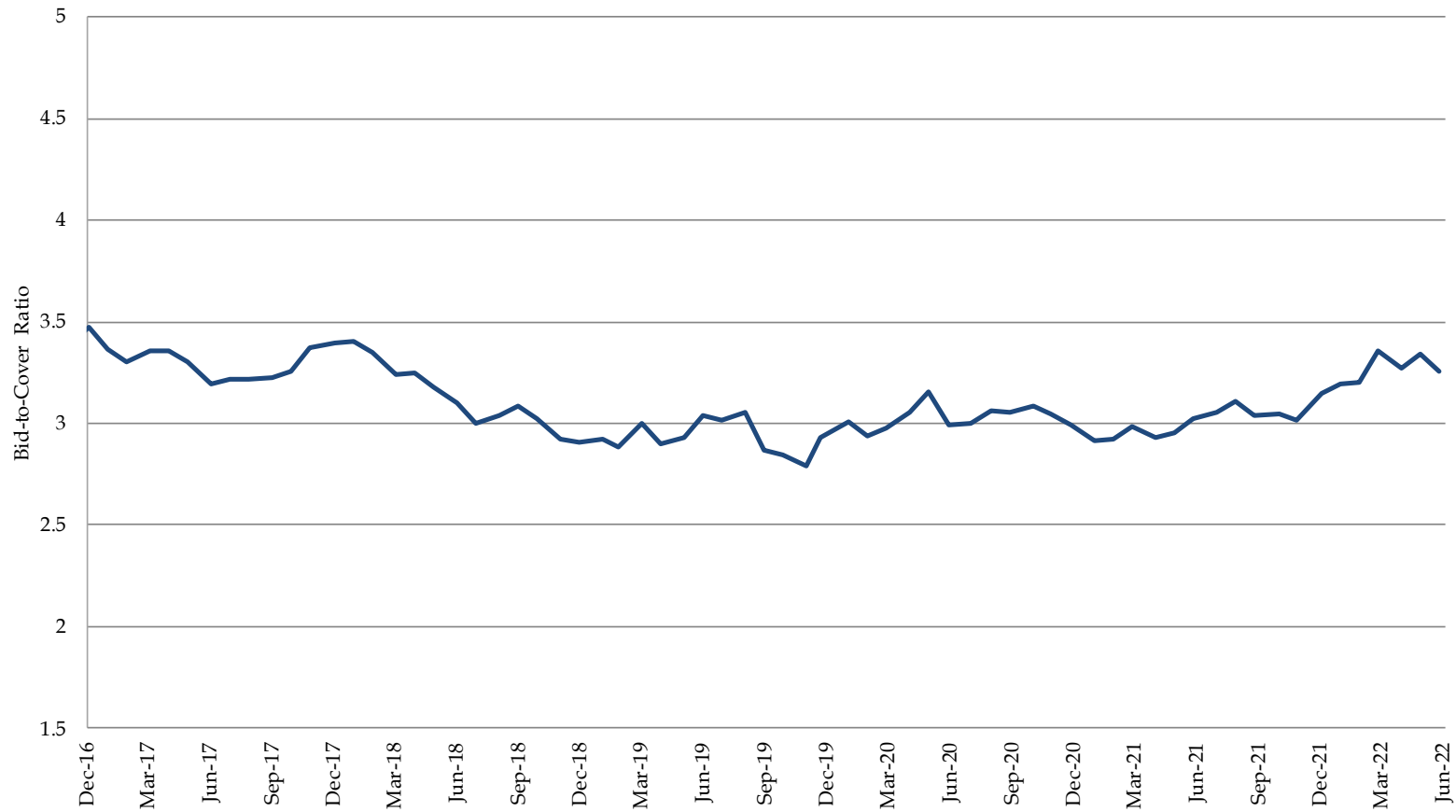|										
Total Bills		1.22	3.06	2,471.95	45.22	3.71	51.07	59.06	256.74	96.29
Total Coupons		2.90	2.49	752.49	17.36	19.57	63.07	4.51	157.74	700.56
Total TIPS		0.06	2.56	51.70	9.67	7.85	82.47	0.30	3.48	40.01
Total FRN		(0.03)	3.06	67.84	33.12	11.07	55.81	0.16	3.33	0.07

*Weighted averages of Competitive Awards. FRNs are reported on discount margin basis.

**Approximated using prices at settlement and includes both Competitive and Non-Competitive Awards. For TIPS 10-year equivalent, a constant auction BEI is used as the inflation assumption.

Bid-to-Cover Ratios for Treasury Bills

Legend:
- 4-Week (13-week moving average)
- 8-Week (13-week moving average)
- 13-Week (13-week moving average)
- 26-Week (13-week moving average)
- 52-Week (6-month moving average)
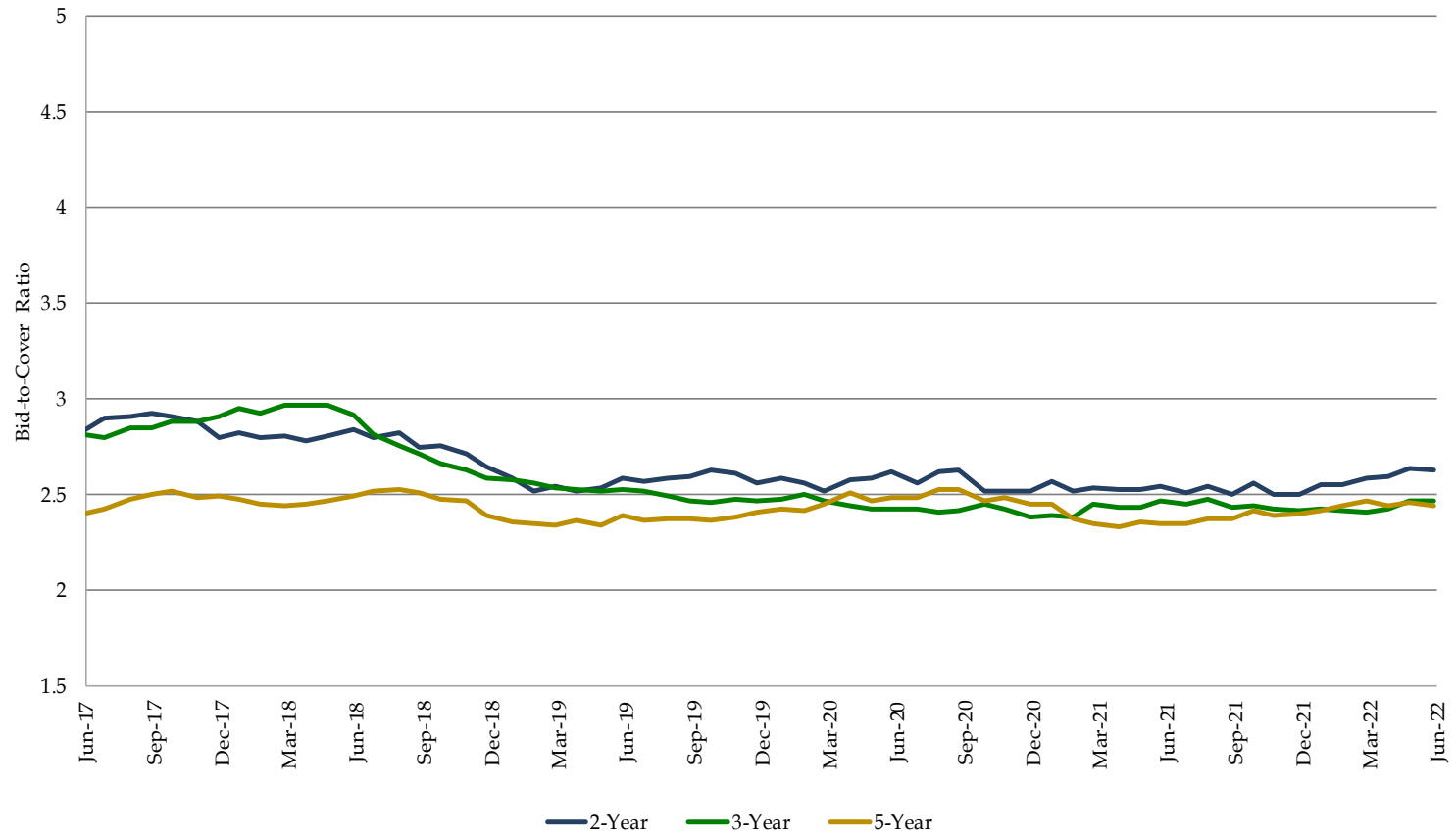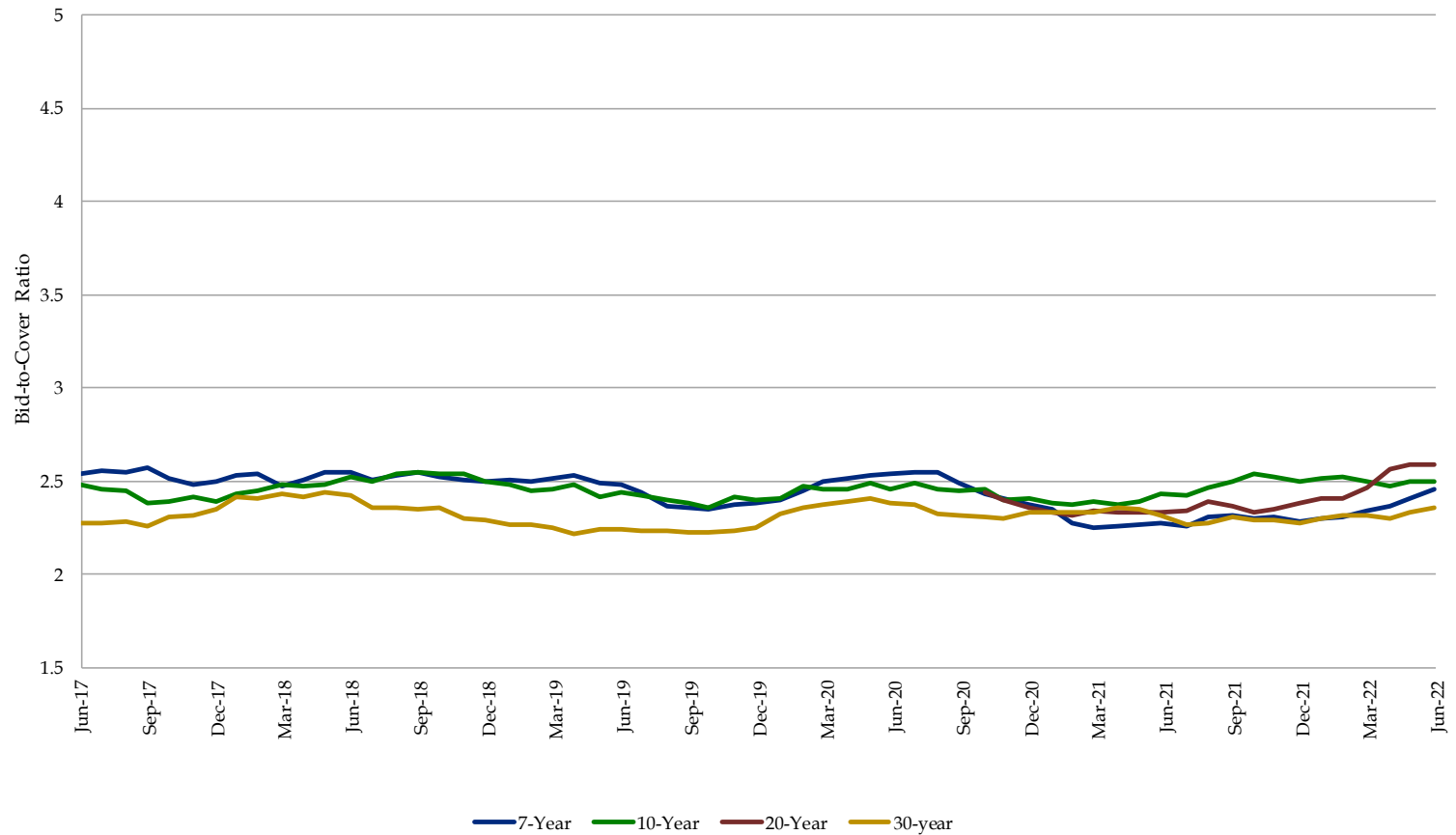
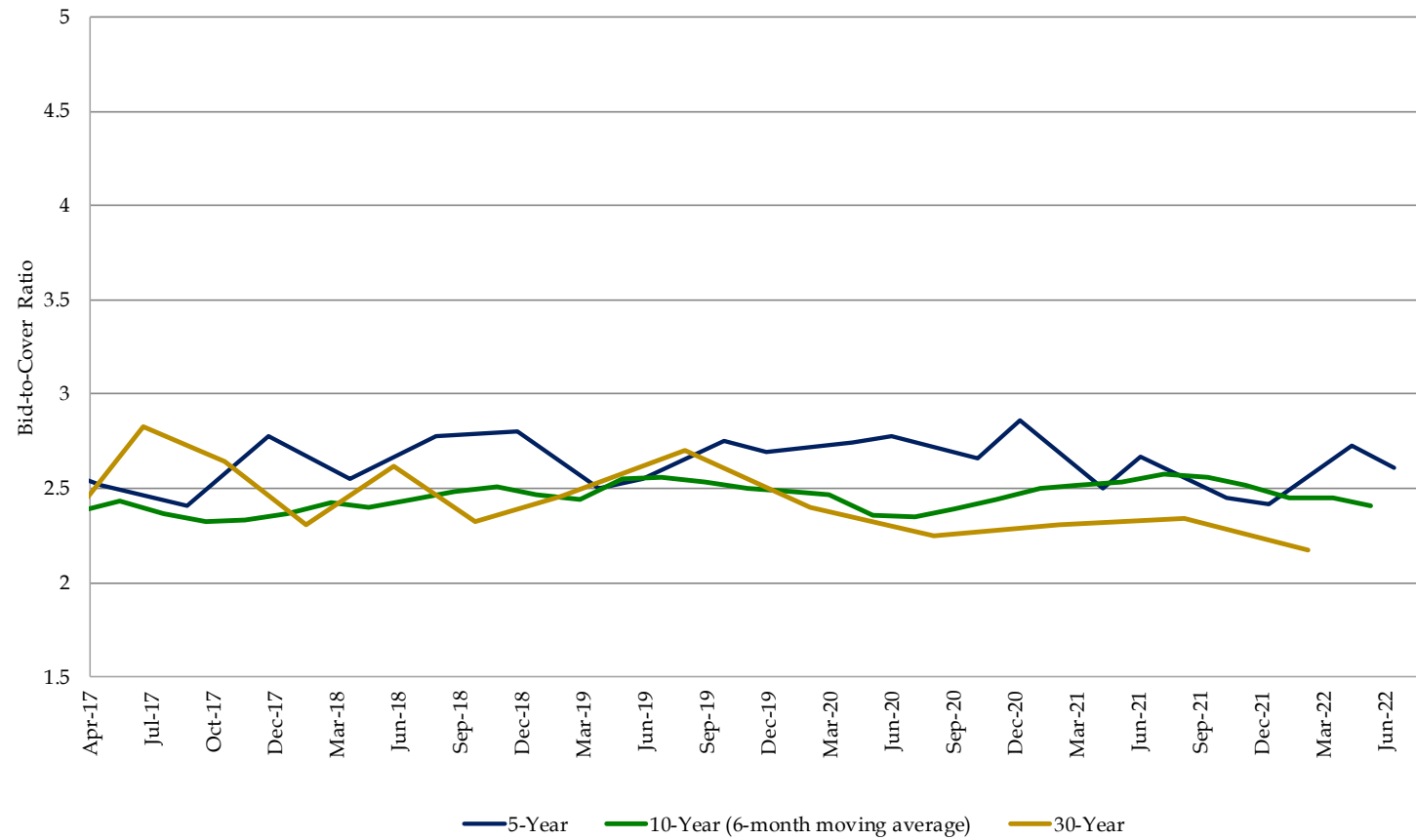# Bid-to-Cover Ratios for FRNs
(6-Month Moving Average)

Bid-to-Cover Ratios for 2-, 3-, and 5-Year Nominal Securities
(6-Month Moving Average)
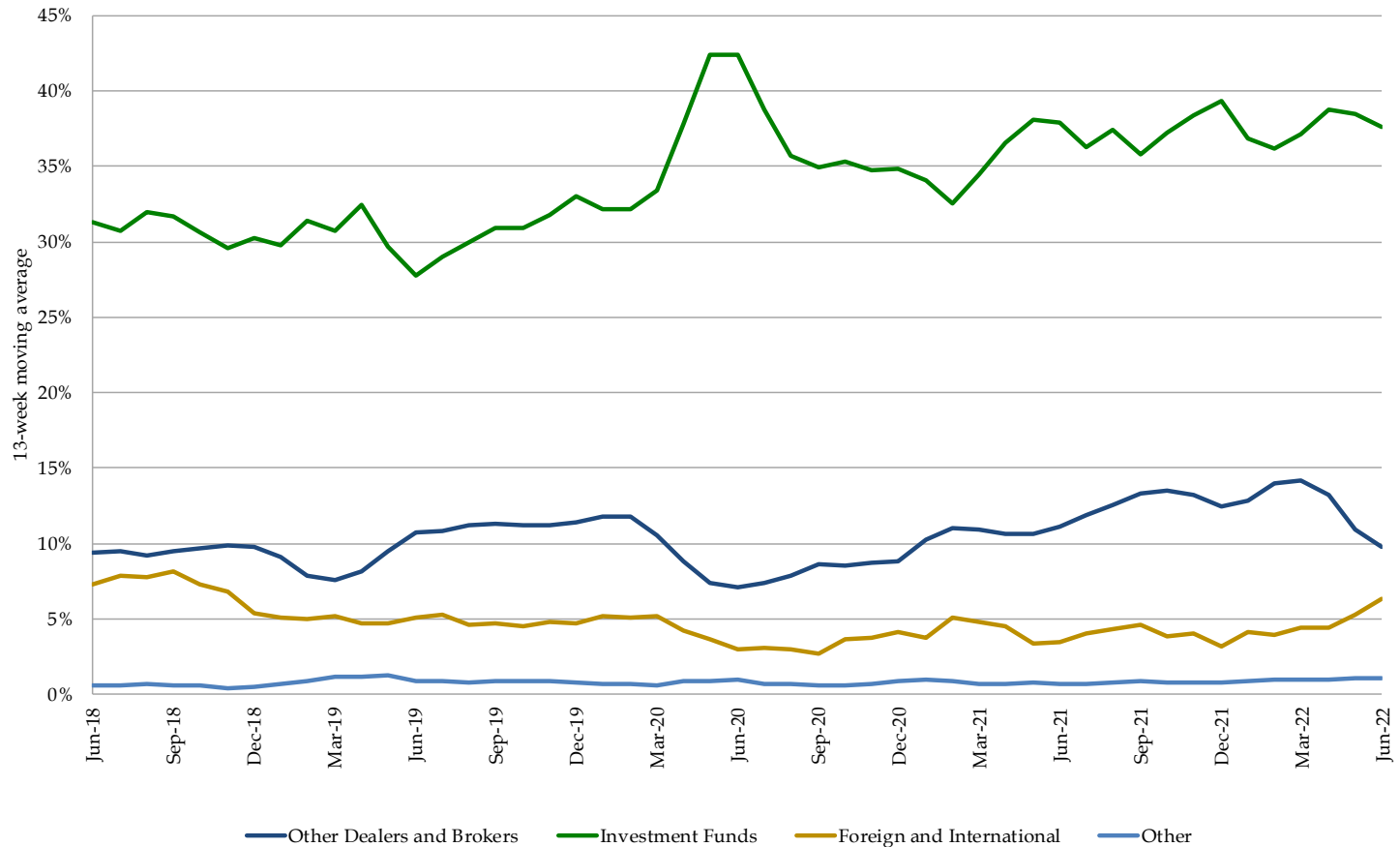
Bid-to-Cover Ratios for 7-, 10-, 20-, and 30-Year Nominal Securities (6-Month Moving Average)

