BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM
DIVISION OF MONETARY AFFAIRS

Date: June 19, 2020
To: Board of Governors
From: Arsenios Skaperdas[1]
Subject: Treasury Issuance Following Covid-19: Implications for Interest Rates

This memo will be the basis for my briefing to the Board on Monday, June 22.

Overview

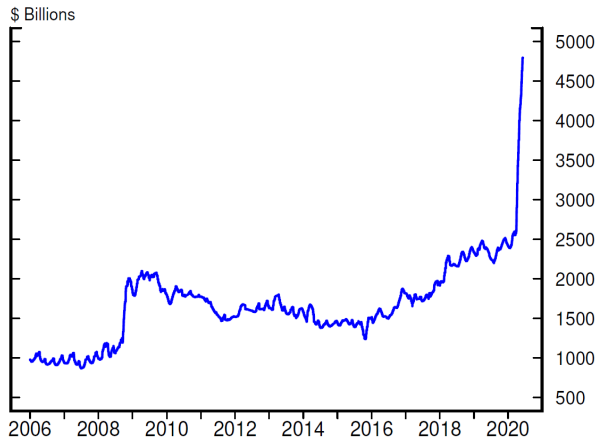
Treasury debt issuance has increased substantially this year to fund increases in the budget deficit associated with the coronavirus pandemic. In its most recent Quarterly Refunding Statement, the Treasury indicated that it will increase coupon auction sizes across the curve, with the largest increases in the long-end. Treasury's actions have important implications for the determination of interest rates in the current environment in which the federal funds rate is at the effective lower bound (ELB) and the Federal Reserve is conducting asset purchases. This memo provides an overview of how the Treasury has systematically varied the average maturity of its issuance in the past, the current outlook for Treasury issuance, and the implications of the size and composition of Treasury's issuance for interest rates going forward.

Treasury's Debt Management Practices

Following the passage of the CARES Act earlier this year, the Treasury increased bill issuance substantially to meet its increased financing needs. Figure 1 shows that, since March, bills outstanding have cumulatively increased by over $2 trillion. This large increase in bill issuance is consistent with how the Treasury has reacted in the past to finance large deficits: it first meets financing needs with bills and subsequently adjusts its issuance of longer-dated securities in a more gradual way. As shown in Figure 2, changes to coupon auctions take place slowly, and are typically announced to market participants in advance.

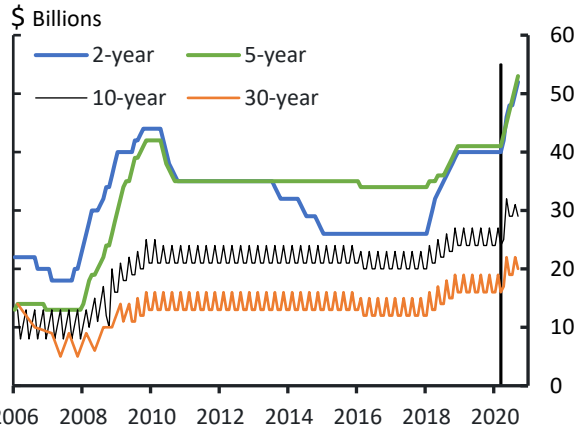
[1] This memo benefited from comments and contributions by Alyssa Anderson, David Bowman, Jim Clouse, Dan Covitz, Eric Engen, Erin Ferris, Chris Gust, Laura Lipscomb, Trevor Reeve, Zeynep Senyuz, Nicole Trachman, and James Trevino.

Figure 1
Treasury Bills Outstanding



Source: US Treasury.

