Treasury Presentation to TBAC

Office of Debt Management

Fiscal Year 2018 Q1 Report

Table of Contents

Section I:
Executive Summary

Highlights of Treasury's January 2018 Quarterly Refunding Presentation to the Treasury Borrowing Advisory Committee (TBAC)

Receipts and Outlays

- Receipts totaled $770 billion in Q1 FY18, an increase of $29 billion (4%) year-over-year. Withheld income taxes (including FICA) were up $45 billion (8%) year-over-year due to economic growth, and increases in employment and wages. Corporate taxes were down $10 billion (11%), which could be attributed to companies timing payments or shifting expenses in anticipation of tax reform legislation.

- Outlays totaled $994 billion in Q1 FY18, $44 billion (5%) higher year-over-year. Department of Homeland Security outlays were $10 billion (78%) higher due to increased payments for disaster relief. Department of Defense outlays, adjusted for calendar effects, were $9 billion (6%) higher year-over-year due to increases in spending for operations and maintenance, procurement, research and development. Treasury outlays were $9 billion (6%) higher due to increased interest on the public debt. Social Security Administration outlays, adjusted for calendar effects, were up $8 billion (3%) due to an increase in program enrollment.

Sources of Financing

- Based on the Quarterly Borrowing Estimate, Treasury's Office of Fiscal Projections currently projects a net privately-held marketable borrowing need of $441 billion for Q2 FY 2018, with an end-of-March cash balance of $210 billion. For Q3 FY 2018, the net privately-held marketable borrowing need is projected to be $176 billion, with an end-of-June cash balance of $360 billion.

Projected Net Marketable Borrowing

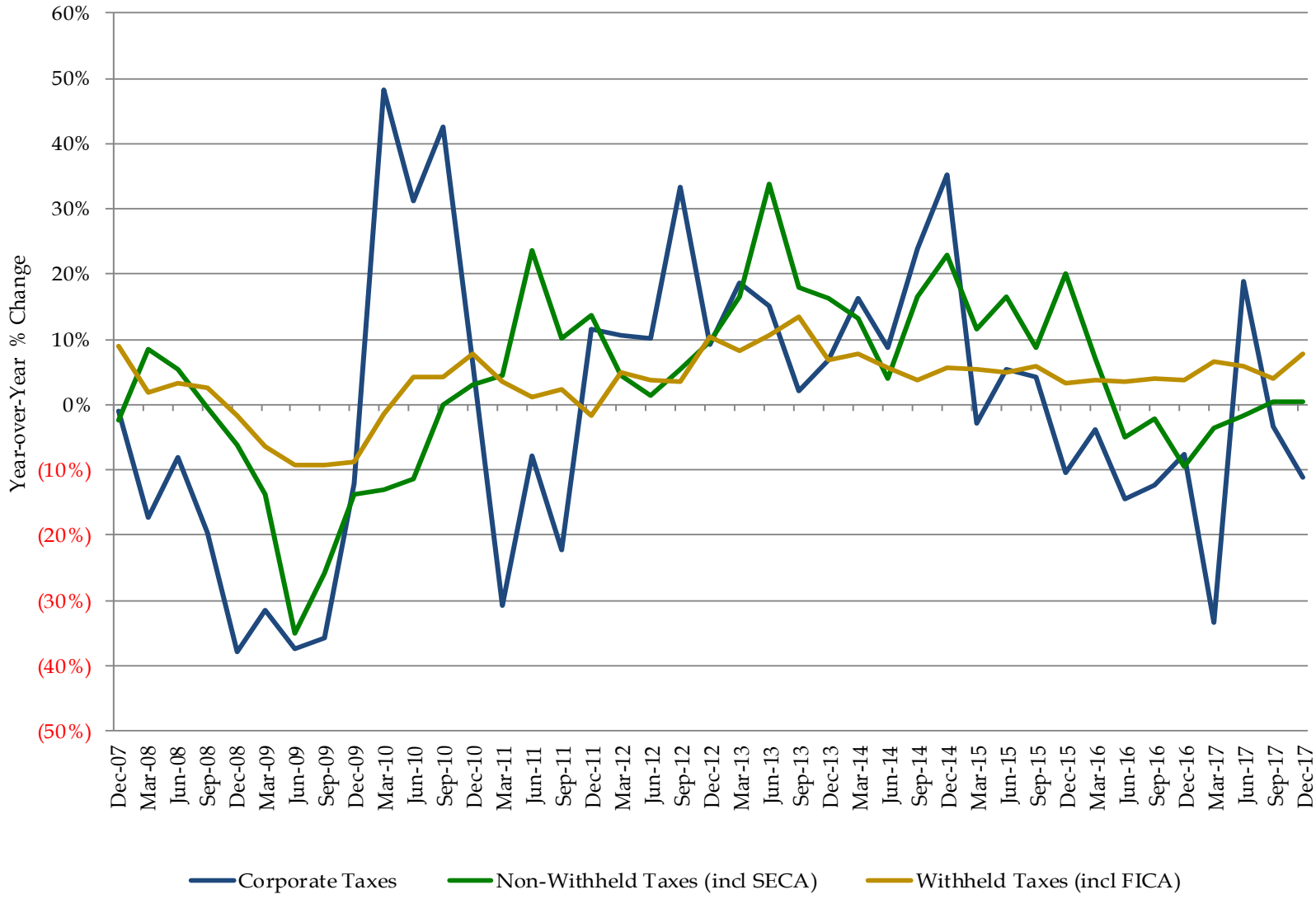
- Recent borrowing estimates from primary dealers suggest that Treasury auction sizes will need to rise substantially over the next few years, reflecting both the impact of SOMA redemptions and the dealers' views of the fiscal outlook. Yet-to-be-released updated budget estimates by OMB and CBO will provide additional information on the amount of borrowing needed over the next few years.

Demand for Treasury Securities

- Bid-to-cover ratios for bills remain above crisis-era levels, at a time when overall bill issuance has been rising. Demand for nominal coupons, TIPS, and FRNs remains consistent with the recent past.

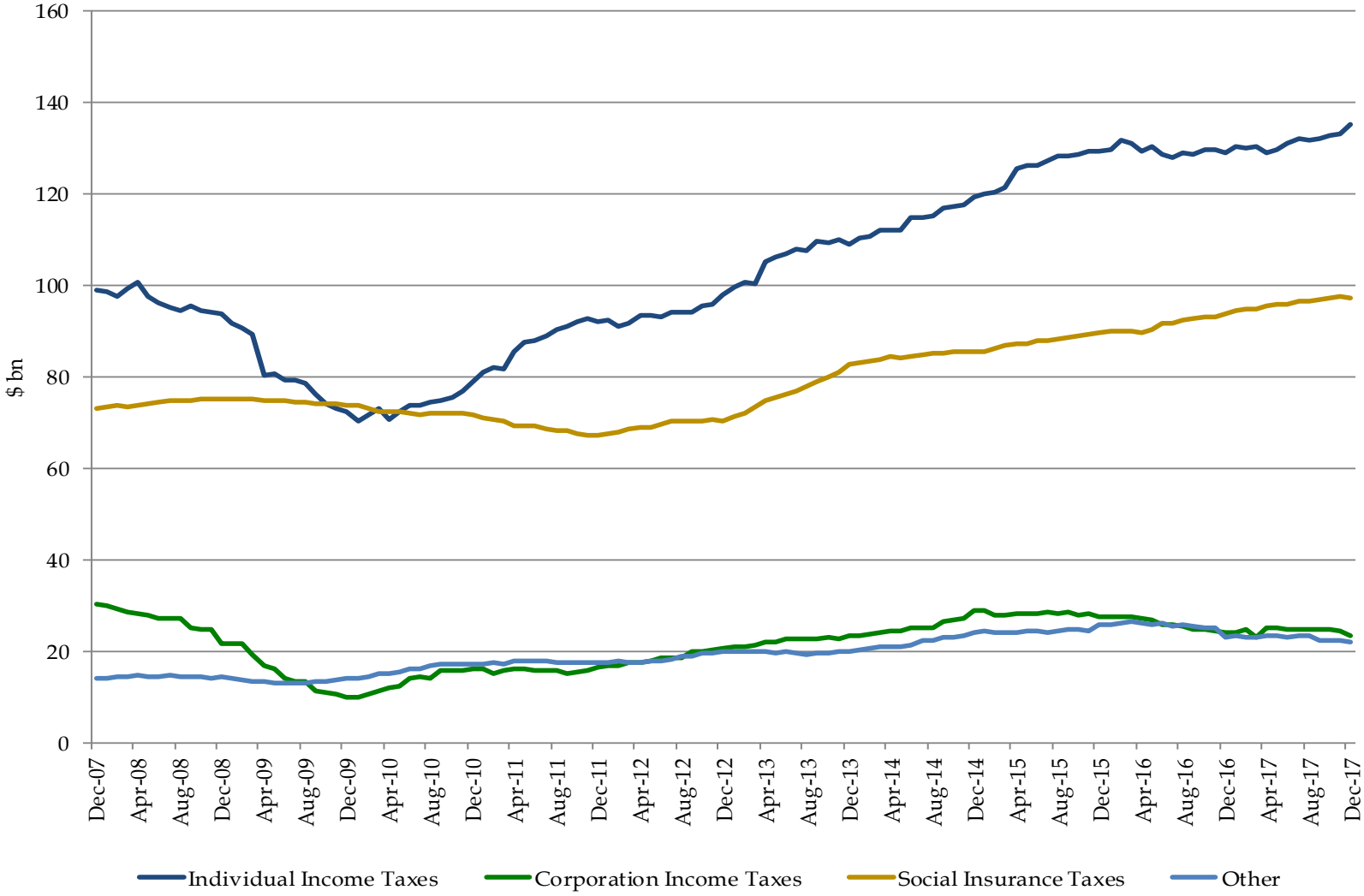
Section II: Fiscal

Quarterly Tax Receipts



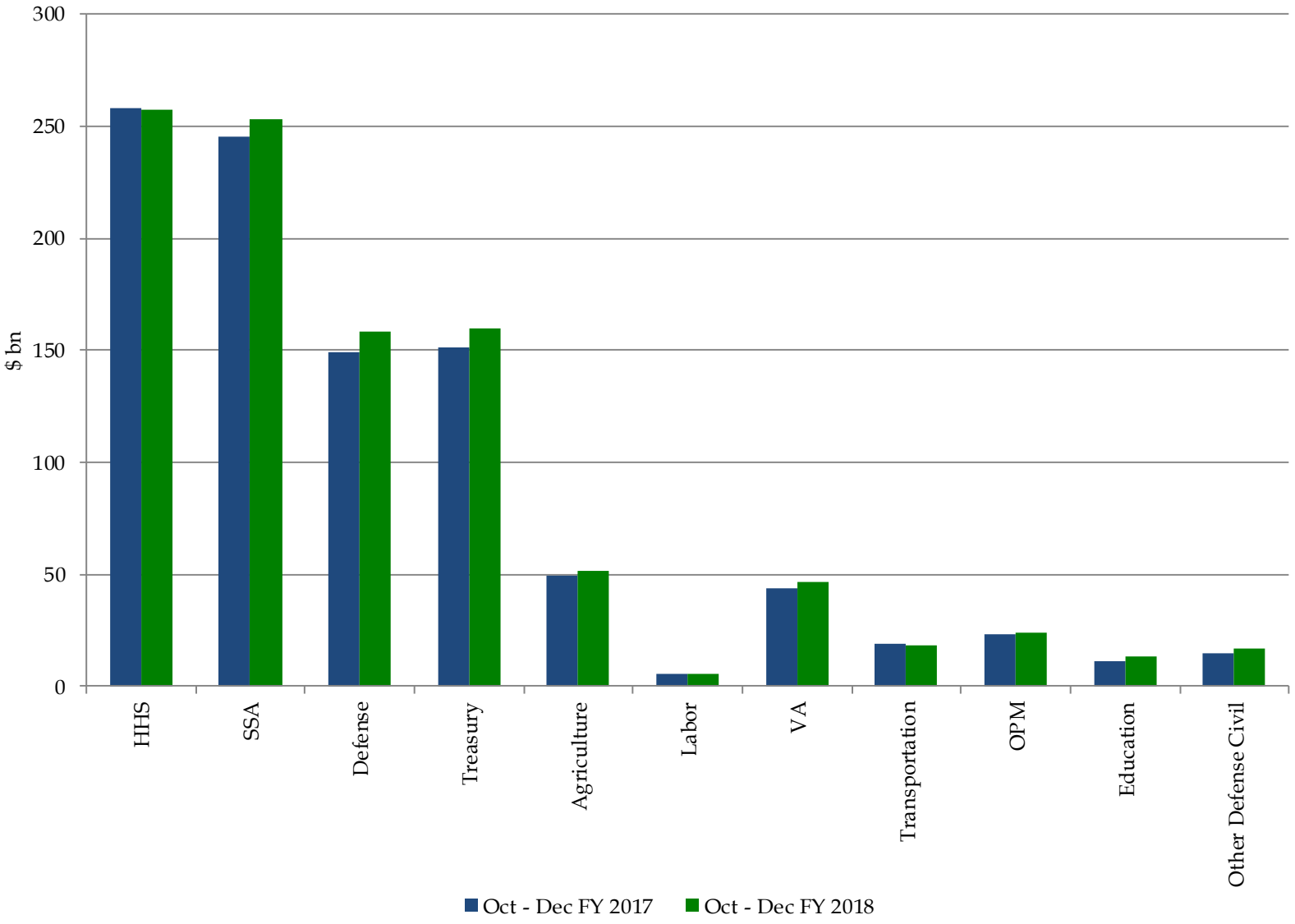
Source: United States Department of the Treasury

Monthly Receipt Levels
(12-Month Moving Average)



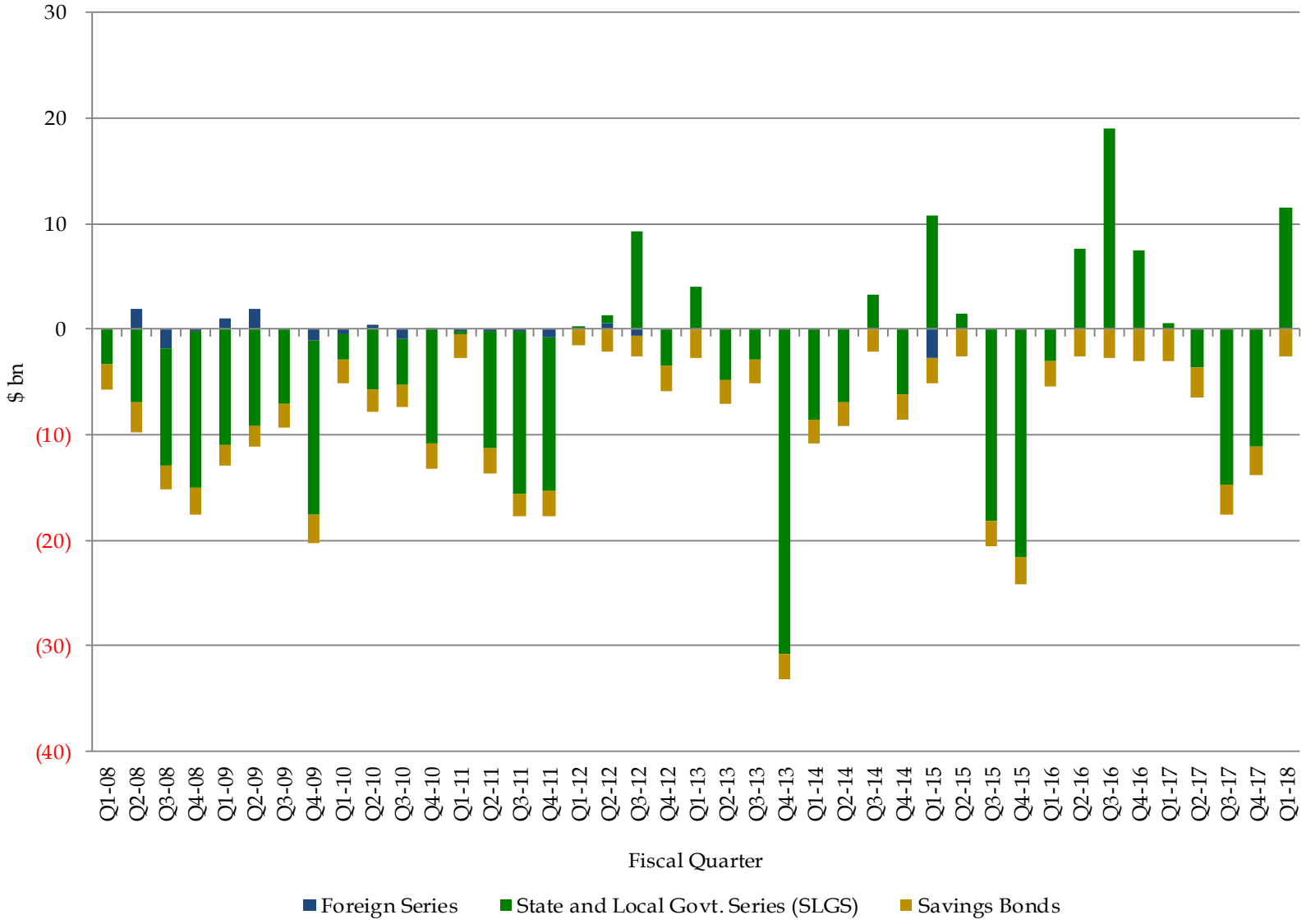
Individual Income Taxes include withheld and non-withheld. Social Insurance Taxes include FICA, SECA, RRTA, UTF deposits, FUTA and RUIA. Other includes excise taxes, estate and gift taxes, customs duties and miscellaneous receipts.
Source: United States Department of the Treasury

Eleven Largest Outlays



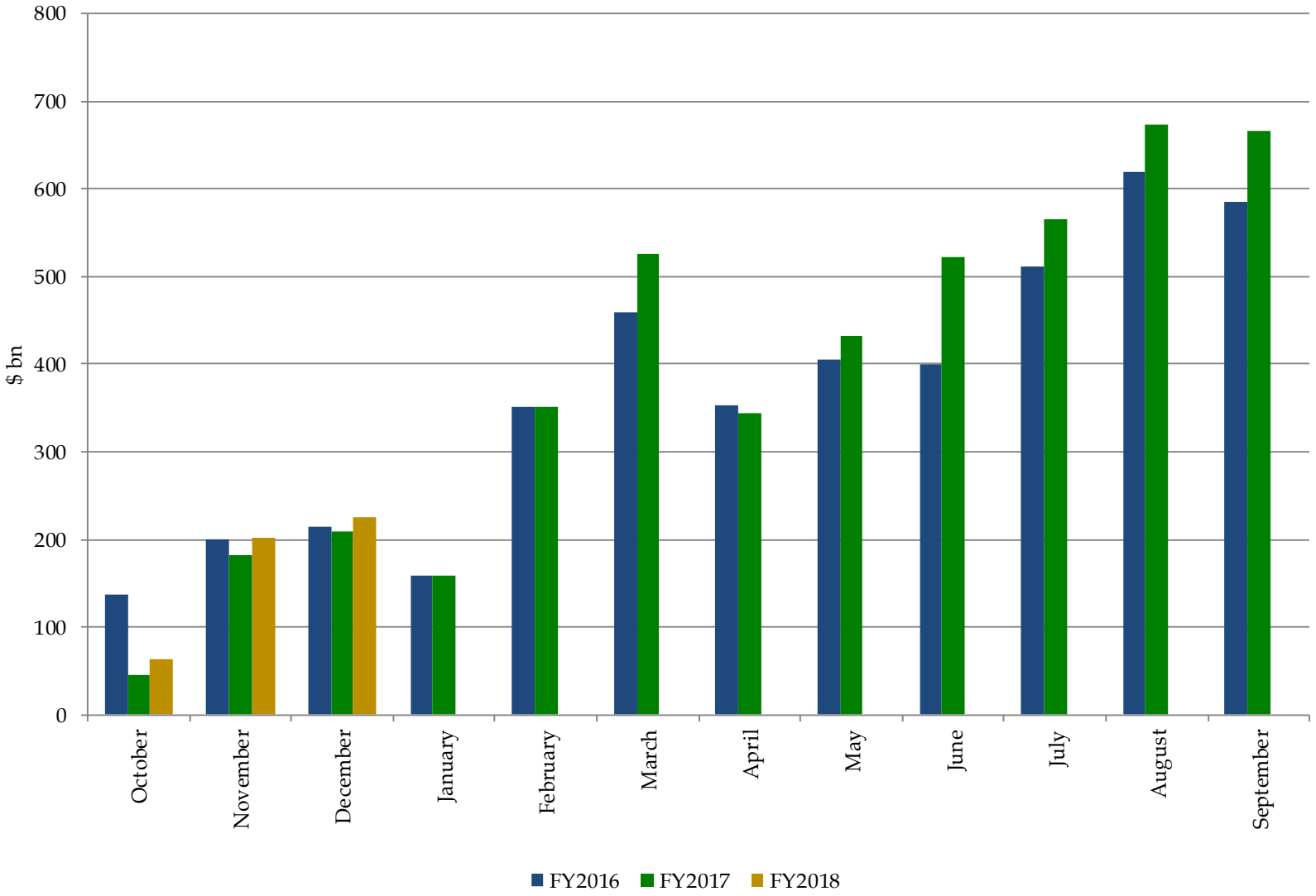
Source: United States Department of the Treasury

Treasury Net Nonmarketable Borrowing



Source: United States Department of the Treasury

Cumulative Budget Deficits by Fiscal Year



Source: United States Department of the Treasury

FY 2018-2020 Deficits and Net Marketable Borrowing Estimates — In $ billions

	Primary Dealers[1]	CBO[2]	CBO[3]	OMB[4]
FY 2018 Deficit Estimate	750	563	593	440
FY 2019 Deficit Estimate	965	689	689	526
FY 2020 Deficit Estimate	1025	775	664	488
FY 2018 Deficit Range	641-895			
FY 2019 Deficit Range	800-1140			
FY 2020 Deficit Range	950-1250			
FY 2018 Net Marketable Borrowing Estimate	955	881*	912*	529
FY 2019 Net Marketable Borrowing Estimate	1083	745	748	604
FY 2020 Net Marketable Borrowing Estimate	1128	826	719	552
FY 2018 Net Marketable Borrowing Range	800-1160			
FY 2019 Net Marketable Borrowing Range	970-1265			
FY 2020 Net Marketable Borrowing Range	1000-1300			
Estimates as of:	Jan-18	Jul-17	Jun-17	Feb-17

1 Based on primary dealer survey, January, 2018. Estimates above are medians.

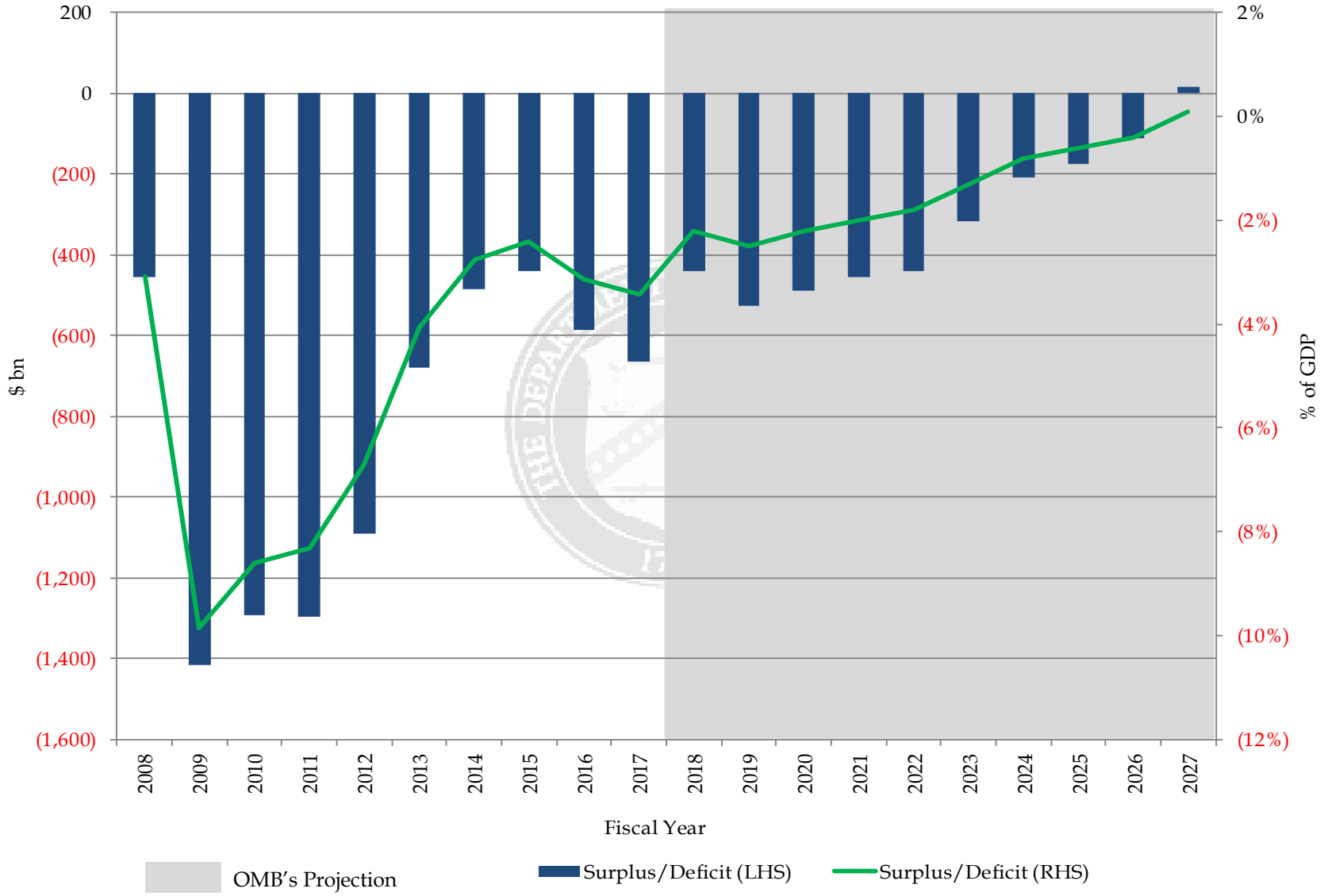
2 Summary Table 1 of CBO's "An Update to the Budget and Economic Outlook: 2017 to 2027," July, 2017.

3 Table 1 and 2 of CBO's "An Analysis of the President's 2018 Budget," June, 2017.

4 Table S-10 of OMB's "Budget of the United States Government, Fiscal Year 2018," February, 2017.

*For FY 2018, the restoration of extraordinary measures used during the 2017 debt limit impasse artificially adds this amount to "Other means of financing," which shows a larger net borrowing assumption.

Budget Surplus/Deficit



Projections are from Table S-10 of "Budget of The U.S. Government Fiscal Year 2018," February, 2017.

Section III: Financing

Assumptions for Financing Section (pages 15 to 20)

- Portfolio and SOMA holdings as of 12/31/2017.
- Estimates assume an end date for SOMA capped redemptions of Q1 CY 2022. The assumption is based on September 2017 *FEDS Notes* of "Projected Evolution of the SOMA Portfolio and the 10-year Treasury Term Premium Effect."
- Estimates assume announced issuance sizes and patterns constant for nominal coupons, TIPS, and FRNs as of 12/31/2017, while using an average of ~$1.96 trillion of bills outstanding.
- The principal on the TIPS securities was accreted to each projection date based on market ZCIS levels as of 12/31/2017.
- No attempt was made to account for future financing needs.

Sources of Privately-Held Financing in Fiscal Year 2018 Q1

October - December 2017	
Net Bill Issuance	154
Net Coupon Issuance	128
Subtotal: Net Marketable Borrowing	282
Ending Cash Balance	229
Beginning Cash Balance	159
Subtotal: Change in Cash Balance	70
Net Implied Funding for FY 2018 Q1*	213

Security	October - December 2017 Bill Issuance			Fiscal Year-to-Date Bill Issuance		
	Gross	Maturing	Net	Gross	Maturing	Net
4-Week	575	520	55	575	520	55
13-Week	555	513	42	555	513	42
26-Week	477	429	48	477	429	48
52-Week	60	60	(0)	60	60	(0)
CMBs	59	50	9	59	50	9
Bill Subtotal	1,726	1,572	154	1,726	1,572	154

Security	October - December 2017 Coupon Issuance			Fiscal Year-to-Date Coupon Issuance		
	Gross	Maturing	Net	Gross	Maturing	Net
2-Year FRN	41	41	(0)	41	41	(0)
2-Year	78	26	52	78	26	52
3-Year	72	78	(6)	72	78	(6)
5-Year	102	147	(45)	102	147	(45)
7-Year	84	72	12	84	72	12
10-Year	63	17	46	63	17	46
30-Year	39	0	39	39	0	39
5-Year TIPS	14	0	14	14	0	14
10-Year TIPS	11	0	11	11	0	11
30-Year TIPS	5	0	5	5	0	5
Coupon Subtotal	509	381	128	509	381	128

Total	2,235	1,953	282	2,235	1,953	282

*An end-of-December 2017 cash balance of $229 billion versus a beginning-of-October 2017 cash balance of $159 billion. By keeping the cash balance constant, Treasury arrives at the net implied funding number.