Bid-to-Cover Ratios for TIPS

Percent Awarded in Bill Auctions by Investor Class
(13-Week Moving Average)

Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Percent Awarded in 2-, 3-, and 5-Year Nominal Security Auctions by Investor Class (6-Month Moving Average)

Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Percent Awarded in 7-, 10-, 20-, 30-Year Nominal Security Auctions by Investor Class (6-Month Moving Average)

Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.
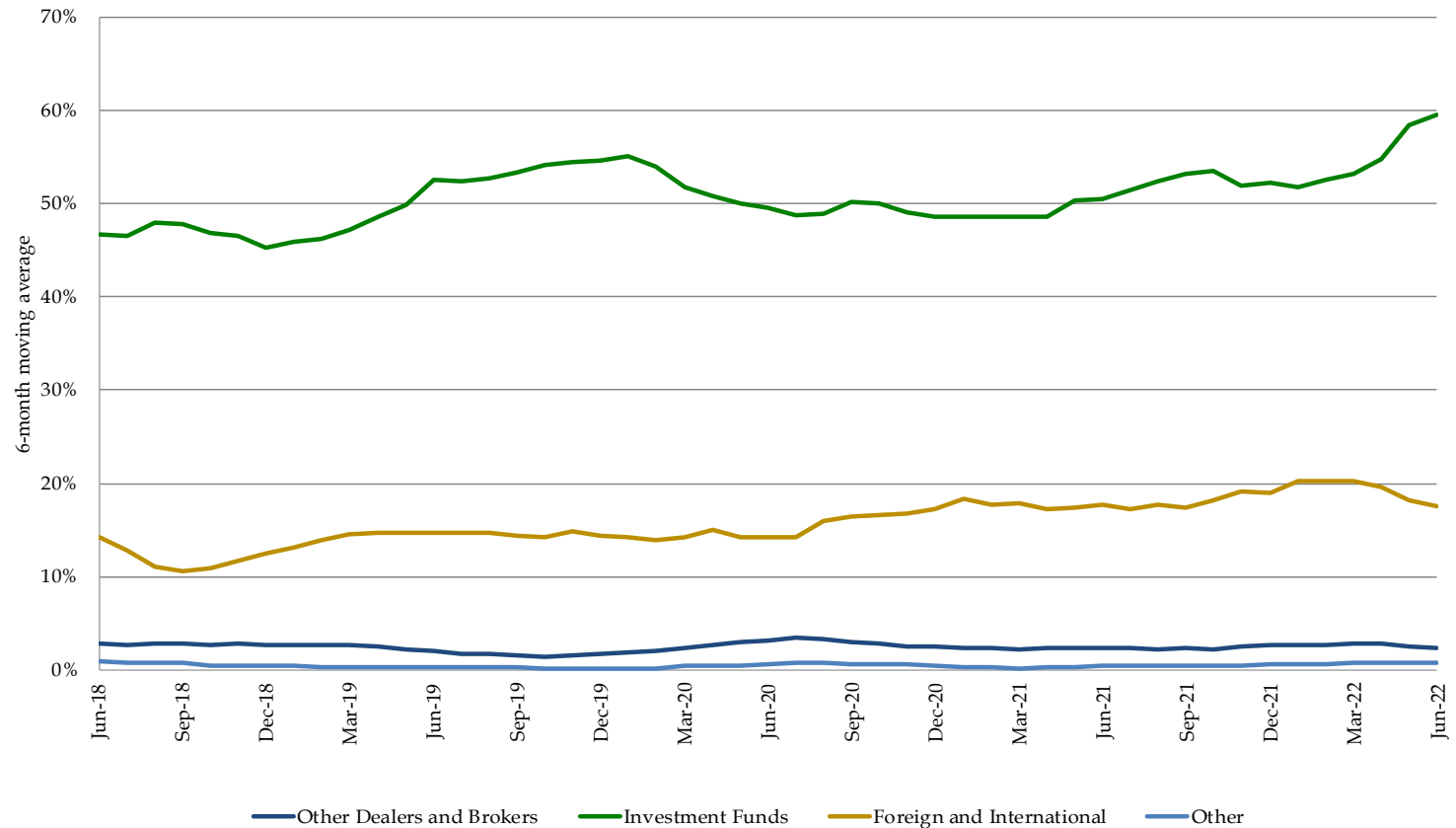
Percent Awarded in TIPS Auctions by Investor Class
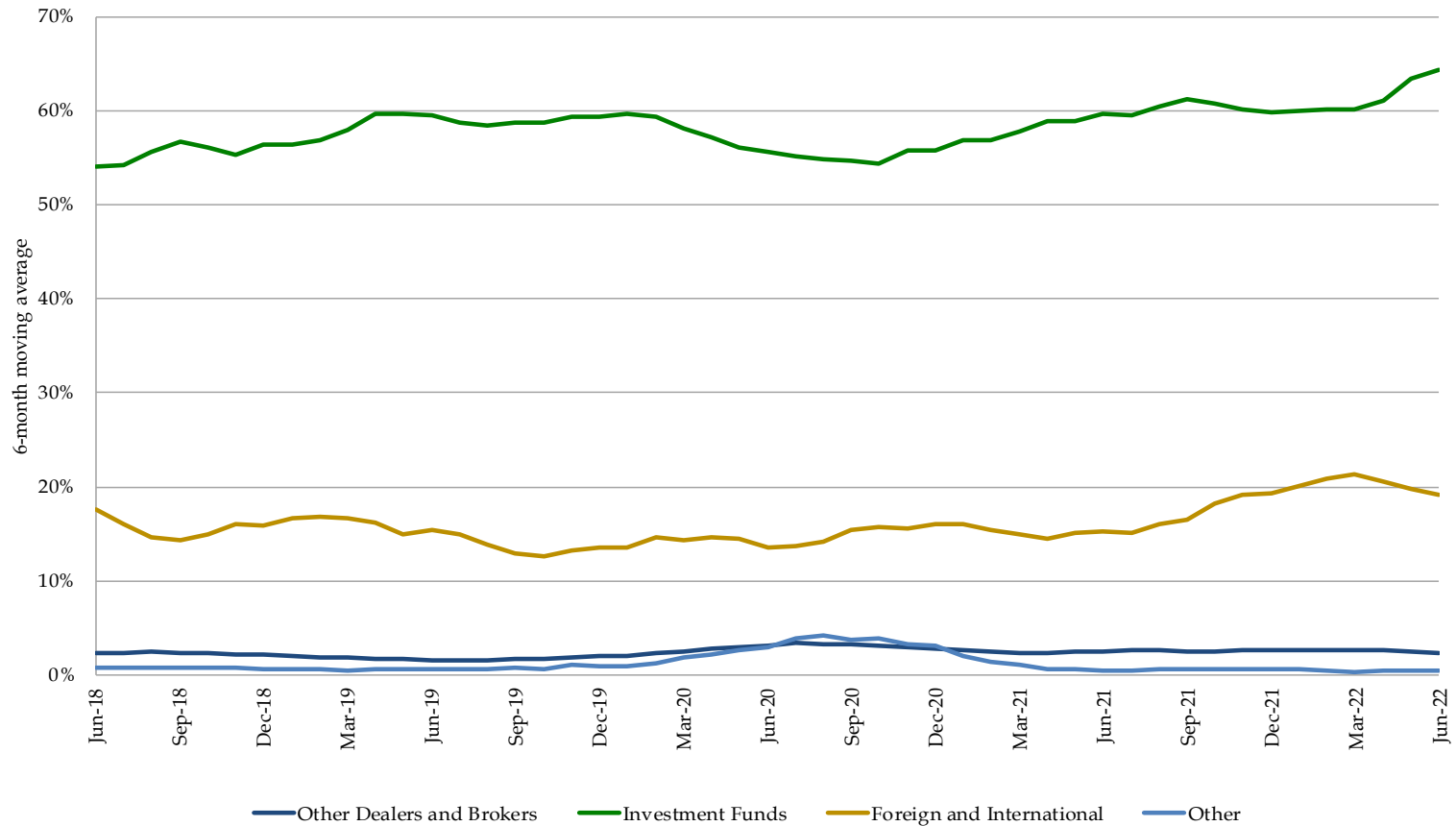## (6-Month Moving Average)

Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Percent Awarded in FRN Auctions by Investor Class
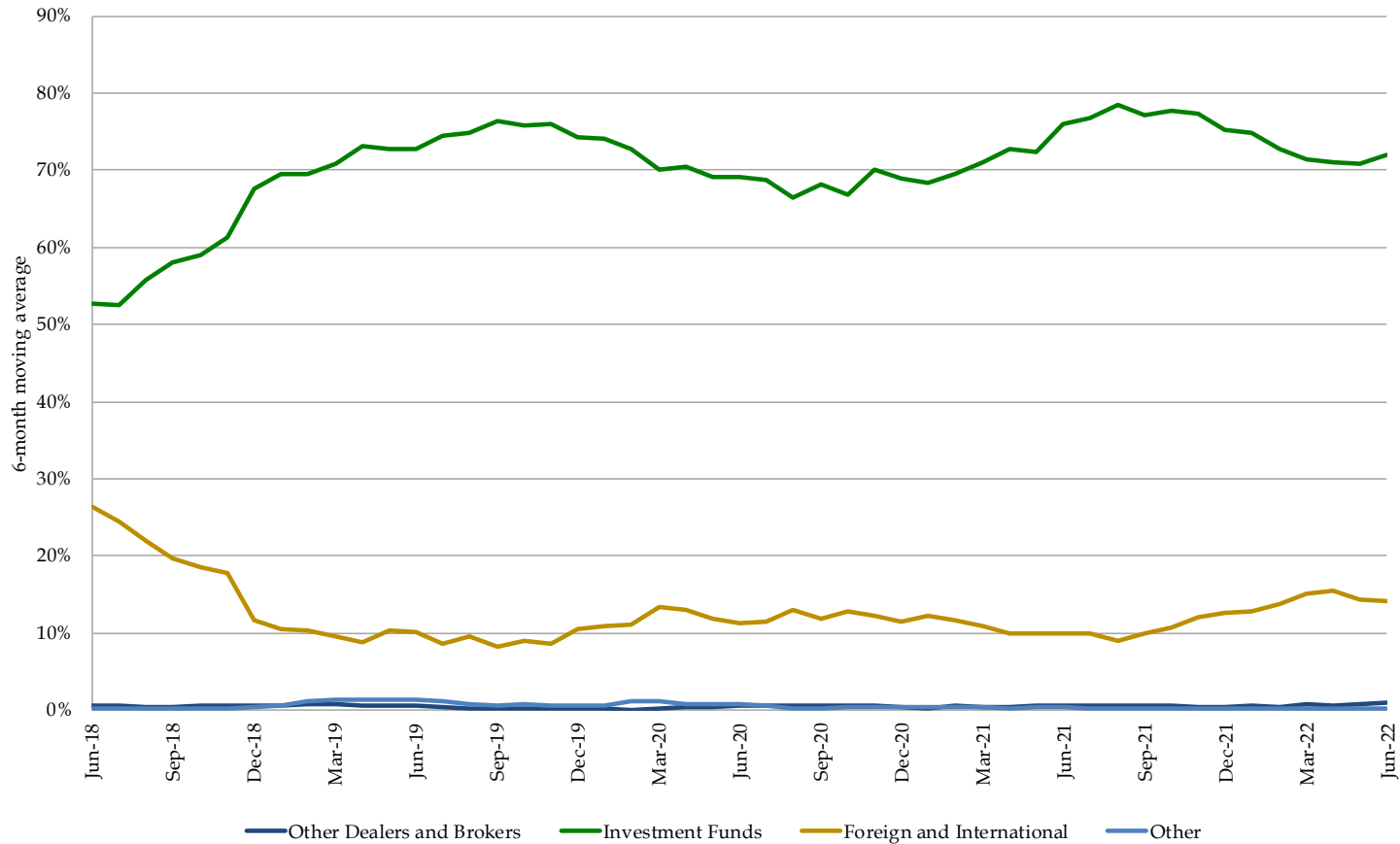## (6-Month Moving Average)
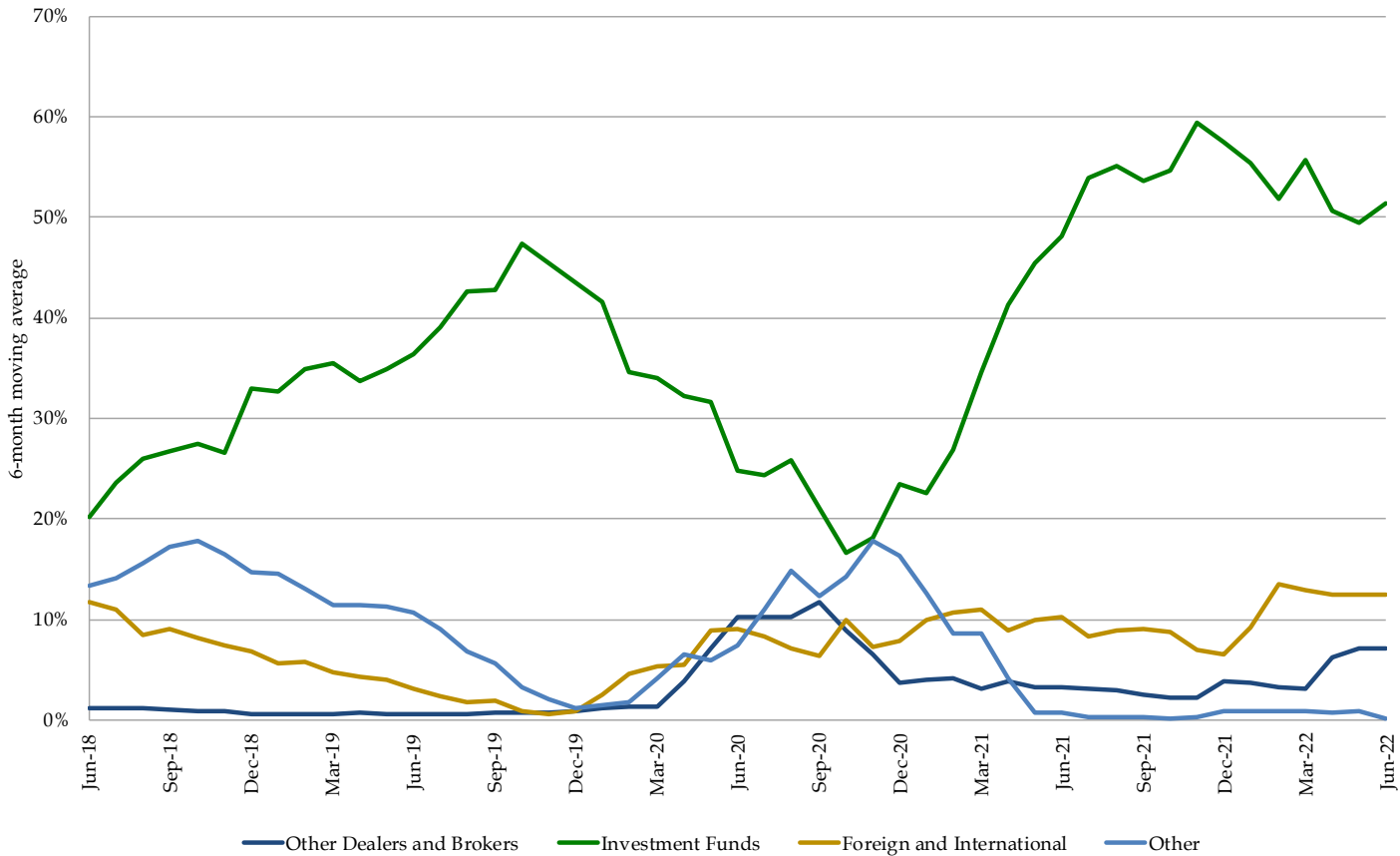
Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Primary Dealer Awards at Auction
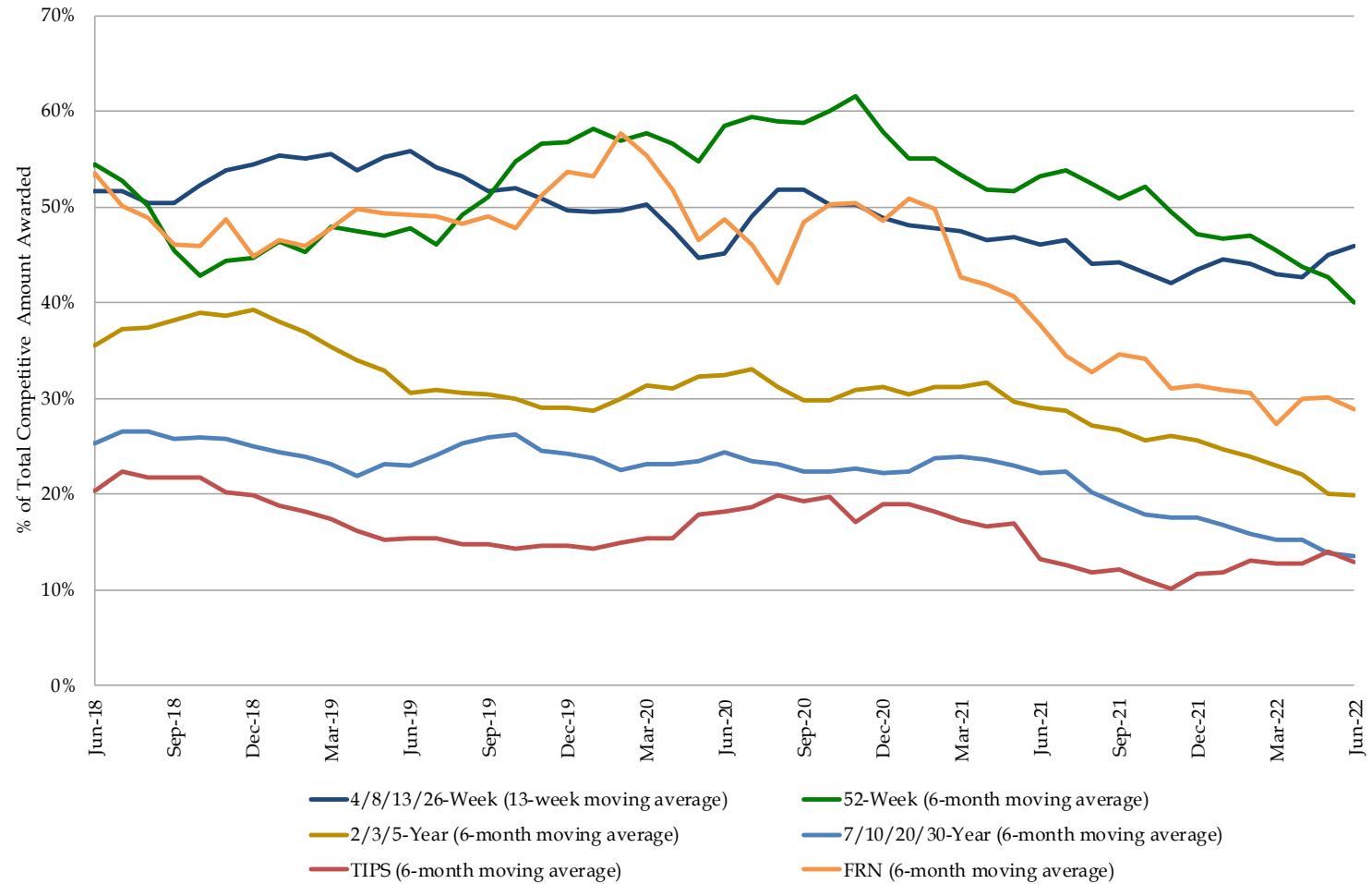
Competitive Amount Awarded excludes SOMA add-ons.

