MARKET INSIGHTS

Running Low:

The 2020 Test for Bonds as Hedging Assets

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D E Shaw & Co

Introduction

Much ink has been spilled on how investors should adjust their portfolios to take into account the low interest rate environment observed in recent years. In particular, many have questioned whether government bonds will continue to serve their longstanding role as safe haven assets—that is, assets that provide an effective hedge against significant downturns in equity prices.

Events in 2020 represented a key test in that regard, as markets faced an extremely large negative shock from a starting point of low rates. By studying that episode, we can assess the degree to which the hedging properties of those bonds were impaired.

We find that U.S. government bonds passed the test, reacting normally to the risk-off episode that struck markets in February and March. However, with yields now even lower than they were entering the crisis and with rate volatility substantially reduced at shorter maturities, investors may need to shift toward longer-term bond holdings to achieve similar hedging utility going forward. Moreover, the hedging performance of government bonds was much worse in countries that began the year with less room for monetary policy intervention, suggesting some risk regarding future conditions in the United States.

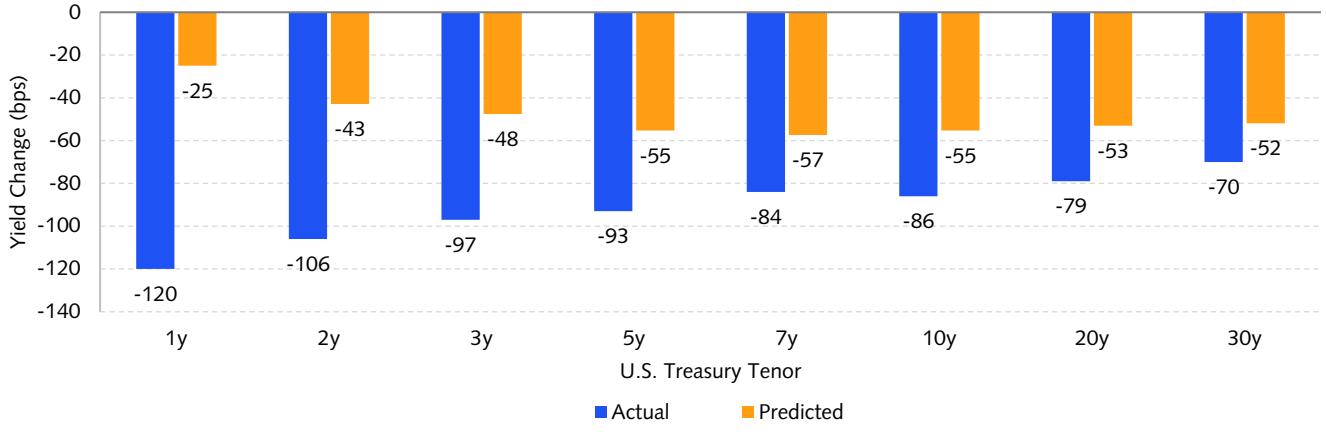
U.S. Treasuries' Reaction to the Pandemic Shock

As the COVID-19 pandemic spread, uncertainty about the outlook for global economic activity drove a steep decline in equity markets beginning in mid-February, with the S&P 500® experiencing its most severe sell-off since the 2008 financial crisis.

In response to these developments, central banks took extraordinary actions, including the U.S. Federal Reserve's aggressive steps to inject short-term liquidity into the financial system and support the functioning of critical markets.

The Fed also deployed its traditional monetary policy instrument to the extent possible. With the federal funds target rate at just over 1.5%, the Fed was constrained in the amount that it could reduce short-term rates, given that it had ruled out the use of negative interest rates for now. However, following the playbook that we discussed in an earlier paper on the lower bound on interest rates,[1] the Fed cut the federal funds rate quickly to the effective lower bound and communicated that it expected to keep the rate at that level for an extended period.

Figure 1: Changes in Treasury Yields (Actual and Predicted) during Equity Drawdown in Early 2020
(February 14, 2020 to March 16, 2020)



The graph above reflects actual and predicted changes (in basis points) in constant maturity U.S. Treasury yields during the period indicated. (For reference, the decline in the S&P 500® over this period was roughly 30%.) Actual changes were calculated by the D. E. Shaw group based on daily yield data obtained from Bloomberg. Predicted changes were calculated by the D. E. Shaw group using typical betas from regressions of daily changes in U.S. Treasury yields on daily changes in the S&P 500® based on an unweighted sample from the period January 1, 2004 through December 31, 2019.