Figure 2
Coupon Auction Sizes



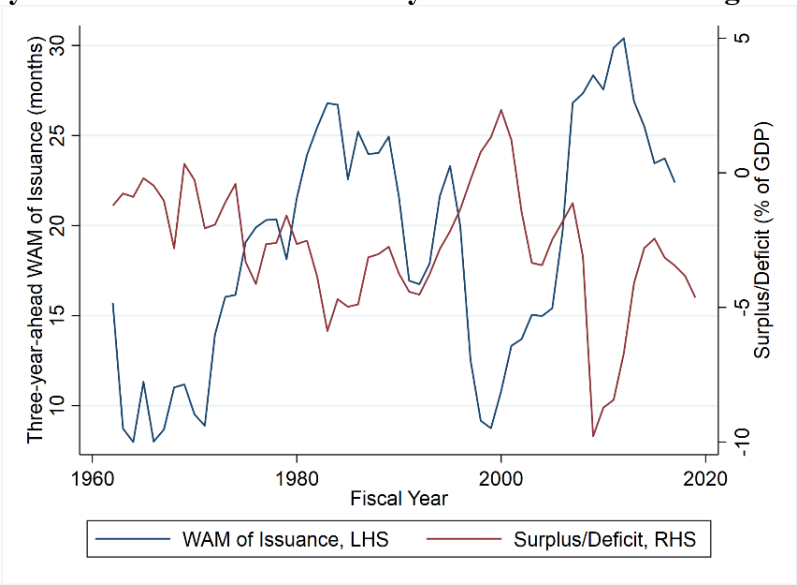
Note: Vertical line denotes start of forecast.
Sources: US Treasury, staff calculations.

Gradual changes to coupon issuance give rise to a systematic relationship between the budget balance and the weighted average maturity (WAM) of Treasury issuance.[2] Figure 3 shows the historical relationship between the budget balance and the WAM of Treasury issuance three years later.[3] As surpluses turn to deficits or deficits grow, the Treasury typically increases the WAM of its issuance, which mitigates rollover risk and smooths the volume of issuance over time. For example, as a surplus of 2.3% fell to a deficit of about -10% between 2000 and 2009, the WAM of Treasury issuance subsequently increased by about 17 months between 2003 and 2012.

[2] I calculate the WAM of issuance as the average of each month's WAM in each fiscal year. This calculation yields an approximation of the WAM per dollar of financing, rather than per dollar of gross issuance. This memo focuses on the WAM of Treasury issuance because it is a useful summary statistic of Treasury's debt management. More comprehensive metrics of the Treasury's debt management are discussed in Belton, Dawsey, Greenlaw, Li, Ramaswamy, and Sack. *Optimizing the maturity structure of US Treasury debt: A model-based framework*. Hutchins Center Working Paper 46, 2018.

[3] On average over this period, the WAM of Treasury issuance was about 1.5 years, while the WAM of Treasuries outstanding was close to 5 years. The WAM of outstanding is typically higher than the WAM of issuance. Because bills have short maturities, a high volume of bill issuance is needed in order to maintain the bills share of Treasuries outstanding, pushing down the WAM of issuance.

Figure 3
Three-year-ahead WAM of Treasury Issuance and the Budget Balance



Sources: Center for Research on Security Prices, U.S. Office of Management and Budget, and author's calculations.

To quantify the strength of the relationship between the WAM of Treasury issuance and the budget balance, I estimate a regression model using annual data from fiscal years 1962 to 2019. Column (1) of Table 1 presents the results of a regression model for the WAM of issuance on its first lag. Consistent with changes in issuance occurring gradually, the coefficient on the lagged WAM indicates that the Treasury sets the WAM close to its previous value. Column (2) adds the contemporaneous and lagged budget surplus/deficit to the regression. Taken together, there is an economically meaningful and statistically significant relationship between the WAM of issuance and the size of budget surpluses/deficits. Although not shown in the table, I find little evidence that the Treasury adjusts the WAM of its issuance in response to interest rates or term premiums.[4]