Direct Bidder Awards at Auction
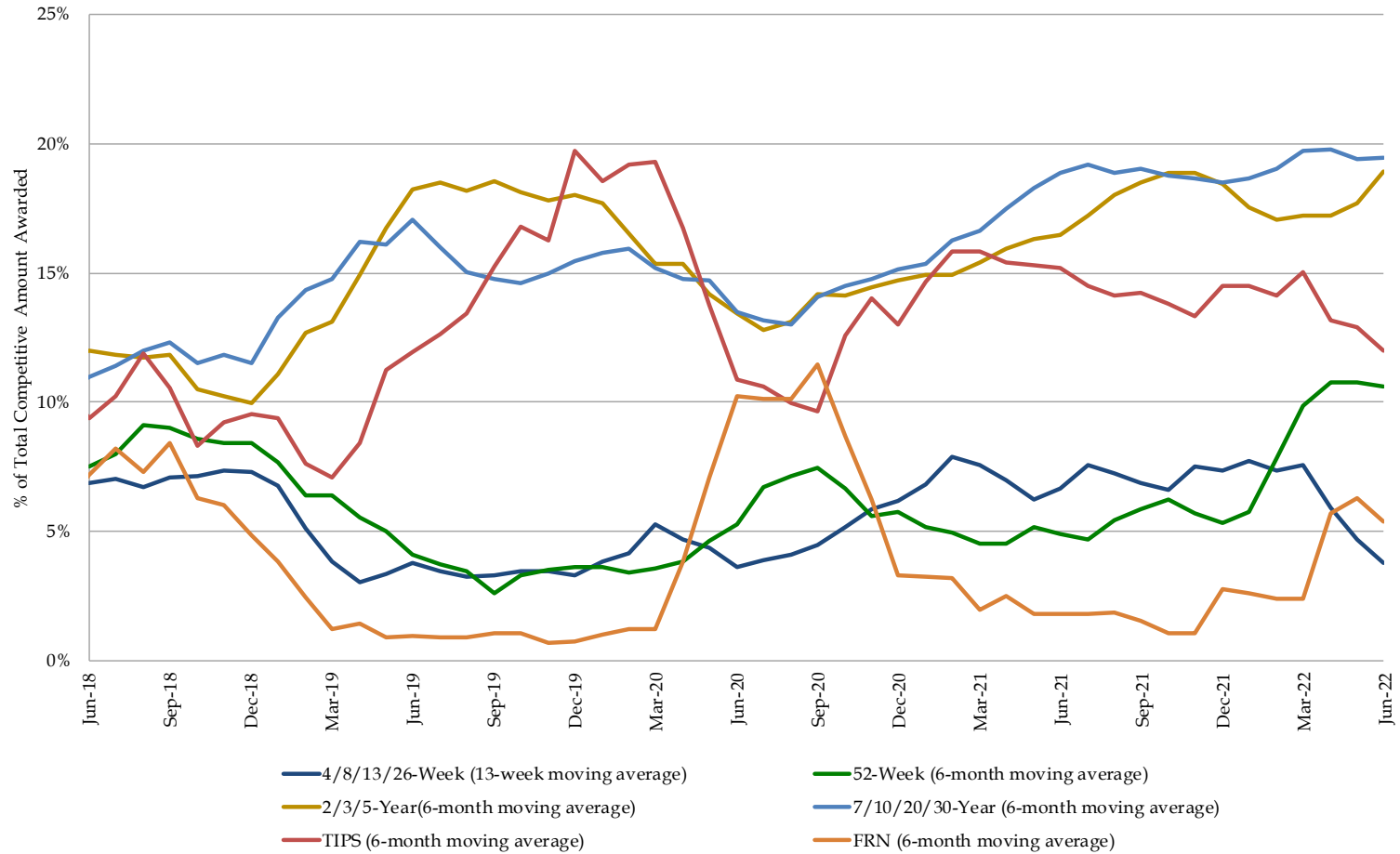
Competitive Amount Awarded excludes SOMA add-ons.

Total Foreign Awards of Treasuries at Auction, $ billions
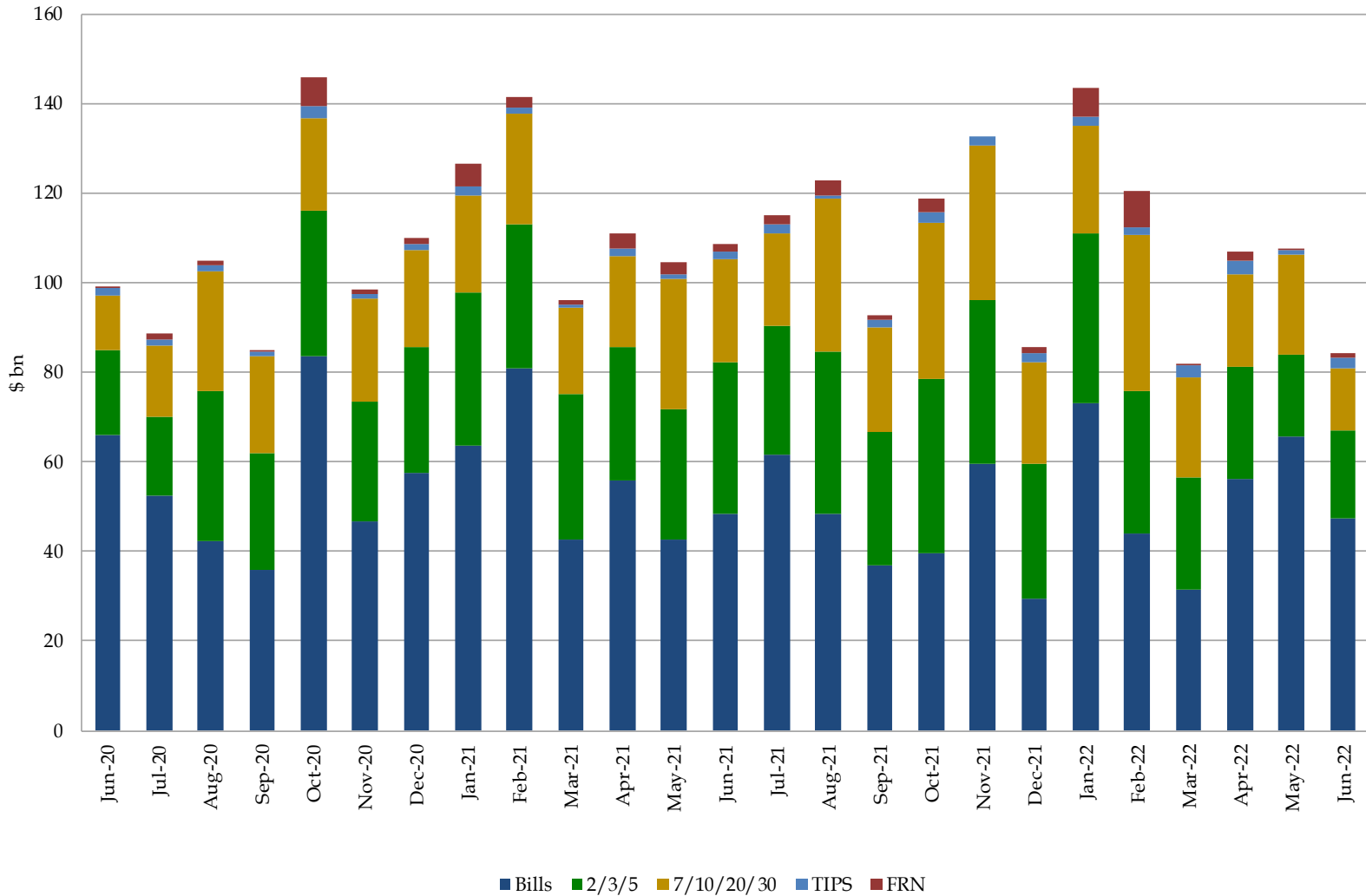
Foreign includes both private sector and official institutions.

Total Foreign Holdings

Bills

Legend: Outstanding — Foreign Holdings — Foreign % (RHS)

Annotations:
- 05/31/22 3,673
- 05/31/22 25%
- 05/31/22 913

Nominal Coupons, TIPS, and FRNs

Legend: Outstanding — Foreign Holdings — Foreign % (RHS)

Annotations:
- 05/31/22 19,628
- 05/31/22 33%
- 05/31/22 6,509
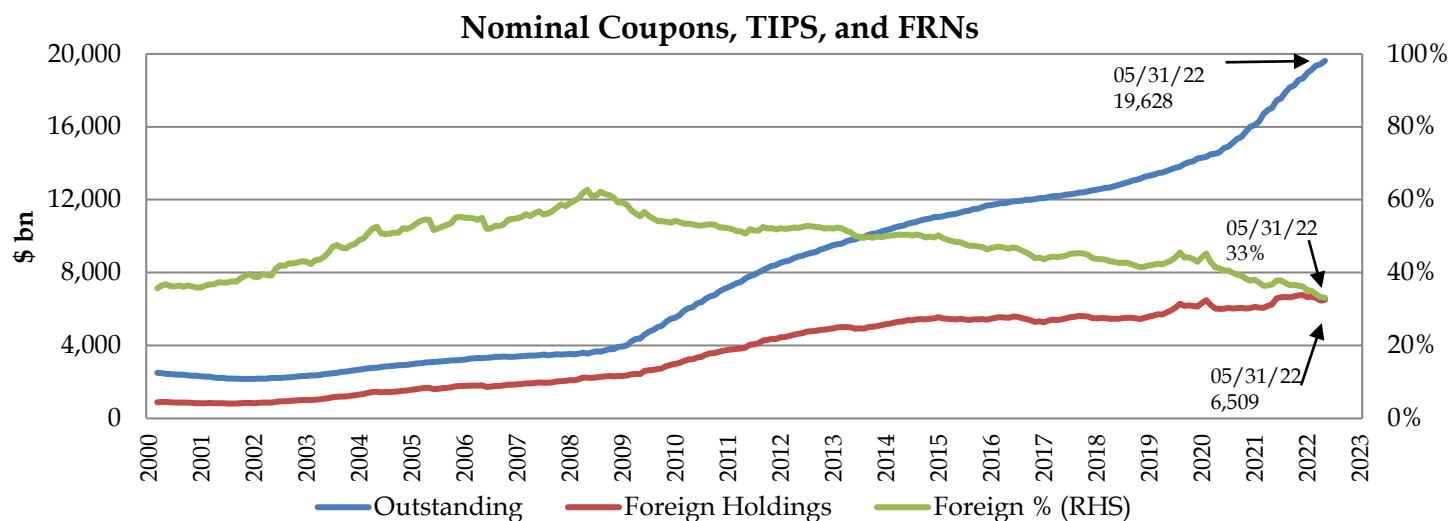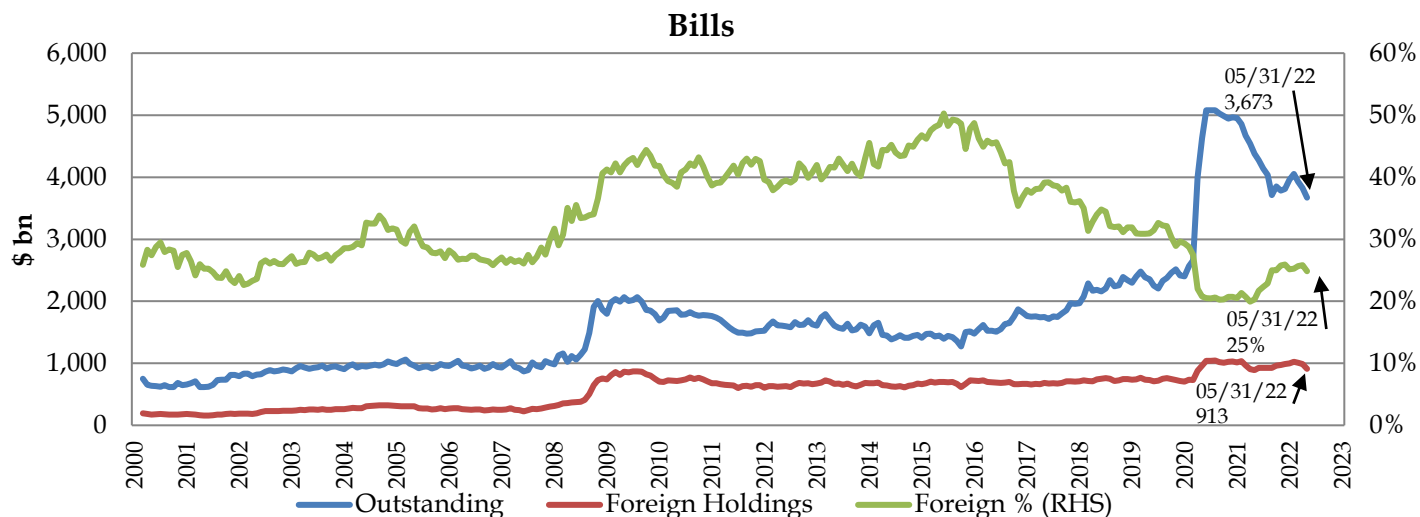
Source: Treasury International Capital (TIC) System as of May 2022.
For more information on foreign participation data, including more details about the TIC data shown here, please refer to Treasury Presentation to TBAC "Brief Overview of Key Data Sources on Foreign Participation in the U.S. Treasury Securities Market" at the Treasury February 2019 Refunding.

Appendix

Projected Privately-Held Net Marketable Borrowing
Assuming Private Coupon Issuance & Total Bills Outstanding Remain Constant as of 06/30/2022*

Fiscal Year	Bills	2/3/5	7/10/20/30	TIPS	FRN	Historical/Projected Net Borrowing Capacity
2017	155	(66)	378	51	(0)	519
2018	438	197	493	45	23	1,196
2019	137	498	534	51	59	1,280
2020	2,652	538	724	46	55	4,015
2021	(1,315)	1,260	1,328	55	92	1,420
2022	(190)	762	1,044	59	42	1,717
2023	0	443	769	39	(42)	1,209
2024	0	174	797	64	(10)	1,026
2025	0	43	812	(3)	0	852
2026	0	(112)	808	15	0	712
2027	0	2	691	(2)	0	691
2028	0	0	372	(19)	0	353
2029	0	0	490	(13)	0	477
2030	0	0	558	2	0	561
2031	0	0	387	(10)	0	378

*Projections reflect only SOMA rollovers at auction of principal payments of Treasury securities. No adjustments are made for open-market outright purchases and subsequent rollovers.