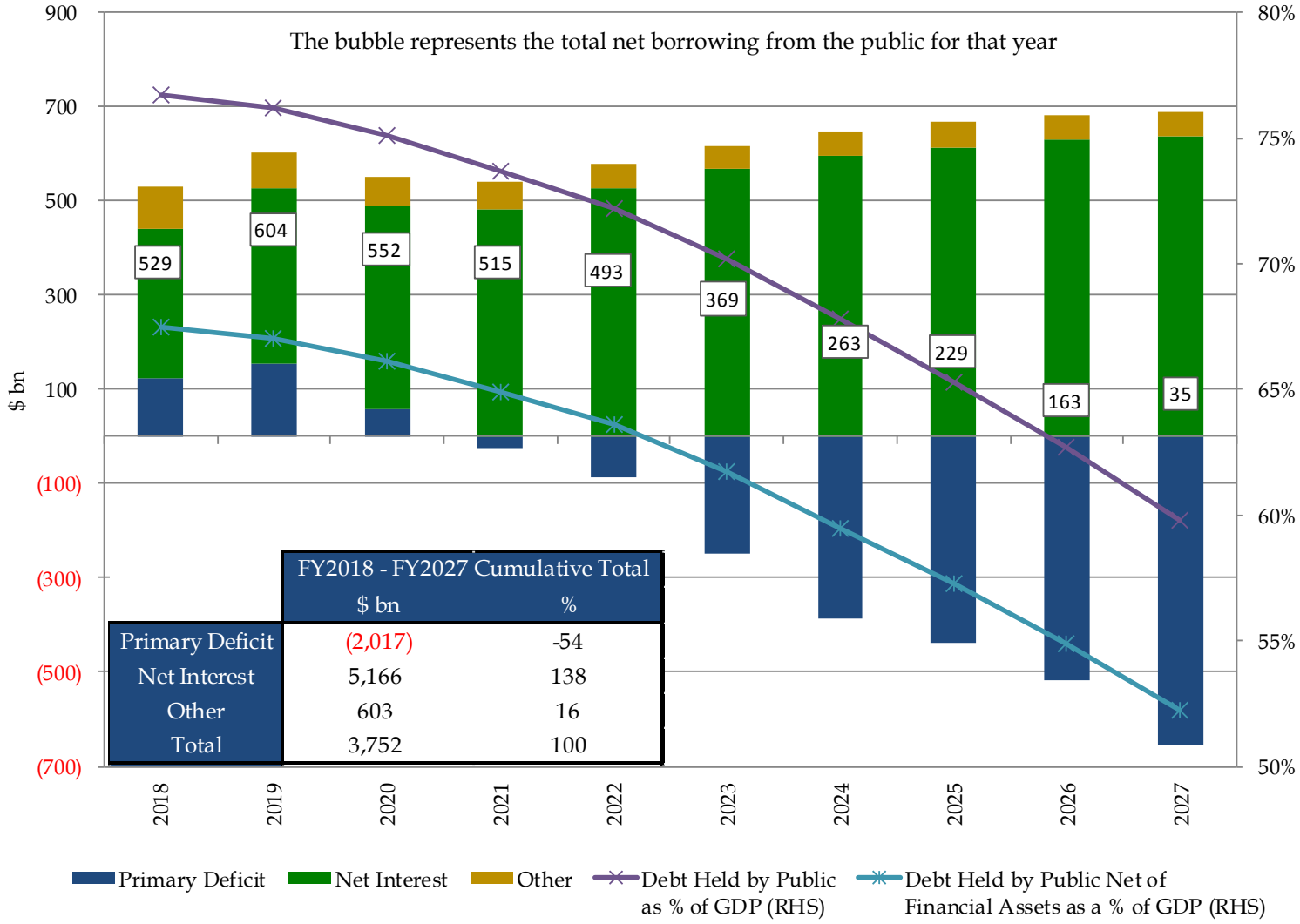
Sources of Privately-Held Financing in Fiscal Year 2018 Q2

January - March 2018	
Assuming Constant Coupon Issuance Sizes*	
Treasury Announced Net Marketable Borrowing**	441
Net Coupon Issuance	139
Implied Change in Bills	302

Security	January - March 2018 Coupon Issuance			Fiscal Year-to-Date Coupon Issuance		
	Gross	Maturing	Net	Gross	Maturing	Net
2-Year FRN	28	41	(13)	69	82	(13)
2-Year	78	52	26	156	78	78
3-Year	72	72	(0)	144	150	(6)
5-Year	102	108	(6)	204	255	(51)
7-Year	84	46	38	168	118	50
10-Year	63	23	40	126	39	87
30-Year	39	0	39	78	0	78
5-Year TIPS	0	0	0	14	0	14
10-Year TIPS	24	16	8	35	16	19
30-Year TIPS	7	0	7	12	0	12
Coupon Subtotal	497	358	139	1,006	738	268

*Keeping announced issuance sizes and patterns constant for nominal coupons, TIPS, and FRNs as of 12/31/2017.
**Assumes an end-of-March 2018 cash balance of $210 billion versus a beginning-of-January 2018 cash balance of $229 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

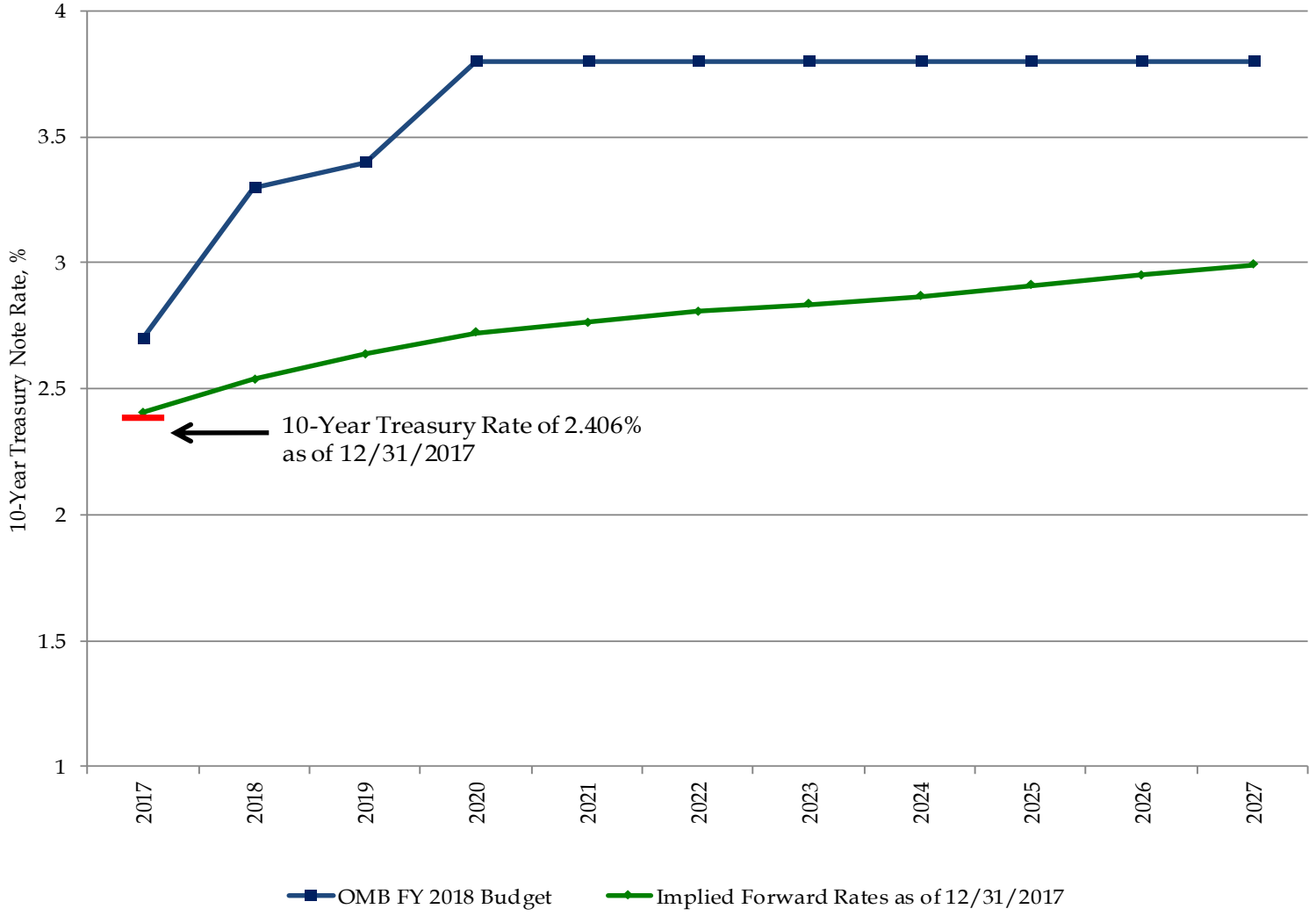
OMB's Projection of Borrowing from the Public



	FY2018 - FY2027 Cumulative Total	
	$ bn	%
Primary Deficit	(2,017)	-54
Net Interest	5,166	138
Other	603	16
Total	3,752	100

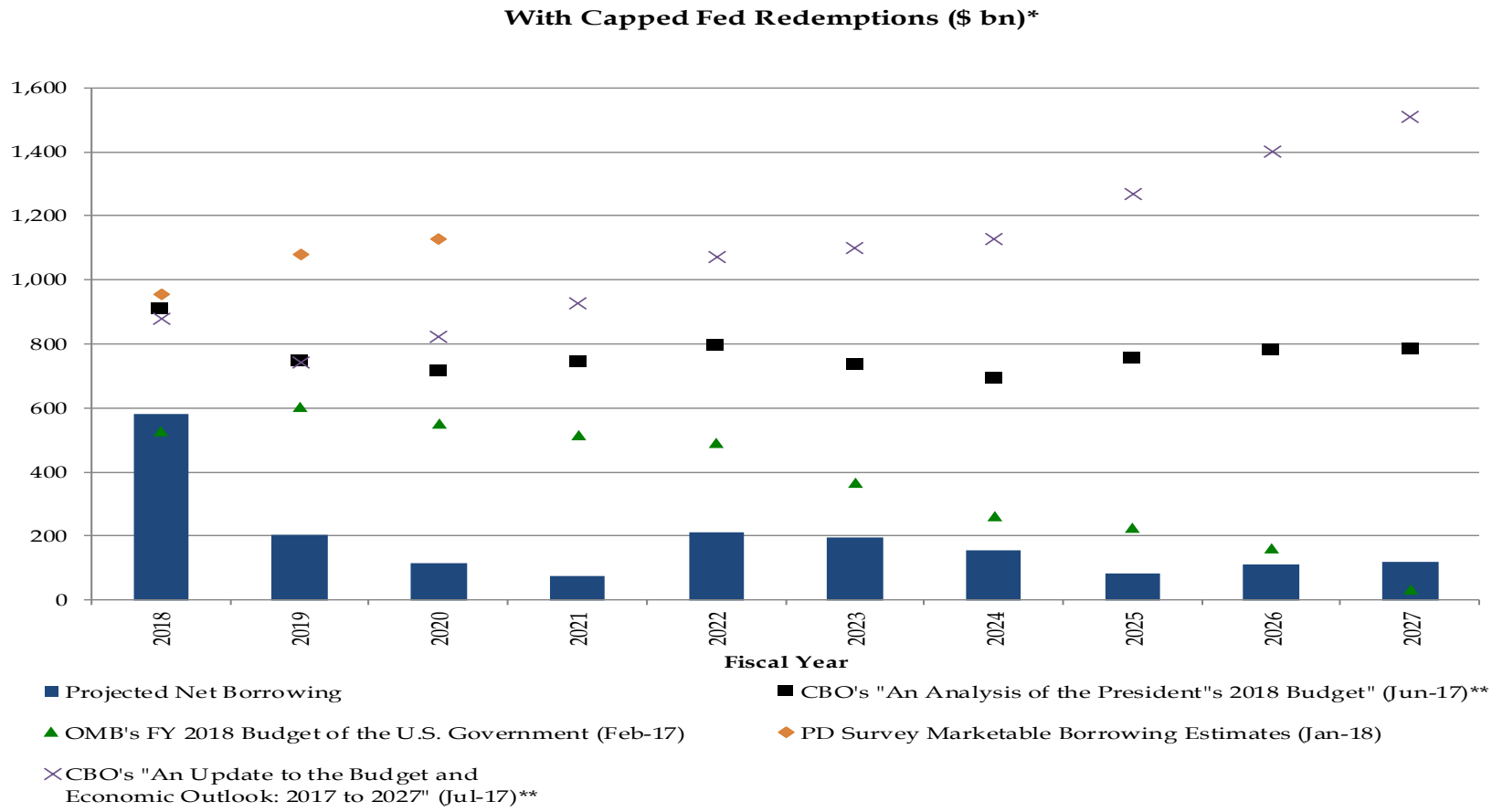
OMB's projections of net borrowing from the public are from Table S-10 of "Budget of the U.S. Government Fiscal Year 2018," February, 2017. "Other" represents borrowing from the public to provide direct and guaranteed loans.

Interest Rate Assumptions: 10-Year Treasury Note



OMB's economic assumption of the 10-Year Treasury Note rates are from Table S-9 of OMB's "Budget of the United States Government, Fiscal Year 2018," February, 2017. The forward rates are the implied 10-Year Treasury Note rates on December 31, 2017.

Projected Net Borrowing Assuming Future Issuance Remains Constant



Treasury's January 2018 primary dealer survey estimates can be found on page 11. OMB's projections of net borrowing from the public are from Table S-10 of "Budget of the U.S. Government Fiscal Year 2018," February, 2017. CBO's estimates of the borrowing from the public are from Summary Table 1 of "The Budget and Economic Outlook: 2017 to 2027," July, 2017. CBO's analysis of the President's budget for net public borrowing estimates are from Table 2 of CBO's "An Analysis of the President's 2018 budget," June, 2017. See table at the end of this section for details.

*Projections reflect capped SOMA Treasury redemptions up until the first quarter of CY 2022.

**For both of CBO's FY 2018 projections, the restoration of extraordinary measures used during the 2017 debt limit impasse artificially adds this amount to "Other means of financing" which shows a larger net borrowing assumption.

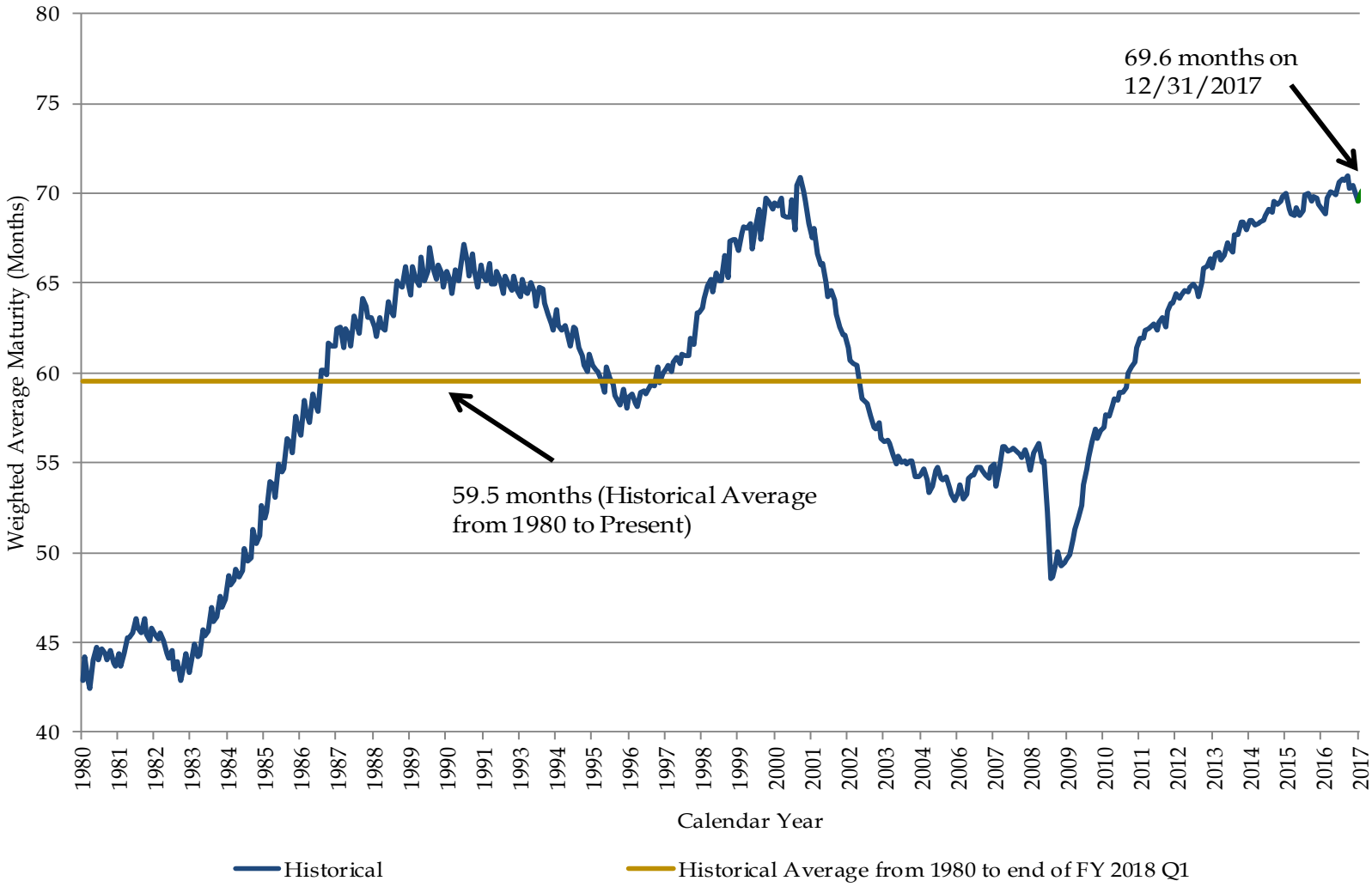
Historical Net Marketable Borrowing and Projected Net Borrowing Assuming Future Issuance Remains Constant, $ billions

Fiscal Year	Bills	2/3/5	7/10/30	TIPS	FRN	Historical/Projected Net Borrowing Capacity	OMB's FY 2018 Budget of the U.S. Government (Feb-17)	CBO's "An Analysis of the President"s 2018 Budget " (Jun-17)	Primary Dealer Survey
2013	(86)	86	720	111	0	830			
2014	(119)	(92)	669	88	123	669			
2015	(53)	(282)	641	88	164	558			
2016	289	(82)	477	64	47	795			
2017	155	9	292	55	9	519			
2018	160	90	275	55	3	583	529	912*	955
2019	0	61	101	46	(6)	201	604	748	1,083
2020	0	(31)	138	16	(9)	114	552	719	1,128
2021	0	(53)	134	(4)	(3)	73	515	747	
2022	0	15	205	(11)	2	211	493	797	
2023	0	63	136	(9)	6	196	369	737	
2024	0	12	152	(10)	2	155	263	694	
2025	0	(21)	158	(53)	(1)	83	229	758	
2026	0	(21)	177	(43)	(2)	110	163	782	
2027	0	4	151	(33)	(3)	119	35	787	

Net borrowing capacity reflects capped SOMA redemptions up until the first quarter of CY 2022.
Treasury's January 2018 primary dealer survey estimates can be found on page 11. OMB's projections of net borrowing from the public are from Table S-10 of "Budget of the U.S. Government Fiscal Year 2018," February, 2017. CBO's analysis of the President's budget for net public borrowing estimates are from Table 2 of CBO's "An Analysis of the President's 2018 budget," June, 2017.
*For FY 2018, the restoration of extraordinary measures used during the 2017 debt limit impasse artificially adds this amount to "Other means of financing" which shows a larger net borrowing assumption.

Section IV:
Portfolio Metrics

Historical Weighted Average Maturity of Marketable Debt Outstanding



Recent Maturity Profile, $ billions

End of Fiscal Year	<= 1yr	(1,2]	(2,3]	(3,5]	(5,7]	(7,10]	> 10	Total	(0,5]
2010	2,563	1,141	895	1,273	907	856	853	8,488	5,872
2011	2,620	1,334	980	1,541	1,070	1,053	1,017	9,616	6,476
2012	2,951	1,373	1,104	1,811	1,214	1,108	1,181	10,742	7,239
2013	2,939	1,523	1,242	1,965	1,454	1,136	1,331	11,590	7,669
2014	2,935	1,739	1,319	2,207	1,440	1,113	1,528	12,281	8,199
2015	3,097	1,775	1,335	2,382	1,478	1,121	1,654	12,841	8,589
2016	3,423	1,828	1,538	2,406	1,501	1,151	1,800	13,648	9,195
2017	3,631	2,027	1,504	2,433	1,466	1,180	1,946	14,188	9,596

Recent Maturity Profile, Percent

End of Fiscal Year	<= 1yr	(1,2]	(2,3]	(3,5]	(5,7]	(7,10]	> 10	(0,3]	(0,5]
2010	30.2	13.4	10.5	15.0	10.7	10.1	10.0	54.2	69.2
2011	27.2	13.9	10.2	16.0	11.1	10.9	10.6	51.3	67.3
2012	27.5	12.8	10.3	16.9	11.3	10.3	11.0	50.5	67.4
2013	25.4	13.1	10.7	17.0	12.5	9.8	11.5	49.2	66.2
2014	23.9	14.2	10.7	18.0	11.7	9.1	12.4	48.8	66.8
2015	24.1	13.8	10.4	18.5	11.5	8.7	12.9	48.3	66.9
2016	25.1	13.4	11.3	17.6	11.0	8.4	13.2	49.7	67.4
2017	25.6	14.3	10.6	17.1	10.3	8.3	13.7	50.5	67.6

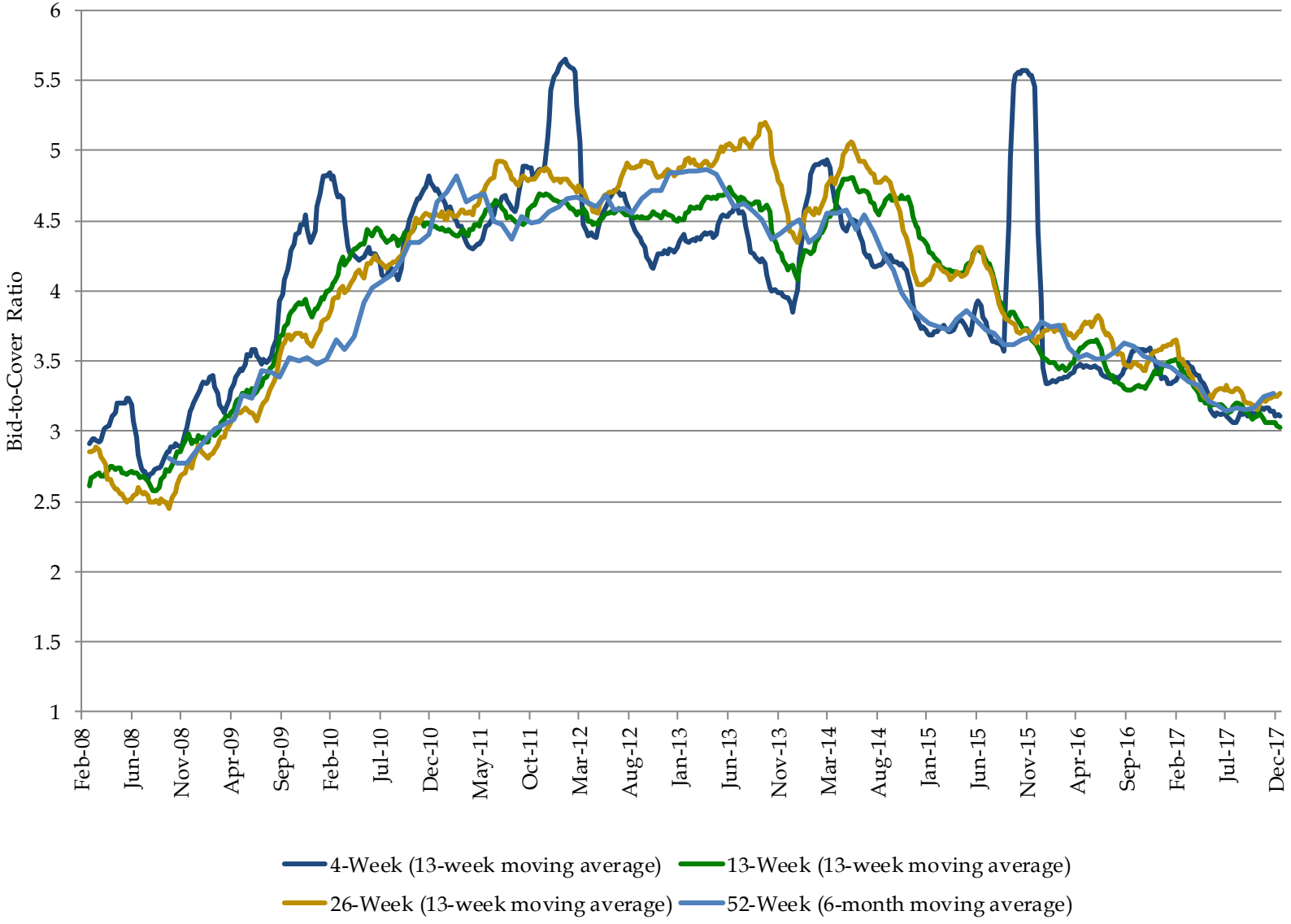
Section V: Demand

Summary Statistics for Fiscal Year 2018 Q1 Auctions

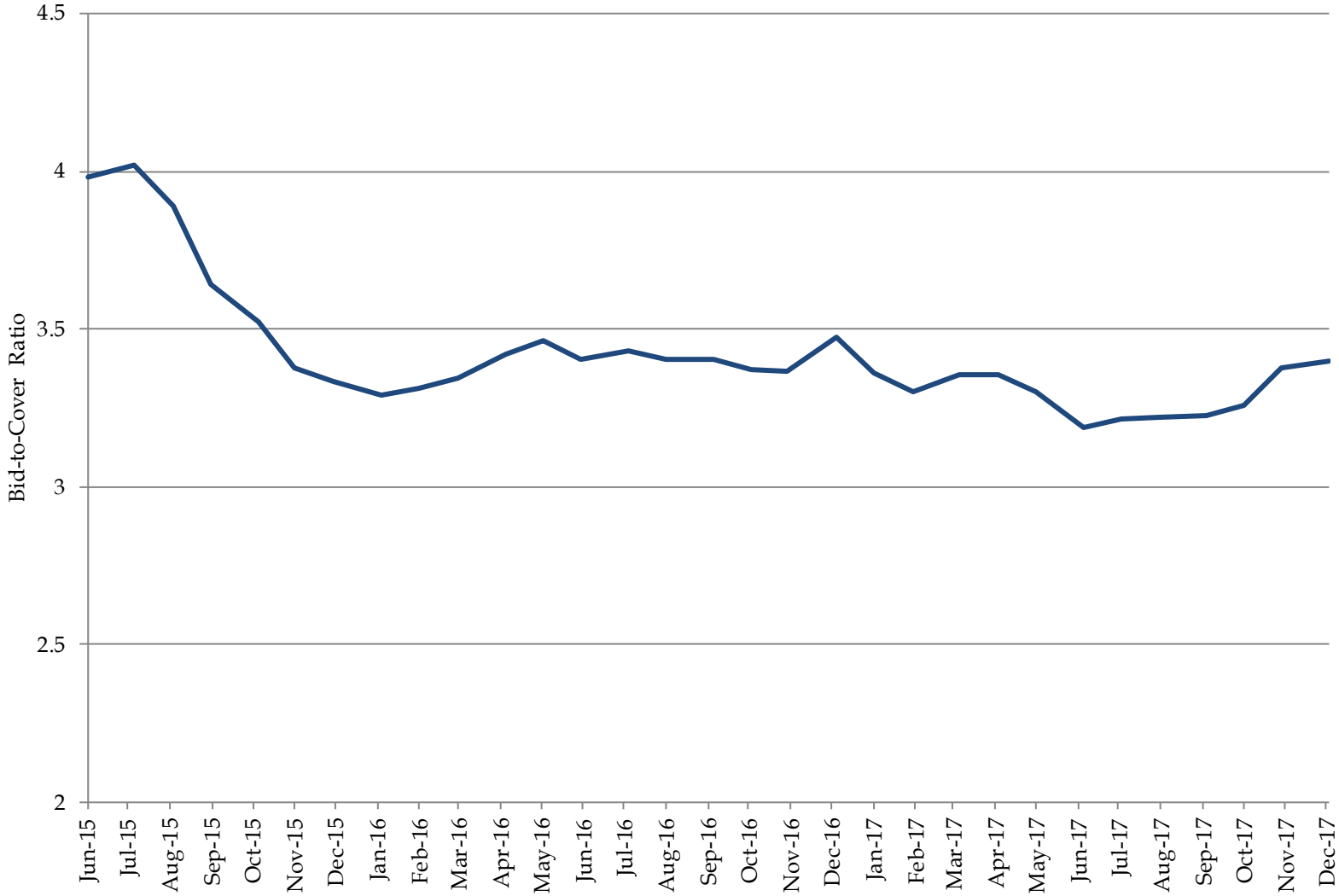
Security Type	Term	Stop Out Rate (%)*	Bid-to-Cover Ratio*	Competitive Awards ($bn)	% Primary Dealer*	% Direct*	% Indirect*	Non-Competitive Awards ($bn)	SOMA Add Ons ($bn)	10-Year Equivalent ($bn)**
Bill	4-Week	1.104	3.1	566.8	56.7	8.6	34.7	7.0	0.0	5.0
Bill	13-Week	1.223	3.0	543.8	59.5	7.7	32.9	7.5	0.0	15.7
Bill	26-Week	1.355	3.3	465.1	43.8	3.5	52.7	6.2	0.0	27.1
Bill	52-Week	1.500	3.3	59.3	48.9	7.0	44.1	0.7	0.0	6.8
Bill	CMB	1.051	3.4	59.0	54.3	8.1	37.6	0.0	0.0	0.7
Coupon	2-Year	1.761	2.7	77.2	41.4	15.2	43.3	0.5	5.5	18.6
Coupon	3-Year	1.780	2.9	71.5	36.5	7.8	55.6	0.2	2.9	24.9
Coupon	5-Year	2.123	2.4	101.9	28.0	10.1	61.9	0.1	7.1	58.7
Coupon	7-Year	2.293	2.4	84.0	25.8	13.4	60.8	0.0	5.9	66.0
Coupon	10-Year	2.346	2.5	62.9	27.2	7.9	64.9	0.1	2.8	66.4
Coupon	30-Year	2.823	2.4	39.0	29.3	8.5	62.1	0.0	1.8	94.3
TIPS	5-Year	0.370	2.8	14.0	16.1	12.2	71.7	0.0	0.0	6.8
TIPS	10-Year	0.512	2.4	11.0	26.2	4.8	69.0	0.0	0.6	12.3
TIPS	30-Year	0.908	2.6	5.0	23.1	0.5	76.4	0.0	0.1	15.1
FRN	2-Year	0.040	3.5	41.0	40.1	2.2	57.6	0.0	0.4	0.0
Total Bills		1.223	3.1	1,693.9	53.7	6.8	39.5	21.3	0.0	55.3
Total Coupons		2.130	2.6	436.5	31.3	10.8	57.8	0.9	26.0	328.9
Total TIPS		0.512	2.6	29.9	21.0	7.5	71.5	0.1	0.7	34.2
Total FRN		0.040	3.5	41.0	40.1	2.2	57.6	0.0	0.4	0.0

*Weighted averages of Competitive Awards.
**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.