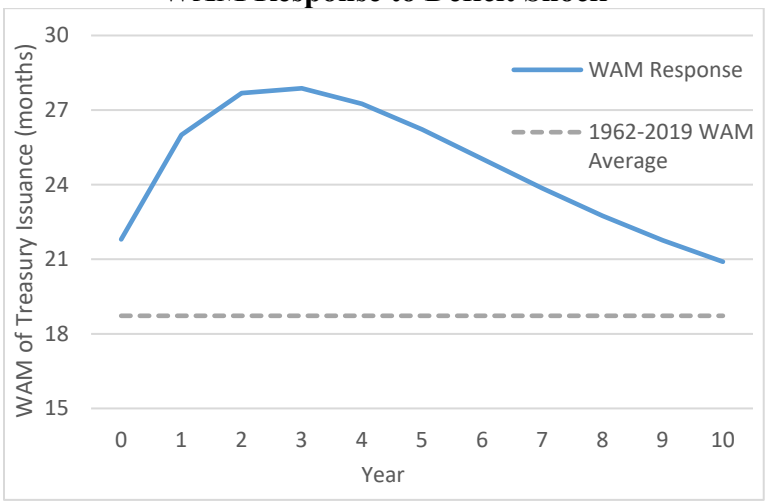
[4] The WAM of issuance is uncorrelated with contemporaneous and lagged measures of nominal interest rates, real interest rates, and term premiums. These results hold both in simple correlations and in regressions that include the budget balance and lagged WAM of issuance.

Table 1

	(1)	(2)
Dependent Variable	WAM of Treasury Issuance (months)	
Lagged WAM	0.82***	0.70***
	(0.060)	(0.052)
Surplus/Deficit (% of GDP)		-0.53**
		(0.231)
Lagged Surplus/Deficit (% of GDP)		-0.47*
		(0.247)
Constant	3.25***	2.74***
	(1.216)	(0.981)
Observations	59	58
R-squared	0.77	0.87
Note: Standard errors in parentheses. Data is yearly from 1962-2019		
*** p<0.01, ** p<0.05, * p<0.1		

Figure 4 presents the WAM response to a deficit shock based upon the regression in Column (2) of Table 1.[5] After a 6 percentage point increase in the deficit/GDP, about equal to the increase in 2009, the Treasury initially increases its WAM by 3 months. Over the next three years, the WAM response peaks at about 9 months higher than the WAM's average value.

Figure 4
WAM Response to Deficit Shock



Sources: Center for Research on Security Prices, U.S. Office of Management and Budget, and author's calculations.

[5] In order to create the deficit/GDP impulse, I estimate an AR-1 process on the fiscal surplus/deficit over the same period as the regression. Relative to a one-period increase, the impulse created by a shock to the AR-1 process leads to a temporary but persistent effect on the deficit that more closely resembles the true evolution of the deficit over time.

The Outlook for Issuance and Implications for Monetary Policy

In its May Quarterly Refunding Statement, the Treasury indicated that it plans to increase longer-term issuance somewhat sooner and to a larger extent than most market participants expected. Table 2 shows that monthly auction sizes of notes and bonds will increase by between $2 billion and $9 billion each from April to July. In addition, the introduction of the 20-year bond will add significant longer-term issuance. The Treasury's announced auction sizes are expected to increase the WAM of its issuance by about 2 months, from about 10 months in April to about 12 months in July.

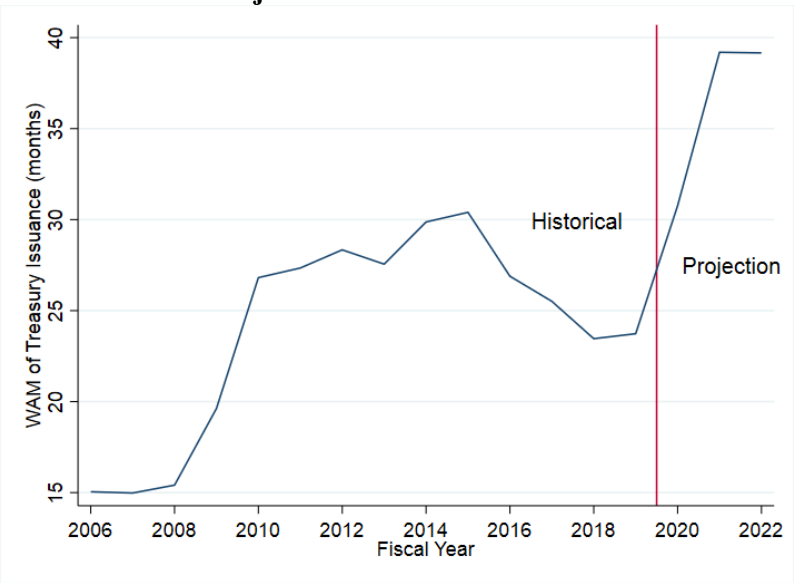
Table 2: Announced Coupon Auction Sizes ($ billions)