					Bills					
Issue	Settle Date	Stop Out Rate (%)	Bid-to-Cover Ratio	Competitive Awards ($bn)	% Primary Dealer	% Direct	% Indirect	Non-Competitive Awards ($bn)	SOMA "Add Ons" ($bn)	10-Year Equivalent ($bn)*
4-Week	4/12/2022	0.205	3.38	34.4	32.4	1.2	66.4	0.6	3.5	0.3
4-Week	4/19/2022	0.370	2.84	34.3	56.3	3.6	40.1	0.7	3.6	0.3
4-Week	4/26/2022	0.500	3.21	34.3	53.3	4.0	42.7	0.7	2.9	0.3
4-Week	5/3/2022	0.480	3.50	33.7	41.4	0.4	58.2	1.3	3.5	0.3
4-Week	5/10/2022	0.490	3.06	33.5	43.4	2.1	54.6	1.5	3.5	0.3
4-Week	5/17/2022	0.600	2.70	34.1	70.5	2.9	26.6	0.9	3.6	0.3
4-Week	5/24/2022	0.640	3.07	34.2	47.0	4.0	49.1	0.8	3.0	0.3
4-Week	5/31/2022	0.740	2.79	34.2	56.4	3.8	39.8	0.8	3.6	0.3
4-Week	6/7/2022	0.860	3.07	34.3	47.9	0.9	51.2	0.7	3.5	0.3
4-Week	6/14/2022	1.040	2.82	33.8	51.7	3.0	45.3	1.2	3.6	0.3
4-Week	6/21/2022	1.180	3.17	33.8	50.2	4.0	45.8	1.2	3.0	0.3
4-Week	6/28/2022	1.100	2.90	34.0	44.5	2.5	53.0	1.0	3.6	0.3
4-Week	7/5/2022	1.240	2.97	34.1	43.4	4.5	52.2	0.9	3.5	0.3
8-Week	4/12/2022	0.500	2.96	29.8	59.1	16.1	24.8	0.2	3.0	0.6
8-Week	4/19/2022	0.570	3.56	29.8	40.5	0.8	58.7	0.2	3.1	0.6
8-Week	4/26/2022	0.625	3.24	29.5	55.3	2.9	41.8	0.5	2.5	0.6
8-Week	5/3/2022	0.710	3.64	28.8	46.4	6.8	46.9	1.2	3.0	0.6
8-Week	5/10/2022	0.710	3.55	29.3	42.7	0.0	57.3	0.7	3.0	0.6
8-Week	5/17/2022	0.755	3.02	29.7	63.1	3.4	33.6	0.3	3.1	0.6
8-Week	5/24/2022	0.900	2.90	29.7	53.8	4.2	42.0	0.3	2.6	0.6
8-Week	5/31/2022	0.915	3.36	29.3	44.7	0.9	54.3	0.7	3.1	0.6
8-Week	6/7/2022	1.040	3.23	29.4	43.2	2.1	54.7	0.6	3.0	0.6
8-Week	6/14/2022	1.150	3.06	29.5	49.8	1.9	48.3	0.5	3.1	0.6
8-Week	6/21/2022	1.470	3.28	29.4	40.7	2.4	56.9	0.6	2.5	0.6
8-Week	6/28/2022	1.500	2.97	29.6	42.8	1.9	55.3	0.4	3.0	0.6
8-Week	7/5/2022	1.650	2.89	29.7	50.1	2.9	47.1	0.3	3.0	0.6

*Approximated using prices at settlement and includes both competitive and non-competitive awards.

					Bills (cont.)						
Issue	Settle Date	Stop Out Rate (%)	Bid-to-Cover Ratio	Competitive Awards ($bn)	% Primary Dealer	% Direct	% Indirect	Non-Competitive Awards ($bn)	SOMA "Add Ons" ($bn)	10-Year Equivalent ($bn)*
13-Week	4/7/2022	0.670	2.46	56.2	59.9	8.7	31.4	0.8	7.8	1.8
13-Week	4/14/2022	0.785	2.64	55.9	44.4	4.7	50.9	1.1	7.1	1.8
13-Week	4/21/2022	0.860	2.72	56.0	47.3	2.7	50.0	1.0	7.4	1.8
13-Week	4/28/2022	0.890	2.96	49.1	52.8	4.6	42.7	1.9	7.0	1.6
13-Week	5/5/2022	0.910	3.27	43.7	37.3	6.5	56.2	1.3	8.0	1.5
13-Week	5/12/2022	0.900	3.18	42.9	41.6	10.5	47.9	2.1	6.2	1.4
13-Week	5/19/2022	1.050	2.82	43.9	40.5	7.9	51.6	1.2	6.9	1.5
13-Week	5/26/2022	1.060	3.06	43.4	36.3	4.9	58.7	1.6	5.8	1.4
13-Week	6/2/2022	1.120	2.98	43.9	35.4	2.7	61.9	1.1	7.8	1.5
13-Week	6/9/2022	1.230	2.98	44.0	29.8	2.7	67.6	1.0	5.2	1.4
13-Week	6/16/2022	1.640	2.27	43.9	76.8	3.9	19.2	1.1	5.2	1.5
13-Week	6/23/2022	1.670	2.83	43.4	41.7	6.3	52.0	1.6	2.1	1.4
13-Week	6/30/2022	1.750	2.84	44.1	39.5	5.0	55.5	0.9	8.1	1.5
26-Week	4/7/2022	1.110	3.29	46.9	34.4	5.2	60.5	1.1	6.6	3.0
26-Week	4/14/2022	1.220	3.32	46.8	29.6	4.9	65.5	1.2	6.0	3.0
26-Week	4/21/2022	1.250	3.29	46.9	31.9	1.0	67.1	1.1	6.2	3.0
26-Week	4/28/2022	1.370	2.99	43.3	47.3	1.8	50.9	1.7	6.2	2.9
26-Week	5/5/2022	1.420	2.99	40.8	35.5	0.1	64.4	1.2	7.5	2.8
26-Week	5/12/2022	1.385	2.72	40.2	60.7	3.4	35.8	1.8	5.8	2.7
26-Week	5/19/2022	1.490	3.09	40.8	47.4	3.1	49.5	1.2	6.4	2.8
26-Week	5/26/2022	1.530	3.07	40.6	35.1	1.8	63.1	1.4	5.4	2.7
26-Week	6/2/2022	1.580	2.81	40.9	46.9	2.8	50.3	1.1	7.3	2.8
26-Week	6/9/2022	1.710	2.87	41.0	42.5	2.0	55.5	1.0	4.8	2.7
26-Week	6/16/2022	2.160	3.26	41.1	28.3	3.7	68.1	0.9	4.9	2.7
26-Week	6/23/2022	2.390	2.44	40.8	66.1	3.8	30.2	1.2	1.9	2.5
26-Week	6/30/2022	2.500	2.79	40.1	43.7	2.2	54.2	1.9	7.6	2.9
52-Week	4/21/2022	1.870	3.31	33.3	44.3	10.6	45.1	0.7	4.4	4.3
52-Week	5/19/2022	2.100	3.12	33.1	35.8	3.5	60.7	0.9	5.2	4.5
52-Week	6/16/2022	3.020	3.14	33.1	32.4	2.3	65.2	0.9	3.9	4.4

*Approximated using prices at settlement and includes both competitive and non-competitive awards.

					Bills (cont.)					
Issue	Settle Date	Stop Out Rate (%)	Bid-to-Cover Ratio	Competitive Awards ($bn)	% Primary Dealer	% Direct	% Indirect	Non-Competitive Awards ($bn)	SOMA "Add Ons" ($bn)	10-Year Equivalent ($bn)*
17-Week	4/12/2022	0.910	3.70	30.0	36.8	7.5	55.7	0.0	0.0	1.1
17-Week	4/19/2022	0.965	3.59	30.0	41.9	3.5	54.6	0.0	0.0	1.1
17-Week	4/26/2022	1.070	3.82	30.0	51.3	1.8	46.9	0.0	0.0	1.1
17-Week	5/3/2022	1.110	3.56	29.6	33.5	0.0	66.5	0.4	0.0	1.1
17-Week	5/10/2022	1.225	3.31	29.8	42.0	0.9	57.1	0.2	0.0	1.1
17-Week	5/17/2022	1.160	3.29	29.0	47.0	3.8	49.2	1.0	0.0	1.1
17-Week	5/24/2022	1.250	3.05	29.9	54.5	3.3	42.1	0.1	0.0	1.1
17-Week	5/31/2022	1.280	3.21	29.6	41.6	5.5	52.9	0.4	0.0	1.1
17-Week	6/7/2022	1.390	3.09	29.8	35.2	3.3	61.6	0.2	0.0	1.1
17-Week	6/14/2022	1.510	3.14	30.0	38.2	2.1	59.7	0.0	0.0	1.1
17-Week	6/21/2022	2.090	3.20	30.0	53.3	1.7	45.1	0.0	0.0	1.1
17-Week	6/28/2022	2.060	3.00	29.8	54.9	2.6	42.5	0.2	0.0	1.1
17-Week	7/5/2022	2.185	3.72	29.0	40.9	2.7	56.3	1.0	0.0	1.1

*Approximated using prices at settlement and includes both competitive and non-competitive awards.

Nominal Coupons										
Issue	Settle Date	Stop Out Rate (%)*	Bid-to-Cover Ratio	Competitive Awards ($bn)	% Primary Dealer	% Direct	% Indirect	Non-Competitive Awards ($bn)	SOMA "Add Ons" ($bn)	10-Year Equivalent ($bn)**
2-Year	5/2/2022	2.585	2.74	47.0	12.6	21.4	66.0	1.0	6.7	12.0
2-Year	5/31/2022	2.519	2.61	46.2	15.4	22.1	62.6	0.8	7.1	12.2
2-Year	6/30/2022	3.084	2.51	45.1	23.2	25.3	51.5	0.9	3.5	11.3
3-Year	4/18/2022	2.738	2.48	45.6	29.0	17.6	53.4	0.4	11.0	18.4
3-Year	5/16/2022	2.809	2.59	44.7	20.0	18.0	62.0	0.3	31.5	25.0
3-Year	6/15/2022	2.927	2.45	43.6	24.9	23.6	51.5	0.4	2.6	15.5
5-Year	5/2/2022	2.785	2.41	48.8	16.5	19.5	64.0	0.2	6.8	29.4
5-Year	5/31/2022	2.736	2.44	47.8	17.0	20.0	62.9	0.2	7.2	29.8
5-Year	6/30/2022	3.271	2.28	46.9	23.8	19.7	56.5	0.1	3.6	27.3
7-Year	5/2/2022	2.908	2.41	44.0	15.2	19.8	65.0	0.0	6.1	35.9
7-Year	5/31/2022	2.777	2.69	42.0	6.4	15.8	77.9	0.0	6.3	35.5
7-Year	6/30/2022	3.280	2.48	40.0	17.7	20.4	61.9	0.0	3.1	31.5
10-Year	4/18/2022	2.720	2.43	34.0	18.7	17.0	64.3	0.0	8.1	42.0
10-Year	5/16/2022	2.943	2.49	35.9	11.5	18.2	70.3	0.1	25.2	60.4
10-Year	6/15/2022	3.030	2.41	33.0	17.0	19.4	63.6	0.0	1.9	34.9
20-Year	5/2/2022	3.095	2.80	16.0	8.7	15.3	75.9	0.0	2.2	31.6
20-Year	5/31/2022	3.290	2.50	17.0	13.0	16.4	70.6	0.0	2.6	33.0
20-Year	6/30/2022	3.488	2.60	14.0	12.4	20.2	67.4	0.0	1.1	25.5
30-Year	4/18/2022	2.815	2.30	20.0	15.9	18.9	65.2	0.0	4.8	58.6
30-Year	5/16/2022	2.997	2.38	22.0	13.7	16.6	69.7	0.0	15.4	84.9
30-Year	6/15/2022	3.185	2.35	19.0	14.1	16.9	69.0	0.0	1.1	46.0
2-Year FRN	5/2/2022	(0.075)	2.51	23.9	49.6	20.9	29.5	0.1	3.3	0.01
2-Year FRN	5/27/2022	0.000	3.22	22.0	22.3	4.6	73.1	0.0	0.0	0.03
2-Year FRN	6/24/2022	(0.003)	3.49	21.9	25.9	6.9	67.2	0.1	0.0	0.04

TIPS										
Issue	Settle Date	Stop Out Rate (%)	Bid-to-Cover Ratio	Competitive Awards ($bn)	% Primary Dealer	% Direct	% Indirect	Non-Competitive Awards ($bn)	SOMA "Add Ons" ($bn)	10-Year Equivalent ($bn)**
5-Year TIPS	4/29/2022	(0.340)	2.73	19.9	6.5	4.0	89.5	0.1	0.0	11.3
5-Year TIPS	6/30/2022	0.362	2.61	17.9	6.8	9.3	83.9	0.1	1.4	10.9
10-Year TIPS	5/31/2022	0.232	2.24	14.0	17.9	11.4	70.7	0.0	2.1	17.9

*FRNs are reported on discount margin basis.
**Approximated using prices at settlement and includes both competitive and non-competitive awards.
For TIPS 10-Year equivalent, a constant auction BEI is used as the inflation assumption.

TBAC Charge – Update of Model Results for Optimal Treasury Debt Structure

- *Since the start of the pandemic, there have been substantial changes to macroeconomic conditions, fiscal and monetary policy, and Treasury issuance. Given these changes, pursuant to the extensive TBAC work over the last several years on an optimal debt model, please provide an update on the output of the model. How have the model's results changed and what have been the main drivers of those changes? What insights can the model offer about the current stock of debt and upcoming issuance decisions?*

Executive Summary

- This presentation provides an update on the output of the optimal debt issuance model that has been used previously by TBAC.[1] The update shows the model results as of the end of the first quarter of 2022 and compares them to the results from the last quarter of 2019, just before the onset of the COVID-19 pandemic.

- While model outputs should not be (and are not being) used prescriptively, they do provide a number of insights on how the shift in the macroeconomic and fiscal environments, along with the debt issuance decisions made over this period, have affected the expected cost of U.S. debt and the risks surrounding these costs.

- The model results show that the Treasury faces a less favorable frontier for the expected cost of its debt at given levels of risk relative to the situation in 2019Q4. This outward shift in the frontier mainly reflects the increased size of the outstanding debt stock, with only a small portion explained by the change in the macroeconomic environment.

  - The shift in the macroeconomic environment is seen as less important in the model in part because of the substantial mean-reverting properties of the model

  - Alternative model structures that do not assume the same degree of mean reversion could produce different conclusions

  - In addition, this version of the model includes the full stock of outstanding debt, without taking into consideration the effects of the SOMA portfolio

- Similar to previous results, the model continues to see increased issuance of Bills, short- and intermediate-maturity Notes, TIPS, and FRNs as most favorable. According to the results, the expected cost of Treasury debt could be lowered by several tenths of a percent of GDP, with only limited incremental risk to the overall fiscal deficit, by shifting issuance in those directions.
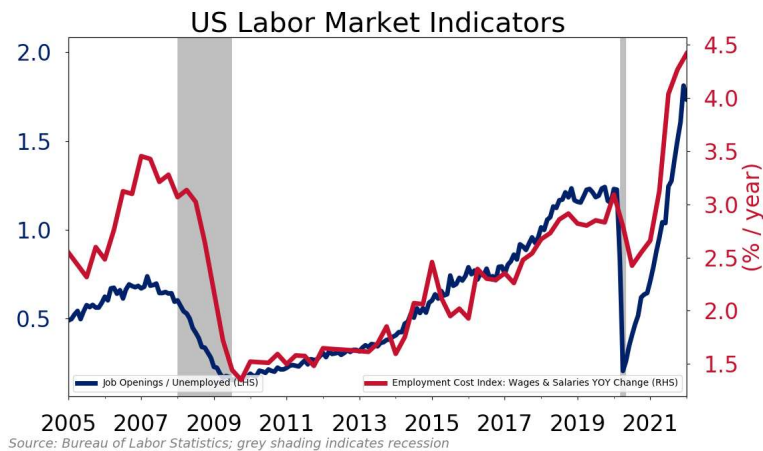
[1]Belton, Dawsey, Greenlaw, Li, Ramaswamy, and Sack, "Optimizing the maturity structure of U.S. Treasury debt: A model-based framework", The Hutchins Center on Fiscal and Monetary Policy, Brookings Institution (October 10, 2018).   https://www.brookings.edu/research/optimizing-the-maturity-structure-of-u-s-treasury-debt/

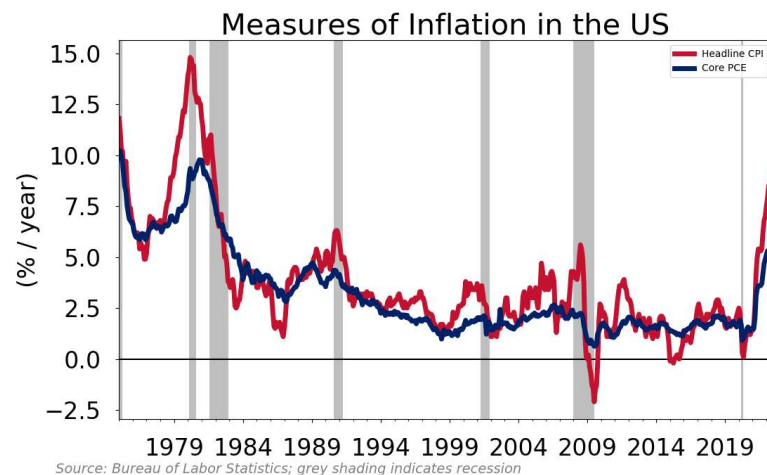# Macroeconomic, Fiscal, and Market Context

Change in Macroeconomic Environment

As the US emerges from the COVID-19 pandemic, supply / demand imbalances have driven the economy into a period of elevated inflation.
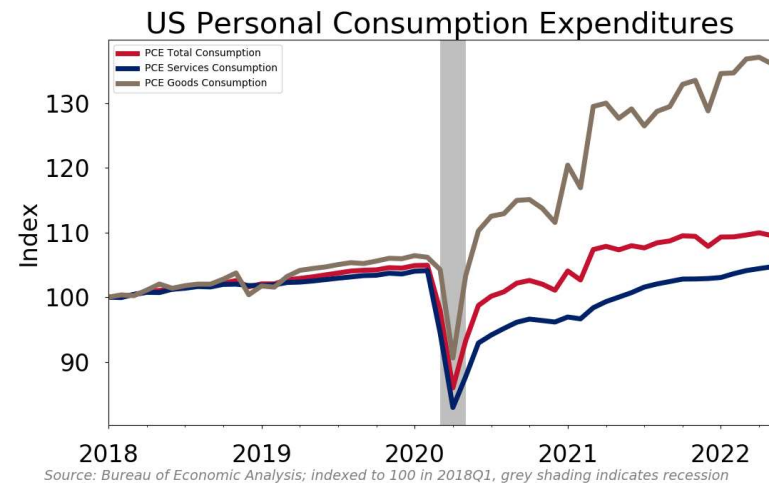
After experiencing significant job losses during 2020, the labor market is now extremely tight