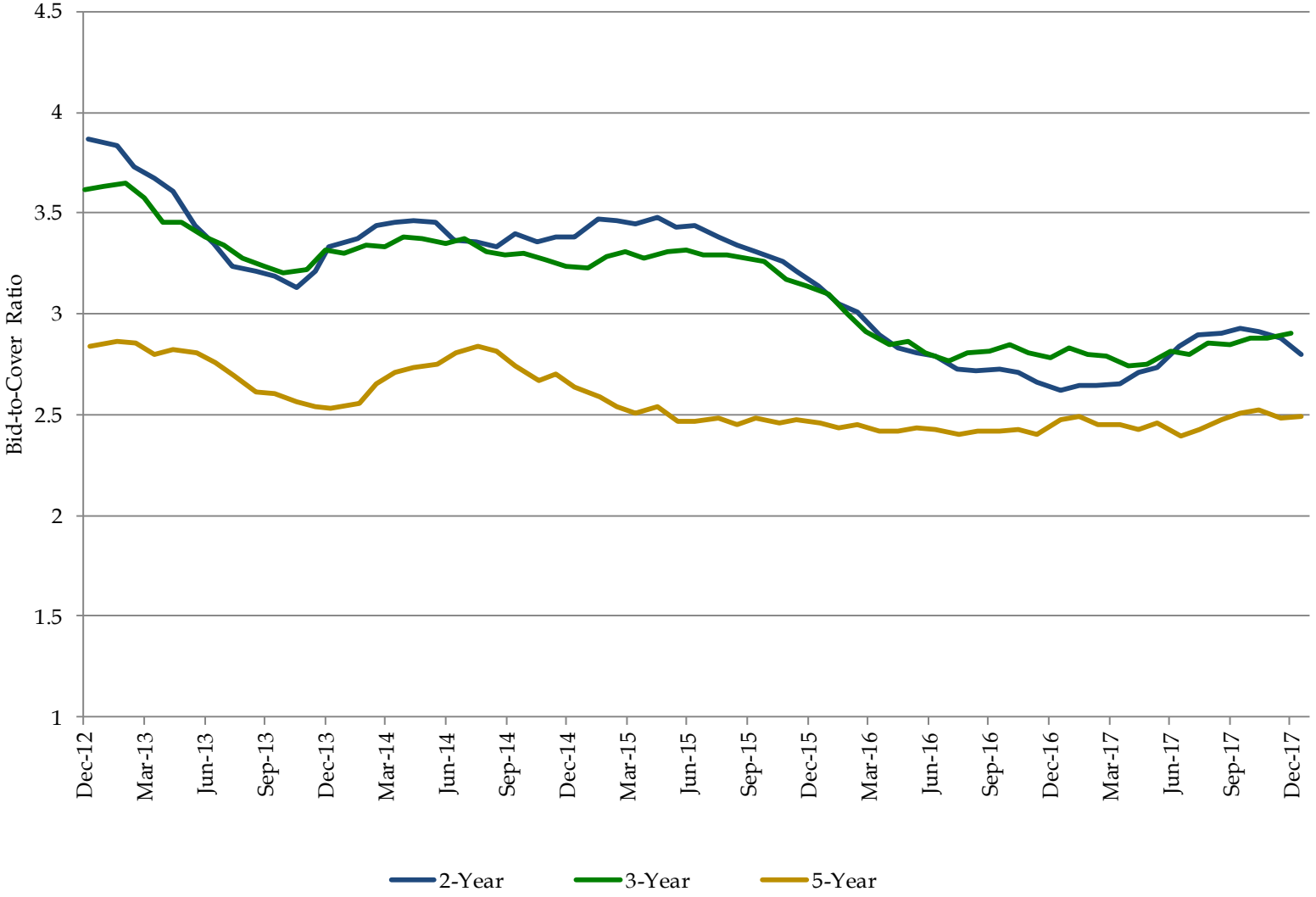
Bid-to-Cover Ratios for Treasury Bills



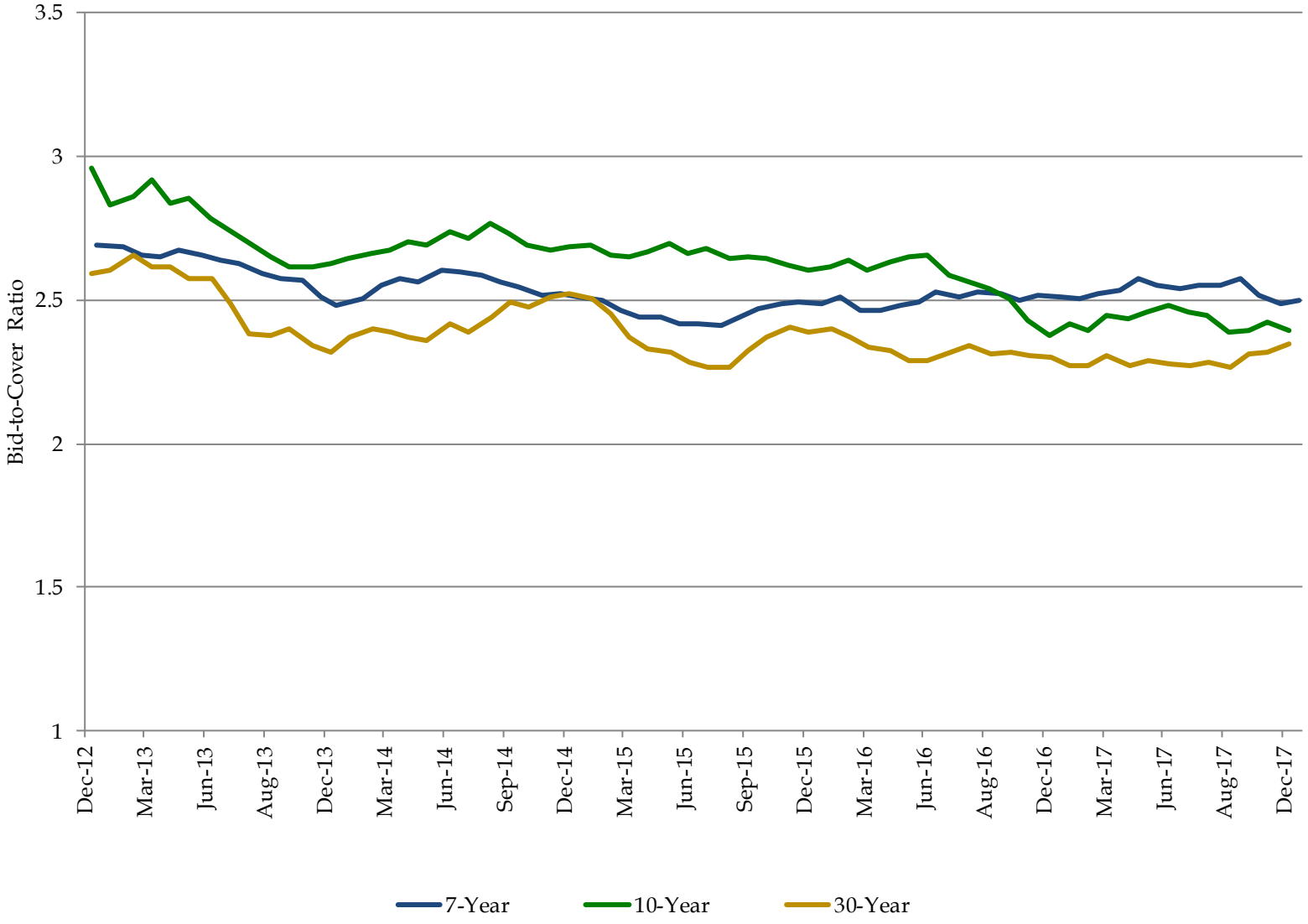
Bid-to-Cover Ratios for FRNs
(6-Month Moving Average)



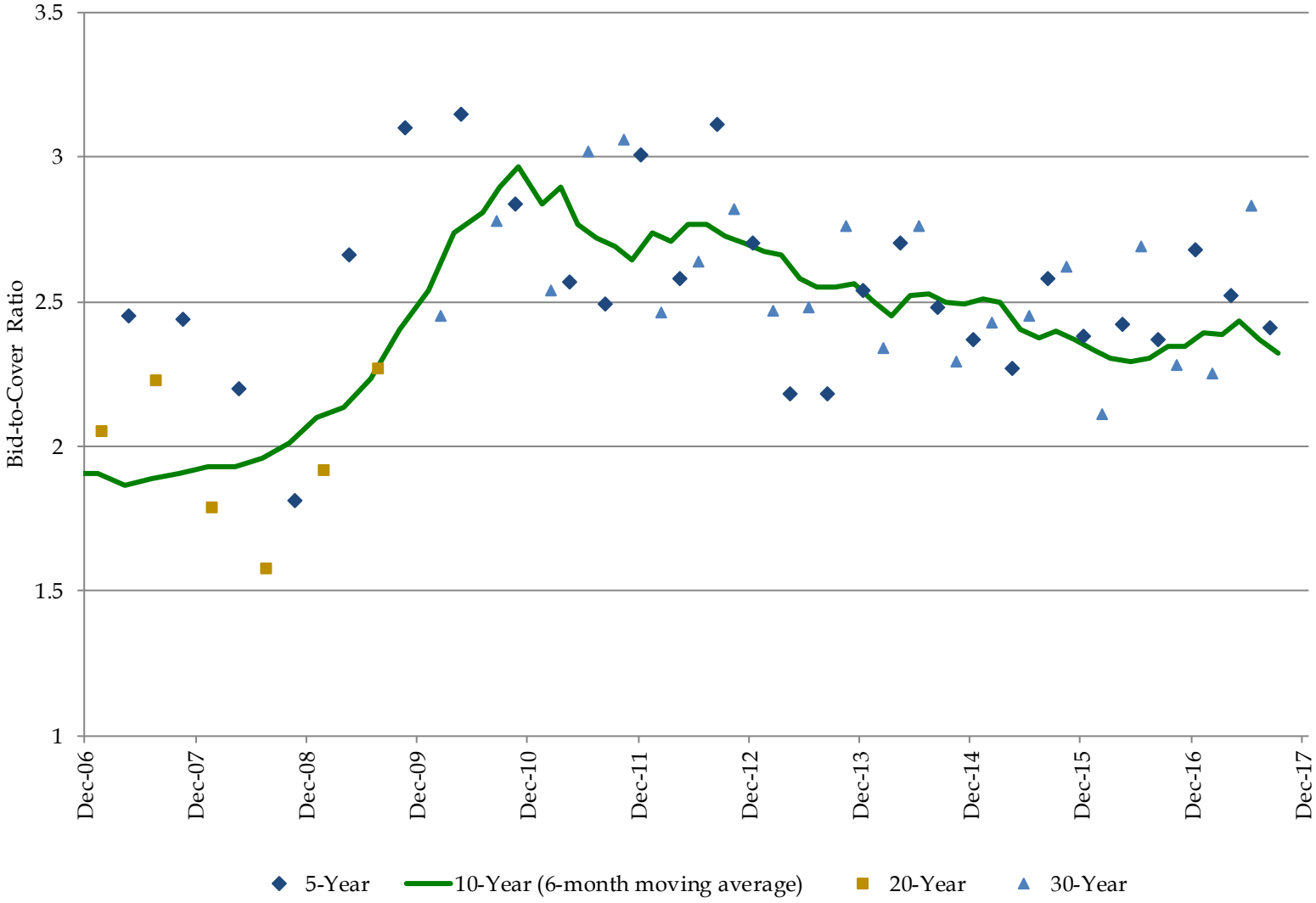
Bid-to-Cover Ratios for 2-, 3-, and 5-Year Nominal Securities (6-Month Moving Average)



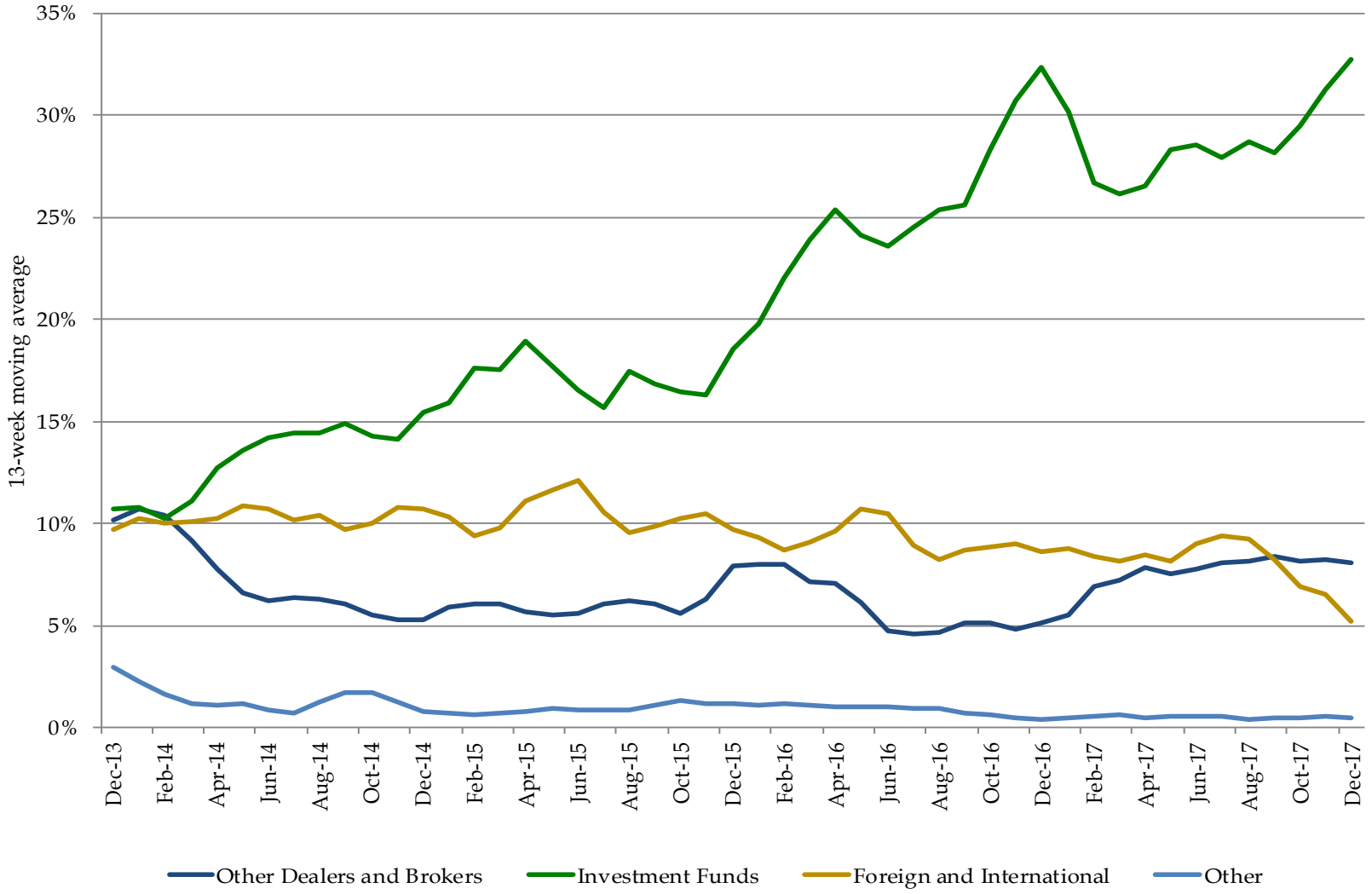
Bid-to-Cover Ratios for 7-, 10-, and 30-Year Nominal Securities (6-Month Moving Average)



Bid-to-Cover Ratios for TIPS

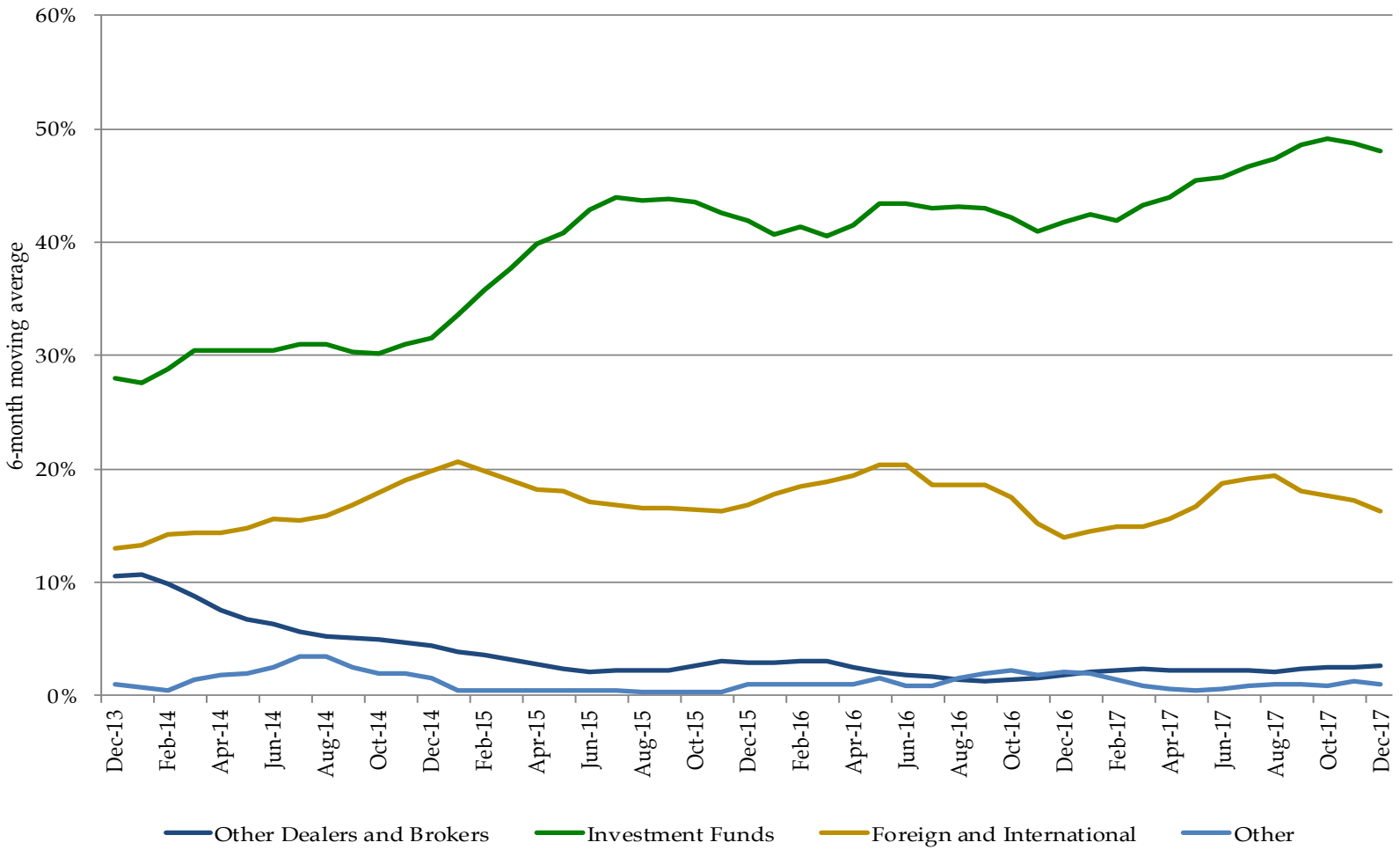


Percent Awarded in Bill Auctions by Investor Class (13-Week Moving Average)



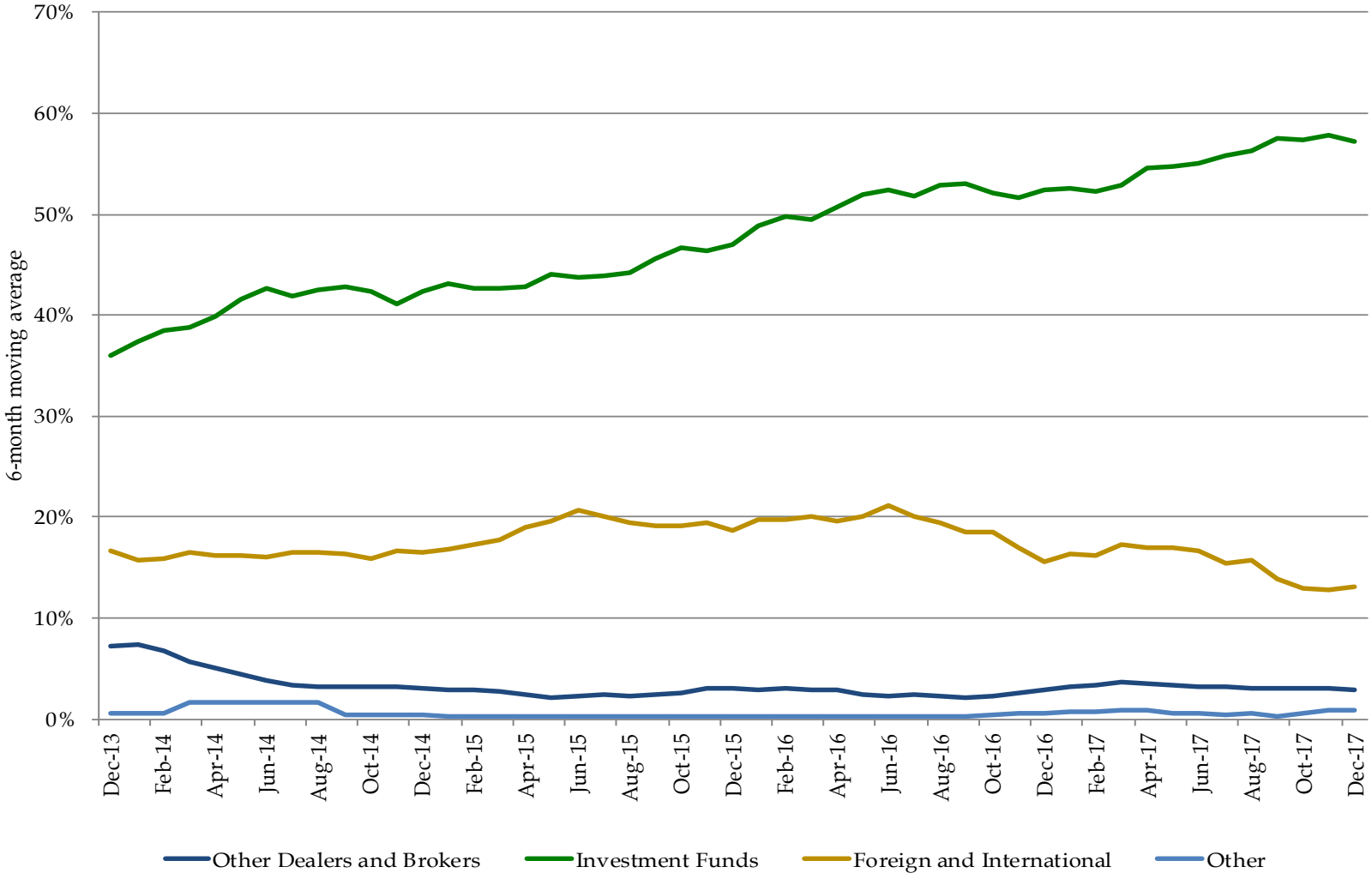
Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

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



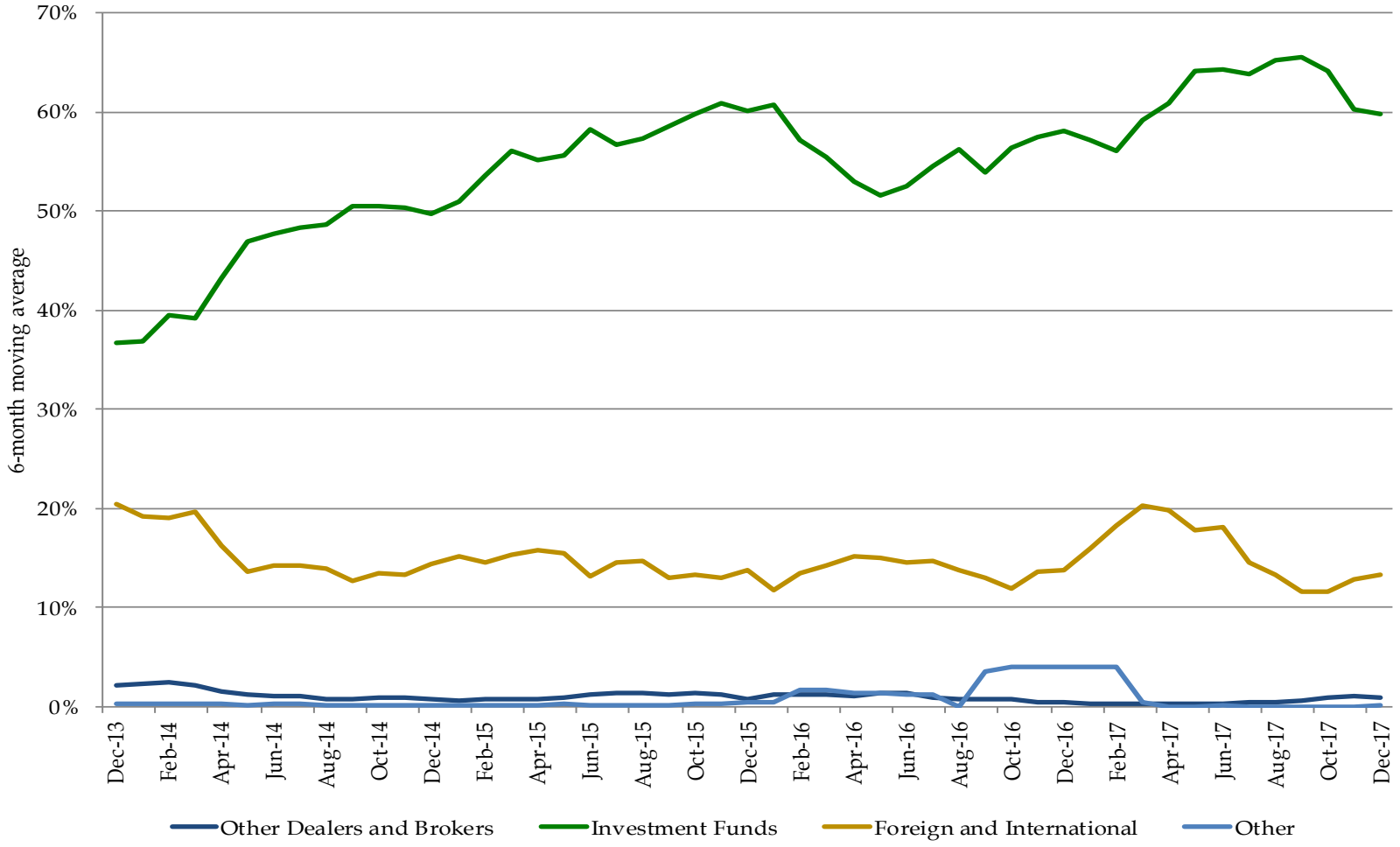
Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