Sources: Bloomberg (U.S. Treasury yield and S&P 500® data); the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

[1] *Floor It: Market Pricing of the Lower Bound on Interest Rates*, available here.

The decline in the federal funds rate and the shift in its expected path in coming years prompted a sizable rally in the U.S. Treasury market. As can be seen in Figure 1, Treasury yields fell notably across all maturities over this period (blue bars). In fact, those changes in yield exceeded what one might have predicted based on the response of Treasury yields to equity prices over a long sample period leading up to 2020 (orange bars).

This pattern, in which yields fall and produce positive realized returns on Treasury securities, is typical during periods of weakening economic outlook and rising risk aversion. It is the foundation for why government debt securities have been considered an effective hedging instrument and thus often play a key role in portfolio diversification.[2] What is notable, however, is that the low level of rates at the start of 2020 did not appear to curtail the rally in Treasury securities.

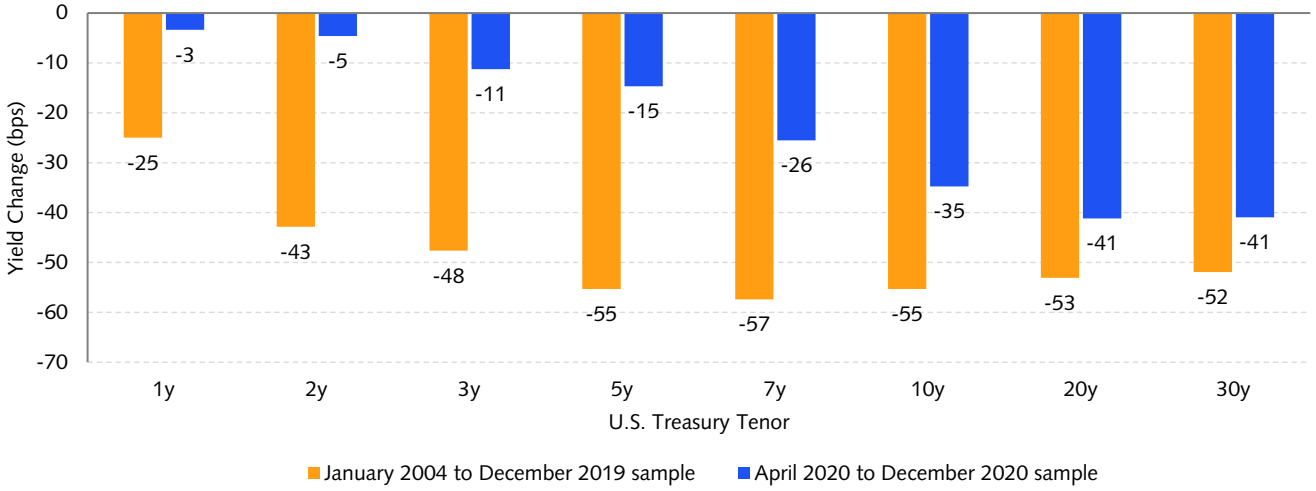
Cracks Starting to Show

The observed behavior of U.S. Treasury securities through the equity market sell-off is encouraging, but fails to provide complete comfort. The pattern realized in early 2020 reflected the Fed's ability to push yields to remarkably low levels, so that what seemed to be an uncomfortably low starting point ended up being less problematic than feared. Of course, with yields now at even lower levels, such concerns may reasonably persist.

Indeed, cracks have begun to appear in the hedging behavior of Treasury securities over the period since March. By measuring the relationship of Treasury yields to daily changes in equity prices observed over this more recent period, we can examine how one might now expect Treasury yields to respond in the face of an S&P 500® downdraft of the same size considered in Figure 1. These predicted responses are represented by the blue bars in Figure 2.

The results provide a cautionary message. From April through December, when the yield curve was at lower levels than at the start of the year, the response of yields to equity prices was much more muted. If that more recent relationship were to continue to hold going forward, Treasury securities would provide meaningfully less protection against a substantial decline in equity prices.