US Labor Market Indicators

Job Openings / Unemployed (LHS)   Employment Cost Index: Wages & Salaries YOY Change (RHS)

Source: Bureau of Labor Statistics; grey shading indicates recession

Overall consumption has returned to trend, but goods consumption is extremely elevated relative to pre-pandemic levels, while services consumption is lagging

US Personal Consumption Expenditures

PCE Total Consumption
PCE Services Consumption
PCE Goods Consumption

Source: Bureau of Economic Analysis; indexed to 100 in 2018Q1, grey shading indicates recession

The demand for labor, significant changes in consumption behavior, supply chain disruptions, and global events have resulted in inflation reaching multi-decade highs

Measures of Inflation in the US

Headline CPI
Core PCE

Source: Bureau of Labor Statistics; grey shading indicates recession

In response, the Federal Reserve has begun to raise the target range for the Federal Funds Rate aggressively

Federal Funds Target (Top of Range)

Source: Federal Reserve; grey shading indicates recession

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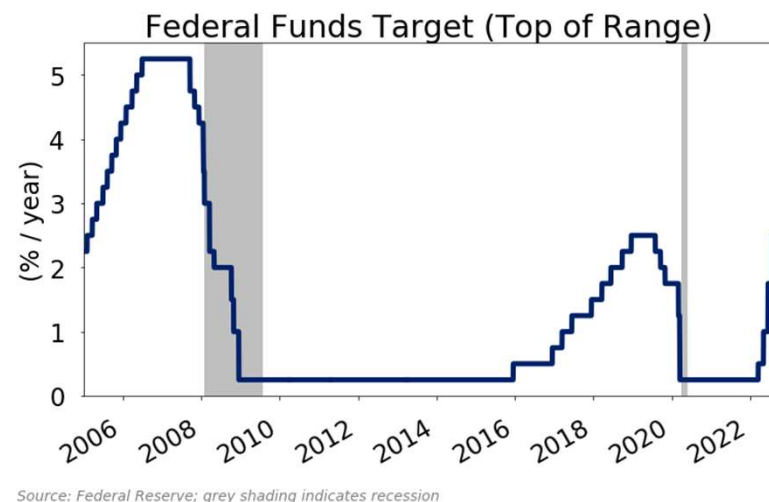
Change in Fiscal and Monetary Environment

The US government's response to the COVID-19 pandemic included large fiscal outlays and an increase in the public debt.   Separately, the Federal Reserve significantly increased its balance sheet.

Treasury total marketable debt has increased $6.6TN since the end of 2019Q4, up about 40%.
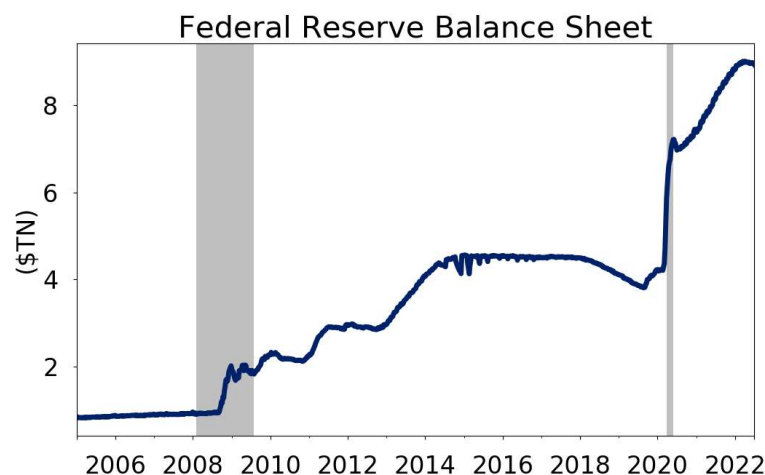
The balance sheet of the Federal Reserve has increased $4.7TN since the end of 2019Q4, up more than 100%.

Total Marketable Debt

Source: US Treasury; grey shading indicates recession

Federal Reserve Balance Sheet
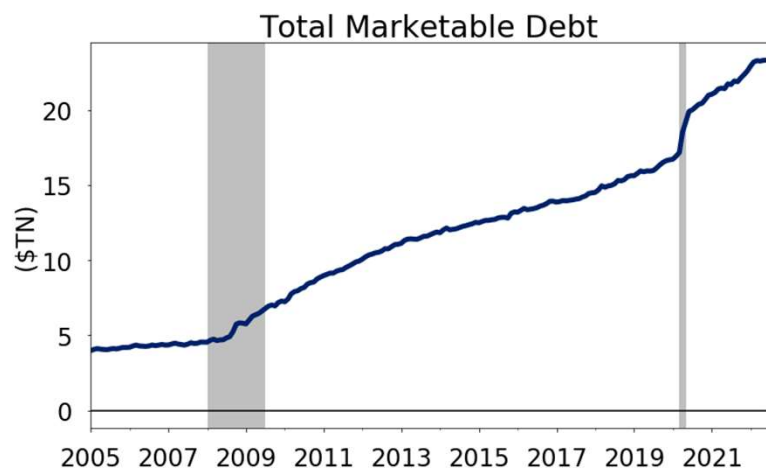
Source: Federal Reserve Board H.4.1; grey shading indicates recession

The Federal budget deficit has averaged -11.4% of GDP since 2019Q4

The weighted average maturity (WAM) of Treasury marketable debt has increased from 69.7 months pre-pandemic to 74.3 months currently

US Budget Deficit as a Percent of GDP

Source: US Treasury; grey shading indicates recession

WAM of Total Outstanding Marketable Debt

Source: US Treasury; grey shading indicates recession

5
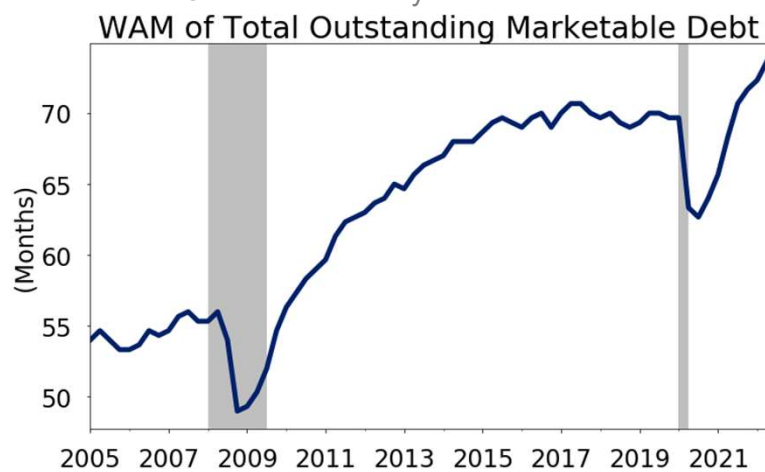
Change in Financial Market Environment

After an initial steep decline at the onset of the pandemic, US bond market yields have responded to the rapid pace of Fed tightening, largely returning to pre-pandemic levels or higher.

Treasury yields, after dropping to historic lows, have now risen and are above pre-pandemic levels


Source: Bloomberg; grey shading indicates recession

Some of the increase in Treasury yields has been due to an increase in term premium

Source: Federal Reserve Bank of New York; grey shading indicates recession
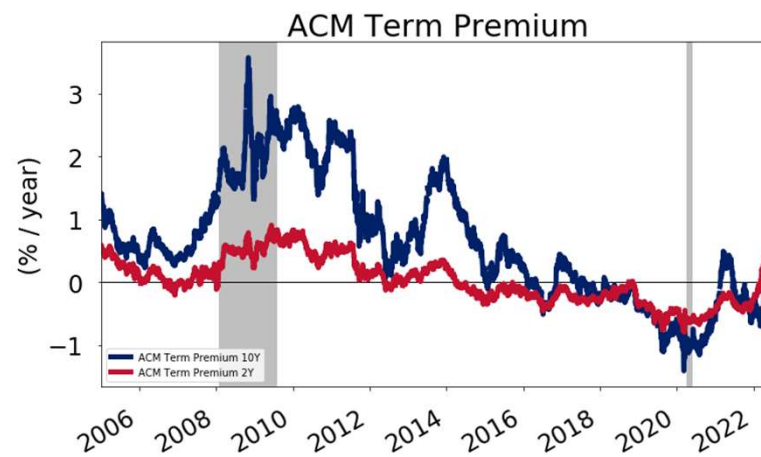
Spot market measures of inflation have increased significantly, but market implied forward inflation expectations remain contained. Real rates have risen significantly.

Source: Bloomberg; grey shading indicates recession

The forward curve implies a continuation of Fed hikes but then a quick reversal, likely due to the risk of the Fed responding to a slowing economy
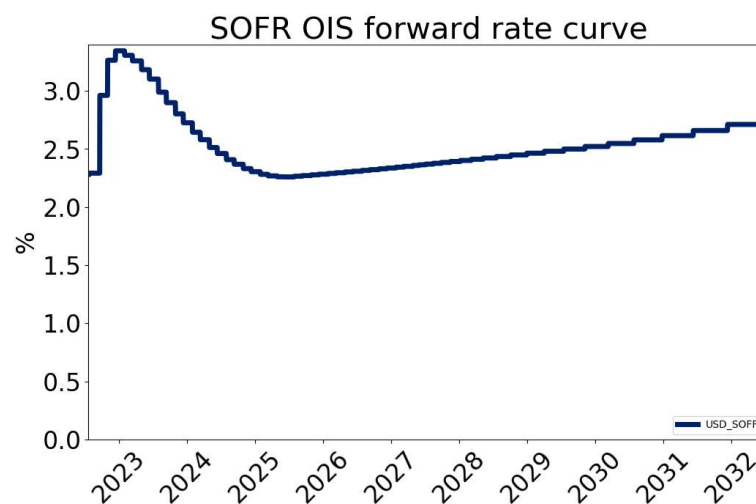
Model Review and Outputs

Model Description

- The debt optimization model contains:
  - A macroeconomic model for the unemployment gap, core PCE inflation, headline CPI, the Fed Funds target rate, the rate of change of potential real GDP, and the equilibrium real rate of interest
  - A model for the nominal and real Treasury yield curves using expected Fed policy and risk premiums
  - A fiscal equation for the primary budget deficit
  - A debt dynamics module that tracks debt based on current and future issuance of Bills, Notes, Bonds, TIPS, and FRNs

- The model can be used to assess the effects of various hypothetical debt management decisions:
  - It can trace out frontiers reflecting the trade-off between expected debt cost and risk under various issuance strategies
  - It can be used to optimize static issuance strategies (in which issuance fractions are held constant)
  - And it can be used for dynamic optimizations (in which issuance fractions depend on macro variables)

- The results of the model are forward looking
  - These results are affected by the macroeconomic, financial market, and fiscal conditions prevailing at the start of the simulation.
  - Following previous work, we focus on the distribution of debt outcomes at a horizon of 20 years.

- None of the parameters that determine the forward evolution of model macroeconomic and rates variables have been changed since the last time the model was used. However, we did make a few changes to the model:
  - The Bond kernel has been modified to include the 20Y Bond, with 20Y and 30Y issued at their current ratio.
  - An additional liquidity premium has been introduced for the 20Y Bond. This liquidity premium begins at 15 bp and linearly drops to zero over 5 years.
  - We are using the last published value of Laubach-Williams R-star as the initial value, and imputing long term R-star from the FOMC Summary of Economic Projections.

- The model implementation is the author's and is the source for all of the charts displayed in what follows. Another implementation of the model is now publicly available, courtesy of the Hutchins Center at the Brookings Institution, at the Brookings Institution GitHub: https://github.com/BrookingsInstitution/Treasury-Issuance-Model.
  - These results of these two code bases are largely in agreement, although there are some small differences.

Model Macroeconomic and Fiscal Variable Behavior

We display simulated paths from 2019Q4, and actual paths + simulated paths from 2022Q1. We display the sample mean and 15%/85% percentile bands for a collection of model variables.
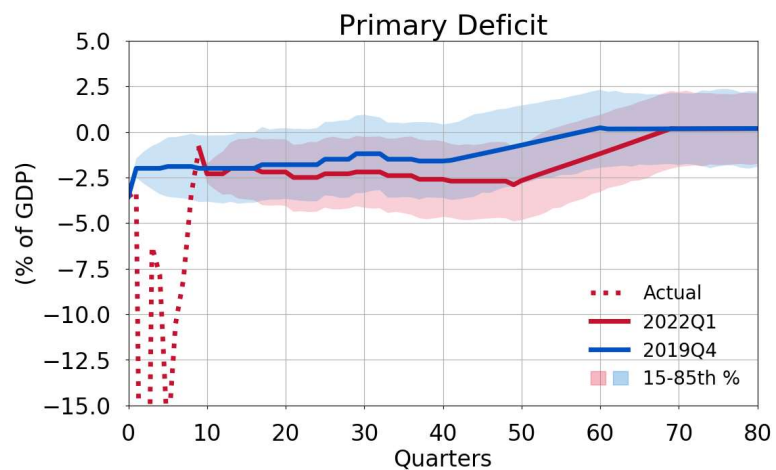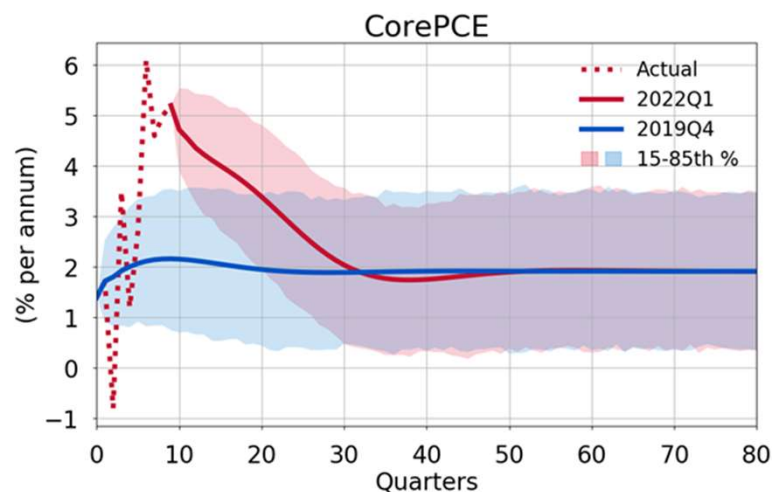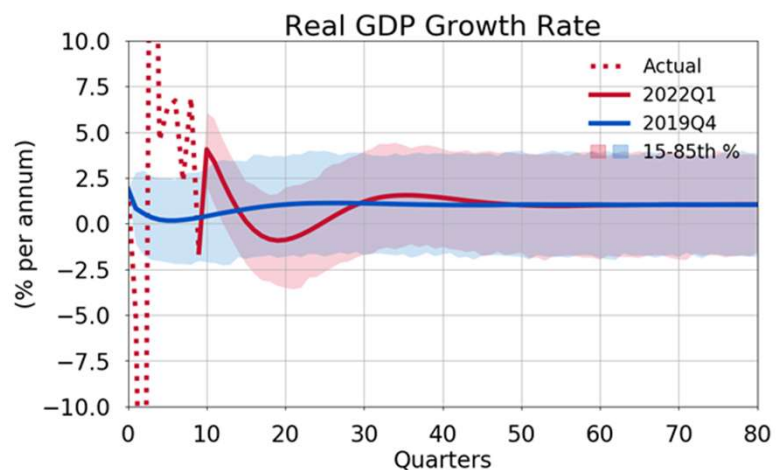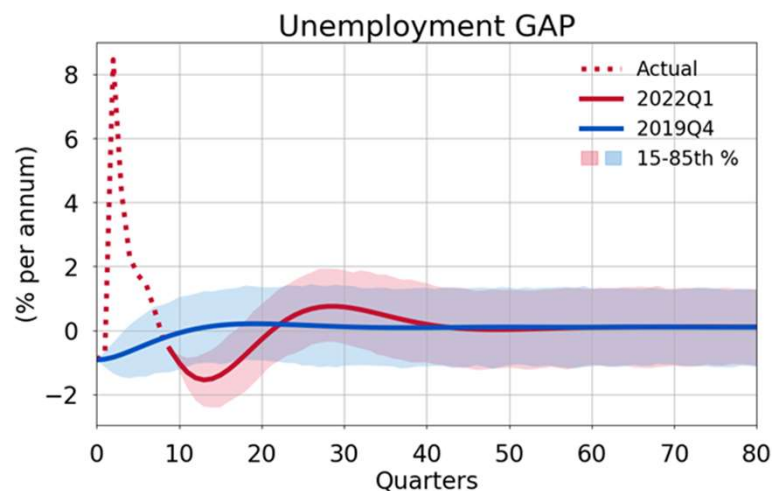
Model Rates Variable Behavior

We display simulated paths from 2019Q4, and actual paths + simulated paths from 2022Q1. We display the sample mean and 15%/85% percentile bands for a collection of model variables.