	2-Year	3-Year	5-Year	7-Year	10-Year	20-Year	30-Year	FRN
April 2020	42	40	43	35	25	0	17	22
July 2020	48	46	49	44	29	17	19	24
April to July Change	6	6	6	9	4	17	2	2

Upon release of the Treasury's refunding statement, 10- and 30-year yields rose modestly by about 5 basis points. Dealers expect the increased longer-term issuance to steepen the slope of the yield curve, but note that the magnitude is contingent on both the economic outlook and the pace of Treasury purchases by the Federal Reserve. Thus far, increased auctions of longer-term securities have been met with solid demand as measured by auction yields and bid-to-cover ratios; however, the 5-30 year Treasury spread has widened.

Given historical experience and potential future increases in financing needs, the Treasury may further lengthen the maturity of its issuance over the next few years. Figure 5 presents the predicted WAM of Treasury issuance based upon recent estimates of Treasury's financing needs and the historical relationship between issuance maturity and the size of deficits. The deficit is projected to reach $3.5 trillion this year, equal to about 17% of GDP. The WAM associated with current and projected deficits is predicted to reach a peak of above 3 years in 2021.

Figure 5
Projected WAM of Issuance



Sources: Center for Research on Security Prices, U.S. Office of Management and Budget, and author's calculations.

Implications of maturity lengthening and increased issuance for longer-term interest rates

In order to understand the implications of Treasury's increased issuance and maturity lengthening for longer-term rates, I use the Li-Wei term-premium model, under which the term premium embedded in the ten-year Treasury yield is affected by the amount of debt held by the public.[6] In Tealbook B Balance Sheet Projections, the Li-Wei model is used to estimate the Total Term Premium Effect (TTPE) of the Federal Reserve's balance sheet on longer-term interest rates holding all else equal, but is not used to measure the effects of Treasury issuance. In this analysis, I use the model, combined with changes in the projections of both the public's holdings of Treasury debt expressed in ten-year duration equivalents (TYEs) as well as the public's holdings of MBS securities at par, to measure how the Treasury's issuance offsets the effects of recent asset purchases on term premiums.[7]

Figure 6 presents the January to June forecast revision of securities held by the public from changes in Treasury issuance and the Federal Reserve's SOMA holdings. Since January,

[6] See Li and Wei (2013), "Term Structure Modeling with Supply Factors and the Federal Reserve's Large-Scale Asset Purchase Programs," *International Journal of Central Banking*, vol. 9 (March), pp. 3-39.
[7] Treasury ten-year equivalents are calculated as the par amount of on-the-run ten-year Treasury notes that would have the same par value times duration as the portfolio under consideration. In the model, Treasury supply affects ten-year term premiums as a function of changes to the projected path of the public's holdings of TYEs over nominal GDP. SOMA MBS affect ten-year Treasury term premiums as a function of changes to the projected par value of SOMA MBS holdings over nominal GDP.

the Federal Reserve has increased its holdings of Treasury securities by nearly $2 trillion. The green line indicates that these purchases correspond to a decline of almost $1 trillion in TYEs held by the public, which is projected to persist over the next several years as the Federal Reserve continuously holds a larger duration-weighted amount of Treasury securities than was projected in the January Tealbook.