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



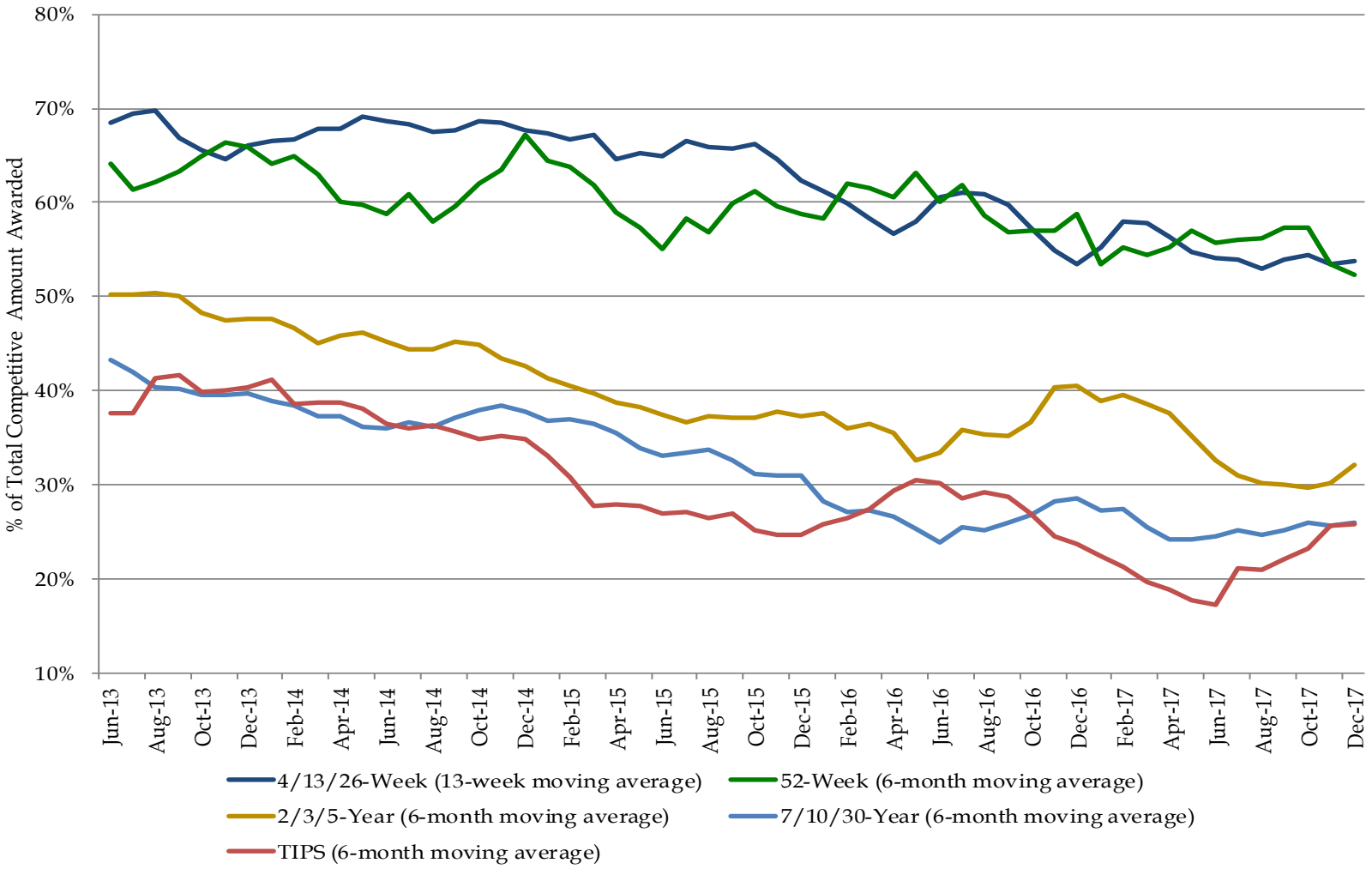
Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Percent Awarded in TIPS Auctions by Investor Class (6-Month Moving Average)



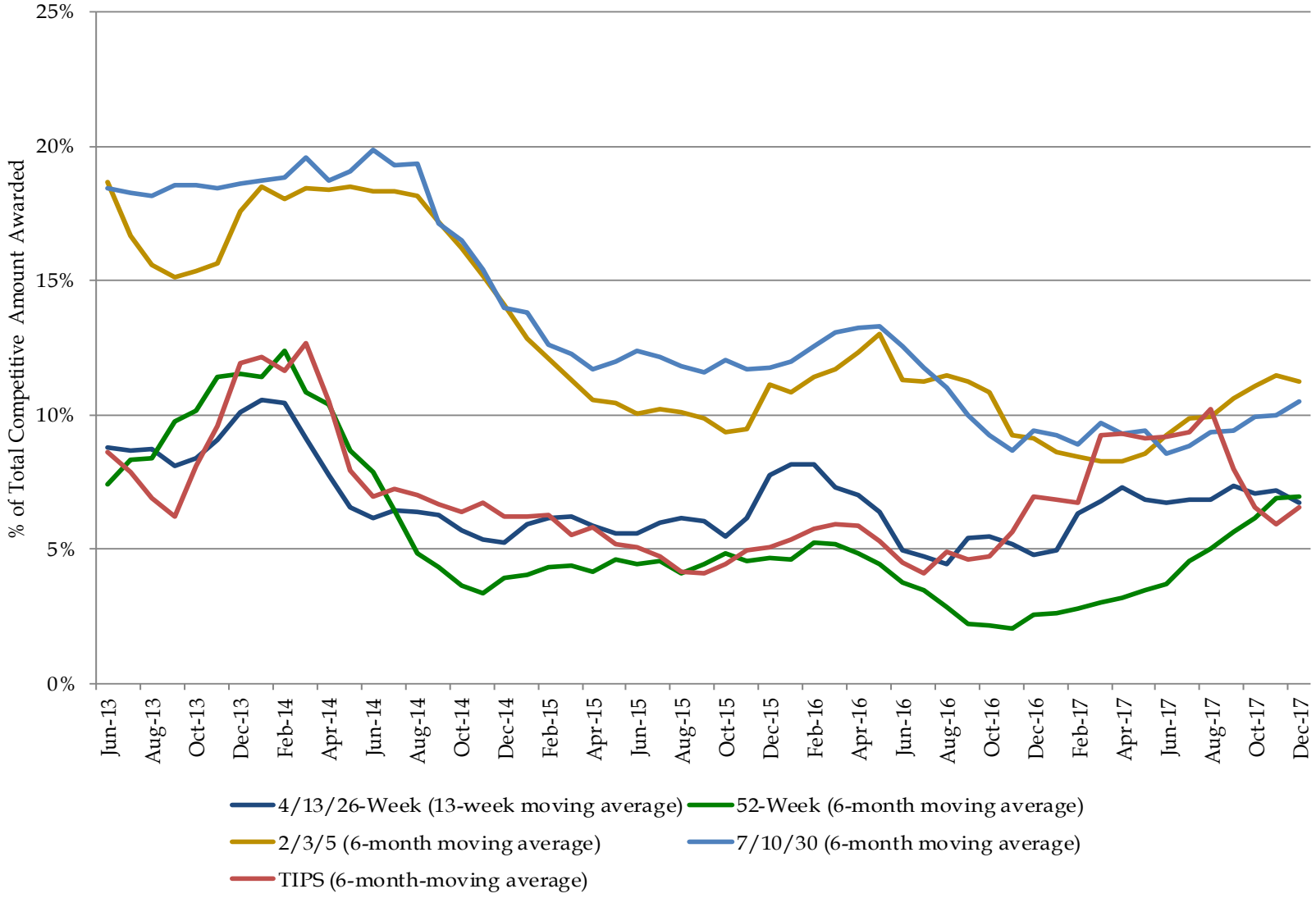
Excludes SOMA add-ons. The "Other" category includes categories that are each less than 5%, which include Depository Institutions, Individuals, Pension and Insurance.

Primary Dealer Awards at Auction



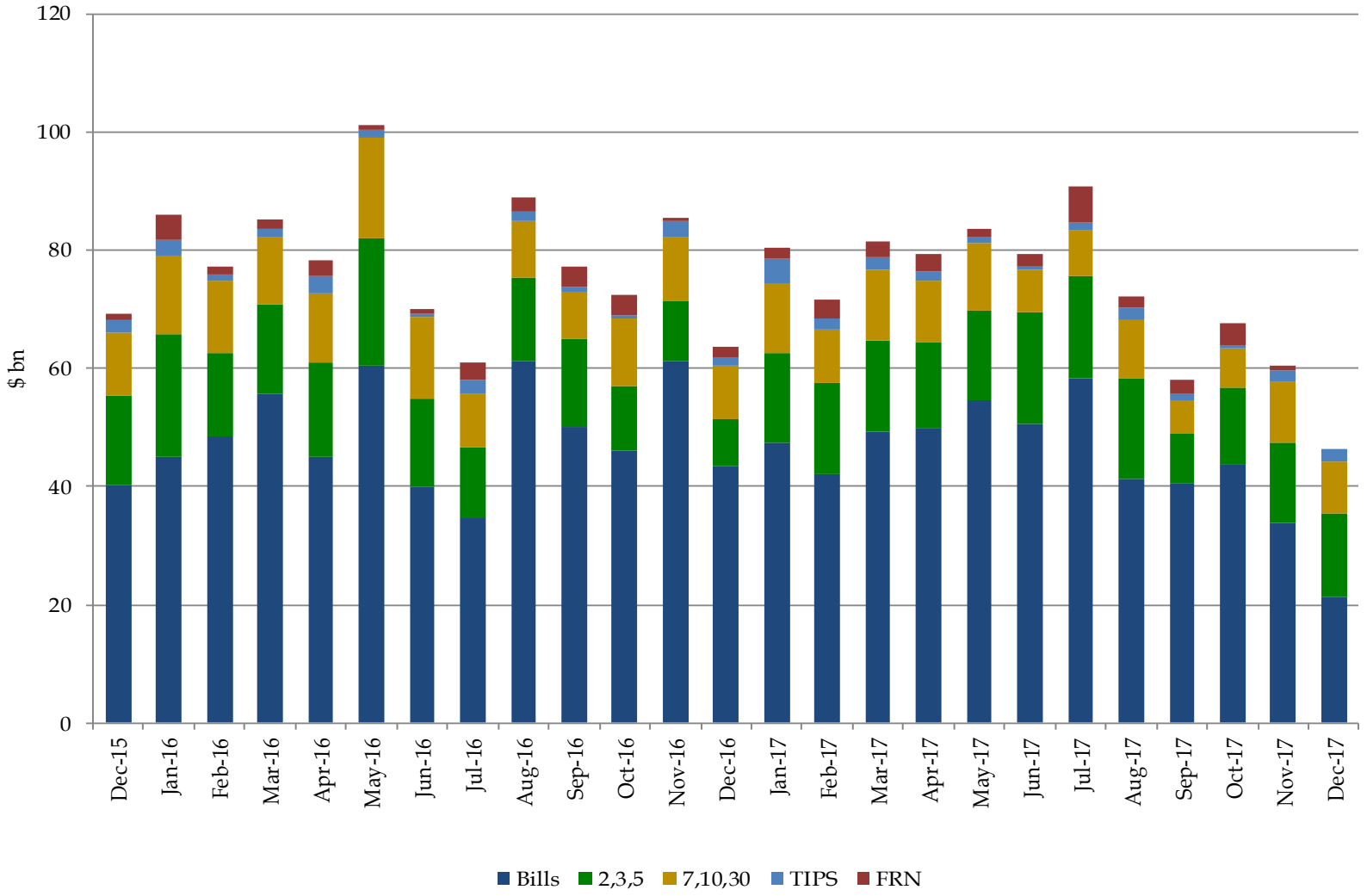
Excludes SOMA add-ons.

Direct Bidder Awards at Auction



Excludes SOMA add-ons.

Total Foreign Awards of Treasuries at Auction, $ billions



Foreign includes both private sector and official institutions.

Appendix

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	10/5/2017	0.980	3.23	34.5	66.8	11.9	21.3	0.5	0.0	0.3
4-Week	10/12/2017	1.015	2.90	34.4	76.8	6.1	17.1	0.6	0.0	0.3
4-Week	10/19/2017	0.995	3.24	39.4	65.4	11.9	22.7	0.5	0.0	0.4
4-Week	10/26/2017	1.005	3.30	44.5	54.7	6.9	38.4	0.5	0.0	0.4
4-Week	11/2/2017	1.020	2.99	49.5	61.5	8.7	29.8	0.5	0.0	0.4
4-Week	11/9/2017	1.035	3.01	49.4	63.3	9.9	26.8	0.5	0.0	0.4
4-Week	11/16/2017	1.045	3.13	49.3	45.3	6.5	48.1	0.6	0.0	0.4
4-Week	11/24/2017	1.130	2.99	44.5	53.2	5.5	41.2	0.5	0.0	0.4
4-Week	11/30/2017	1.170	3.12	43.6	43.5	9.8	46.7	0.6	0.0	0.4
4-Week	12/7/2017	1.180	3.10	34.4	73.1	5.2	21.6	0.5	0.0	0.3
4-Week	12/14/2017	1.240	3.09	44.5	58.3	9.4	32.3	0.5	0.0	0.4
4-Week	12/21/2017	1.245	3.29	49.5	38.5	9.7	51.8	0.5	0.0	0.4
4-Week	12/28/2017	1.245	2.96	49.5	50.6	9.8	39.6	0.5	0.0	0.4
13-Week	10/5/2017	1.050	2.89	41.5	70.0	7.1	22.9	0.5	0.0	1.2
13-Week	10/12/2017	1.085	2.90	41.2	58.1	7.7	34.2	0.6	0.0	1.2
13-Week	10/19/2017	1.090	3.19	41.4	45.5	10.9	43.6	0.5	0.0	1.2
13-Week	10/26/2017	1.105	3.20	40.5	42.1	10.2	47.7	0.6	0.0	1.2
13-Week	11/2/2017	1.130	3.02	41.3	57.0	8.1	34.9	0.5	0.0	1.2
13-Week	11/9/2017	1.185	3.17	40.8	52.8	5.9	41.3	0.6	0.0	1.2
13-Week	11/16/2017	1.240	3.11	41.2	46.2	8.7	45.0	0.6	0.0	1.2
13-Week	11/24/2017	1.285	3.18	41.1	62.2	6.1	31.7	0.6	0.0	1.2
13-Week	11/30/2017	1.285	3.07	40.9	61.3	10.3	28.4	0.6	0.0	1.2
13-Week	12/7/2017	1.290	3.09	41.4	59.3	5.4	35.3	0.5	0.0	1.2
13-Week	12/14/2017	1.320	2.99	44.2	67.1	7.3	25.6	0.6	0.0	1.3
13-Week	12/21/2017	1.355	2.79	44.1	74.3	6.1	19.7	0.7	0.0	1.3
13-Week	12/28/2017	1.445	2.71	44.2	74.0	5.9	20.1	0.5	0.0	1.3
26-Week	10/5/2017	1.190	3.03	35.1	48.4	5.9	45.7	0.5	0.0	2.0
26-Week	10/12/2017	1.220	3.01	34.9	51.6	2.0	46.4	0.5	0.0	2.0
26-Week	10/19/2017	1.240	3.35	35.1	40.5	3.4	56.2	0.5	0.0	2.0
26-Week	10/26/2017	1.245	3.21	34.5	54.0	4.5	41.6	0.5	0.0	2.1
26-Week	11/2/2017	1.260	3.47	35.0	38.6	2.6	58.8	0.5	0.0	2.1
26-Week	11/9/2017	1.300	3.23	35.3	45.0	3.2	51.9	0.5	0.0	2.1
26-Week	11/16/2017	1.360	3.30	35.3	37.1	3.0	60.0	0.5	0.0	2.1
26-Week	11/24/2017	1.415	3.33	35.3	45.5	2.0	52.5	0.5	0.0	2.0
26-Week	11/30/2017	1.435	3.34	35.2	35.6	3.9	60.5	0.4	0.0	2.0
26-Week	12/7/2017	1.450	3.30	35.3	43.2	3.1	53.7	0.4	0.0	2.0
26-Week	12/14/2017	1.460	3.26	38.3	46.8	4.2	49.0	0.5	0.0	2.2
26-Week	12/21/2017	1.480	3.09	38.2	50.4	4.0	45.6	0.5	0.0	2.2
26-Week	12/28/2017	1.530	3.61	37.5	32.7	3.7	63.7	0.5	0.0	2.2
52-Week	10/12/2017	1.365	3.27	19.8	58.8	6.2	35.0	0.2	0.0	2.3
52-Week	11/9/2017	1.485	3.34	19.8	49.8	7.9	42.3	0.2	0.0	2.3
52-Week	12/7/2017	1.650	3.44	19.7	38.2	6.9	54.9	0.3	0.0	2.2
CMB	11/1/2017	1.030	3.33	50.0	48.8	9.3	41.9	0.0	0.0	0.6
CMB	12/8/2017	1.170	4.01	9.0	85.1	1.4	13.5	0.0	0.0	0.1

*Weighted averages of competitive awards.
**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	10/31/2017	1.596	2.74	25.8	37.7	14.1	48.2	0.1	0.7	6.0
2-Year	11/30/2017	1.765	2.73	25.7	41.2	17.0	41.9	0.2	1.4	6.1
2-Year	1/2/2018	1.922	2.52	25.7	45.5	14.5	40.0	0.2	3.4	6.5
3-Year	10/16/2017	1.657	2.83	23.8	38.6	7.1	54.3	0.1	0.0	8.0
3-Year	11/15/2017	1.750	2.76	23.8	37.5	9.0	53.5	0.1	2.9	9.0
3-Year	12/15/2017	1.932	3.15	23.8	33.6	7.4	59.0	0.1	0.0	7.9
5-Year	10/31/2017	2.058	2.44	33.9	27.4	11.0	61.6	0.1	0.9	19.0
5-Year	11/30/2017	2.066	2.46	34.0	22.8	11.4	65.8	0.0	1.8	19.1
5-Year	1/2/2018	2.245	2.36	34.0	33.7	7.9	58.4	0.0	4.4	20.6
7-Year	10/31/2017	2.280	2.39	28.0	23.2	13.3	63.4	0.0	0.7	21.3
7-Year	11/30/2017	2.230	2.36	28.0	27.7	13.7	58.6	0.0	1.5	21.5
7-Year	1/2/2018	2.370	2.55	28.0	26.4	13.1	60.5	0.0	3.7	23.2
10-Year	10/16/2017	2.346	2.54	20.0	24.9	6.0	69.1	0.0	0.0	20.0
10-Year	11/15/2017	2.314	2.48	23.0	23.0	9.0	68.0	0.0	2.8	26.5
10-Year	12/15/2017	2.384	2.37	20.0	34.4	8.4	57.2	0.0	0.0	20.0
30-Year	10/16/2017	2.870	2.53	12.0	26.6	10.6	62.8	0.0	0.0	27.5
30-Year	11/15/2017	2.801	2.23	15.0	31.8	6.4	61.8	0.0	1.8	39.3
30-Year	12/15/2017	2.804	2.48	12.0	29.1	9.0	61.9	0.0	0.0	27.5
2-Year FRN	10/31/2017	0.048	3.56	15.0	39.2	0.7	60.2	0.0	0.4	0.0
2-Year FRN	11/24/2017	0.035	3.69	13.0	44.1	6.3	49.6	0.0	0.0	0.0
2-Year FRN	12/29/2017	0.035	3.26	13.0	37.3	0.0	62.7	0.0	0.0	0.0

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	12/29/2017	0.370	2.78	14.0	16.1	12.2	71.7	0.0	0.0	6.8
10-Year TIPS	11/30/2017	0.512	2.43	11.0	26.2	4.8	69.0	0.0	0.6	12.3
30-Year TIPS	10/31/2017	0.908	2.64	5.0	23.1	0.5	76.4	0.0	0.1	15.1

*Weighted averages of competitive awards.
**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.

January 2018

TIPS Program Assessment, and Recommendations for Future Issuance

Treasury has issued Treasury Inflation Protected Securities (TIPS) since 1997 and currently there are $1.3 trillion TIPS outstanding, representing about 9 percent of Treasury marketable debt outstanding. We would like the Committee to assess the TIPS issuance programs based on Treasury's regular and predictable issuance framework, liquidity, cost, investor-base diversification, borrowing needs, and risk. Please provide perspectives on the costs and benefits of any adjustments to the TIPS program in light of these considerations.

Recommendations for Future Issuance

Treasury should maintain the current share of TIPS issuance (~7%) over time within its broader funding portfolio.

- Given lower than average estimates for inflation risk premium we recommend the Treasury increase TIPS issuance in 2018 by not more than $26 bn.
- We recommend that gross issuance increases are tilted toward the 5yr tenor, given more robust liquidity and demand, and negative inflation risk premium in longer-dated breakeven tenors.

Supply-side considerations

- Ex-post direct cost estimates conclude the TIPS program has benefited Treasury relative to nominal securities; however ex-ante estimates point to a diminished future benefit of the program if the recent decline in inflation risk premiums persist.
- We expect the factors that have recently held down inflation risk premiums to fade overtime. In this situation the Treasury should be able to maintain the current share of the TIPS issuance in a gradual and predictable fashion.
- We find revenues and outlays have similar sensitivities to inflation. Changing the size of the TIPS issuance should not have a significant impact on funding volatility in most circumstances.

Demand-side considerations

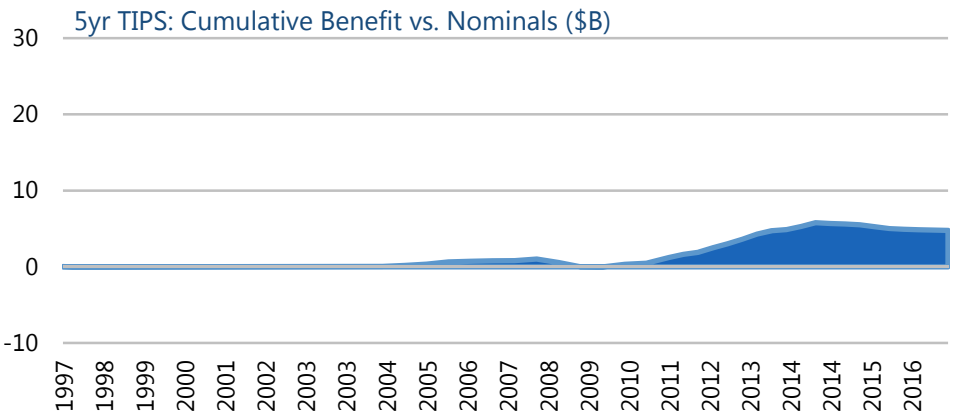
- Foreign holdings of TIPS have increased with room to growth further. Domestic demand has also increased, with sharp growth in target date-funds.
- Including TIPS in the broader bond indices would be a significant boost to demand. A more robust inflation derivatives market would also augment demand for the product overtime.

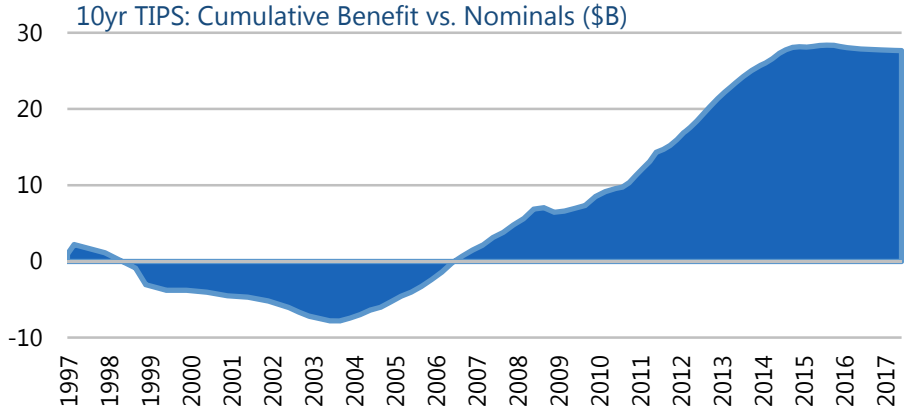
Supply-Side Considerations: Summary of TIPS Program Performance

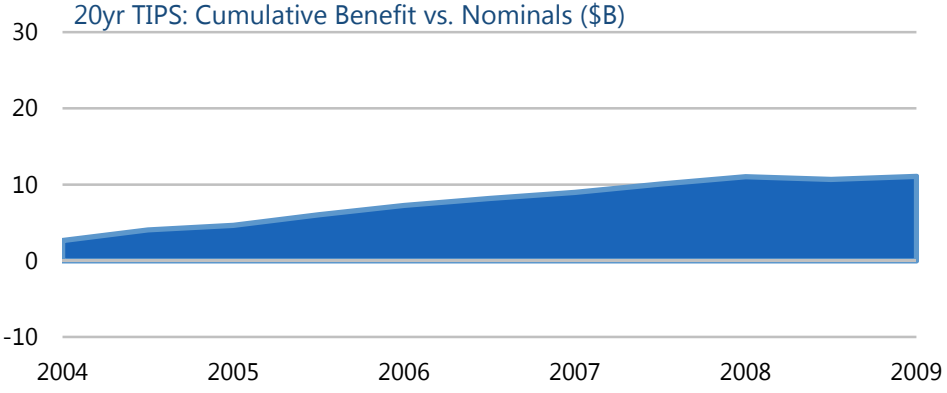
- **Ex-post, the TIPS program has benefited Treasury relative to nominal securities.**
  - To-date the TIPS program has saved the Treasury an estimated $47bn relative to the alternative nominal issuance, ex-post, suggesting that Treasury has captured inflation risk premium over time.
- **However, ex-ante estimates conclude the TIPS program has been more costly.**
  - Comparing TIPS auction breakevens to survey-based measures of long-term inflation expectations, shows that Treasury regularly issues TIPS at breakeven levels that are under professional forecasters' inflation projections.
- **Recently, TIPS breakevens have fallen toward the low end of their historical range, implying a diminished future advantage of the TIPS program. This raises several key questions for Treasury:**
  - Has the decline resulted from a change in the TIPS relative liquidity premium, which the Office of Debt Management (ODM) can influence, or a change in inflation risk premiums, which ODM cannot influence?
  - Are the drivers structural or cyclical?
  - Does the TIPS program benefit (or cost) the government in other ways that are not captured by direct cost calculations?
- **Conclusions: The recent decline in TIPS breakevens is likely the result of a decline in inflation risk premiums. However, we expect the factors that have held down inflation risk premiums to fade overtime.**
  - Historically, inflation risk premiums have followed monetary policy cycles and the recent decline appears consistent with the removal of monetary policy accommodation.
  - The recent period of low realized inflation is also likely affecting investors' willingness to pay for inflation protection. However, we expect the factors that have recently held down inflation to also fade.

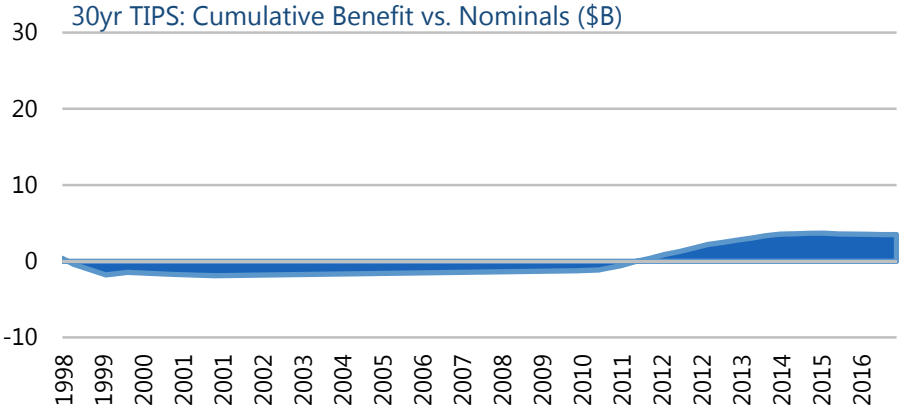
Ex-post, TIPS have benefited Treasury relative to nominal securities.