Fed Funds

2-Year Treasury Yield

10-Year Treasury Yield
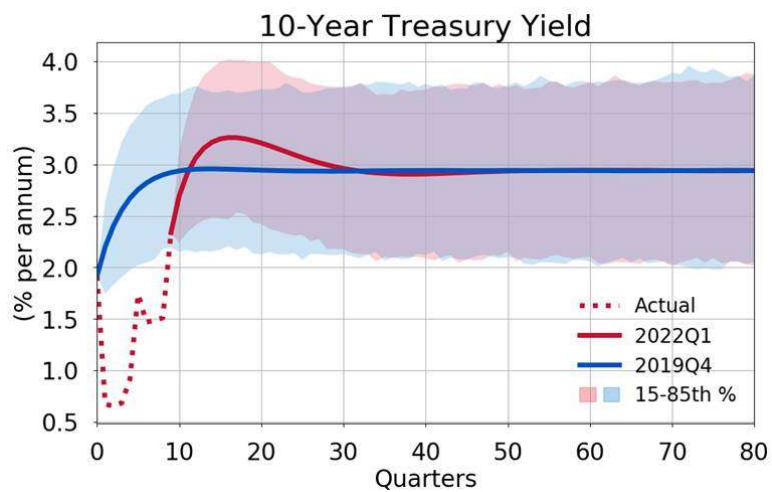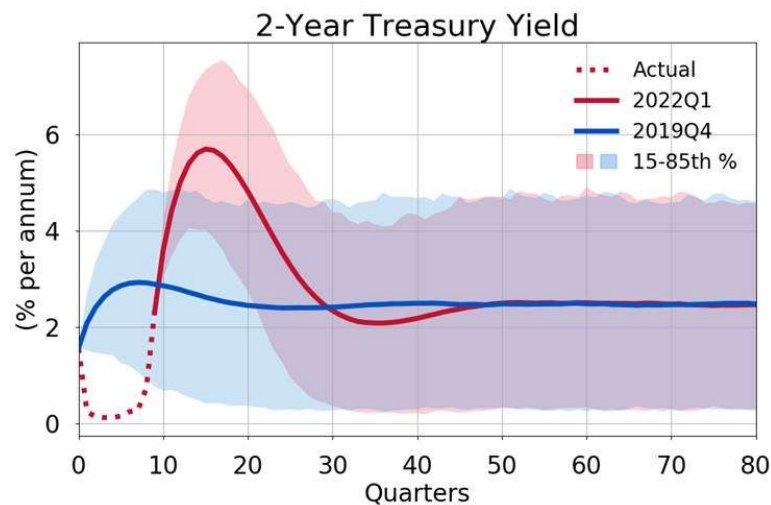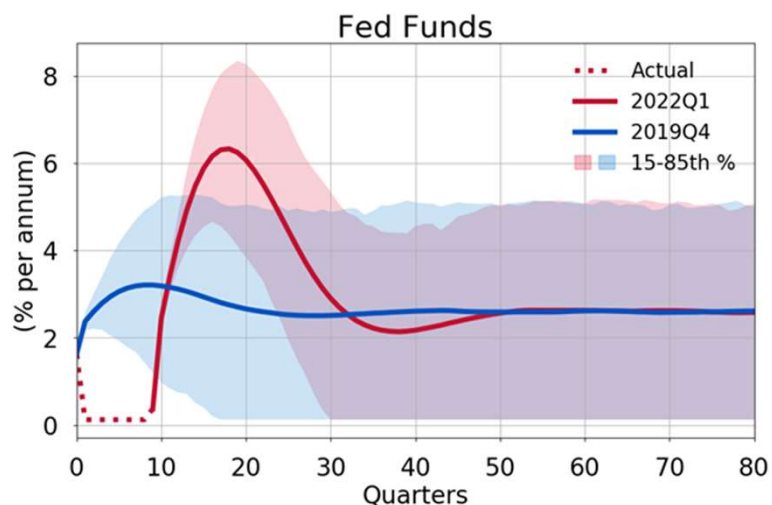
- The different initial conditions have a strong effect on the path of various variables in the model, but the terminal distributions are not significantly different.

- The cost and variability of an issuance strategy does depend on the entire path, however, so it is important to note the significantly different evolutions implied by the two sets of initial conditions.

- While the macroeconomic and rates models are useful for analyzing long-term effects of debt management decisions, they are not sophisticated forecasting models and these outputs should not be understood as taking a meaningful view on the near-term outlook for rates or the economy

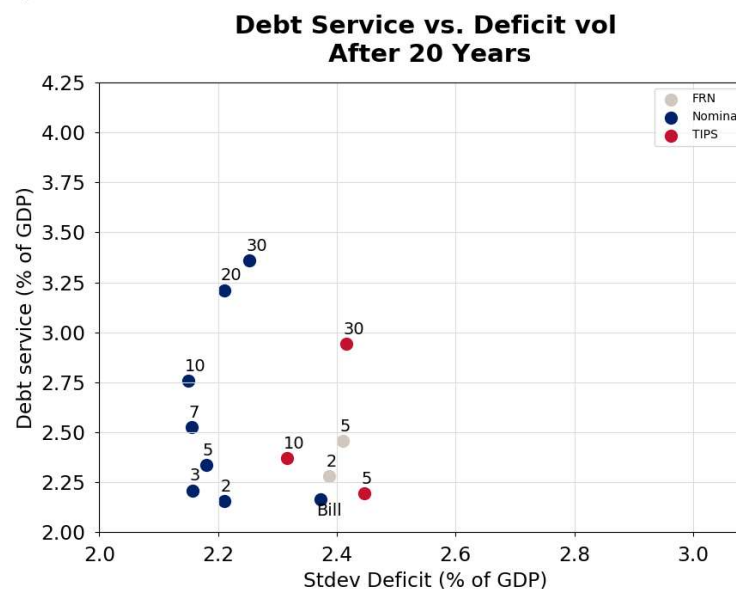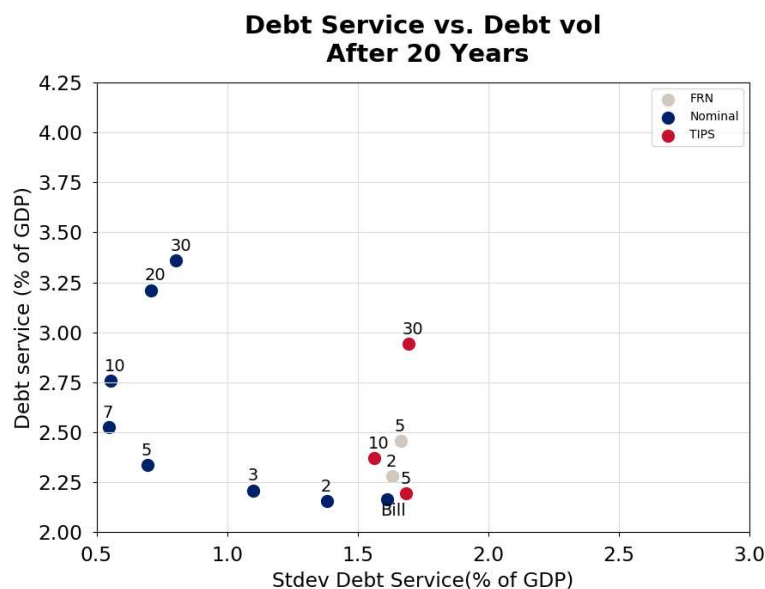# Model Output: Single Security Issuance Strategies

Results show average debt service cost in year 20 versus two different measures of variance across the path population.

- In the model, economic variables (such as inflation, the unemployment gap, etc.), interest rates, and the primary budget deficit are forecasted first along each path in the simulation. These depend only on the initial conditions put into the model, and the model's own internal equations used to generate evolution along the paths; they are independent of the choice of issuance.

- The control variable in the model is the choice of how to issue debt at each time step and on each path of the simulation, and is called the issuance strategy.

- Strategy results are evaluated on the basis of expected future cost (debt service) versus risk (variation of either debt service or deficit).

- While the model has the ability to vary issuance strategies at each time step and along each path in response to the changes of various macroeconomic variables, we do not employ that technology here. Instead, we focus only on static issuance strategies, for which an array of issuance percentages is applied to all the available Bills, Notes, Bonds, TIPS, and FRNs. The results for such a static strategy reflect the outcome should Treasury pick a single strategy and not change it for the next 20 years.

- We begin by considering single security issuance strategies, in which one element of the array is 100%, and the rest are 0%. That is, the Treasury chooses to issue nothing but Bills, or nothing but 2Y Notes, or nothing but long Bonds, for the next 20 years.
    - These strategies are of course unrealistic, but they serve to illustrate the properties of each of the available securities under the assumptions of the model.

- Single security issuance plots are displayed on the next page. The qualitative behavior of the strategies remains the same from 2019Q4 to 2022Q1, with all strategies shifting up and to the right.
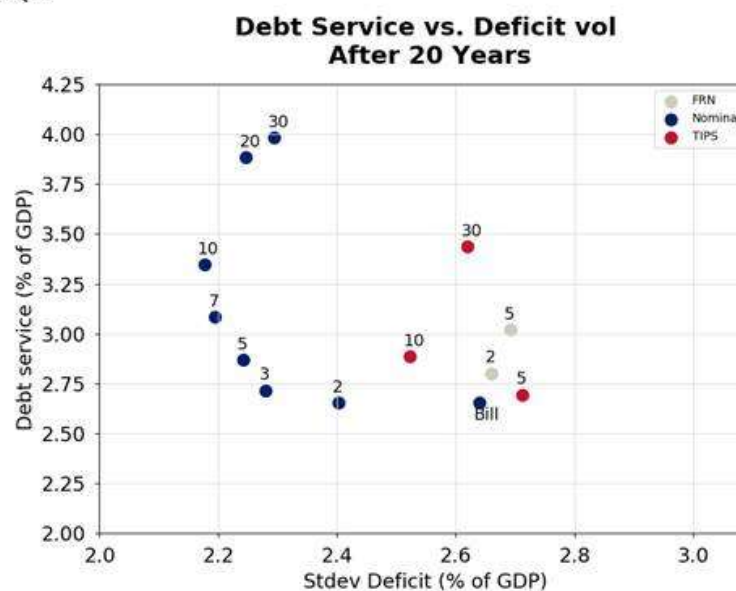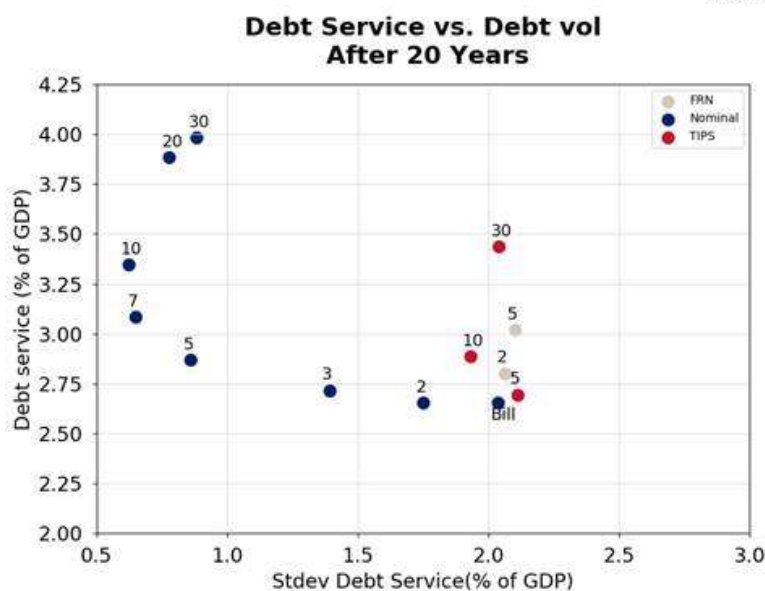
Model Output: Single Security Issuance Plots

Single security issuance results have shifted up and to the right (more cost and more volatility), primarily due to the increased size of the stock of Treasury debt.

2019Q4

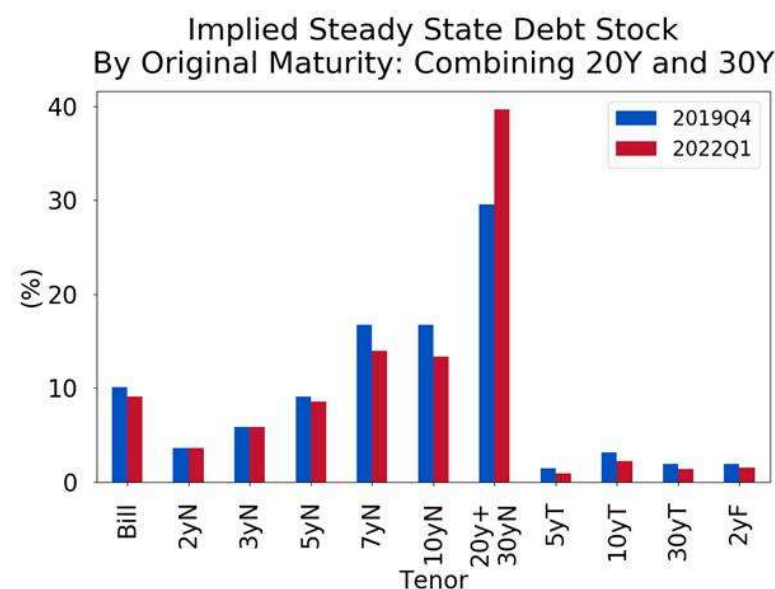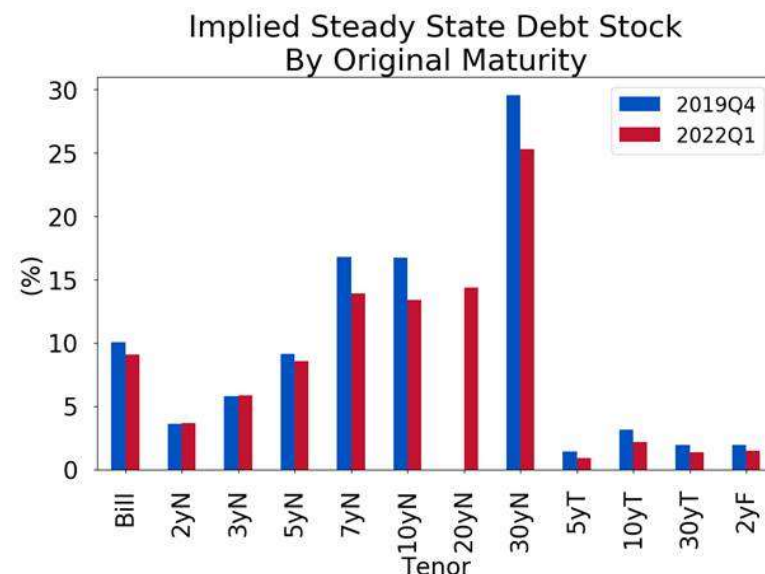Debt Service vs. Debt vol
After 20 Years

Debt Service vs. Deficit vol
After 20 Years

2022Q1

Debt Service vs. Debt vol
After 20 Years

Debt Service vs. Deficit vol
After 20 Years

Impact of Current Debt Management Choices

Historical Issuance
Projecting observed Treasury issuance patterns

- We can evaluate the Treasury issuance pattern at a given point in time by assuming it is a static strategy that will be maintained going forward.

- The steady-state debt stocks[1] implied by Treasury's issuance patterns in 2019Q4 and 2022Q1 are displayed to the right. These show the steady-state amount of outstanding debt, grouped by original issue maturity.

- The charts show the effect of changes to the issuance strategy post the onset of the pandemic. The most notable change was the introduction of the 20Y Bond, which involved a relative decrease in issuance of Bills, 5Y – 10Y Notes, 30Y Bonds, TIPS, and FRNs.

- The second chart highlights the significant increase in long-end issuance by combining 20Y and 30Y into a single bucket. This demonstrates how the change in issuance is dominated by the increased supply in the long end.

- We compare these strategies in the different environments in what follows.

- The assumption that Treasury would not modify its issuance pattern over the course of 20 years is not reasonable; nevertheless, these analyses can provide a way to compare issuance choices and suggest changes.


Implied Steady State Debt Stock By Original Maturity

Implied Steady State Debt Stock By Original Maturity: Combining 20Y and 30Y

[1]For a review of how to derive the steady-state debt stock from a given quarterly or annual issuance pattern, see the Appendix to the charge "Fixed vs. Floating Rate Treasury Securities", published in the 2019Q2 quarterly refunding documents

Efficient Frontiers and Historical Issuance

Macroeconomic and fiscal environment just before the pandemic compared to recent environment

- Efficient frontiers are obtained by comparing the trade-off between debt service and the standard deviation of the deficit under various static issuance strategies.

- Here we compare the model efficient frontier using macroeconomic and fiscal environments observed at the end of 2019Q4 (blue line), to the model efficient frontier as computed using the macroeconomic and fiscal environments as of the end of 2022Q1 (red line).

- The efficient frontier has moved up (higher cost) and to the right (higher volatility). As we will show below, this is primarily due to the change in the fiscal environment between 2019Q4 and 2022Q1.

- The blue and red dots in the upper right plot represent Treasury's issuance kernel as of 2019Q4 and 2022Q1, respectively. The degree to which issuance lies off the model efficient frontier has remained about the same.

- The graph in the lower right shows the efficient frontier using the macroeconomic environment in 2019Q4, but the fiscal environment from 2022Q1. To do this, we use the debt stock from 2022Q1 shifted back in time 9 quarters and rescaled by nominal GDP, in order to ascertain the effect of having a debt to GDP ratio in 2019Q4 equal to that in 2022Q1. We also use the primary deficit as a percent of GDP from 2022Q1.

- The modified 2019Q4 frontier lies almost on top of the 2022Q1 frontier, implying that most of the difference in the frontiers in the upper chart can be attributed to the shift in the fiscal environment. The remaining distance is due to the difference in the macroeconomic environment.
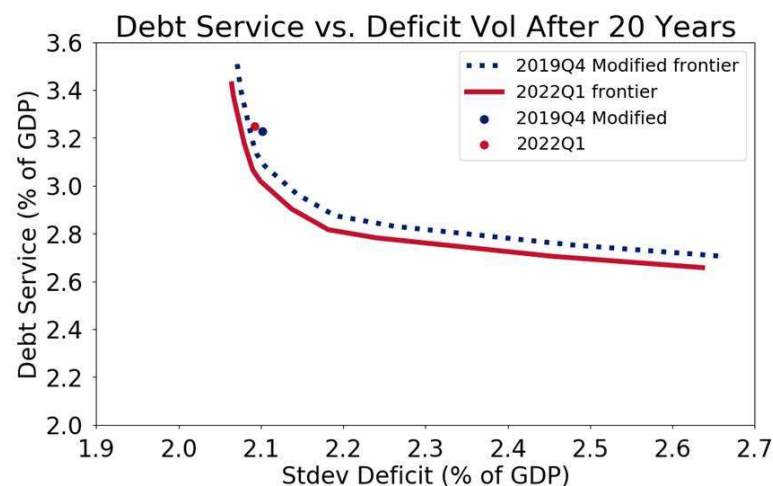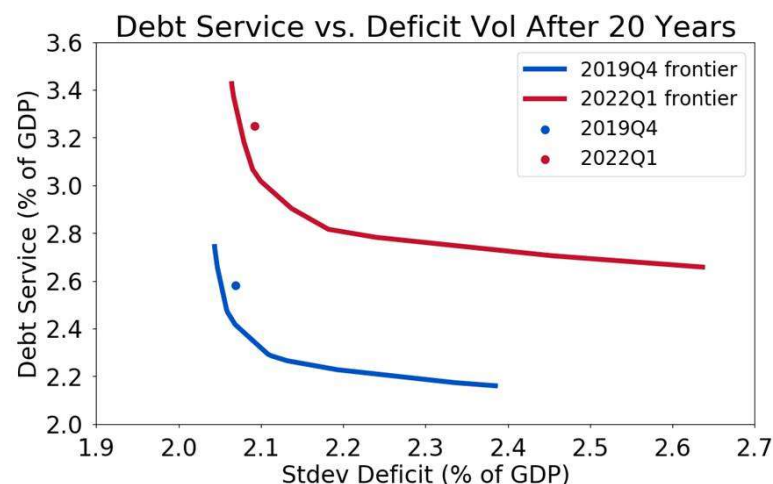
Efficient Frontiers and Historical Issuance

Comparing recent Treasury issuance patterns in differing macroeconomic and fiscal environments

- Next we consider Treasury's current and previous issuance in the same environment. We examine both 2019Q4 and 2022Q1.