The blue line shows the increase in the public's holdings of TYEs based on the projected increase in Treasury issuance, holding the WAM of issuance constant near 2019 pre-pandemic levels. The blue line indicates that the cumulative effects of budget deficits are projected to increase the public's holdings of TYEs to about $2 trillion by late 2022; thereafter, these holdings are projected to grow about in line with nominal GDP

The grey line shows the increase in the public's holdings of TYEs resulting from both the projected increase in the volume of Treasury issuance, and the projected increase in the WAM of this issuance according to the prediction in Figure 5.[8] An important takeaway is that the effect of the Treasury's projected maturity lengthening is sizeable, and adds an average of about $900 billion in TYEs over the projection as compared to the blue line with no change in WAM.

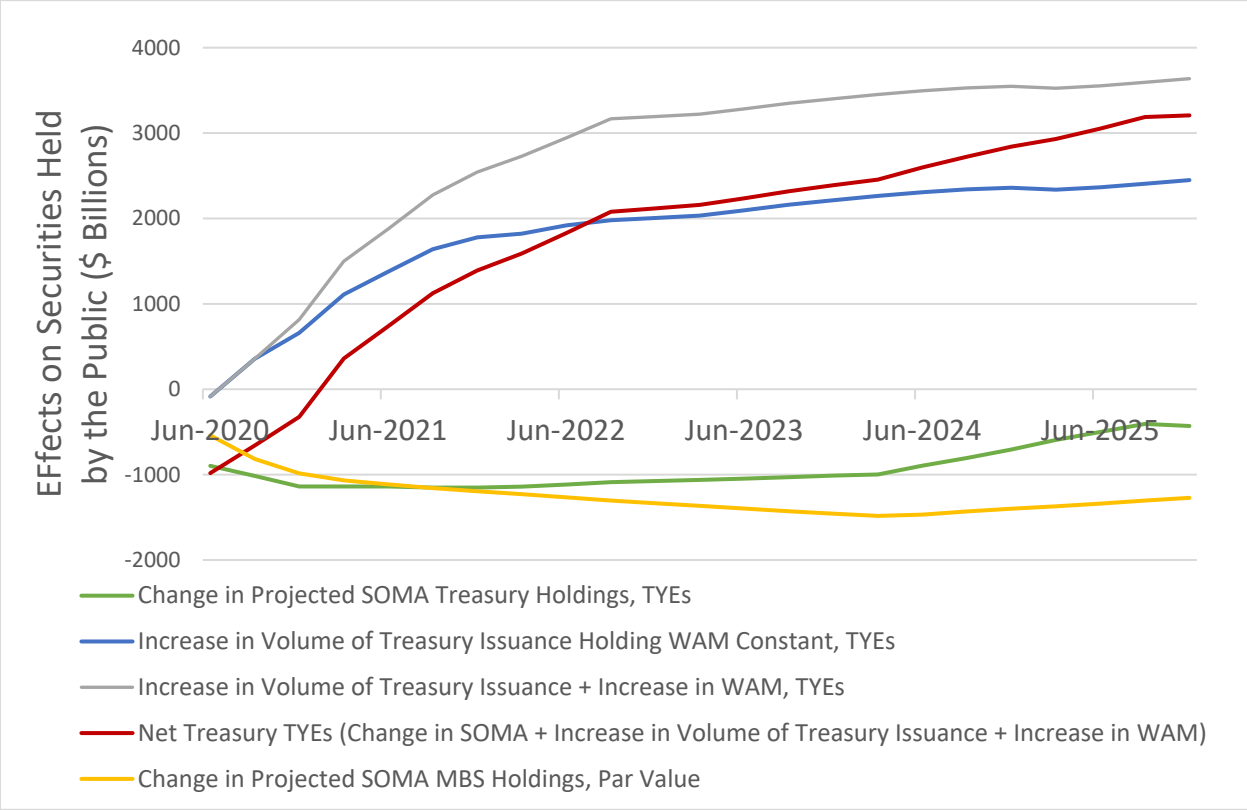
Finally, the red line shows the net effect of the projected increase in SOMA Treasury holdings, represented by the green line, and the increase in the volume and WAM of Treasury issuance, represented by the grey line. The net effect of these factors continuously increases the public's holdings of TYEs over the projection, which reach $2 trillion in 2022. After 2023, SOMA Treasury securities purchased for market functioning are assumed to begin rolling off the Federal Reserve's balance sheet, corresponding to an increase in the public's net holdings of TYEs.