Figure 2: Predicted Changes in Treasury Yields during Large Equity Drawdown



The graph above reflects predicted changes (in basis points) in constant maturity U.S. Treasury yields during an equity market drawdown of the same magnitude as that considered in Figure 1. Predicted changes were calculated by the D. E. Shaw group using typical betas from regressions of daily changes in U.S. Treasury yields on daily changes in the S&P 500® based on an unweighted sample from each of the periods (i) January 1, 2004 through December 31, 2019 and (ii) April 1, 2020 through December 31, 2020.

Sources: Bloomberg (U.S. Treasury yield and S&P 500® data); the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

[2] In our earlier paper *Positively Negative: Stock-Bond Correlation and Its Implications for Investors* (available here), we argued that the correlation between Treasury security prices and equity prices depends on the underlying shocks in the economy, and that the greater importance of changes in the growth outlook and risk aversion (relative to inflation) had pushed the correlation negative. Based on that perspective, we would expect the favorable correlation properties of Treasury securities to remain in place in the absence of a significant inflationary shock.

A Closer Look across the Yield Curve

Deterioration in the hedging properties of Treasury securities since March has been more acute at short and intermediate maturities. That conclusion is apparent in the sensitivities shown in Figure 2 (blue bars), and it is intuitive, as those yields are in closest proximity to the constraint of the zero lower bound.

To dive in further, Table 1 takes a closer look at the betas of 2-, 10-, and 30-year Treasury yields to the S&P 500® over the two periods shown in Figure 2.[3] As one can see, the beta of the 2-year yield to equities fell substantially in the recent period, while the betas for the 10- and 30-year yields have held up much better.[4]

Why have the hedging properties of longer-term Treasury yields held up better? To understand this divergence, it is instructive to look at the components of the beta. Empirical beta can be expressed as the product of the correlation coefficient between the Treasury yield and the S&P 500® and the ratio of their respective volatilities. We consider these two components in turn.

Table 1: Variation in Yield Betas over Time

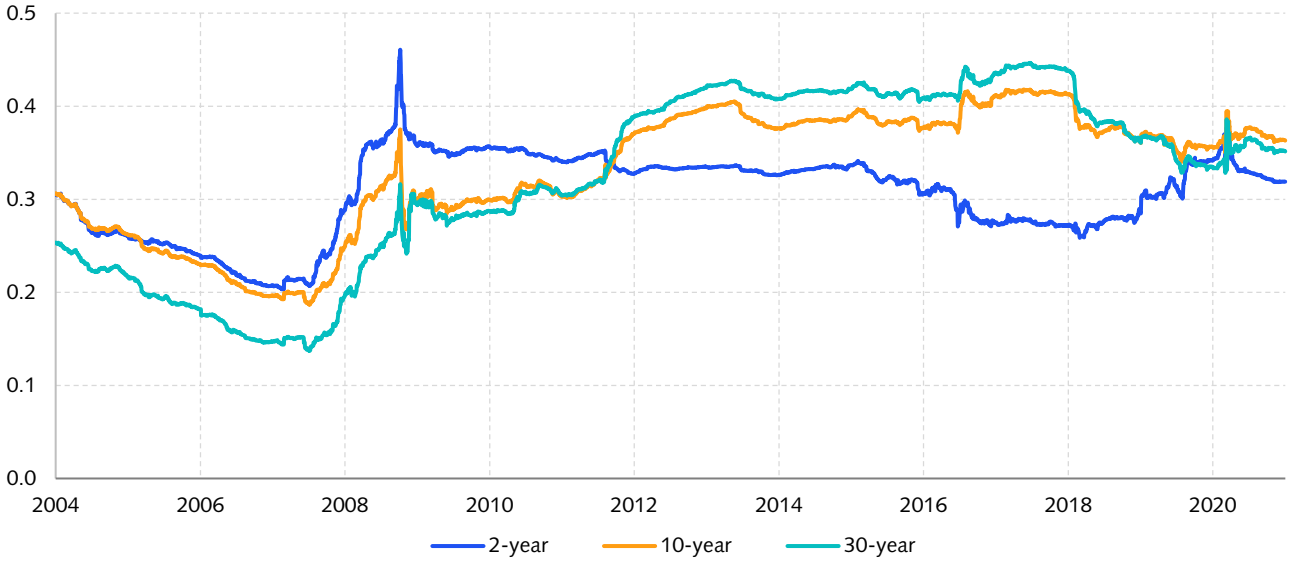
Period	2-year	10-year	30-year
Jan 2004 to Dec 2019	1.41	1.69	1.52
Apr 2020 to Dec 2020	0.41	1.00	1.10