- The chart in the upper right displays the efficient frontier as computed in 2019Q4 for the macroeconomic and fiscal environment observed in 2019Q4, and the blue and red dots represent the cost and volatility of holding fixed the issuance patterns used in 2019Q4 and 2022Q1, respectively. The chart in the lower right represents the same analysis performed using the macroeconomic and fiscal environment existing in 2022Q1.

- **The two issuance patterns are close to each other, but in both cases, the modeled cost of the 2022Q1 issuance pattern is judged to be slightly higher than that in 2019Q4, while their risk is quite similar. This is mostly due to the increased issuance in the long end and reduction in Bills and belly issuance, as a percentage of the overall issuance.**

- **Both the 2019Q4 and the 2022Q1 issuance patterns are close to the efficient frontier, particularly the 2022Q1 frontier, but the issuance strategies are near the very steep (risk averse) part of the frontier.**
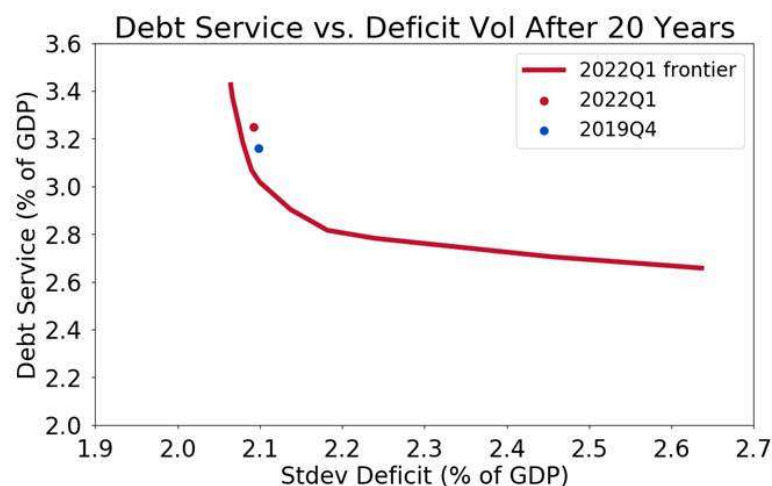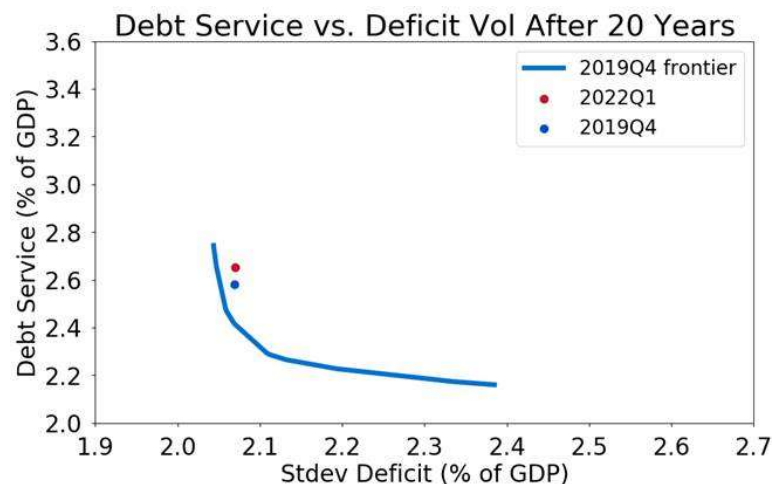
Insights for Future Issuance
Recommendations from the model

- Although the macroeconomic and fiscal situations have changed significantly since the advent of the COVID-19 pandemic, looking much further out into the future, the fundamental conclusions from the model listed in previous charges have not significantly changed, in large part due to the substantial mean-reverting properties of the model.

- The model continues to favor more belly, Bill, TIPS, and FRN issuance, while decreasing issuance in the longer end.
  - When risk is measured by the variation of the deficit (right chart), increasing TIPS issuance is strictly improving initially, as it lowers expected cost and does not increase risk (hence, it moves the issuance pattern closer to the efficient frontier). Increased belly, Bill, and FRN issuance initially reduce cost with minimal additional risk, but then become more risk additive. These observations are consistent with the comparison of 2019Q4 to 2022Q1 issuance on the previous page.
  - When risk is measured by the variation in funding costs (left chart), expected cost can only be reduced if more risk is assumed. However, that trade-off appears relatively attractive, especially in terms off increased belly issuance.

- While taking the model output into account in its objective of minimizing cost and risk to the US tax payer, Treasury should also consider the benefits of maintaining a regular and predictable issuance strategy and preserving market liquidity across a range of maturity points. Additionally, Treasury should consider the extent to which different models could produce different conclusions.

2022Q1

17
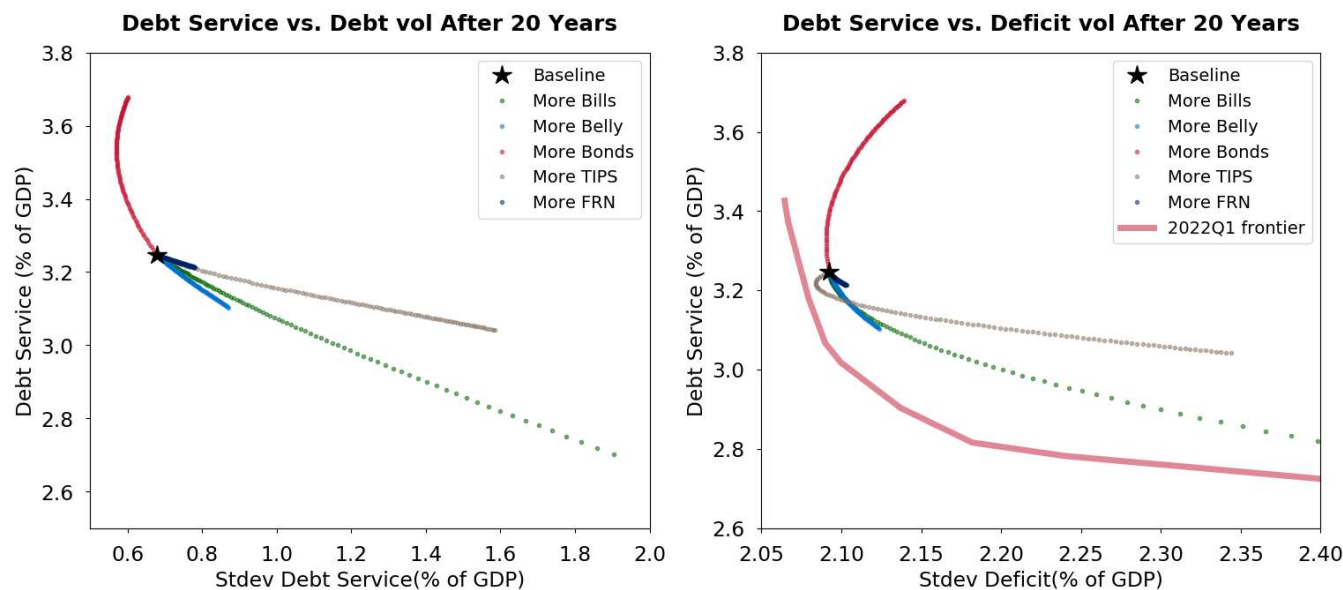
Revisiting Treasury Buybacks

TBAC Charge

Treasury last conducted "non-test" buyback operations between March 2000 and April 2002 to support its debt management goals during a period of budget surpluses. In the last several years, Treasury has conducted regular test buyback operations to maintain operational capabilities. Some have suggested that Treasury conduct buybacks to achieve various objectives, including promoting liquidity of on-the-run securities, improving cash management, and reducing variations in auction sizes (for example, see Garbade and Rutherford, 2007).

Should Treasury consider regular buyback operations? If regular buyback operations were conducted, what considerations should inform their design? How might regular buyback operations help Treasury achieve its objectives? What are the key limitations of buyback operations, in particular during periods of market stress?

Agenda

- Summary of prior TBAC work on buybacks

- Market developments since 2015

- Buybacks as a tool to improve liquidity and cost of funding

- Design and potential limitations of buybacks

- Conclusion

Summary of Prior TBAC Work on Buybacks

Summary of Prior TBAC Work on Buybacks

- The 2015 TBAC Charge examined the pros and cons for Treasury buybacks. On the potential benefits, the Charge suggested that buybacks could:

    - Enhance the liquidity of Treasury securities through buybacks of off-the-runs and issuing larger on-the-runs

    - Span temporary periods of overfunding

    - Dampen swings in bills issuance / cash balances

    - Reduce maturity peaks in outstanding debt

    - Allow more efficient changes to debt profile

- However, buybacks could have costs:

    - To create the cash needed to fund buybacks, Treasury would need to increase issuance of either bills or coupons, which would need to factor in quarterly refunding needs. Raising issue sizes could also be costly; for example, by increasing auction concession sizes and on-the-run yield levels

    - Buybacks that are too variable in size or timing might be at odd with Treasury's regular and predictable debt management strategy

Market Developments since 2015

US Treasury Outstanding Has Grown Materially since 2015

The growth of the US Treasury Market:

- Debt outstanding has doubled since 2015 and stands at historical highs
- Going forward, debt to GDP is projected to grow steadily
- The share of public debt held by the private sector will also have to increase as a consequence of Fed balance sheet runoff
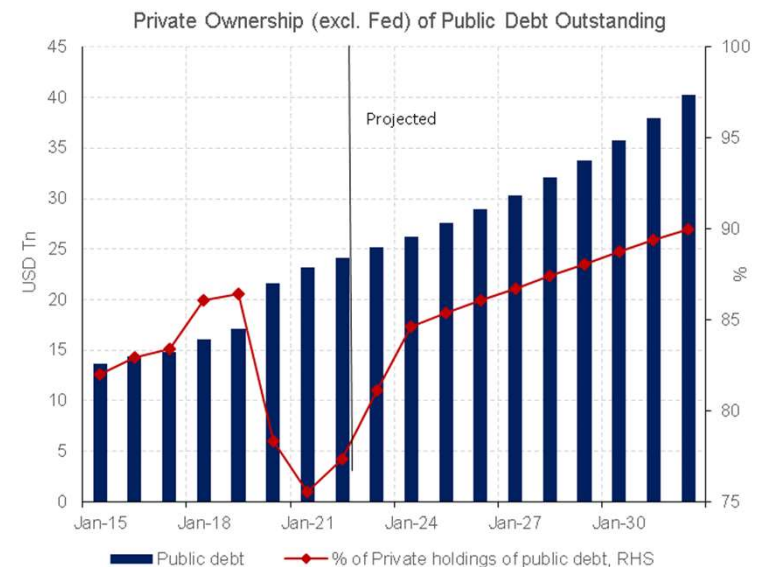
Sources: US Treasury, Congressional Budget Office, Federal Reserve, Haver Analytics

Market Developments since 2015

Regulatory changes and increased volatility have reduced dealers' intermediation capacity
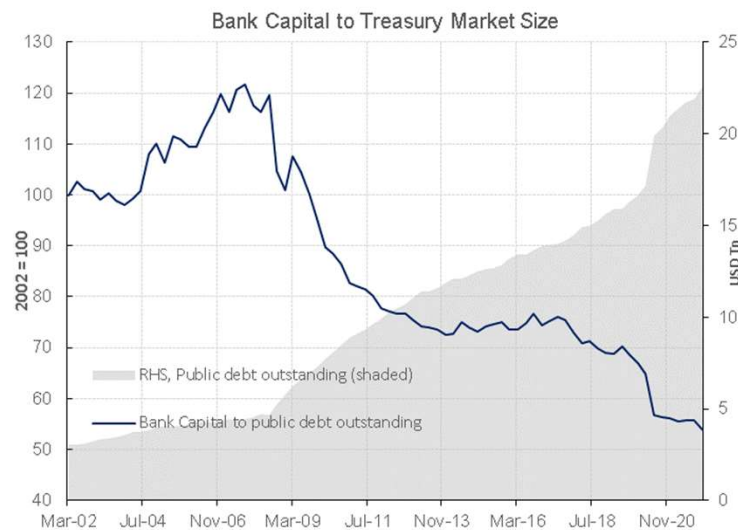
- Supplementary Leverage Ratio (final rule effective in 2018):

  - SLR acts as a constraint on the balance sheet growth of banks – including holding and intermediating US Treasuries. SLRs have been particularly binding during a time of large and rapid monetary and fiscal stimulus

- GSIB capital surcharges (phased in from 2016):

  - Intermediation capacity is sensitive to size and complexity sub-scores

- SA-CCR Stress capital buffer (effective 2022):

  - Can increase risk capital sensitivity to balance sheet intensive businesses

- Broad adoption of Basel III banking regulation standards globally (finalized 2017 with adoption at various times thereafter)

- In addition to regulatory constraints, VAR constraints reduce risk appetite in moments of heighted volatility

Market Developments since 2015

The growth of the market and changes in regulation have impacted intermediation capacity

Various metrics suggest dealers face binding constraints resulting in low participation relative to the growth of the market

- US Treasury market growth has outpaced the growth in bank capital

- Dealers' transaction volume falling as % of debt outstanding

Bank Capital to Treasury Market Size

RHS, Public debt outstanding (shaded)
Bank Capital to public debt outstanding

Primary Dealers Transactions vs Outstanding USTs

Primary dealers transactions — RHS, Transactions as % of outstanding debt

Sources: U.S. Treasury, Federal Reserve, Haver Analytics
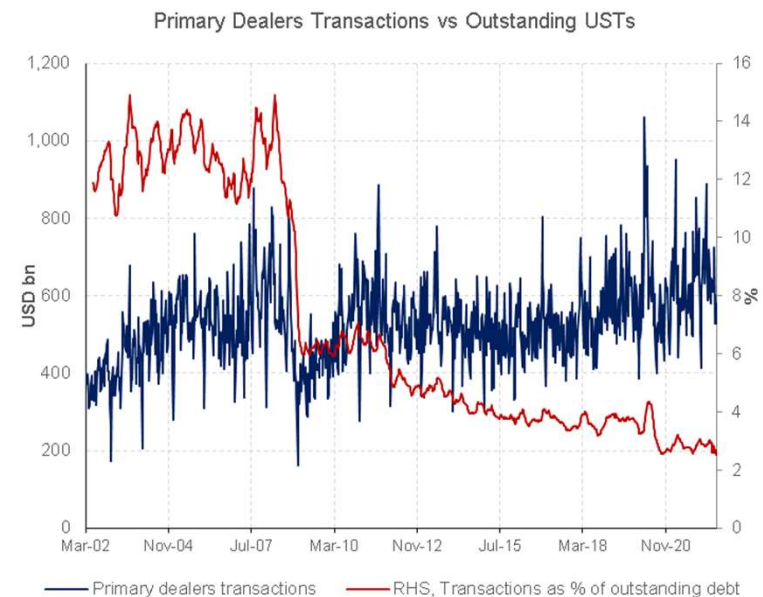
Market Developments since 2015

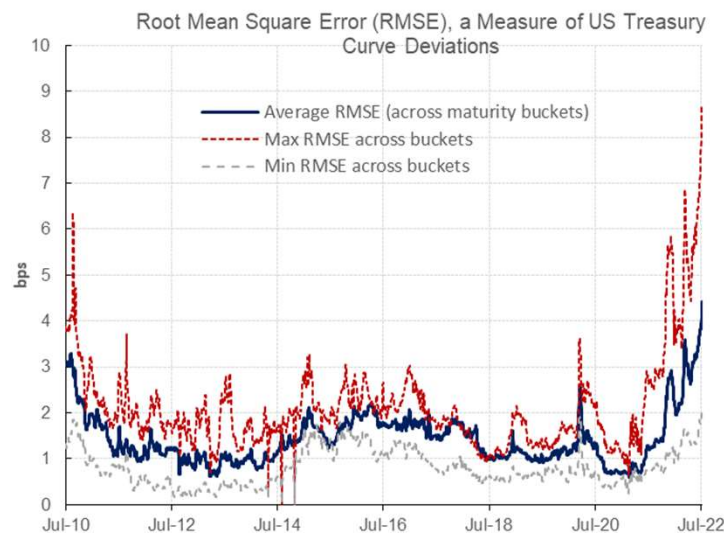Liquidity measures have worsened somewhat recently. Two suggestive metrics are Treasury curve deviations and Treasury market depth. The changes of these liquidity proxies could be related to changes in macroeconomic conditions but are likely to have been exacerbated by the market developments described previously

Root Mean Square Error (RMSE), a Measure of US Treasury Curve Deviations

— Average RMSE (across maturity buckets)
--- Max RMSE across buckets
- - - Min RMSE across buckets

Treasury Market Depth, 1-month moving average

Note: Treasury market depth is the duration weighted average of the sum of (daily) top three bids and offers by queue position for 2, 3, 5, 7, 10, 20 and 30 year bonds.