To-date, the TIPS program has saved the Treasury an estimated $47bn relative to nominal issuance, indicating that Treasury has captured inflation risk premium over time.

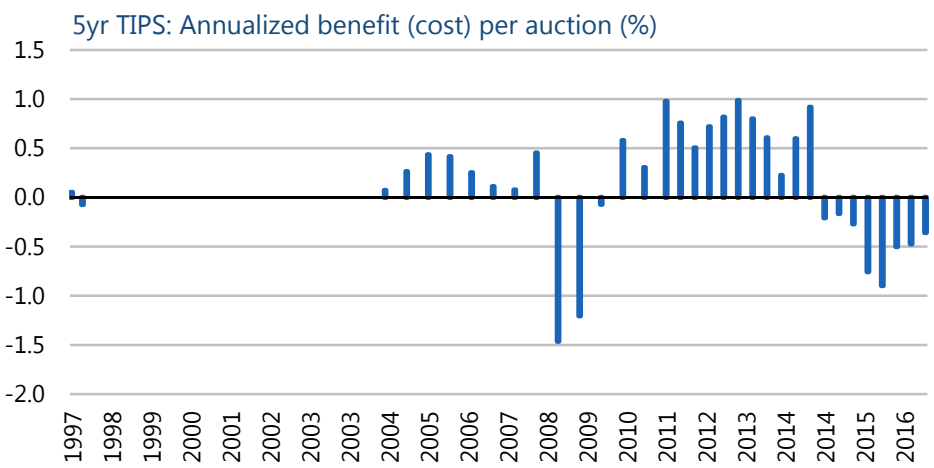


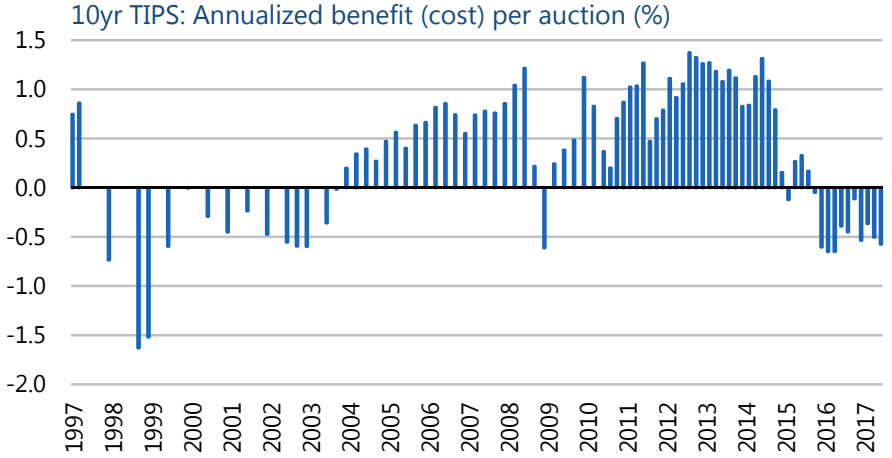


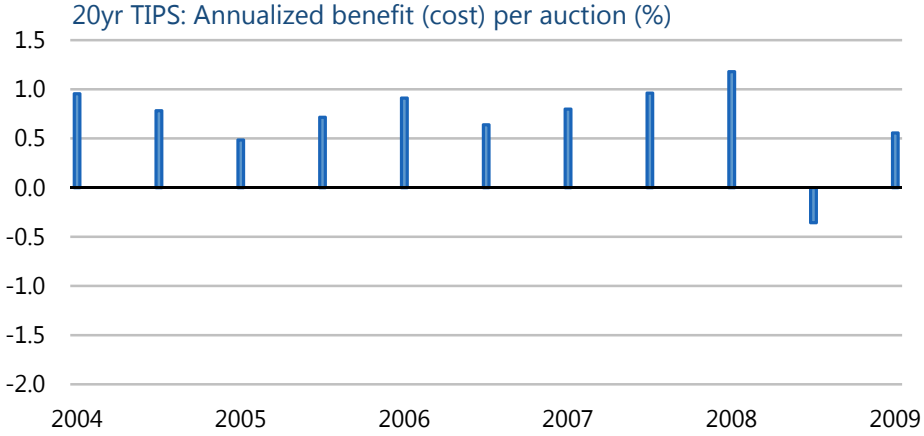


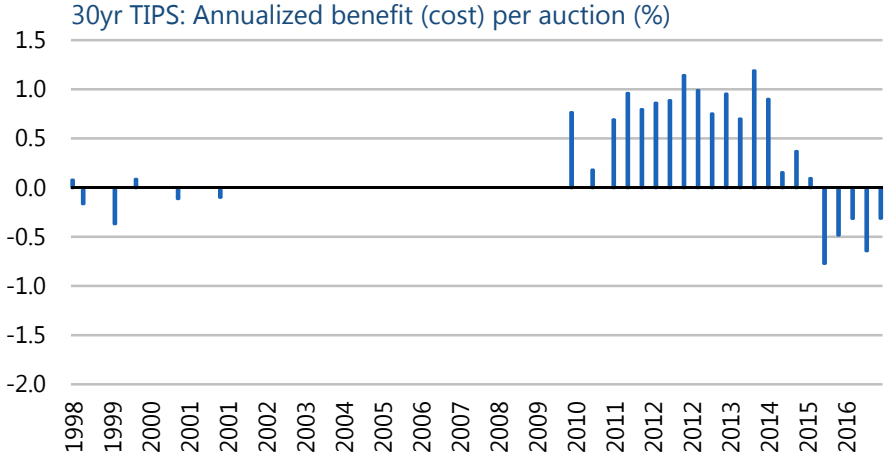


Ex-post benefit (cost) of issuing TIPS relative to nominal Treasuries
(% annualized, per auction)



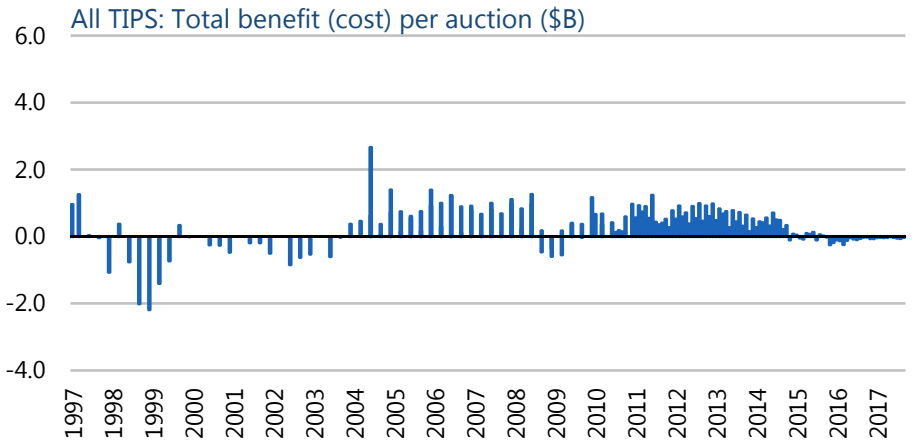


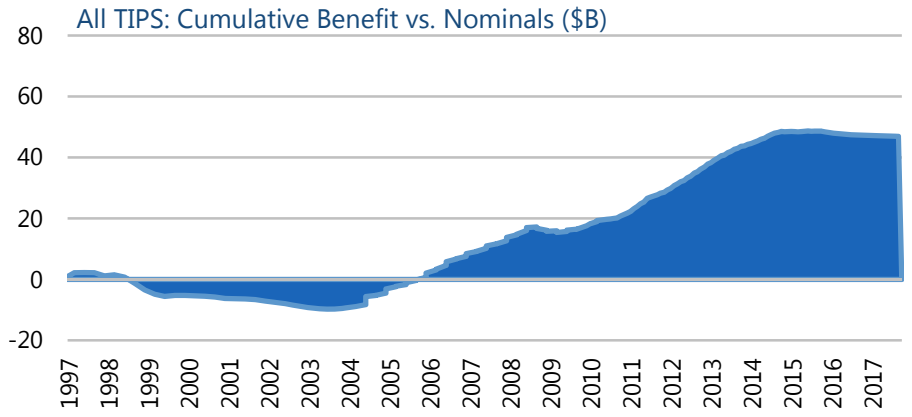




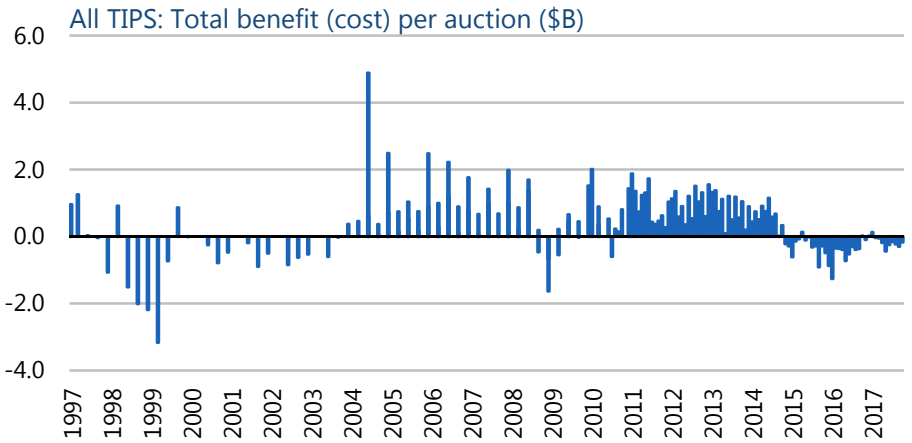
Implying future CPI in line with 11/30/17 (swap) breakeven curve increase TIPS savings to $58bn*. Total benefit is highly sensitive to future inflation

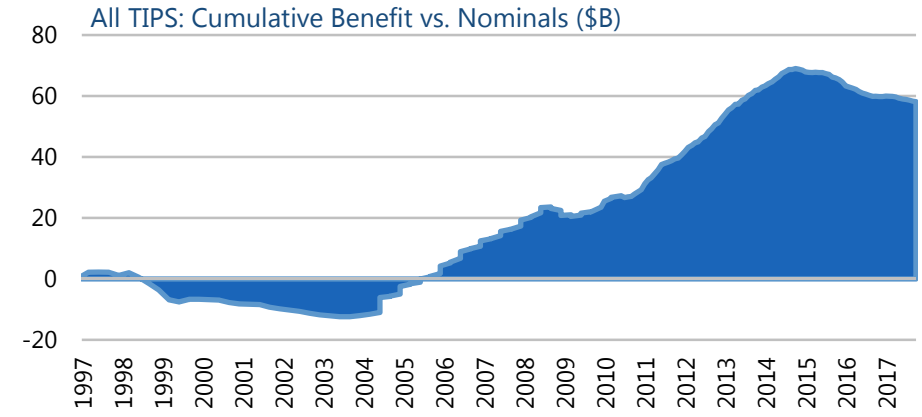
Ex-post benefit of TIPS to-date





Ex-post benefit of TIPS implying inflation in line with ZC BEI as of 11/30/17*



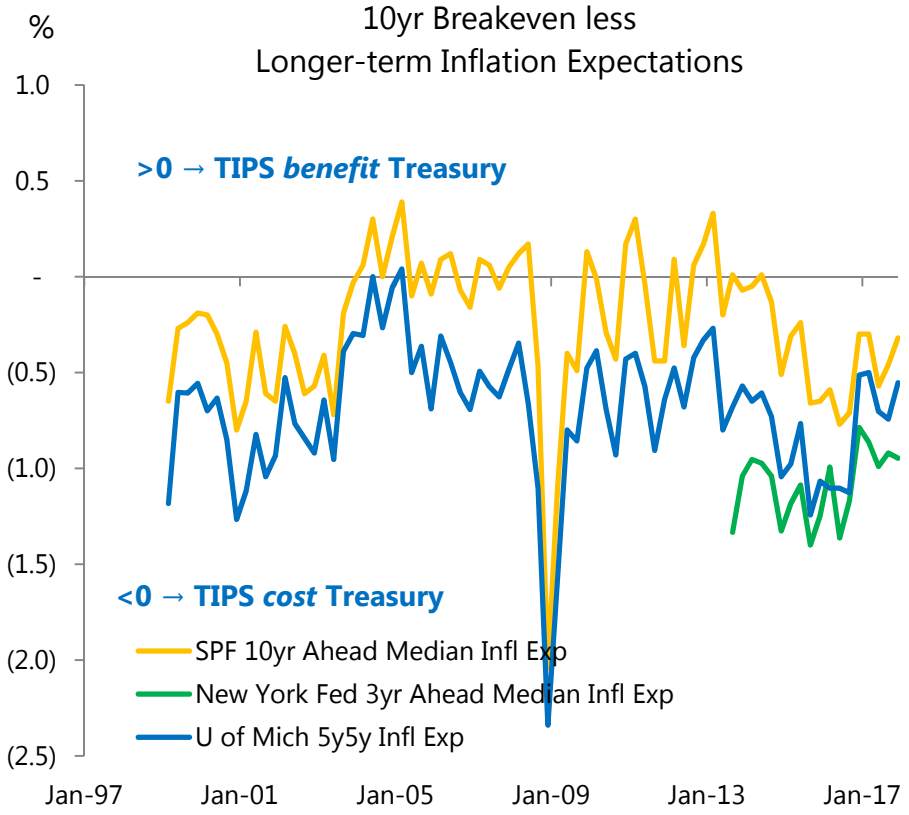


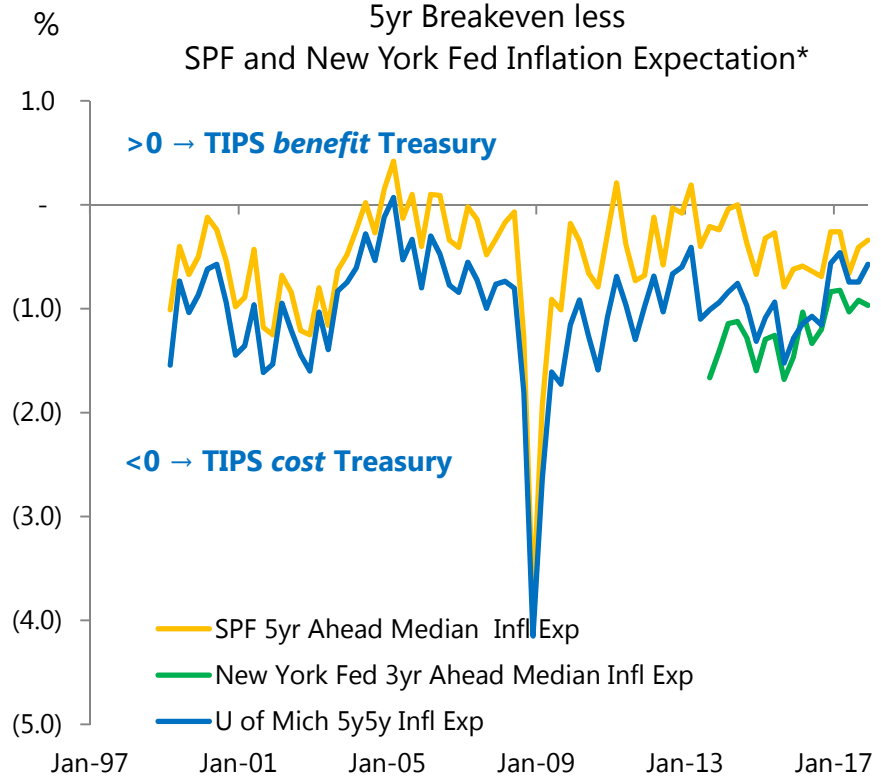
*TIPS cost estimates based on assumed future inflation projections are similar to Dave Chung Colin Kim, and Allen X. Zhang, "An Ex Post Performance Analysis of the TIPS Program", 2013
Future benefits discounted to 11/30/17

	Future inflation relative to BEI				
	-0.2%	-0.1%	0.0%	0.1%	0.2%
Benefit	83	70	58	46	33

Ex-ante estimates conclude the TIPS program has been more costly

Based on various surveys of professional forecasters' and consumers' inflation expectations, Treasury has regularly issued TIPS at a *higher* ex-ante cost than nominal securities.





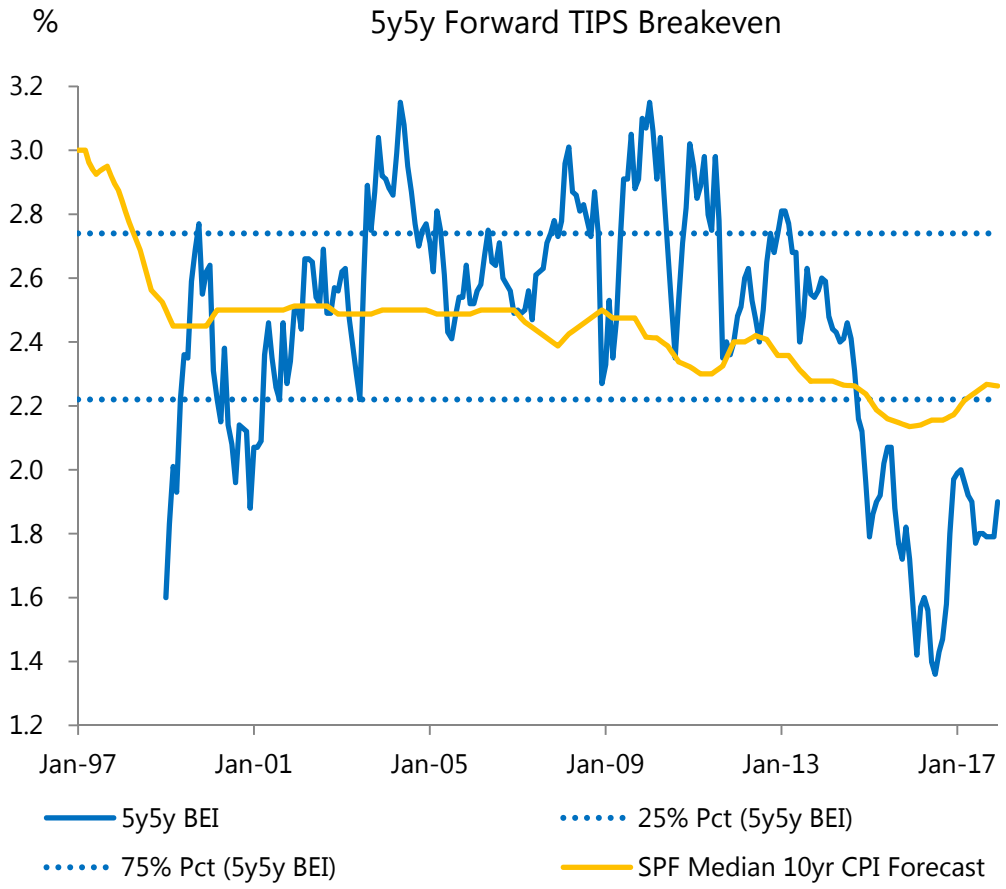
*Source: Philadelphia Federal Reserve Bank, Federal Reserve Bank of New York, University of Michigan, Haver

TIPS Breakeven decline implies diminished future advantage

Since 2014, the 5y5y forward TIPS breakeven has declined by roughly 70bps, and is now trading at the low end of its historical range. This has happened amid largely stable long-term inflation expectations.

Key questions for Treasury:

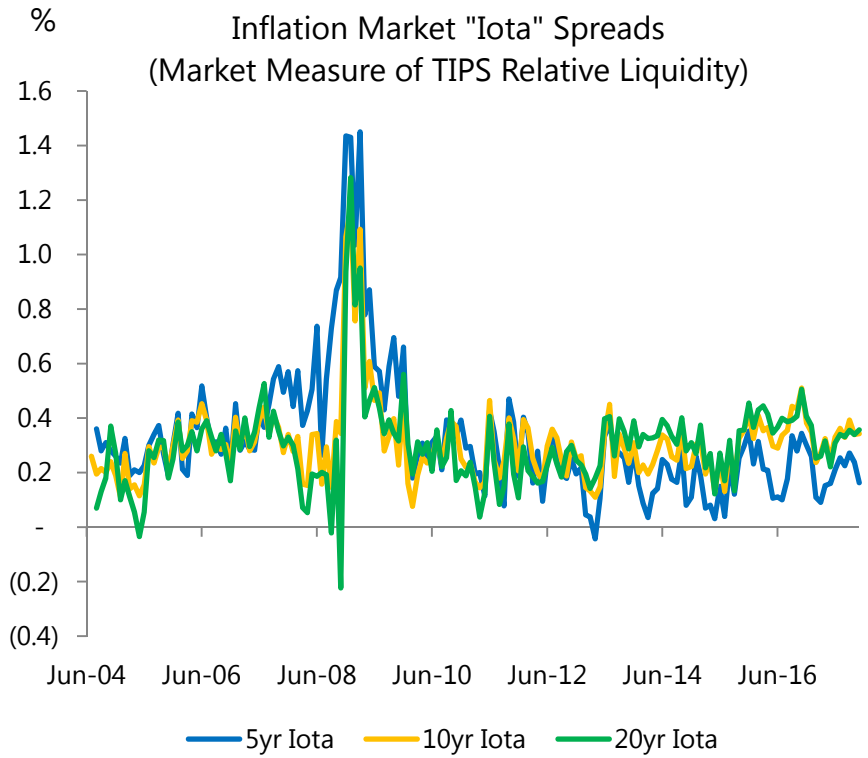
1. What's changed - TIPS relative liquidity premiums, which the Treasury can influence, or inflation risk premiums?
2. Are the drivers structural or cyclical?
3. Does the TIPS program benefit or cost the government in other ways not captured by direct cost calculations?

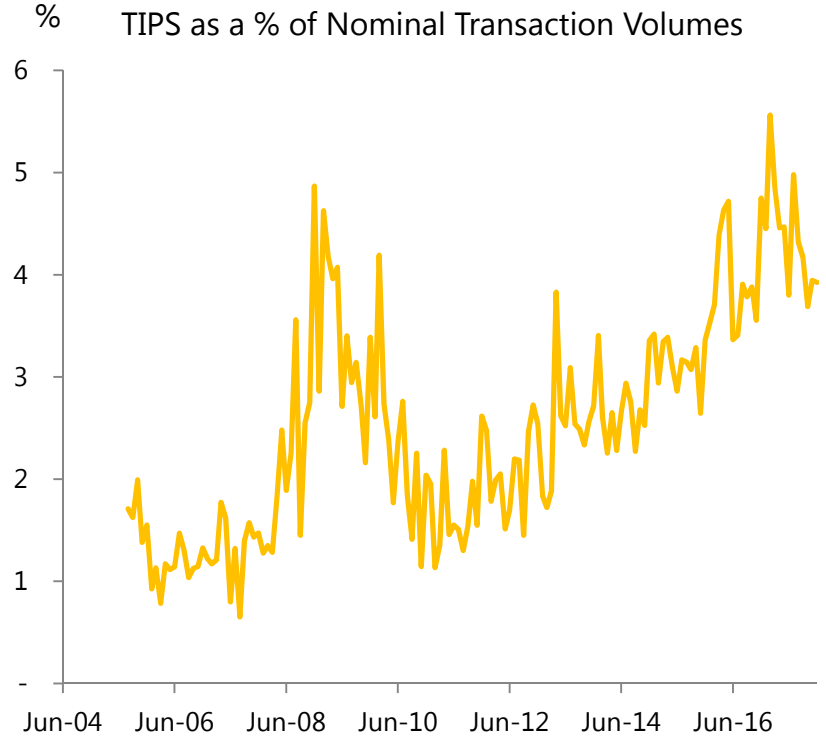


*Source: Philadelphia Federal Reserve Bank, Haver. SPF median forecast series is smoothed via a trailing 2q moving average.

Fall in Breakevens unlikely the result of changing liquidity premiums

Inflation "iota" spreads – a market-based measure of TIPS relative liquidity – suggest that relative TIPS liquidity has been stable since the 2008 financial crisis. TIPS transactions have increased as a percentage of nominal transactions.

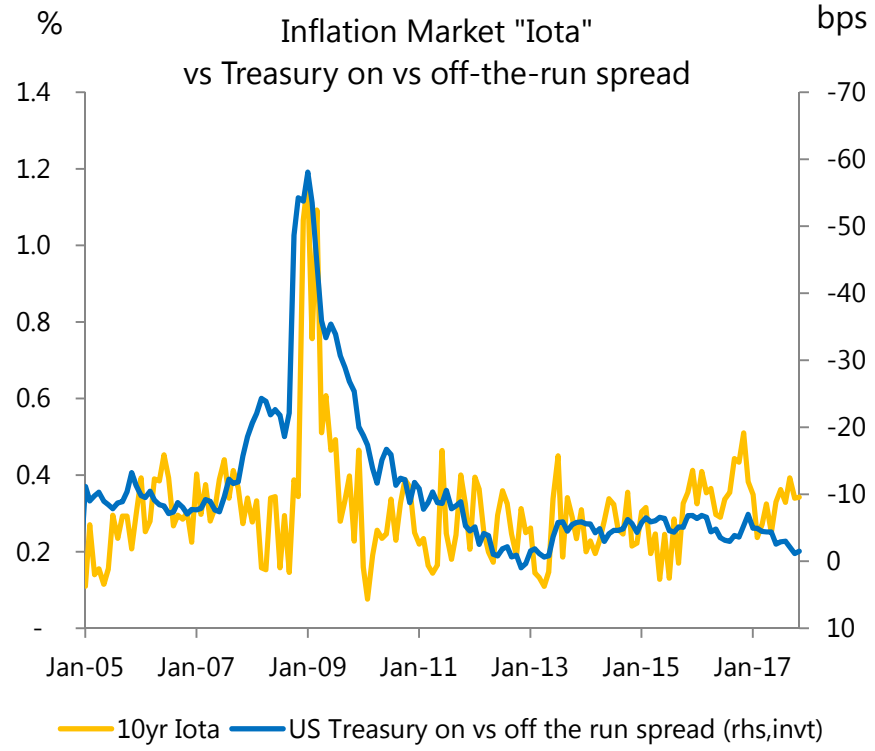


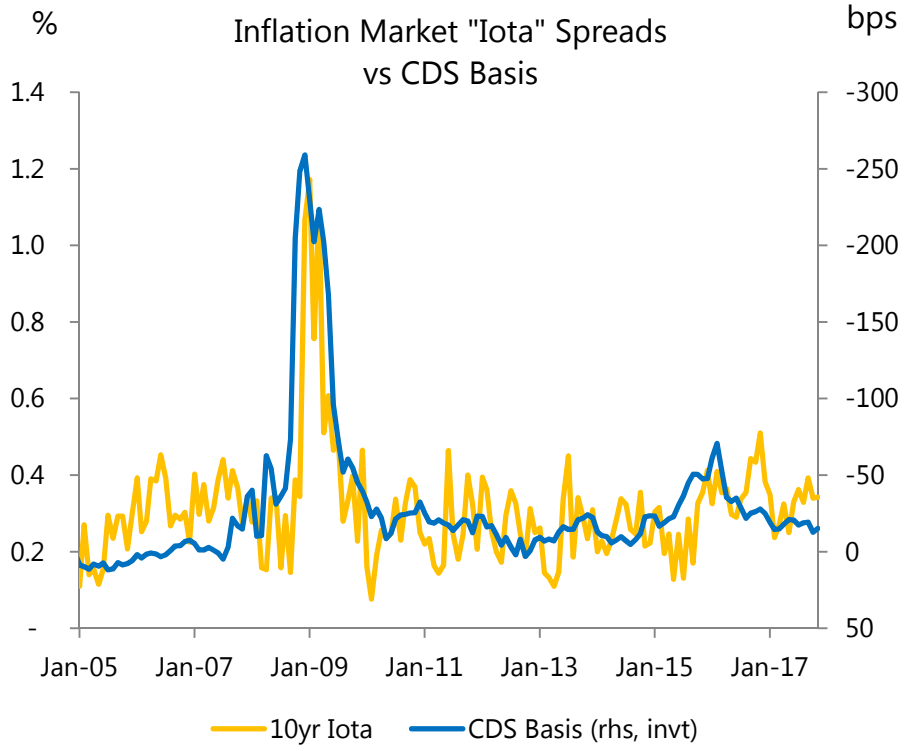


*Inflation iota spreads are defined as the spread between zero coupon inflation swaps, and constant maturity TIPS breakeven inflation rates calculated from a par yield curve.
Source: Bloomberg, Haver, Federal Reserve Bank of New York

Other measures of market liquidity corroborate this conclusion

Other market-based measures that tend to be correlated with inflation Iota spreads suggest TIPS market liquidity isn't a material detriment to Treasury.





Source: Bloomberg, Federal Reserve Bank of New York, JPM
CDS Basis: High Grade All CDS-Bond Basis

Regressions of BEI-Inflation Swap Differentials on Proxies of Liquidity (Monthly data)

TIPS market liquidity measures are highly correlated with other market liquidity measures, including nominal treasury on- vs off-the-run spreads, and the CDS basis.