*The table above presents the D. E. Shaw group's determinations of average betas of 2-, 10-, and 30-year U.S. Treasury yields to the S&P 500® during each of the periods shown. Betas were computed using the formula correlation*vol(rate)/vol(equity), where each correlation was determined as outlined in the note to Figure 3 below, and implied volatilities of U.S. interest rates were based on the applicable Barclays aggregate index.*

Sources: Bloomberg; Barclays Research Services; the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

First, as can be seen in Figure 3, the correlations of the 10- and 30-year yields to equity prices have been relatively high in recent years. Those correlations appear even higher than they were in the early 2000s, despite short-term rates

Figure 3: Correlation of Treasury Yields to S&P 500®



The graph above reflects the D. E. Shaw group's determinations of rolling correlations over the period shown between (i) daily changes in U.S. Treasury yields (2-, 10-, and 30-year) and (ii) daily S&P 500® returns. Such correlations were calculated after exponentially weighting each series with a half-life of four years and rolling window of eight years.

Sources: Bloomberg (U.S. Treasury yield and S&P 500® data); the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

[3] An estimated beta of 1.41, for example, means that a 10% move in the S&P 500® would produce a yield response of 14.1 basis points in the same direction.

[4] The 2004–2019 sample used for comparison includes a substantial period when the policy rate was at the lower bound, which likely reduces the beta on the 2-year Treasury yield. Indeed, over the period from January 2004 through November 2008, before the lower bound was reached, the beta for the 2-year yield was significantly higher, at 1.67. Nevertheless, even with some dampening effect from the lower bound, there was enough variation in the 2-year yield over the full 2004–2019 sample to produce a much higher beta than observed in the more recent subsample.

having frequently been constrained by the lower bound in the more recent period. It may be that constraints on lowering short-term interest rates have forced the Fed to operate further out the yield curve, through both policy guidance and asset purchases, helping to keep these correlations elevated. In fact, the correlations of the 10- and 30-year yields with the S&P 500® have been higher than that of the 2-year yield since 2012.

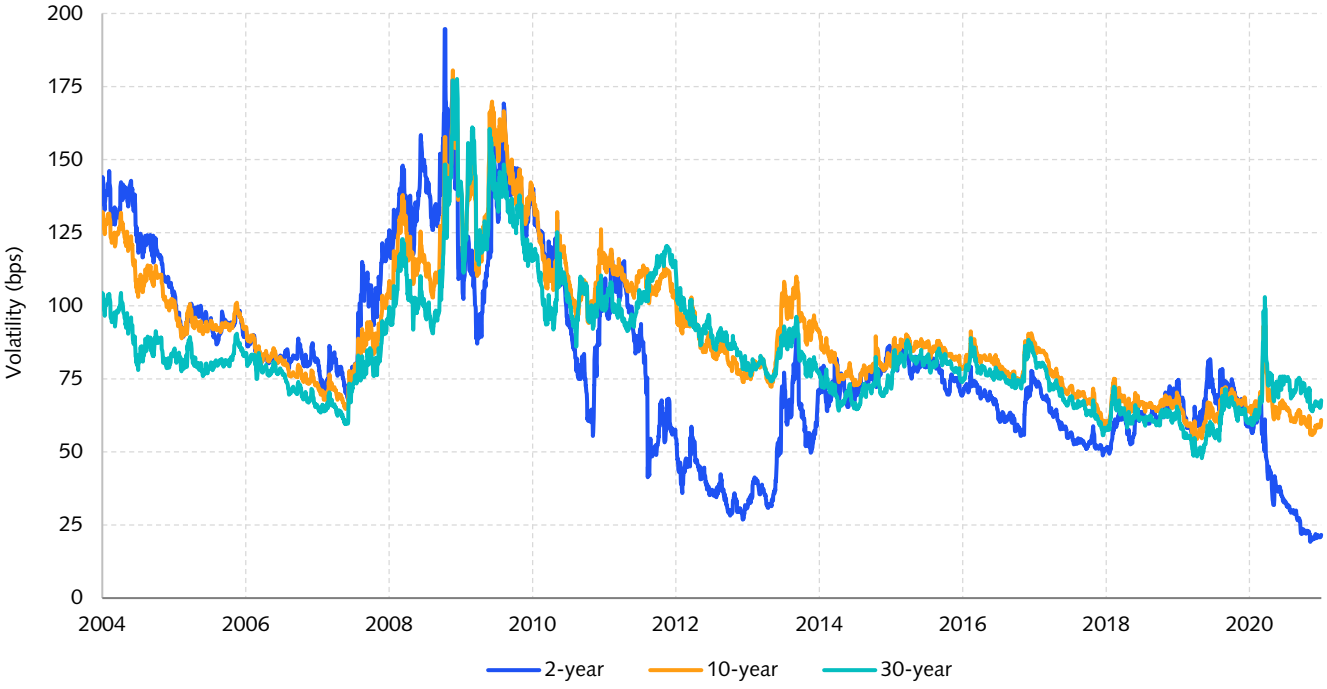
Volatility, the second component of the beta, has also held up better for longer-term yields, as shown in Figure 4. The sharp decline in implied volatility of the 2-year yield following the initial pandemic shock is hardly detectible in the volatilities of the 10- and 30-year yields, as the primary effect on rate volatility has been to steepen its term structure. This pattern suggests that markets still see longer-term yields as having considerable room to vary—a view that, when combined with high correlation to equity prices, has sustained the hedging benefits of longer-term Treasury securities.