While the staff do not measure MBS in terms of TYEs because of their prepayment option, SOMA MBS holdings at par value are projected to increase and remain above their current level of about $1.8 trillion. The January to June change in the projection of SOMA MBS holdings rises from about $500 billion this month to a peak of about $1.5 trillion in 2024, leading

[8] I assume that the WAM of Treasury issuance increases to predicted levels for fiscal years 2021-2022, and that securities issued from that period are continuously re-issued at the same maturities after fiscal year 2022 over the projection horizon. This leads to a persistent effect on the public's holdings of TYEs. The remainder of Treasury securities issued after 2022 are assumed to be issued at about the level of the WAM in fiscal year 2019. A number of simplifying assumptions are made for this analysis, including that the Treasury's issuance volume is unaffected by its debt management over the near term.

to a substantial downward revision to the projected path of the public's MBS holdings as shown by the yellow line.

Figure 6
Projected Securities Held by the Public,
January to June Forecast Revision



Source: January and June Tealbooks, author's calculations.

Figure 7 presents estimated effects on the ten-year Treasury premium resulting from changes in the public's debt holdings. The green bars show the change in the staff's Total Term Premium Effect (TTPE) baseline between the January and June Tealbooks. The increases in current and projected SOMA Treasury and MBS holdings since January are currently estimated to reduce ten-year Treasury yields by about 100 basis points; this effect is estimated to diminish to about 70 basis points by June 2023. The revision to the projected path of SOMA MBS accounts for more than half of the change in the TTPE over the projection, adding significantly more downward pressure on longer-term yields than that of SOMA Treasury securities alone. Importantly, the TTPE measures the effects of the Federal Reserve's assets while holding all else equal, and does not take into account changes in Treasury issuance.

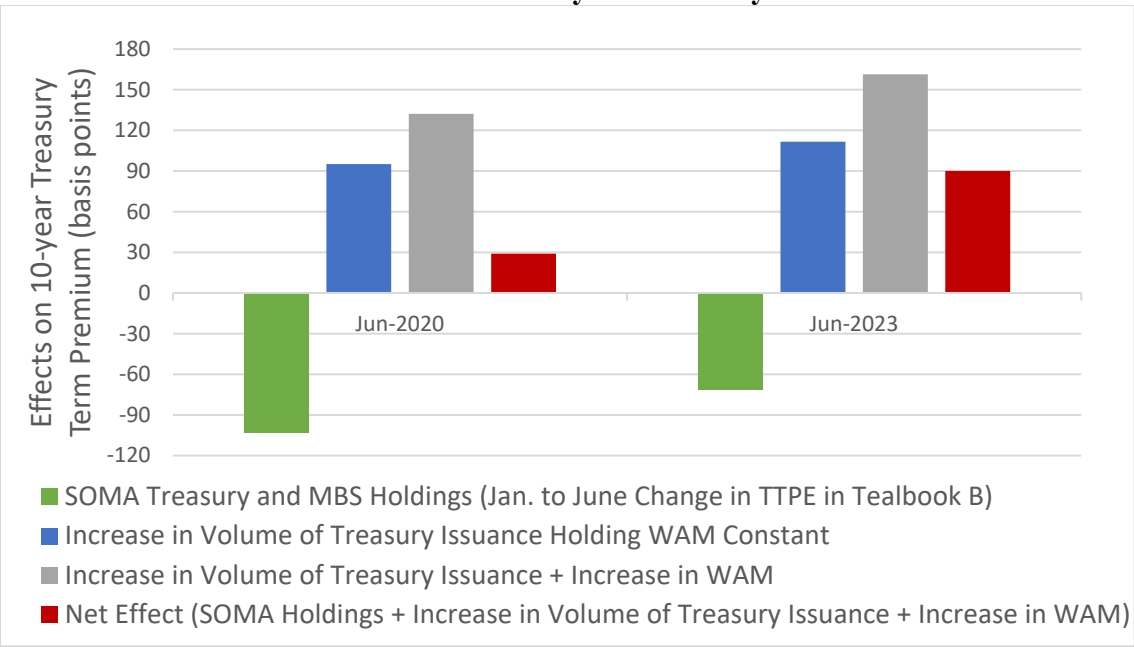
The blue bars show the effects of projected increases in Treasury issuance holding the WAM of issuance constant near 2019 pre-pandemic levels. Over the next three years, the upward pressure on the term premium from the increase in the volume of issuance is projected to rise from 95 basis points currently to about 110 basis points in June 2023. By that time, it is estimated that the volume of issuance will more than fully offset the downward pressure stemming from the Federal Reserve's recent MBS and Treasury purchases.