Model 1:

$$BEI(10y,t) - Inflation\ Swap\ Rate(10y,t) = \alpha + \beta(1)\ Vix\ (t) + \varepsilon(t)$$

Model 2:

$$BEI(10y,t) - Inflation\ Swap\ Rate(10y,t) = \alpha + \beta(1)\ Vix\ (t) + \beta(2)\ treasury\ liquidy\ spread\ (t) + \varepsilon(t)$$

where

treasury liquidity spread (t) = 10y benchmark treasury yield − 10y off−the−run fitted treasury par rate

Model 3:

$$BEI(10y,t) - Inflation\ Swap\ Rate(10y,t) = \alpha + \beta(1)\ Vix\ (t) + \beta(2)\ treasury\ liquidity\ spread\ (t) + \beta(3)\ High\ Grade\ All\ CDS - Bond\ Basis\ (t) + \varepsilon(t)$$

where

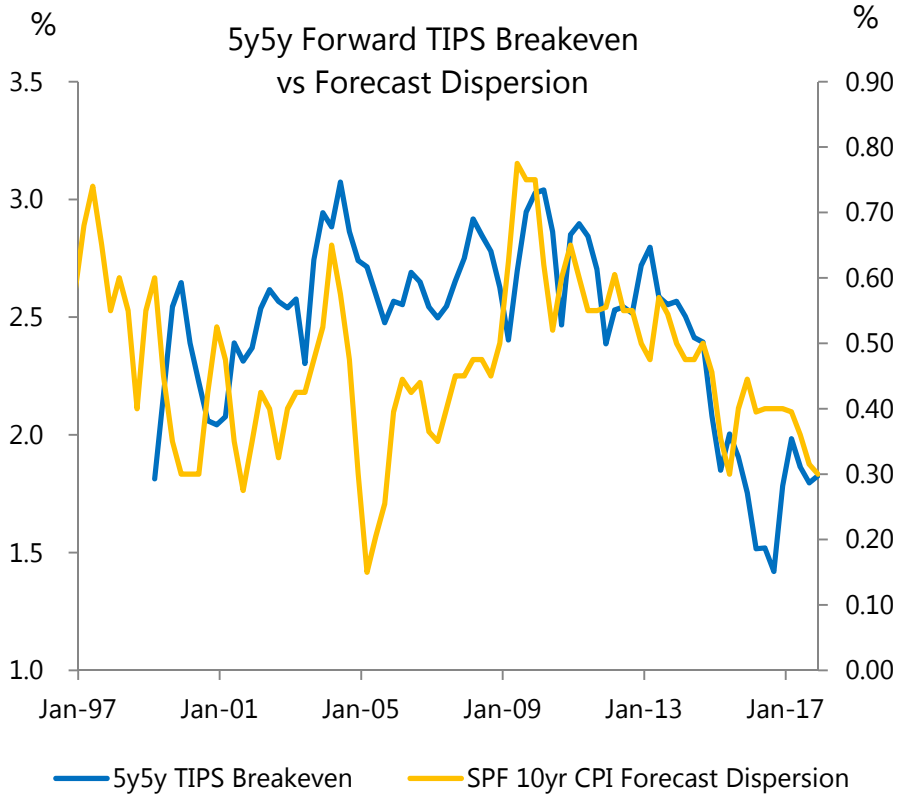
$High\ Grade\ All\ CDS - Bond\ Basis\ (t)\ is$ an estimate for all names by J.P. Morgan using 5y CDS spreads − 5y Cash Spread

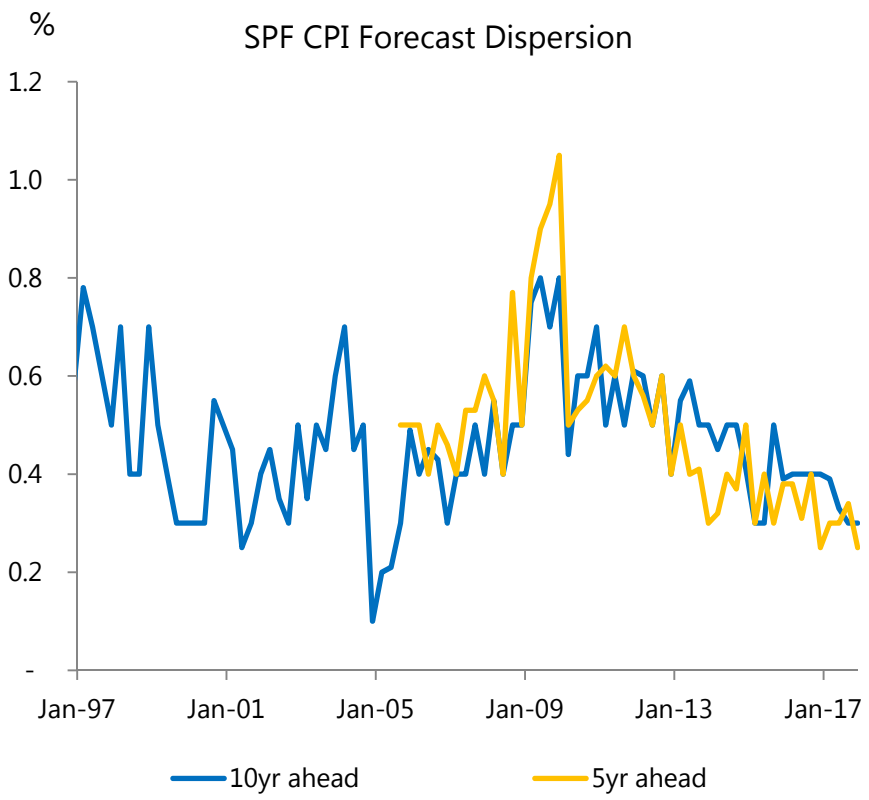
Sample Period	Coeff VIX	Coeff TSY on- vs off-the-run spread	Coeff CDS Basis	R^2
Mar 2005-Jan2016				
Model 1	-1.01*			41%
Model 2	-0.48*	0.51*		47%
Model 3	-0.15	0.04	0.18*	56%
Jan 2010-Jan 2016				
Model 1	-0.34*			9%
Model 2	-0.46*	-0.35		13%
Model 3	-0.47*	-0.46*	0.12*	18%

*statistically significant at 5% confidence interval

Fall in Breakevens more likely the result of changing inflation risk premiums

SPF inflation forecast dispersion, a measure of inflation risks, has declined along with TIPS breakevens.

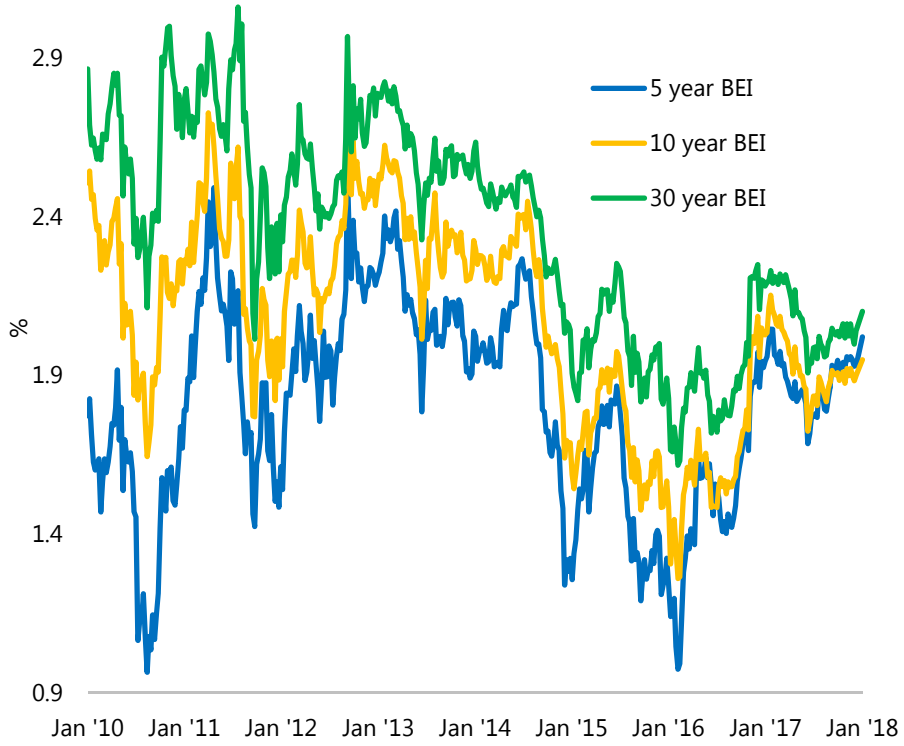




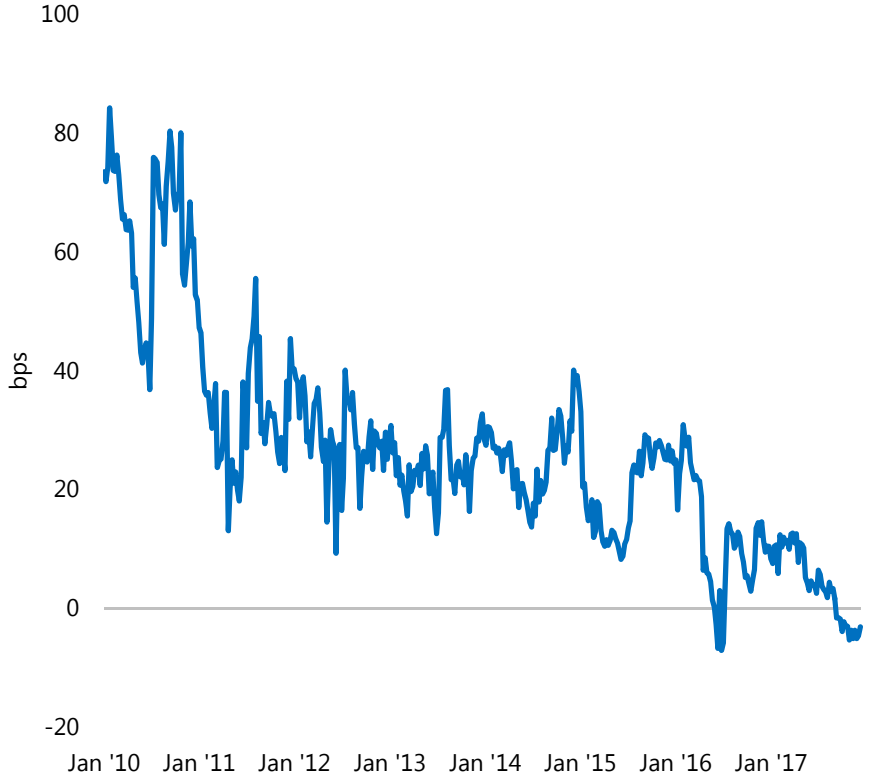
Source: Philadelphia Federal Reserve Bank, Haver

Flattening Breakeven curve also points to lower inflation risk premium

Seasonality adjusted breakevens



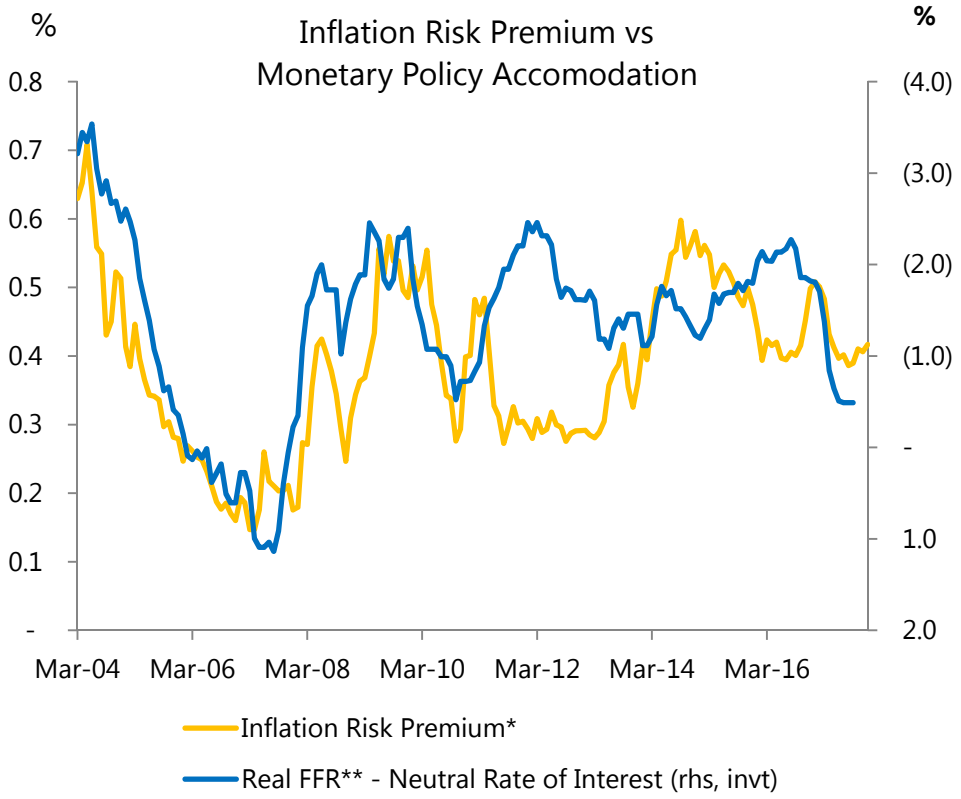
5s30s breakeven spread

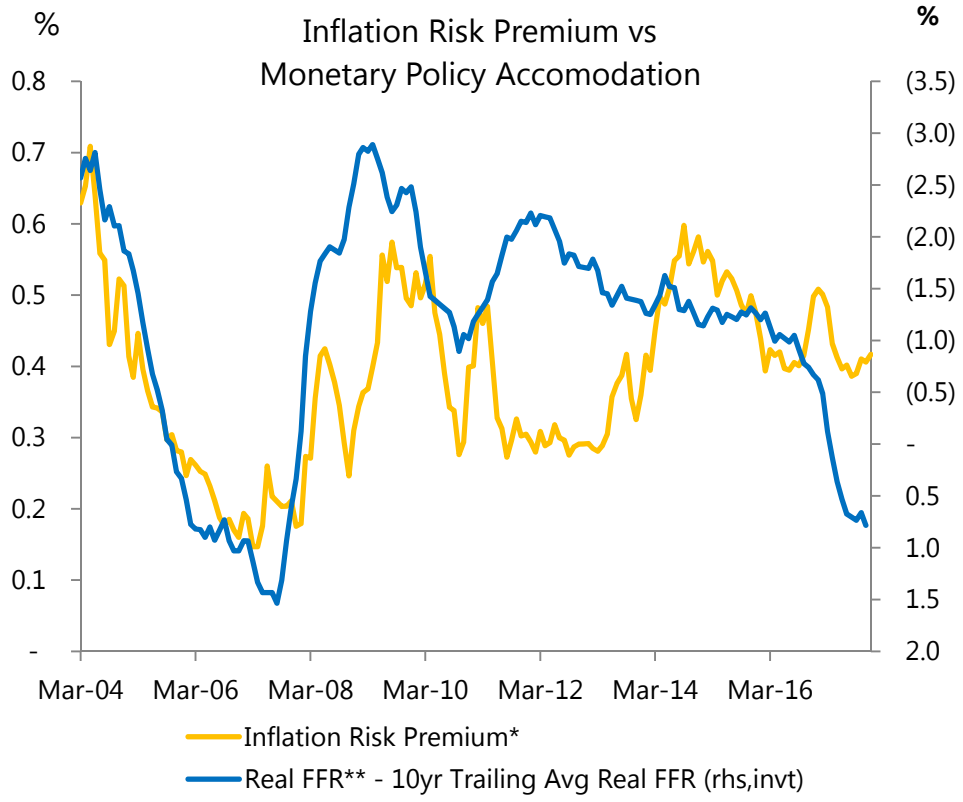


Source: Bloomberg

Is the inflation risk premium decline structural or cyclical?

Historical movements in inflation risk premiums appear cyclical, and can be explained by monetary policy cycles. The recent decline in inflation risk premiums is consistent with the experience during the 2004-2006 Fed rate hiking cycle.





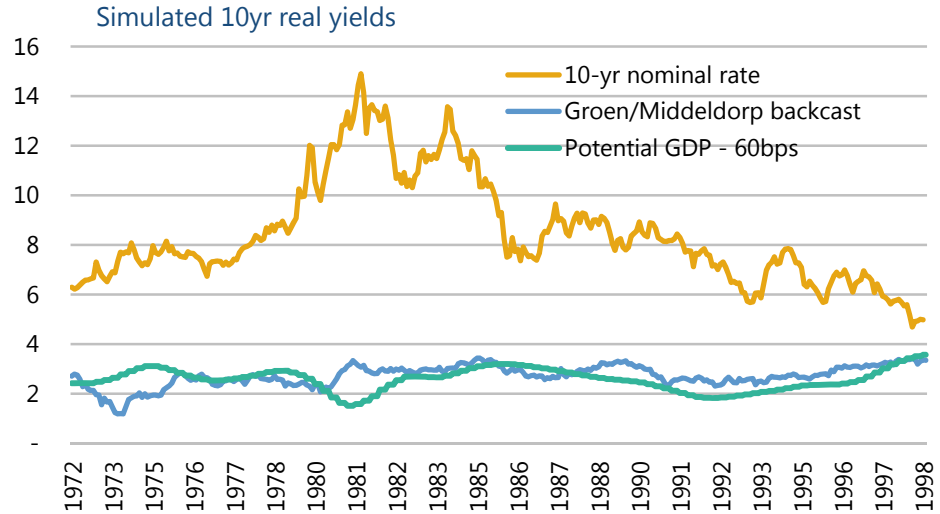
*The decomposition of TIPS breakevens into inflation expectations and liquidity and risk premiums is based on the affine term structure modeling framework of D'Amico, Kim and Wei, "Tips from TIPS: the Information Content of Treasury Inflation-Protected Securities Prices," 2014.

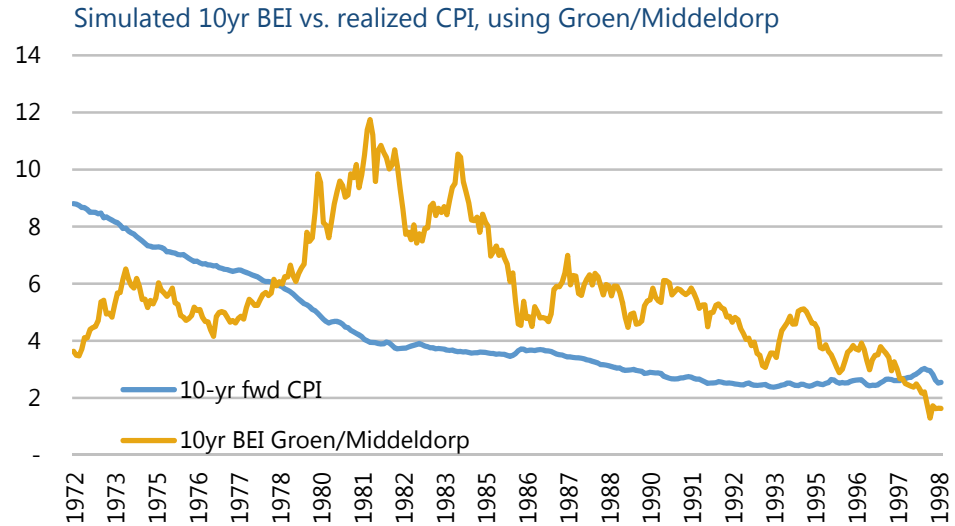
**The real federal funds rate = nominal fed funds target – core CPI inflation (y/y)
Source: Bloomberg, Haver, Laubach and Williams, "Measuring the Natural Rate of Interest Redux," 2015

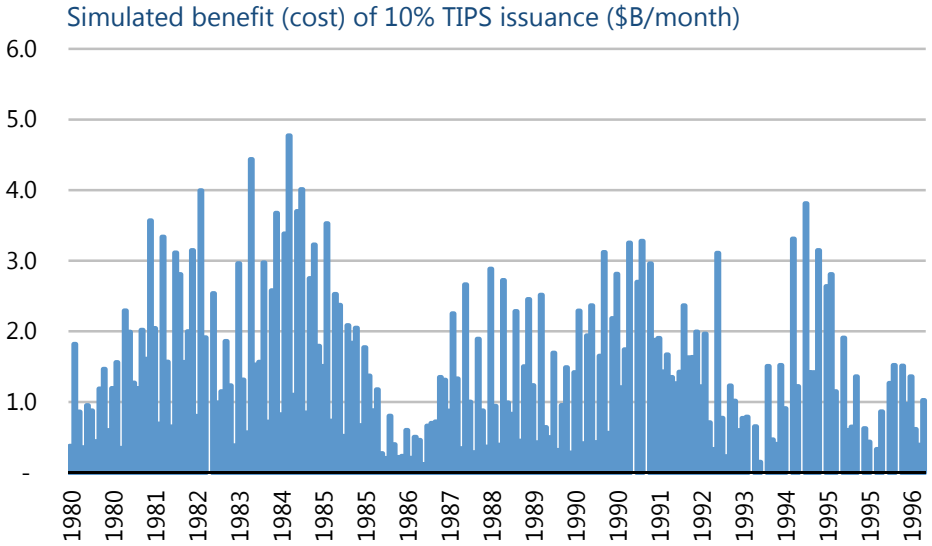
Other factors arguing for a normalization in inflation risk premiums

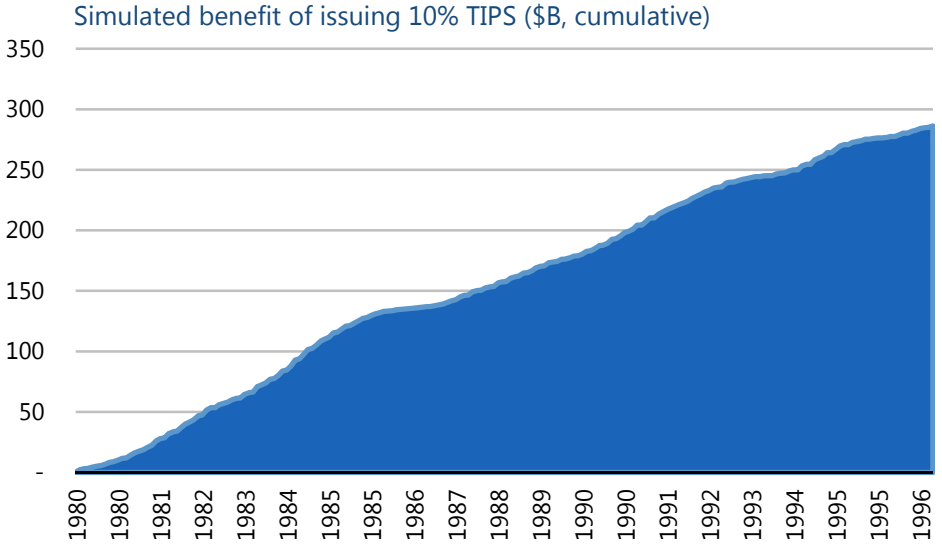
- **Investors' willingness to pay for inflation protection is linked to central bank policy cycles**
  - Federal Reserve actions to remove policy accommodation despite low realized inflation may have lead markets to question the extent to which the 2% PCE inflation target is an average or a ceiling.
  - However, more recent public remarks from various current and former Fed officials indicate that central bankers are starting to re-think their inflation targeting framework.
- **The recent period of low realized inflation has likely moderated investors' perceptions of inflation risks. However, we expect realized inflation will normalize moving forward.**
  - The energy and dollar shocks of 2014 and 2015, heightened competition in the retail goods sector and other idiosyncratic price-level adjustments have dampened realized inflation over the last several years. However, we expect these shocks to fade moving forward.
  - Fiscal policy expansion late in the business cycle should be more inflationary.
  - Restrictive trade policies should also raise price levels.

Based on simulated TIPS breakevens, we estimate TIPS would have saved $286B had they been used for 10% of debt issuance from 1980 to 1996.









Source: Haver, CBO, Groen/Middeldorp (http://libertystreeteconomics.newyorkfed.org/2013/08/creating-a-history-of-us-inflation-expectations.html)
1980 longest available history for gross debt issuance

Bigger Picture, From an ALM perspective Treasury has Matched its Inflation Risks

- **ALM-type arguments for TIPS issuance are not conclusive in light of the fact that government outlays *and* revenues are both positively correlated with inflation.**
- **However, its important to keep in mind that nominal interest expense variability has a higher empirical beta to realized growth relative to TIPS interest expense.**

Conclusions : In high inflationary scenarios, Treasury funding volatility is reduced by issuing more nominal bonds, while in high growth scenarios, Treasury benefits by issuing more TIPS. In more typical scenarios, Treasury should be indifferent to TIPS vs. nominals.

- Further study to include these effects in overall funding model presented earlier.