A Hedging Approach for U.S. Markets?

One approach to preserving the role of U.S. Treasury securities as a portfolio hedge seems straightforward, then—move out the curve. The higher betas of the yields on longer-term Treasury securities suggest that those instruments will continue to serve as an effective hedge against equity prices going forward.[5]

Alternatively, to the extent that deterioration in the hedging properties of shorter-term Treasury securities is associated with lower rate volatility, another approach would be to apply leverage to those holdings; many investors, however, are constrained in their ability to deploy leverage. Moreover, as shown in Figure 3, the correlations of longer-term yields to equities are now actually higher than that of the 2-year yield, making longer-term securities a more apt hedge against equity prices than their shorter-term counterparts.

Figure 4: Implied Volatility of Interest Rates



The graph above presents the implied volatility of interest rates (in basis points) of each of the 2-, 10-, and 30-year U.S. Treasury yields during the period shown, in each case with a one-year horizon. Implied volatilities were based on the applicable Barclays aggregate index.

Sources: Barclays Research Services; the D. E. Shaw group.

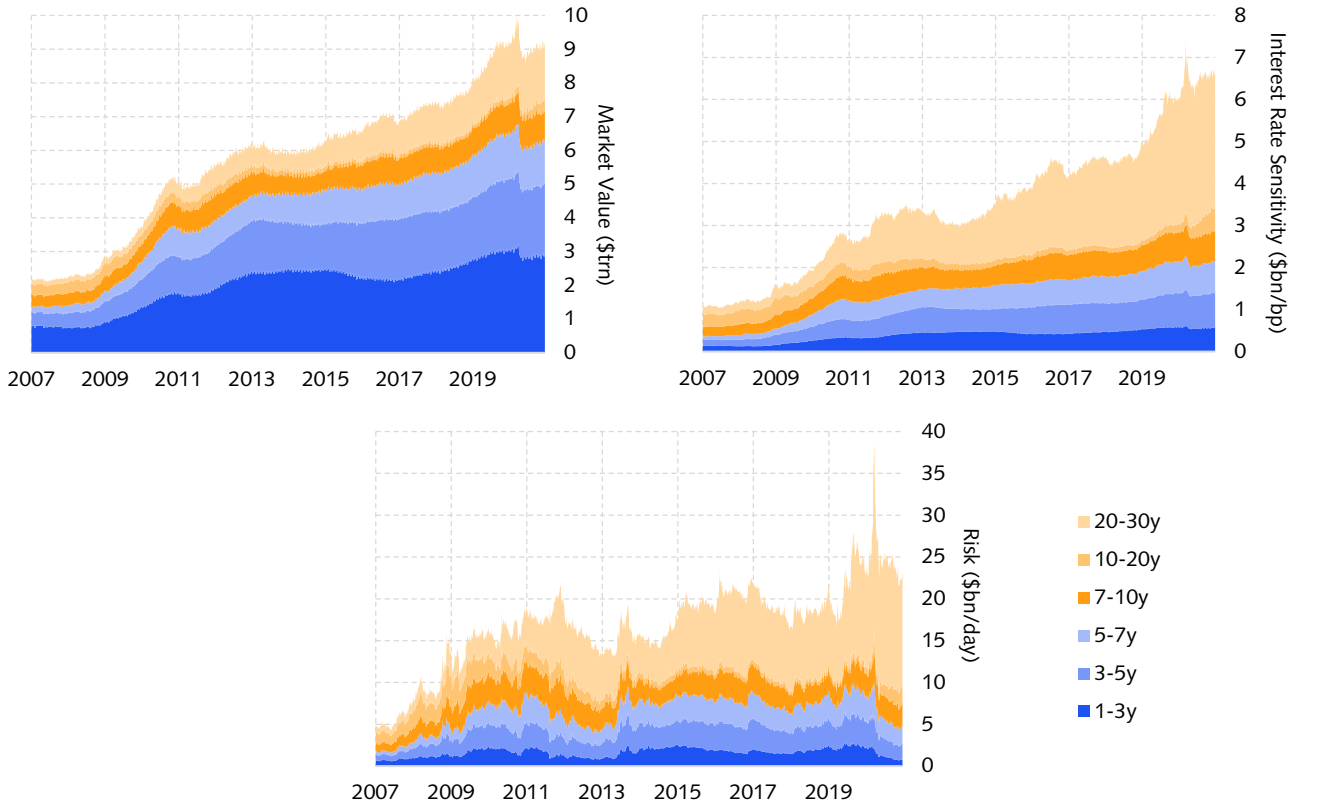
[5] Of course, a complete assessment of the potential advantages of longer-maturity Treasury securities in a diversified portfolio would have to take into account their estimated risk premium, as well as other factors. This paper has a narrower scope, focused on those assets' capacity to provide useful hedging properties and on drawing lessons from what we can observe from 2020.