Sources: JPMorgan DataQuery

Buybacks as a Tool to Improve Liquidity and Cost of Funding

Potential Benefits of Buybacks

This presentation builds on the work presented in the 2015 Charge and focuses on the following benefits

1. Buybacks could potentially lower the cost of funding *indirectly* by promoting Treasury market liquidity

2. Buybacks could potentially generate savings for the taxpayers *directly* by purchasing cheaper securities while Treasury issues richer securities, which also improves liquidity

Academic Work on the Value of Liquidity

- Academic studies have shown that liquidity is valuable for the Treasury and ultimately saves taxpayers money:

  - A liquid market for Treasury securities provides financial services premia that can be captured by the Treasury (see Greenwood, Hanson, Rudolph and Summers 2016; and Brunnermeier, Merkel and Sannikov 2021)

  - The cost of illiquidity borne by taxpayers is directly observable via the liquidity premia embedded in higher yields of less liquid Treasury securities (see Amihud and Mendelson 1991; Warga 1992; Krishnamurthy 2002; and Krishnamurthy and Vissing-Jorgensen 2012)

  - Additional costs to illiquidity can emerge in periods of market stress if the market participants come to question the assumed liquidity of securities they hold, sparking liquidity events akin to a bank run (Logan 2020)

Empirical Evidence for the Value of Liquidity

Recent evidence suggests that better liquidity can lower the cost of funding:

- One narrow channel is that liquidity – measured by Treasury curve dispersion – appears to be correlated with auction tails
- As suggested by the academic literature, other channels likely exist by which greater liquidity lowers Treasury yields
- However, there may be an optimal issue size to maximize capturing liquidity premium. From 1998-2007, the average quarterly 10-year note issuance size was $18bn, and the on-the-run premium was 19.4bps as measured by the Fed's off-the-run yield curve. From 2013-2022, however, the average issuance size rose to $77bn and the premium fell to 3.8bps
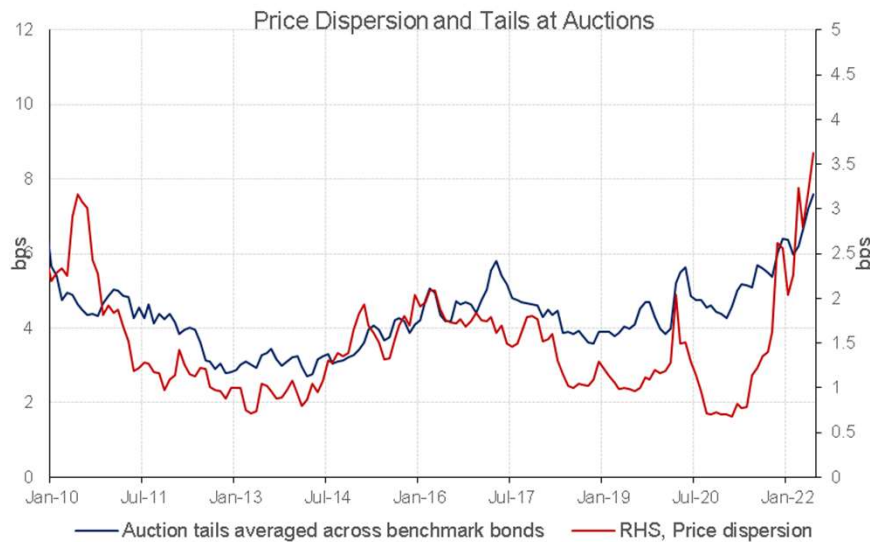
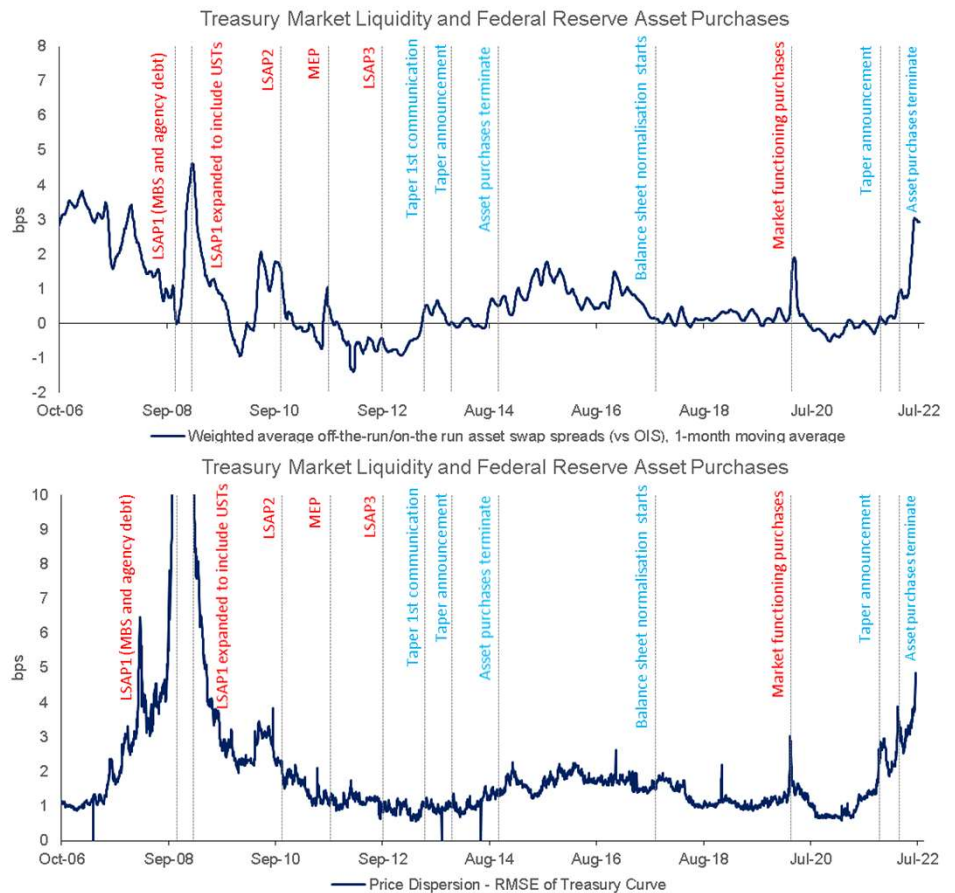Note: Price dispersion is measured as the Root Mean Square Error (RMSE) of a fitted US Treasury curve.

Sources: US Treasury, JPMorgan DataQuery, author's calculations

Empirical Evidence for How Buybacks Could Improve Liquidity

Buybacks can potentially support market liquidity and in turn *indirectly* improve the cost of funding:

- The Fed conducts operations for monetary policy purposes as well as to support market function in times of stress. Treasury buybacks should not be considered a substitute to central bank policy

- However, the experience of the Federal Reserve suggests that market liquidity benefited from regular purchases of less liquid off-the-run securities

- Market liquidity – measured by the on-the-run/off-the-run average spread across the US Treasury curve as well as Treasury curve price dispersion – deteriorated at times when Fed purchases diminished or were terminated

Sources: Author's own sources, Federal Reserve

Treasury Market Liquidity and Federal Reserve Asset Purchases

— Weighted average off-the-run/on-the run asset swap spreads (vs OIS), 1-month moving average

Treasury Market Liquidity and Federal Reserve Asset Purchases

— Price Dispersion - RMSE of Treasury Curve

Note: Red font indicates monetary policy decisions which contributed to the increase of market liquidity; e.g., Fed purchases, while blue font refers to events which had the opposite effects, e.g. tapering asset purchases and termination of Fed purchases.

Academic Work on On-The-Run/Off-The-Run Spreads

- Academic studies have also explained why on-the-run bonds and bills tend to have lower yields than corresponding off-the-run securities:

  - On-the-run bonds benefit from greater liquidity as well as repo value since purchasers can lend these instruments to short sellers and earn additional income (Duffie 1996 and Garbade and Rutherford 2007)

  - Treasury bills also benefit from a liquidity premium. Furthermore, due partly to their short maturity, bill yields are further richened due to safety and moneyness of these securities (Cashin, Ferris, and Klee 2020; Gorton 2017; and Greenwood, Hanson, and Stein 2015)

  - Under these circumstances, buying cheaper off-the-runs while issuing more expensive on-the-runs and bills could reduce the cost of funding. If issuance sizes were increased large enough, however, the on-the-run liquidity premium could diminish

Empirical Evidence on On-The-Run/Off-The-Run Spreads

Treasury buybacks could potentially lower the cost of funding *directly* by purchasing higher-yielding securities while at the same time issuing lower-yielding securities. One concern is that greater buybacks coupled with greater issuance could erode the discount vs premium gap

- One example is buybacks of off-the-run securities that are discounted compared to on-the-runs that are issued with liquidity premia. However, this discount vs premium gap appears to be smaller in recent years, in part reflecting larger issuance sizes for on-the-runs.

- Another example: When bills are more expensive than old notes and bonds, buybacks of coupons paired with issuance of bills may save taxpayers money. Treasury could calibrate the magnitudes of purchases and issuance based on the relative pricing of bills and old coupons

10-Year Off-The-Run versus On-The-Run Spread
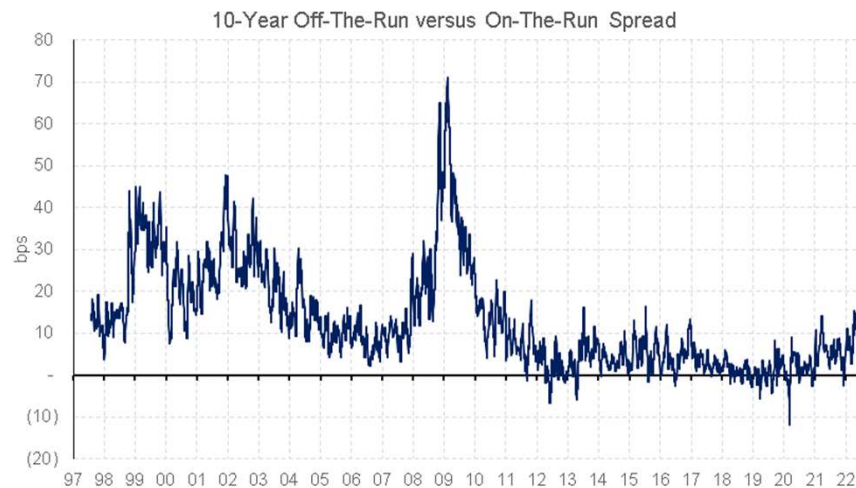
Note: The spread is calculated as the difference between the on-the-run yield and the Fed's off-the-run yield curve. A more positive spread indicates higher off-the-run versus on-the-run yields

Spread between Bills and Old Coups has Widened
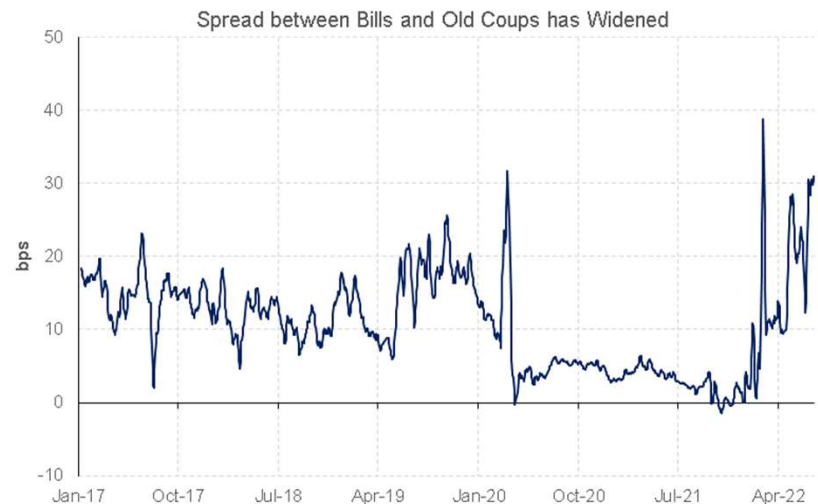
Note: The spread is calculated as the asset swap spread between short-term (6+ months) off-the-run coupons and 3-month bills

Sources: Federal Reserve, Haver Analytics, JPMorgan DataQuery, author's own sources and calculations

Design and Potential Limitations of Buybacks

Design and Potential Limitations of Buybacks

Key parameters to consider for buyback design: size, frequency, composition, market impact, and funding

1. Size

- Over time, buybacks would likely result in greater issuance. It's difficult to determine the point at which the cost savings of purchases alluded to earlier could be outweighed by the reduction in on-the-run premia that would result in costlier issuance (Garbade and Rutherford 2007)

- Illustrative examples for sizing buybacks:

  - 2000-2002 buybacks amounted to $67.5bn

  - 2015 TBAC Charge estimated conservatively that Treasury could buy at least $100bn per year. Scaling for change in market size today, the equivalent purchase amount would be $200bn

- $100-200bn per year could be meaningful in the context of the evolution of primary dealers inventories between 2018 and 2022. Such a size may improve intermediation capacity and market liquidity and, in turn, lower the cost of funding

Design and Potential Limitations of Buybacks

2. Frequency

- There is a trade-off between increased flexibility of buybacks and Treasury's long-standing regular and predictable debt management strategy

- Ways in which buybacks could be made flexible include the timing and magnitude of purchases. For example, buybacks could be more attractive when there is a greater discount of off-the-run coupons versus on-the-run bonds as well as bills

- Flexibility can be introduced via the Treasury refunding process bringing it in line with the existing issuance strategy while providing Treasury with an additional lever to use to achieve its debt management goals

- There are a number of debt management goals that flexible buybacks could help Treasury achieve. For example, managing the Treasury General Account (TGA) to enable a more efficient operating balance relative to target. And reducing the maturity peaks in outstanding debt, which has become more notable as the size of debt has increased

- One limit to how flexible Treasury buybacks can be is that, unlike Federal Reserve purchases, a Treasury program would be more limited in scope and would not be intended to support market functioning in periods of acute market stress

Design and Potential Limitations of Buybacks

3. Composition

- The composition of purchases may greatly affect the economic impact. For example, if Treasury issues more 10-year notes and systematically buys them back one year later, Treasury is paying the 10-year rate and roll down for effectively 1 year of funding

4. Market impact

- Buybacks would need to be monitored for market impact with implementation calibrated accordingly

- Adverse market impact could reduce the ability of buybacks to lower the cost of funding or, in a more extreme scenario, increase the cost of funding

- For example, market concessions around buybacks and auctions could erode the benefits of a buyback program. A potential design to lower the impact of concessions is to institute exchange auctions whereby Treasury simultaneously purchases off-the-runs while issuing on-the-runs. Such an exchange program, however, would likely be more operationally intensive

Design and Potential Limitations of Buybacks

5. Funding

- As discussed previously, buybacks would, over time, result in greater issuance. Treasury would need to consider various factors to determine how this issuance takes place; for example, the relative pricing of auctions versus purchases

- WAM (weighted-average maturity) of the debt is also a factor to consider. How operations impact the WAM requires further analysis, and this Charge has highlighted WAM-neutral implementations such as purchasing off-the-runs versus matched-maturity on-the-runs

- A final, potentially complicating factor is the debt ceiling; for example, if there is a timing mismatch between greater issuance that precedes buybacks

Conclusion

Conclusion

- Prior work including the 2015 TBAC Charge has discussed the pros and cons of buybacks

- Lower market liquidity likely raises Treasury yields and hence is a cost to taxpayers. One potential benefit of buybacks is to bolster market function and, in doing so, *indirectly* lower the cost of Treasury financing

- Buybacks could also *directly* save taxpayers money if, for example, operations were conducted to purchase higher-yielding off-the-run securities while Treasury issues lower-yielding on-the-run bonds and bills

- The case for buybacks may have increased recently as debt outstanding has increased and market liquidity has deteriorated coincident with regulatory changes that have impacted dealers' intermediation capacity

- Buybacks may allow Treasury to achieve other goals in its debt management strategy including the optimization of debt WAM, the management of the TGA, and the reduction of debt maturity peaks

- Further study is warranted. In particular on the cost of larger auction sizes to the on-the-run liquidity premium. More analysis is also needed on how a program could be designed to provide Treasury flexibility while still operating within the well-established regular and predictable framework

References

Amihud, Yakov, and Haim Mendelson, 1991, "Liquidity, Maturity, and the Yields on US Treasury Securities," *Journal of Finance* 46 1411-1425.

Cashin, David B., Ferris, Erin E. Syron, and Klee, Elizabeth, 2020, "Treasury Safety, Liquidity, and Money Premium Dynamics: Evidence from Recent Debt Limit Impasses," Finance and Economics Discussion Series, Board of Governors of the Federal Reserve System 2020-008.

Duffie, Darrell, 1996, "Special Repo Rates," *Journal of Finance*, 51 493-526.

Garbade, Kenneth, 2007, "The Emergence of 'Regular and Predictable' as a Treasury Debt Management Strategy," *Economic Policy Review* 13.

Garbade, Kenneth, and Matthew Rutherford, 2007, "Buybacks in Treasury Cash and Debt Management," SSRN 1022669.

Greenwood, Robin, Samuel Gregory Hanson, Joshua S. Rudolph, and Lawrence Summers, 2015, "The Optimal Maturity of Government Debt," The $13 Trillion Question: How America Manages Its Debt," Brookings 1-41.

Greenwood, Robin, Samuel Gregory Hanson, Jeremy C. Stein, 2015, "A Comparative-Advantage Approach to Government Debt Maturity," *Journal of Finance* 70 1683-1722.

Gorton, Gary B., 2017, "The History and Economics of Safe Assets," *Annual Review of Economics*, 9 547-586.

Krishnamurthy, Arvind, 2002, "The Bond/Old-Bond Spread," *Journal of Financial Economics* 66 463-506.

Krishnamurthy, Arvind, and Annette Vissing-Jorgensen, 2012, "The Aggregate Demand for Treasury Debt," *Journal of Political Economy* 120 233-267.

Logan, Lorie, 2020, "The Federal Reserve's Market Functioning Purchases: From Supporting to Sustaining," Remarks at SIFMA Webinar.

Warga, Arthur, 1992, "Bond Returns, Liquidity, and Missing Data," *Journal of Financial and Quantitative Analysis* 27 605-617.