Government Funding Simulation Model Summary (details in Appendix)

Receipts & Outlays are simulated based on various assumptions for GDP & Inflation

Parameterized to approximately match CBO estimates under CBO base case

CBO Base Case: Real GDP=1.9%, Inflation=2.0%

Receipts & Outlays evolve from the following system of equations

$$X_{i,t+1} = X_{i,t} * (1 + \alpha_i + \lambda_{i,GDP} * GDP_t + \lambda_{i,Inf} * Inf_t + \varepsilon_{i,t}), \qquad i = \{Receipts, Outlays\}$$

Debt issuance in each year is equal to the budget deficit, inclusive of interest expense

$$B_{t+1} = (1 + r_t)B_t + D_t$$

Government Receipts Assumptions

GDP lamda = 2.0, Inf lamda = 1.2, Residual Vol = 6.8%, growth rate matched to CBO

Government Outlay Assumptions

GDP lamda = 0.3, Inf lamda = 1.0, Residual Vol = 6.8%, growth rate matched to CBO

Macro Assumptions

GDP Vol = 1.3%, Inf Vol = 1.3% based on past 10-year realized vol

Independence assumed between GDP & inflation; empirically correlation is slightly negative (-0.1)

Mean levels change for each macro scenario

Interest Cost Assumptions

Starting 10Y Nominal Yield = 2.4% (as of 12/31/17), Starting 10Y Real Yield = 0.43% (as of 12/31/2017)

Yields evolve via CBO Base Case calibrated to CMAs (10Y Nominal=3.2%, 10Y Real=1.1% terminal levels)

Stochastic Component - Nominal Betas: GDP=0.2, Inf=0.36, Real Betas: GDP=0.09, Inf=0

Time-Series Surplus Volatility

Low growth with high inflation – reduced TIPS are optimal.
High growth, high inflation – increased TIPS are optimal
Bias to higher inflation marginally prefer nominals, bias to higher growth marginally prefer TIPS

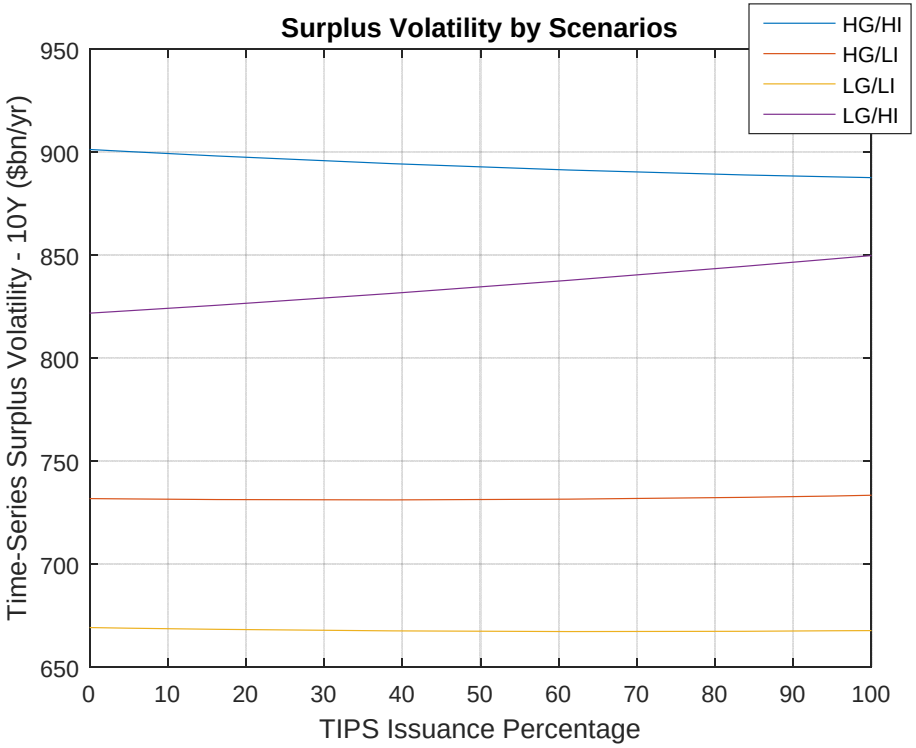
Compute the time-series volatility of the budget surplus for each macro scenario + weighted scenarios

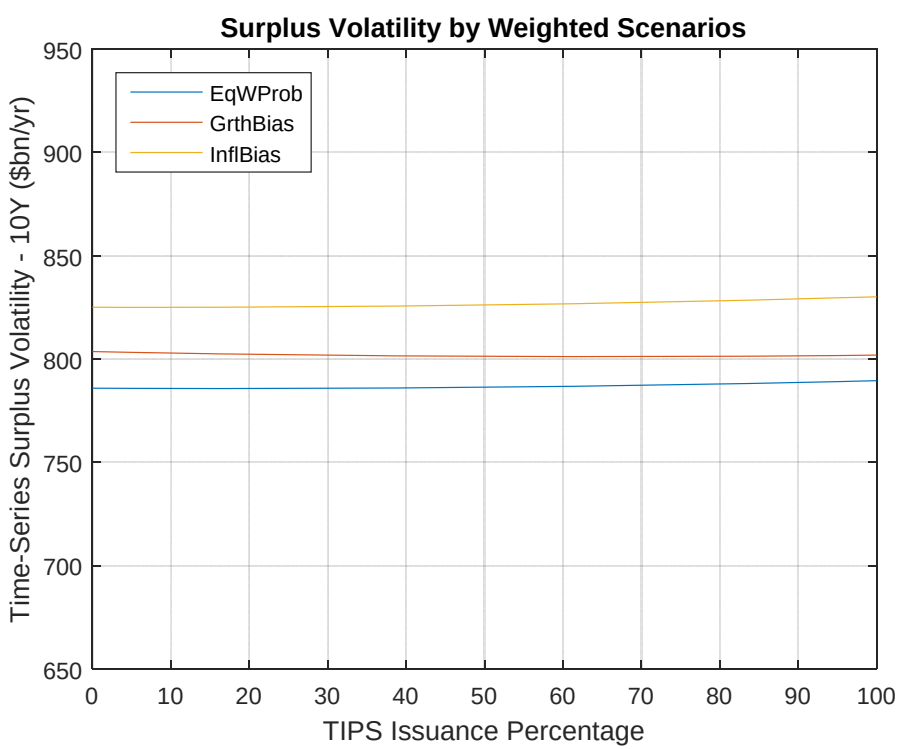
Weighted scenarios defined as follows

Equal probability weighted scenarios= [0.25 0.25 0.25 0.25] *(Q1,Q2,Q3,Q4)*

High growth bias = [0.375 0.375 0.125 0.125]

High inflation bias = [0.375 0.125 0.125 0.375]





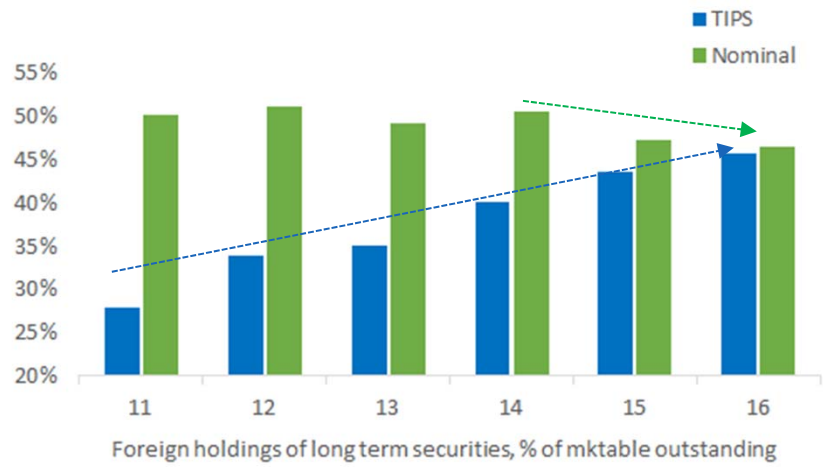
Demand Side Considerations: U.S. TIPS issuance relative to nominals is at the average of international peers

ILB Market	ILB market size ($B)	Total debt outstanding ($B)	% of Total Debt
Australia	$30.3	$576.3	5.2%
Canada	$54.8	$1,136.3	4.8%
Denmark	$6.1	$114.2	5.3%
France	$233.5	$1,921.0	12.2%
Germany	$84.8	$1,715.1	4.9%
Italy	$159.1	$1,974.6	8.1%
Japan	$62.9	$9,007.9	0.7%
New Zealand	$10.3	$122.5	8.4%
Spain	$32.1	$993.4	3.2%
Sweden	$25.4	$155.3	16.4%
U.K.	$760.6	$2,504.2	30.4%
U.S.	$1,210.4	$17,010.8	7.1%
Total	**$2,670.4**	**$37,231.4**	**7.2%**

SOURCE: Barclays, Bank of International Settlements; As of 31 December 2016

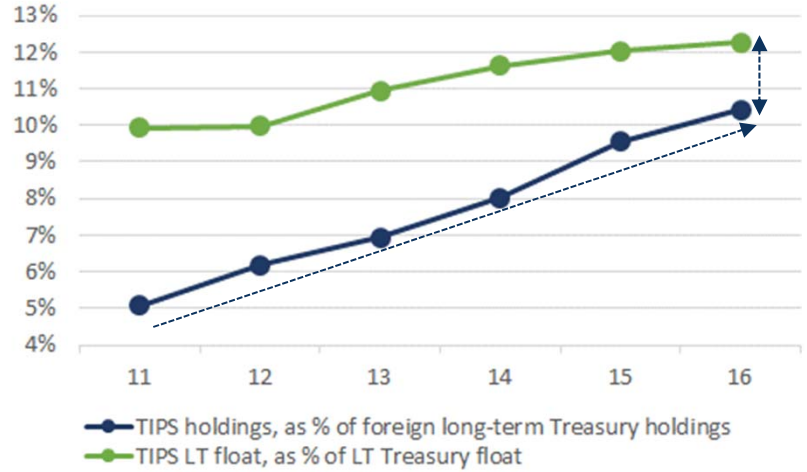
Foreign TIPS holdings have increased with room to grow

Foreign TIPS holdings have increased at a faster rate than nominals



Note: Long term securities defined as securities longer than 1y in maturity
Source: US Treasury, Haver Analytics

TIPS share of foreign long term Treasury portfolio has doubled, with more room to grow



Note: Float calculated as marketable debt outstanding ex SOMA holdings
Source: US Treasury, Haver Analytics

Foreign TIPS demand vs nominals*

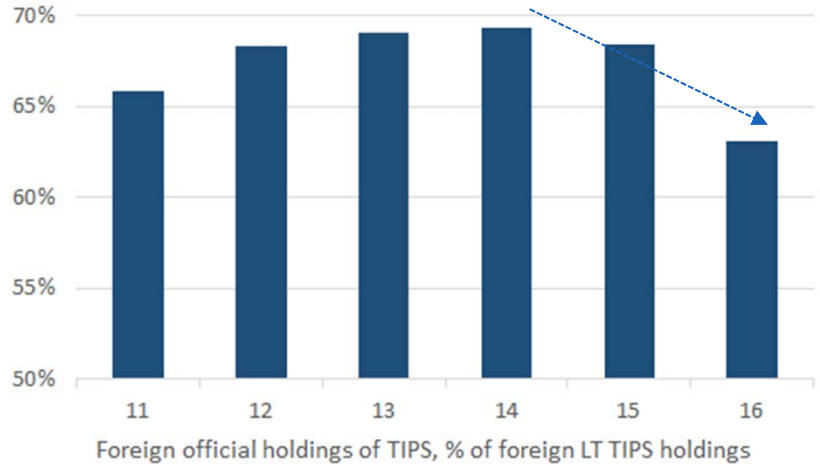
- Foreign investors now own ~50% of TIPS outstanding
  - Up from 30% in 2011
- This growth is more impressive in context of a decline in foreign nominal holdings, as % of nominal float
- Consequently, TIPS holdings are now 10% of foreign long term Treasury portfolios, up from 5% in 2011

Room for foreign demand to grow further

- Importantly, there is room for TIPS allocation in foreign portfolios to grow:
  - Foreign allocation to TIPS still below TIPS float, as % long term Treasuries float
  - TIPS are now more accepted as FX reserve management tool
- Further allocation to TIPS in foreign portfolios can be a source of significant incremental demand:
  - 1% increase in foreign LT TIPS holdings, as % total foreign holdings, translates to ~$50-60bn in additional demand
- *Foreign holders are reported based on country of legal residence, not the nationality of the parent organization of counterparty.*

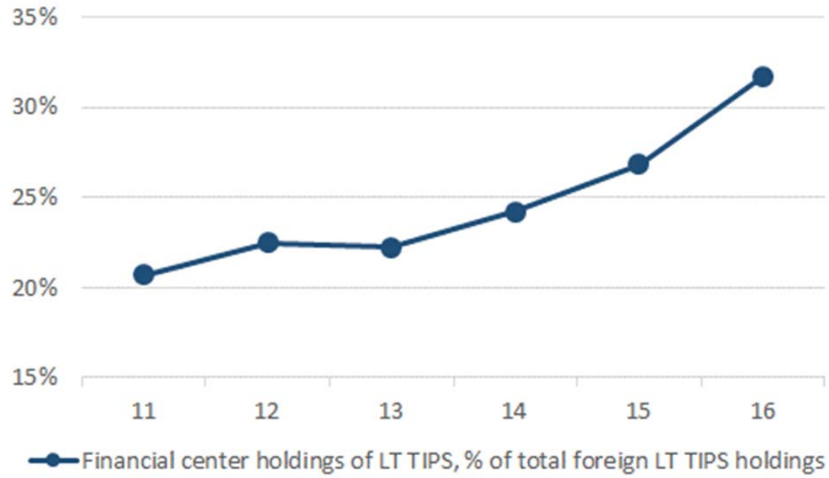
Within foreign holdings, demand showing signs of shifting toward private investors

Foreign official TIPS holdings are now a smaller share…



Source: US Treasury, Haver Analytics

…amid signs that private demand is picking up



Note: Financial centers include Cayman Islands, Luxembourg, the UK and the Caribbean
Source: US Treasury, Haver Analytics

Foreign demand landscape may be changing

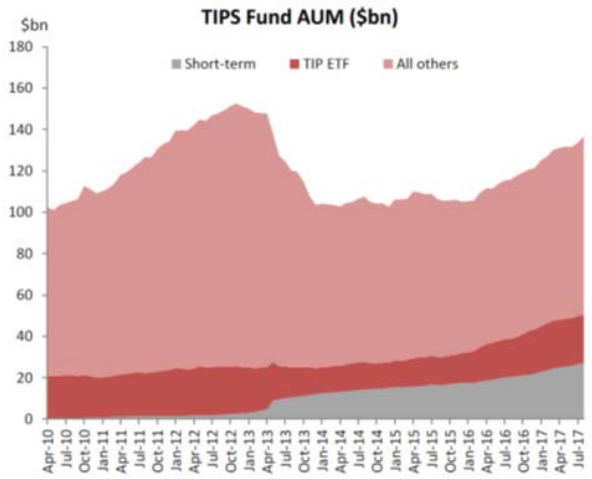
- Over the past year or so, private foreign investors have stepped up
  - Official* foreign investor's share of TIPS has declined
- On the other hand, holdings of TIPS in financial centers, such as Cayman Islands, Luxembourg, the UK and the Caribbean have increased**
  - Growth of risk parity funds has likely contributed to the shift
  - While popularity of these funds might fluctuate over time, the increasing presence of these price-sensitive investors (with potentially two way positions) is a positive for the TIPS program.
- A more diversified TIPS investor base, and potentially a more price sensitive one, is a positive for liquidity

**Foreign official investors include national governments, international and regional organizations, and sovereign wealth funds.*

***TIC data would include transactions between say a US feeder fund and the Cayman Islands Master Fund of a US investment manager*

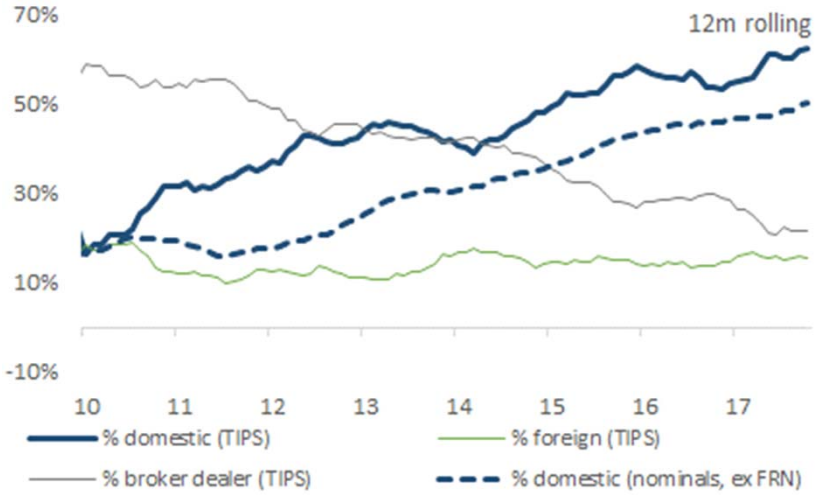
Domestic demand on more solid footing too

Trajectory of domestic TIPS funds AUM suggests renewed demand



Source: Bloomberg, Nomura

Stronger domestic fund participation in TIPS auctions, in line with nominals



Source: US Treasury, Haver Analytics

Recent pickup in domestic demand

- Recent funds data show that TIPS funds AUM has begun to rise again after falling during Taper Tantrum
  - Higher appetite for the asset class, even given declining inflation premium

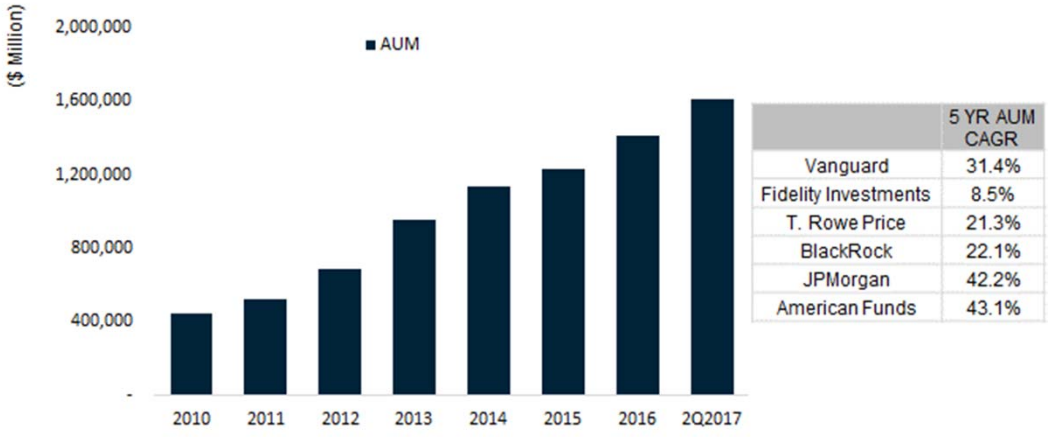
- Data also shows larger allocation to short-term TIPS funds, likely reflecting:
  - Increased popularity of target date funds
  - Greater preference for shorter duration exposure in a hiking cycle

Secular rise in domestic fund participation at auctions

- Investor allotment data for TIPS show a consistently rising domestic fund demand.
  - Domestic fund demand for TIPS has more than kept pace with that for nominals, suggesting it is driven by more than investors seeing auctions as liquidity events

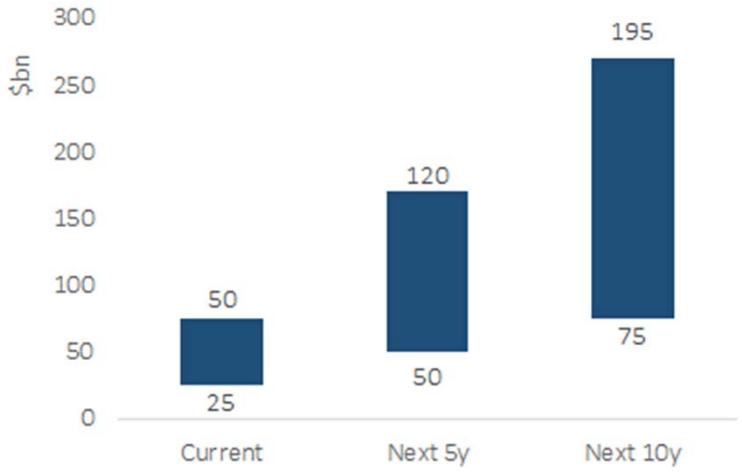
Target Date Funds are growing strongly: additional long term demand

Historical growth of TDF assets



	5 YR AUM CAGR
Vanguard	31.4%
Fidelity Investments	8.5%
T. Rowe Price	21.3%
BlackRock	22.1%
JPMorgan	42.2%
American Funds	43.1%

Estimated growth in TIPS holdings of TDFs



Source: Vanguard

TDFs likely to remain significant source of TIPS demand

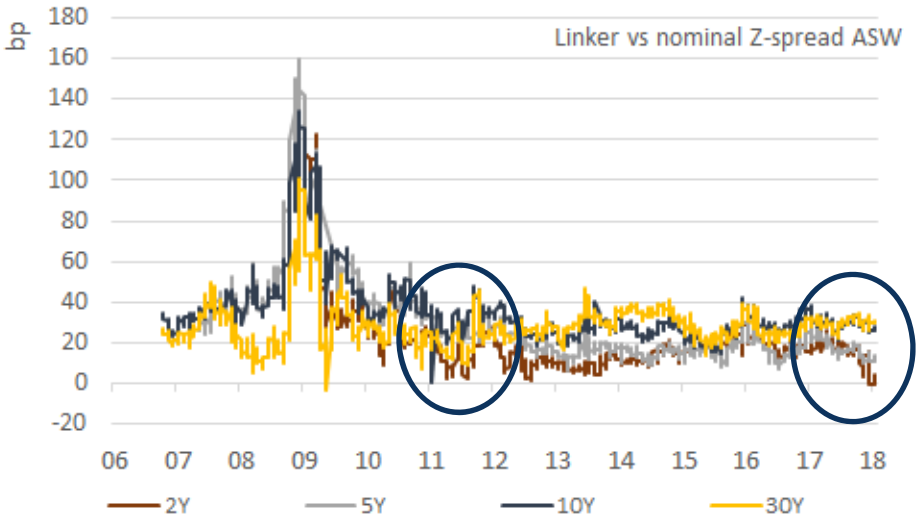
- We estimate TDFs to have $1.6trn in AUM with TIPS allocation between 1.5-3%
- Top six providers of Target Date Funds have shown CAGR of ~25% in 2011-16
  - 20% of 401(k) assets and 50% of 2016 contributions
- TDF TIPS demand will likely have a moderate bias to shorter duration TIPS.

Projections

- Current TIPS holdings in TDFs are ~$25-$50bn.
- Over the next 5 years, estimated TIPS demand will range from $50-120bn
- Over the next 10 years, $75-200bn.
- Our estimate range depends on our assumption of TIPS allocation in TDFs (1.5-3%) and the CAGR of TDF assets (15-20%)

Liquidity at the front end of the TIPS curve has improved

Liquidity has improved at the front end, but less so at the longer end



Source: Barclays

TIPS liquidity has improved at the front end

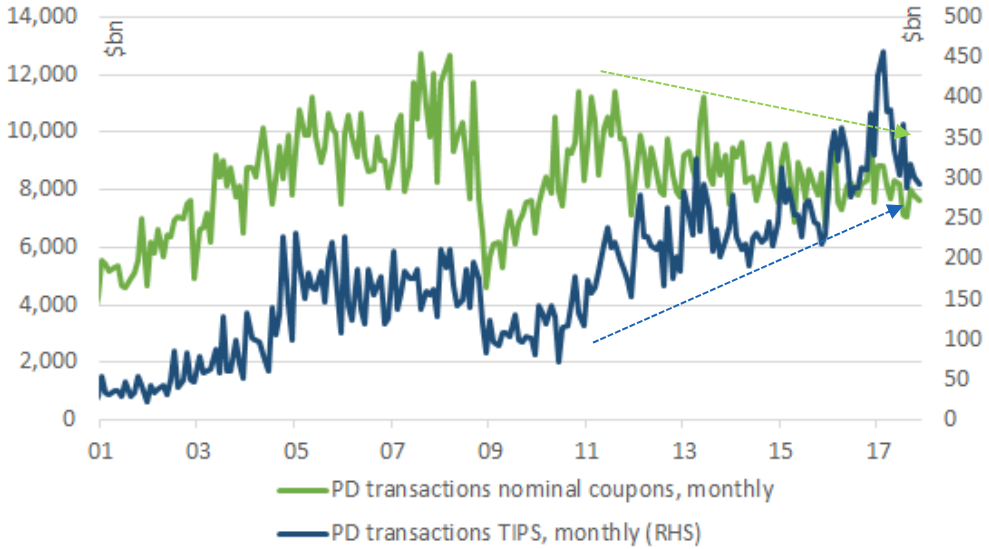
- One liquidity measure of TIPS relative to nominals is the relative Z-spread ASW. This measures the ASW difference between TIPS and matched maturity nominals
  - While imperfect, this is a good way to see evolving liquidity of TIPS vs nominals over time

- Given that TIPS are an "insurance" product, clustering reduces liquidity and off-the-run securities become buy and hold quicker than nominal securities

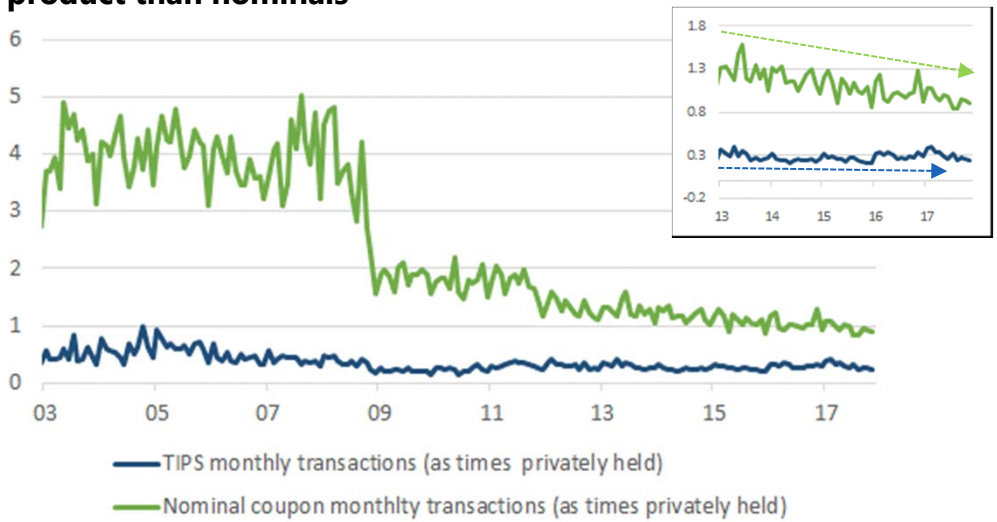
- Models that extract liquidity premium suggest that TIPS security mispricing is in line with nominals once we adjust for liquidity differences

Primary dealer turnover of TIPS rising consistently

Primary dealer TIPS turnover has increased, even as nominal has stabilized…



…but remains below nominals. TIPS more "buy and hold" product than nominals



Source: US Treasury, Haver Analytics

Primary dealer transactions rising for TIPS

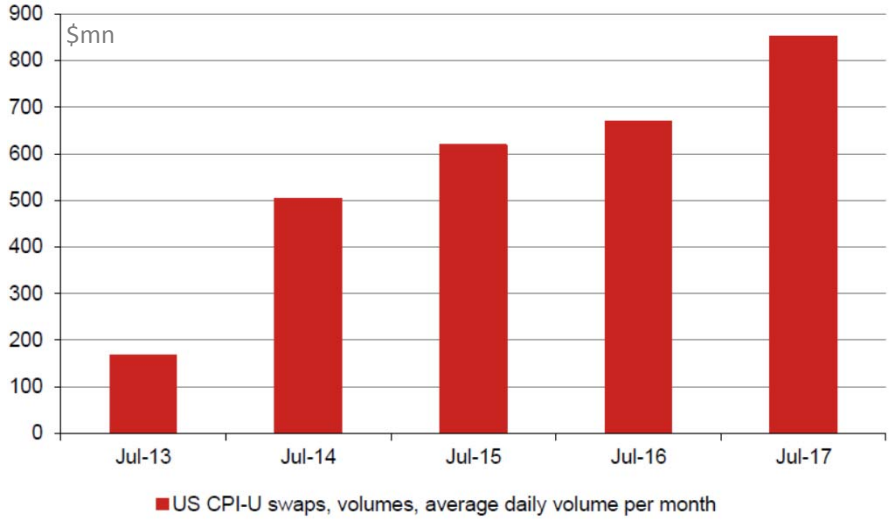
- With greater demand from both domestic and foreign investors over the last few years, primary dealer TIPS transactions have increased consistently
  - Increased prominence of risk parity funds and TDFs are partly responsible for relative increase in TIPS primary dealer transactions

- This is in contrast to nominal markets, where transaction volumes have stabilized in notional terms (even though amount outstanding of nominal Treasuries has increased)
  - Increased "futurization" of the nominal Treasuries market, where a greater share of flows are now in futures (vs cash nominal Treasuries) has likely contributed to the *relative* increase in TIPS transactions

- Despite the increase in TIPS turnover, it remains below nominals, when measured as percentage of float.

Lack of robust inflation derivative market hampering private linked issuance

Traded volume on inflation swaps has increased 5x, but remains small



Source: Bloomberg SDR, Nomura

TIPS well suited for corporate linked issuance

- TIPS returns have a very stable and consistent beta with corporate returns
  - True across several corporate sectors: financials, industrials and utilities
  - Suggesting that TIPS would be well suited for corporate linked issuance as they would minimize net corporate ALM volatility

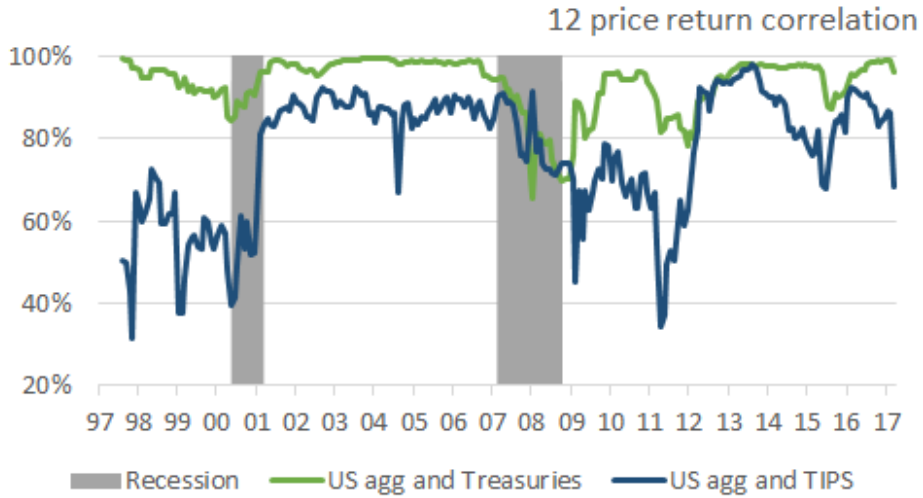
Lack of derivative market an impediment

- Lack of sufficiently liquid inflation derivative market for swapping of linked issuance has been an impediment

- Pickup in centrally cleared inflation swap is a positive step in this direction
  - Allows monetizing of liquidity premium
  - Active hedging of outstanding issuance

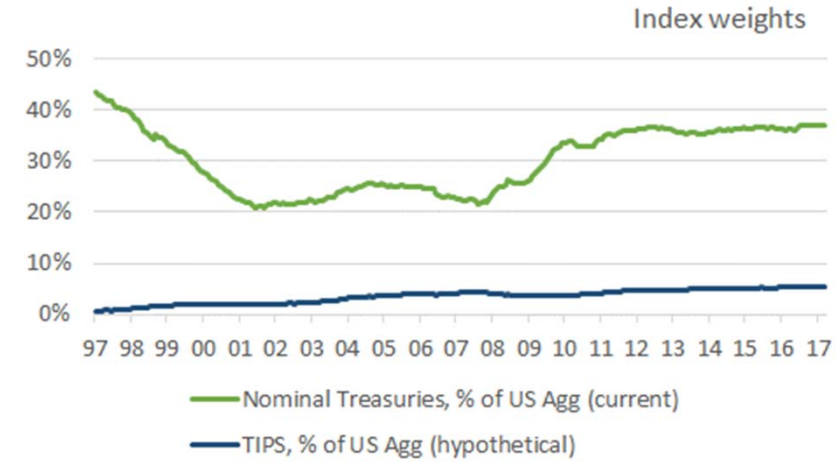
Including TIPS in broader index would be a significant demand boost

Adding TIPS to US Agg would provide diversification benefits to end users



Source: Bloomberg, Vanguard

TIPS inclusion in US Agg would be a significant demand boost from a more diversified investor base



Source: Bloomberg

Adding TIPS to US Agg offers significant benefits

- Correlation between US Treasury Agg and US Agg is very high (typically more than 90%)
  - In other words, investors might be almost as well served buying Treasury linked funds rather than more diversified US Agg linked funds

- Adding TIPS to this index would provide significant diversification benefits to end user as TIPS index return correlation with US Agg is lower

Index inclusion would be a significant demand source

- Bloomberg estimates that $3.2trn+ is linked to US Agg family of indices
  - TIPS would be ~5.5% of US Agg
  - Assuming 30% cannibalization from other TIPS linked products, this translates to $120-150bn in incremental demand
- Importantly, it will provide a way for long only investors to be overweight or underweight the asset class, improving liquidity

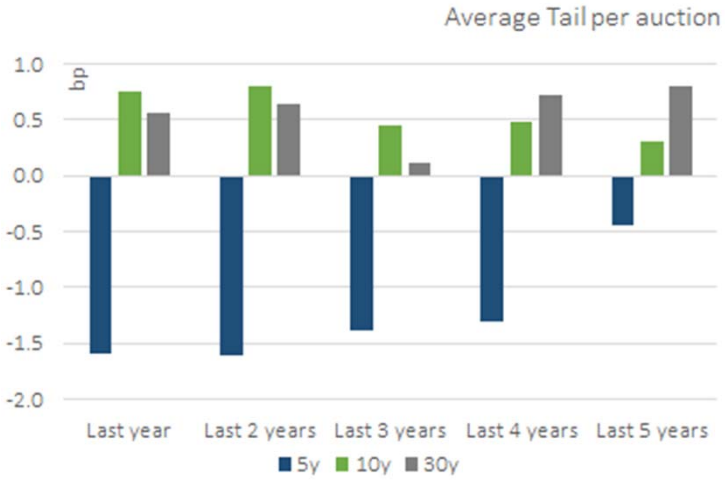
Room to increase auction sizes at the front end

TIPS roll-off under current auction sizes is larger than of nominals

Fiscal Year	2/3/5	7/10/30	TIPS	FRN	Historical/Projected Net Borrowing Capacity
2013	86	720	111	0	830
2014	(92)	669	88	123	669
2015	(282)	641	88	164	558
2016	(82)	477	64	47	795
2017	9	292	55	9	519
2018	92	276	55	0	423
2019	61	101	46	(6)	201
2020	(31)	138	15	(7)	116
2021	(53)	134	(4)	(3)	73
2022	15	205	(11)	2	211
2023	27	172	(9)	6	196
2024	12	152	(10)	1	155
2025	(21)	157	(52)	(1)	83
2026	(22)	177	(43)	(2)	110
2027	3	151	(33)	(2)	119

Source: US Treasury

Front end TIPS auctions have outperformed longer end



Source: Nomura, Vanguard

Room to increase auction sizes, particularly in the front end

- Stated objective could be to maintain the current share of TIPS issuance within its broader funding portfolio over the medium term
  - Given low estimates of inflation risk premium we recommend only a modest increase in TIPS issuance for 2018
  - Retain flexibility to adjust auction sizes in response to future structural pickup in inflation premium

- TIPS roll off at a quicker pace than nominals
  - Therefore, net increase would be relatively even smaller than gross increase.