The grey bars add the effects of Treasury's projected increase in WAM to the effects of issuance volume. The combined effects of fiscal issuance are estimated to increase ten-year Treasury yields by about 130 basis points currently to about 160 basis points in June 2023. Put differently, the projected increase in the WAM of issuance adds between about 40 and 50 basis points of upward pressure to the effects of issuance volume alone.

Finally, the red bars show the net effects of the change in SOMA holdings, the increased volume of Treasury issuance, and the projected increase in the WAM of Treasury issuance. The overall effect of these three factors is projected to add an increasing amount of upward pressure to ten-year Treasury yields over the next three years, rising from about 30 basis points currently, to about 90 basis points in June 2023. A key takeaway is that, once issuance maturity is taken into account, fiscal issuance is estimated to more than offset the effects of recent Federal Reserve's asset purchases over the entirety of the projection horizon.[9]

[9] It is important to note that current term premiums may not reflect the effects of these predictions if market expectations of either the Treasury's and/or the Federal Reserve's actions differ from those projected in the scenario.

Figure 7
Estimated Effects on the 10-year Treasury Term Premium



Source: January and June Tealbooks, author's calculations.

Conclusion

In the same manner as the Federal Reserve's asset purchases, Treasury issuance has meaningful effects on longer-term yields. Historical analysis suggests that Treasury's debt management responds systematically to financing needs. As deficits rise, the Treasury tends to increase the WAM of its issuance, putting further upward pressure on longer-term interest rates than would the volume of increased issuance alone.

Within the current context, it is estimated that the Treasury's projected volume of issuance will soon offset the effects of recent asset purchases. When taking into account projected increases in issuance maturity, Treasury's actions are currently estimated to more than offset the Federal Reserve's asset purchases, and will do so considerably over the medium-run.

References

Belton, Terry, Kristopher Dawsey, David Greenlaw, Huachen Li, Srini Ramaswamy, and Brian Sack. *Optimizing the Maturity Structure of US Treasury Debt: A Model-based Framework*. Hutchins Center Working Paper 46, 2018

Greenwood, Robin, Samuel Hanson, Joshua S. Rudolph, and Lawrence H. Summers. *Government Debt Management at the Zero Lower Bound*. Hutchins Center on Fiscal & Monetary Policy at Brookings Institution, 2014.

Li, Canlin and Min Wei (2013), "Term Structure Modeling with Supply Factors and the Federal Reserve's Large-Scale Asset Purchase Programs," *International Journal of Central Banking*, vol. 9 (March), pp. 3-39.

Appendix

How Did the Treasury Manage its Debt Following the Great Recession?