Tenor recommendation

- Given higher liquidity, demand and negative inflation premia, we recommend focusing on the shorter end of the TIPS curve
  - We do not recommend reducing longer end issuance sizes, so as to not adversely impact liquidity
  - We believe this approach to tenor management would strike a balance between reducing taxpayer cost of issuance and maintaining the "regular and predictable" issuance objective.
    - Just like increasing front end auction sizes now would not compromise the "regular and predictable" objective, postponing the long end auction size increase would not either.
    - Similarly, while lowering auction sizes in light of lower inflation risk premium could be interpreted as a reduction in commitment to the TIPS program, postponing the increase in long end sizes would not.

- **Auction performance over the last five years confirms our analysis of added value of front end TIPS issuance**
  - 5y auctions have significantly outperformed 10y and 30y auctions over 1 to 5y lookback windows

Suggestions for implementing a 26bn increase in gross TIPS issuance

- **Add a new October maturity 5 yr TIPS.**
  - Do not add on to existing 5 yr as this is already the largest issue ~44bn for Apr '22
  - Adding one more October maturity 5 yr achieves the right balance of evening out the calendar and seasonality points as well as avoids fragmenting the market into too many smaller less liquid issues.
  - Add a 5 yr TIPS auction to the months with 30 yr TIPS: Oct, Feb, Jun.
  - Add the auction in the same 'TIPS week' as 30 year TIPS.

Month	Maturity	2017 (bn)	Proposed (bn)
Jan	10 yr	13	13
Feb	30 yr	7	7
	5 yr	-	11
Mar	10 yr	11	11
Apr	**5 yr**	**16**	**13**
May	10 yr	11	11
Jun	30 yr	5	5
	5 yr	-	11
Jul	10 yr	13	13
Aug	5 yr	14	11
Sep	10 yr	11	11
Oct	30 yr	5	5
	5 yr	**-**	**13**
Nov	10 yr	11	11
Dec	5 yr	14	-
	5 yr	-	11
		131	157

Comparison of calendar year 2017 TIPS issuance and suggested new TIPS issuance schedule

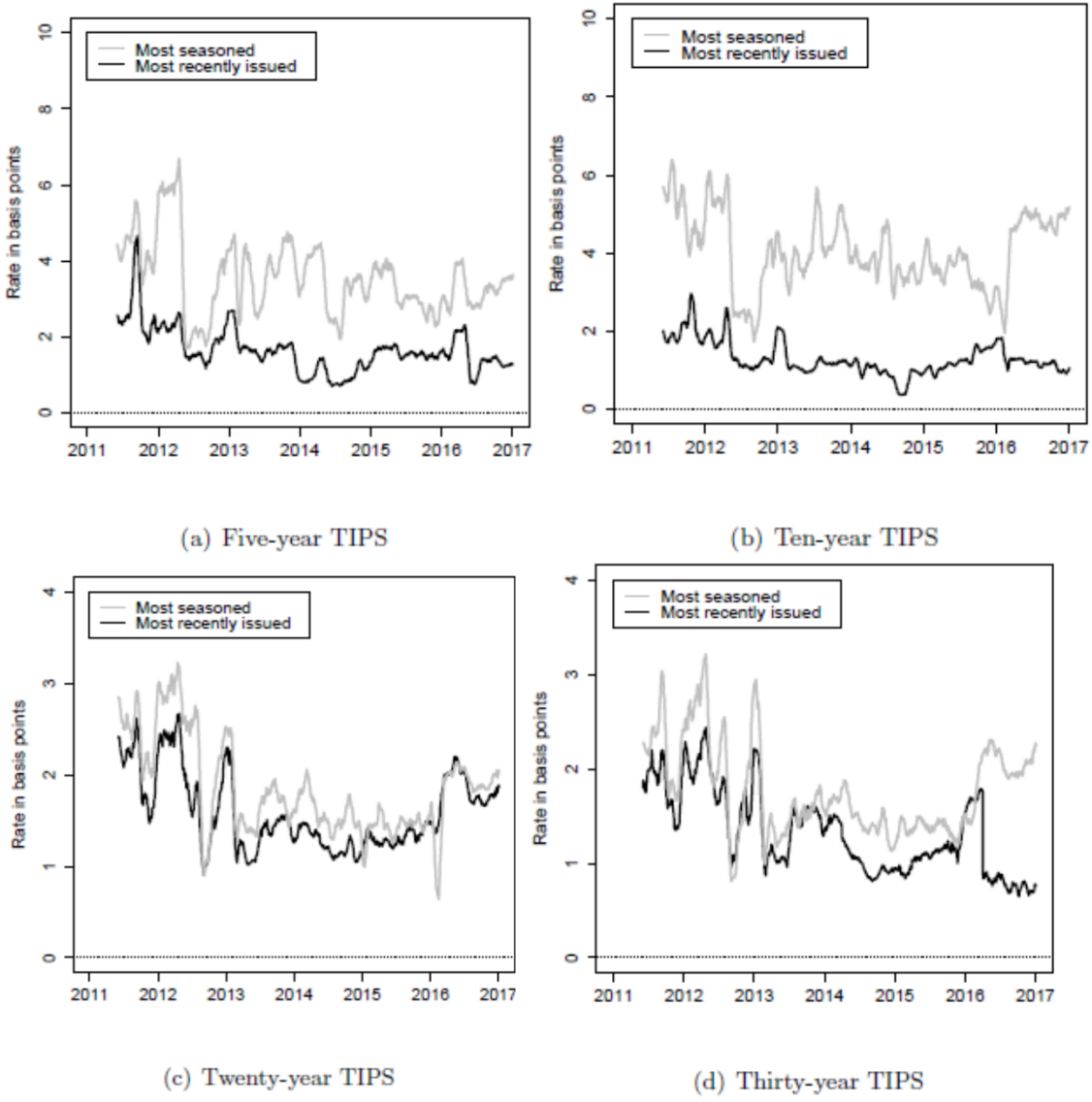
Potential adjustments to the TIPS program: Summary of recommendations

Summary of recommendations	
	Recommendations
Auction Related	
Auction Sizes	Target current share of TIPS issuance (~7%) within its broader funding portfolio over the medium term
Auction tenor management	Add an October 5 year issue
Auction Frequency	Maintain current schedule for most issues. Add Oct, Feb and Jun 5 yr auction
Move auction date closer to settlement	No significant benefit, WI market functioning well
Alternatives to CPI indexing	Likely to be counterproductive, as it will reduce liquidity for "legacy" TIPS currently outstanding PCE is closer aligned to Fed policy, but it is subject to revision. And the PCE-CPI gap is well understood. CPI is likely a better measure of inflation experience for the end investor
Seek broader bond index inclusion	Inclusion likely to improve diversification within the US Agg Could be a potential source of $120bn - $150bn bn in incremental demand
Buying back short dated/less liquid TIPS	TIPS curve on relative ASW basis well behaved We see no real benefit of such a buy-back program.

Appendix

TIPS bid ask spread and liquidity model

***Bid-ask spreads for* TIPS**



(a) Five-year TIPS

(b) Ten-year TIPS

(c) Twenty-year TIPS

(d) Thirty-year TIPS

Source: San Francisco Federal Reserve

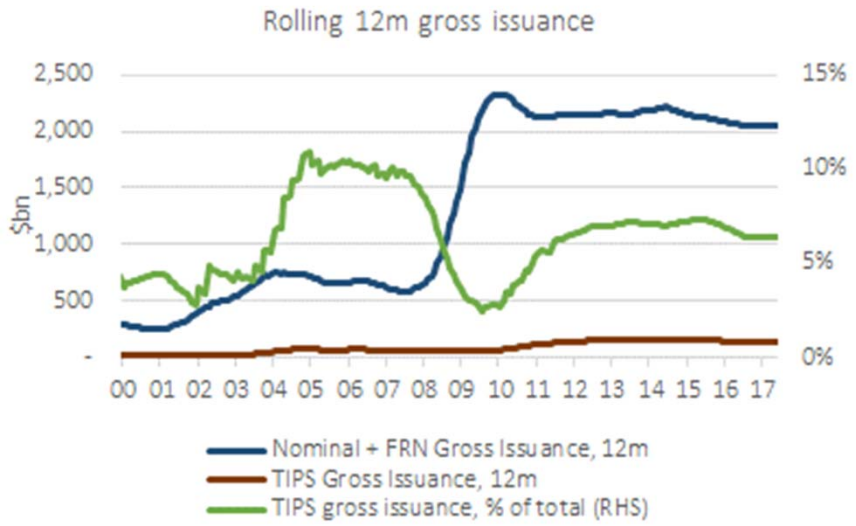
Regressing average TIPS liquidity on observable proxies for liquidity risk

	Regression: Average TIPS liquidity premium	
Constant	−5.21	−4.30
	(5.36)	(4.05)
VIX	0.85**	0.76**
	(0.20)	(0.21)
HPW	−2.00	–
	(1.08)	
On-the-run spread	0.73*	0.49*
	(0.29)	(0.20)
Ratio of Trading vol	0.0001	–
	(0.06)	
GSW TIPS errors	6.06**	5.53**
	(0.47)	(0.34)
Adjusted R^2	0.769	0.765

* and ** indicate significance at 5% and 1% levels respectively
HPW metric is based on deviation in the Treasuries prices from fitted yield curve
GSW TIPS errors are mean absolute fitted errors from Gurkaynak et al (2010)
Weekly data from Jan1999 to Dec 2013

Ascertaining the magnitude of issuance increase

TIPS gross issuance, as % of total coupon issuance (inc FRN)



Source: US Treasury, Haver Analytics

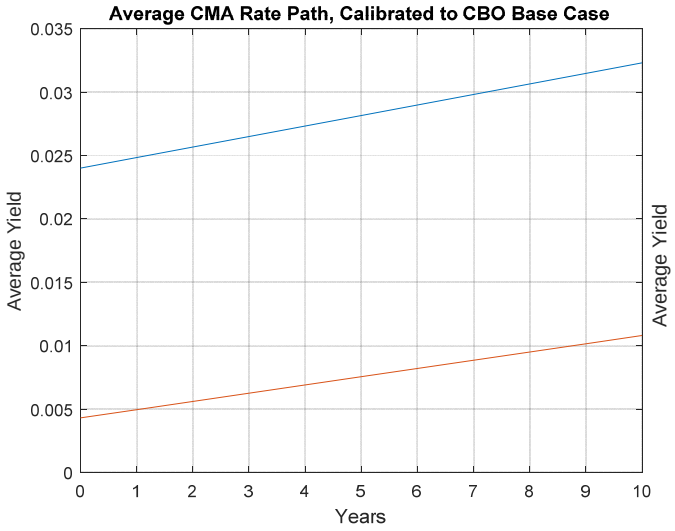
TIPS are ~7% of gross issuance

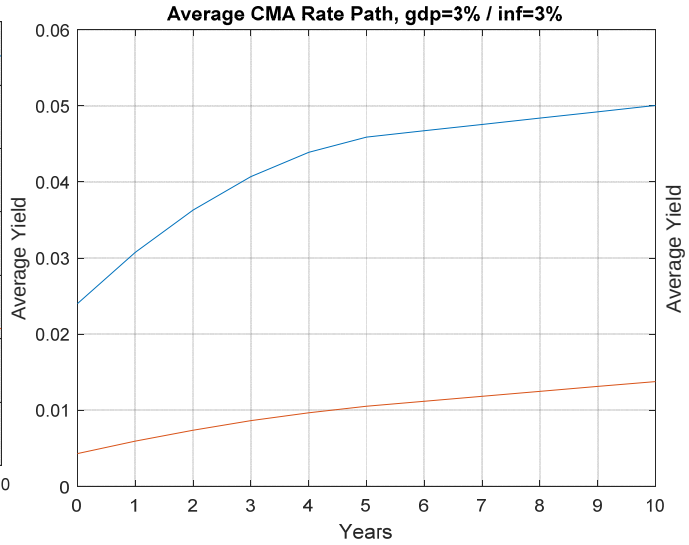
- Estimated gross coupon issuance in 2018: $2200-2500bn
- Gross issuance of TIPS: $2200bn-2500 * 7% = $150-175bn
- Gross issuance under current auction size = $131bn
- **Increase in auction sizes to maintain current gross issuance percent = $150-175bn-$131bn = ~$25-45bn**

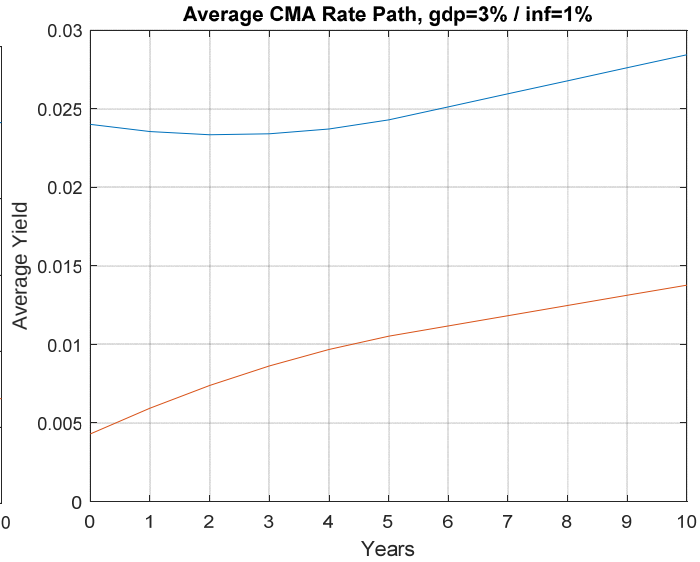
Yield curve model used in ALM exercise (pg 18)

Yield curve evolves over time as a function of CMAs plus shocks to GDP + Inflation

New bond issuance gets assigned a stochastic interest rate based on yield model

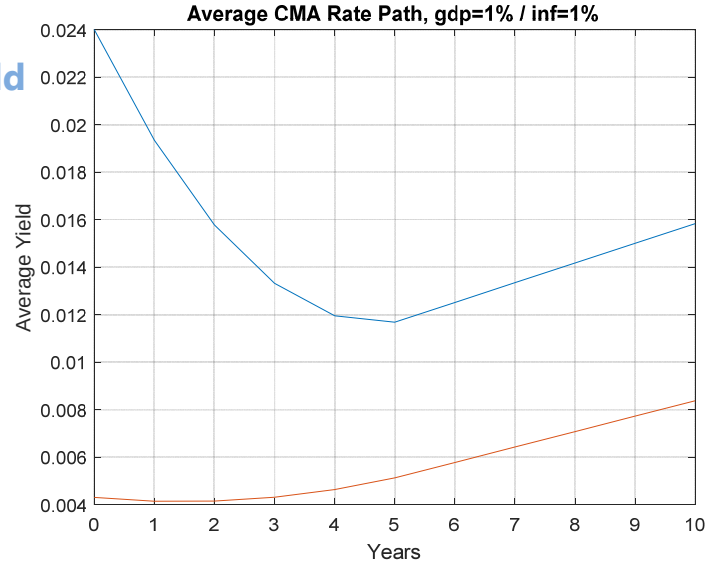


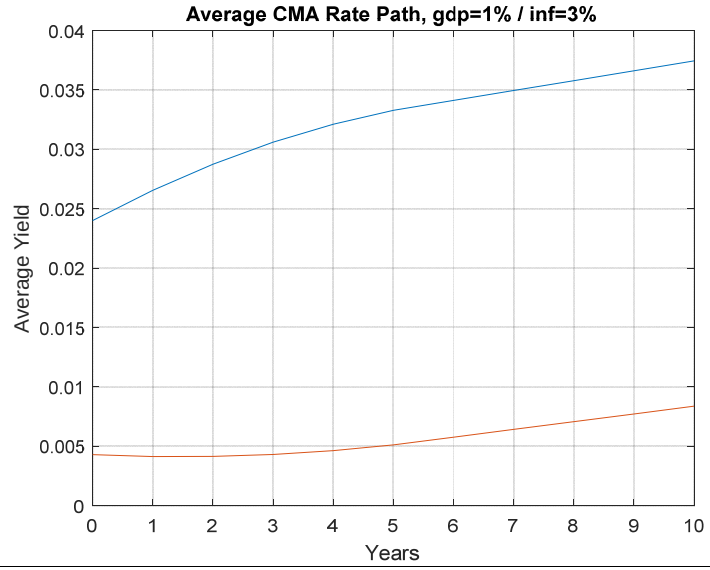




10Y Nominal Yield

10Y Real Yield





10-Year Simulations, 10% TIPS Issuance (ALM exercise pg 18)

High GDP scenarios result in the lowest levels of interest expense and debt outstanding due to high beta of receipts to GDP

Higher inflation is also favorable due to slightly higher assumed inflation passthrough for receipts relative to outlays

			Billions Nominal USD											
			2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Cumulative
	Baseline CBO Sim (gdp=1.9% cpi=2%)	Receipts	*3,315*	3,465	3,618	3,781	3,957	4,143	4,322	4,505	4,727	4,950	5,182	1,867
		Oulays	*4,008*	4,253	4,448	4,645	4,855	5,086	5,302	5,564	5,834	6,105	6,383	2,375
		Budget Surplus	*-693*	-789	-829	-864	-898	-943	-980	-1,058	-1,107	-1,155	-1,201	-508
		Interest Expense	*269*	352	371	392	415	439	465	492	521	553	587	318
		Public Debt	*14,656*	15,445	16,274	17,138	18,036	18,978	19,959	21,017	22,124	23,279	24,480	9,824
High Growth	Quad 1 (gdp=3% cpi=3%)	Receipts	*3,315*	3,577	3,858	4,162	4,497	4,862	5,237	5,638	6,107	6,602	7,137	3,822
		Oulays	*4,008*	4,319	4,572	4,835	5,116	5,423	5,718	6,062	6,417	6,773	7,134	3,126
		Budget Surplus	*-693*	-741	-715	-673	-619	-562	-481	-425	-310	-171	3	696
		Interest Expense	*269*	366	389	415	442	468	492	512	529	540	543	274
		Public Debt	*14,656*	15,397	16,112	16,785	17,404	17,965	18,446	18,870	19,180	19,351	19,349	4,693
	Quad 2 (gdp=3% cpi=1%)	Receipts	*3,315*	3,498	3,688	3,891	4,110	4,345	4,576	4,816	5,101	5,393	5,700	2,385
		Oulays	*4,008*	4,215	4,380	4,543	4,714	4,901	5,069	5,275	5,483	5,685	5,886	1,878
		Budget Surplus	*-693*	-717	-691	-652	-604	-556	-493	-459	-382	-293	-186	507
		Interest Expense	*269*	337	353	369	383	397	409	419	428	436	440	171
		Public Debt	*14,656*	15,373	16,064	16,716	17,320	17,876	18,369	18,828	19,210	19,502	19,689	5,033
Low Growth	Quad 3 (gdp=1% cpi=1%)	Receipts	*3,315*	3,365	3,414	3,465	3,522	3,582	3,629	3,674	3,745	3,809	3,874	559
		Oulays	*4,008*	4,191	4,329	4,464	4,605	4,760	4,897	5,073	5,252	5,427	5,606	1,598
		Budget Surplus	*-693*	-825	-916	-999	-1,083	-1,178	-1,268	-1,398	-1,507	-1,619	-1,733	-1,040
		Interest Expense	*269*	337	352	366	380	393	407	422	440	462	486	217
		Public Debt	*14,656*	15,481	16,397	17,396	18,479	19,657	20,925	22,324	23,830	25,449	27,181	12,525
	Quad 4 (gdp=1% cpi=3%)	Receipts	*3,315*	3,445	3,577	3,716	3,867	4,025	4,175	4,327	4,515	4,700	4,893	1,578
		Oulays	*4,008*	4,295	4,522	4,757	5,011	5,293	5,566	5,894	6,237	6,591	6,961	2,953
		Budget Surplus	*-693*	-850	-945	-1,041	-1,145	-1,267	-1,391	-1,566	-1,723	-1,891	-2,068	-1,375
		Interest Expense	*269*	366	389	417	449	486	528	574	628	689	758	489
		Public Debt	*14,656*	15,506	16,451	17,492	18,636	19,904	21,295	22,861	24,584	26,475	28,543	13,887

2027 Simulated Metrics vs. Level of TIPS Issuance (ALM exercise pg 18)

Red denotes most favorable outcome, **Yellow** denotes base case of 10% TIPS issuance

		2027 Billions Nominal USD																			
		TIPS Issuance																			
		0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Baseline Sim (gdp=1.9% cpi=2%)	Receipts	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182	5,182
	Oulays	6,383	6,383	6,383	6,384	6,384	6,384	6,384	6,384	6,384	6,384	6,384	6,384	6,383	6,383	6,383	6,383	6,382	6,382	6,381	6,381	6,380
	Budget Surplus	-1,200	-1,201	-1,201	-1,201	-1,201	-1,202	-1,202	-1,202	-1,202	-1,202	-1,201	-1,201	-1,201	-1,201	-1,201	-1,200	-1,200	-1,199	-1,199	-1,198	-1,198
	Interest Expense	587	587	587	588	588	588	588	588	588	588	588	588	587	587	587	587	586	586	585	585	584
	Public Debt	24,477	24,478	24,480	24,481	24,482	24,483	24,484	24,484	24,484	24,484	24,484	24,483	24,483	24,482	24,480	24,479	24,477	24,475	24,473	24,471	24,468
	Vol(Budget Surpl)	2,076	2,075	2,074	2,073	2,073	2,072	2,071	2,071	2,070	2,070	2,070	2,070	2,069	2,069	2,069	2,070	2,070	2,070	2,070	2,071	2,071
Quad 1 (gdp=3.0% cpi=3.0%)	Receipts	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137	7,137
	Oulays	7,112	7,123	7,134	7,145	7,156	7,167	7,178	7,189	7,200	7,211	7,221	7,232	7,242	7,252	7,262	7,273	7,283	7,292	7,302	7,312	7,322
	Budget Surplus	25	14	3	-9	-20	-31	-42	-53	-63	-74	-84	-95	-105	-116	-126	-136	-146	-156	-166	-175	-185
	Interest Expense	521	532	543	554	566	577	587	598	609	620	630	641	651	661	672	682	692	702	711	721	731
	Public Debt	19,166	19,258	19,349	19,439	19,529	19,619	19,709	19,798	19,887	19,975	20,063	20,151	20,239	20,326	20,413	20,499	20,586	20,672	20,757	20,842	20,927
	Vol(Budget Surpl)	2,665	2,661	2,657	2,654	2,650	2,647	2,644	2,641	2,637	2,635	2,632	2,629	2,626	2,624	2,621	2,619	2,616	2,614	2,612	2,610	2,608
Quad 2 (gdp=3.0% cpi=1.0%)	Receipts	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700	5,700
	Oulays	5,906	5,896	5,886	5,877	5,867	5,857	5,847	5,838	5,828	5,818	5,808	5,799	5,789	5,779	5,769	5,760	5,750	5,740	5,730	5,720	5,711
	Budget Surplus	-206	-196	-186	-177	-167	-157	-148	-138	-128	-118	-108	-99	-89	-79	-69	-60	-50	-40	-30	-21	-11
	Interest Expense	459	450	440	430	420	411	401	391	381	372	362	352	342	333	323	313	303	294	284	274	264
	Public Debt	19,863	19,776	19,689	19,602	19,515	19,428	19,341	19,254	19,167	19,080	18,993	18,906	18,819	18,732	18,645	18,558	18,470	18,383	18,296	18,209	18,122
	Vol(Budget Surpl)	2,056	2,054	2,051	2,049	2,047	2,045	2,042	2,040	2,038	2,036	2,035	2,033	2,031	2,029	2,028	2,026	2,025	2,024	2,022	2,021	2,020
Quad 3 (gdp=1.0% cpi=1.0%)	Receipts	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874	3,874
	Oulays	5,620	5,613	5,606	5,599	5,592	5,585	5,577	5,570	5,563	5,555	5,548	5,540	5,533	5,525	5,517	5,510	5,502	5,494	5,486	5,478	5,470
	Budget Surplus	-1,747	-1,740	-1,733	-1,726	-1,718	-1,711	-1,704	-1,696	-1,689	-1,682	-1,674	-1,667	-1,659	-1,651	-1,644	-1,636	-1,628	-1,620	-1,613	-1,605	-1,597
	Interest Expense	500	493	486	479	472	465	457	450	443	435	428	420	412	405	397	389	382	374	366	358	350
	Public Debt	27,331	27,256	27,181	27,106	27,031	26,955	26,879	26,803	26,727	26,651	26,574	26,497	26,420	26,342	26,265	26,187	26,109	26,031	25,953	25,874	25,795
	Vol(Budget Surpl)	1,658	1,659	1,659	1,660	1,660	1,661	1,662	1,663	1,664	1,665	1,666	1,667	1,668	1,670	1,671	1,672	1,674	1,676	1,677	1,679	1,681
Quad 4 (gdp=1.0% cpi=3.0%)	Receipts	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893	4,893
	Oulays	6,937	6,949	6,961	6,973	6,985	6,997	7,009	7,020	7,032	7,044	7,056	7,068	7,079	7,091	7,103	7,114	7,126	7,138	7,149	7,161	7,172
	Budget Surplus	-2,044	-2,056	-2,068	-2,080	-2,092	-2,104	-2,116	-2,128	-2,140	-2,151	-2,163	-2,175	-2,187	-2,198	-2,210	-2,222	-2,233	-2,245	-2,257	-2,268	-2,280
	Interest Expense	734	746	758	770	782	794	805	817	829	841	853	864	876	888	900	911	923	935	946	958	969
	Public Debt	28,350	28,446	28,543	28,639	28,736	28,832	28,928	29,024	29,120	29,216	29,312	29,408	29,503	29,599	29,695	29,790	29,885	29,981	30,076	30,171	30,266
	Vol(Budget Surpl)	2,158	2,159	2,159	2,159	2,160	2,161	2,161	2,162	2,163	2,164	2,165	2,166	2,167	2,169	2,170	2,171	2,173	2,174	2,176	2,178	2,180

Vol(Budget Surplus) is the standard deviation of the budget surplus across simulations in 2027. It is not the time-series volatility of the budget surplus.