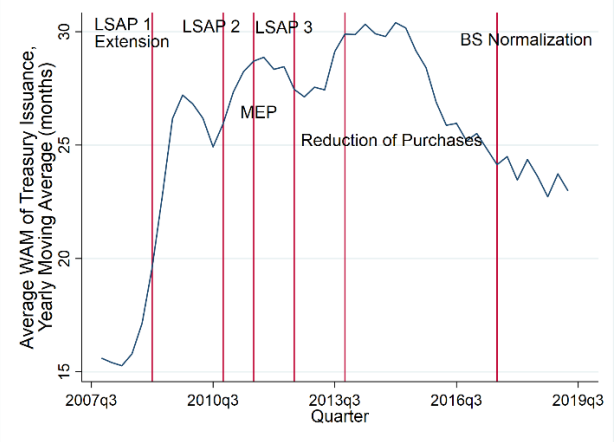
The relationship between the WAM of Treasury issuance and fiscal deficits has important implications for monetary policy. In an influential paper, Summers et. al (2014) measure that, by increasing the WAM of its issuance following the Great Recession, the Treasury offset about one-third of the downward pressure on longer-term rates stemming from the Federal Reserve's asset purchase programs.[10] While the magnitude of this offset is the result of an accounting exercise, my analysis finds little evidence to support the view that the Treasury was responding directly to the Federal Reserve's asset purchase programs.

Appendix Figure 1 presents the yearly moving average WAM of Treasury issuance and indicates the announcements of major changes to balance sheet policy through red vertical lines. First, as shown in the figure, the timing of changes to Treasury issuance does not align well with major announcements of changes to balance sheet policy. For instance, the Treasury began increasing the WAM of its issuance before the announcement that LSAP 1 would be extended to include Treasury securities, and subsequently decreased the WAM of its issuance within a year.

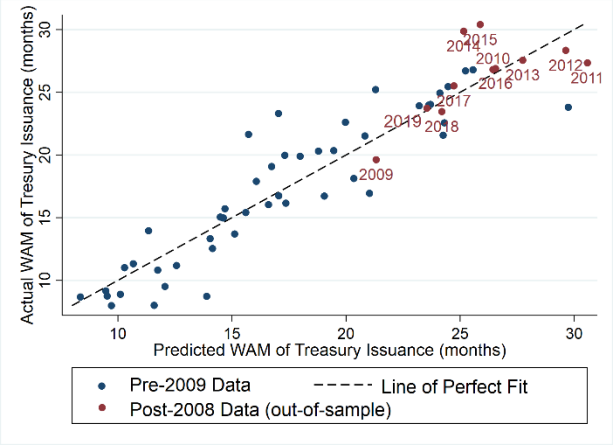
[10] It is estimated in this memo that, over the next few years, Treasury debt management will offset most of the projected effects of the Federal Reserve's asset purchases. This offset is larger than that estimated by Summers et al. (2014) following the Great Recession, in part because the WAM of Treasury issuance is predicted to reach comparatively higher levels from the relatively larger size of fiscal deficits associated with the coronavirus.

Second, my analysis indicates that the pattern of Treasury's issuance at the time is consistent with the historical relationship between the WAM of issuance and the size of budget surpluses/deficits. This point is demonstrated in Appendix Figure 2, which shows that the Treasury's post-2008 issuance is well predicted by the regression in Column (2) of Table 1 estimated using only pre-2009 data. Accordingly, my analysis suggests that the Treasury debt management practices did partially offset the effect of the Federal Reserve's asset purchase programs on longer-term rates. However, this offsetting effect reflected a systematic response of Treasury debt management practices to finance deficits induced by recessionary conditions. The Treasury's response in the aftermath of the Global Financial Crisis was in line with its practices in previous recessions. In addition, there is little evidence that the Treasury's debt management responds to real interest rates or term premiums, which are affected by the Federal Reserve's policies.

Appendix Figure 1
WAM of Treasury Issuance and Balance Sheet Policy Announcements



Appendix Figure 2
WAM of Treasury Issuance, Fiscal Year Actual vs Predicted



Sources: Center for Research on Security Prices, U.S. Office of Management and Budget, and author's calculations.