If we accept that investor appetite for longer-term Treasury securities as a portfolio hedge should be increasing, it is reasonable to consider whether that kind of asset migration on a large scale might create a meaningful supply/demand imbalance in the market. For example, such a shift might further depress term premia at longer horizons—already negative, according to several widely used models—making those Treasuries less attractive on a go-forward basis.[6]

On that question, we would simply note that there is ample supply of duration in the U.S. Treasury market. As can be seen in Figure 5, the notional amount of U.S. Treasury debt outstanding has increased rapidly in recent years as a result of large budget deficits.[7] In notional terms (upper-left panel), much of this supply has been in short- and intermediate-term securities, which at first might seem problematic for the approach discussed here. But by expressing these amounts in terms of duration (upper-right panel), we show that it is the issuance of securities at the longer end that creates the majority of duration available to the market.

Even if we account for the reduction in implied volatility to derive a measure of the total risk available to the market (bottom panel), we see that Treasury issuance has been

Figure 5: Supply of Hedging Capacity



The graphs above present outstanding nominal, coupon-bearing U.S. Treasury securities held by market participants other than the U.S. Federal Reserve (grouped by time to maturity) in terms of market value, duration, and risk, respectively, in each case over the period indicated. The risk measure for each maturity group was computed based on the implied volatilities of swaptions with one-year expiries on the underlying swap with a corresponding time to maturity.

Sources: Bloomberg (outstanding U.S. Treasury market data); Barclays Research Services (swaption implied volatility data); the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

[6] Measuring term premia is challenging, and the estimates that are available depend on the assumed structure of the model used to construct them. Two of the most widely used models are published by the Federal Reserve Board (available here) and by the Federal Reserve Bank of New York (available here).

[7] This figure is based on the Barclays aggregate index and excludes holdings of the Federal Reserve. Thus, it is a measure of the supply of Treasury securities available in aggregate to private investors.

sufficient to offset that effect. The front end is providing less duration risk because of the fall in volatility, but longer-term securities have made up for that decline. The market remains well supplied with Treasury interest rate risk at longer maturities, suggesting that extending out the curve is indeed a viable option for those in search of hedging assets.

Perspectives from Germany and Japan

Although this approach for the U.S. yield curve seems appealing, observations from other countries raise more substantial concerns. Based on the 2020 test, Germany and Japan—two countries that entered the pandemic with yield curves at notably lower levels—have already reached a point at which their government bonds are meaningfully impaired as hedging assets.

In the period leading up to the pandemic, each country's central bank had pushed the effective lower bound for its policy rate into negative territory. Nevertheless, at the onset of the pandemic, the yield curve in each country was already pressed closer to that lower bound than was the case in the United States.

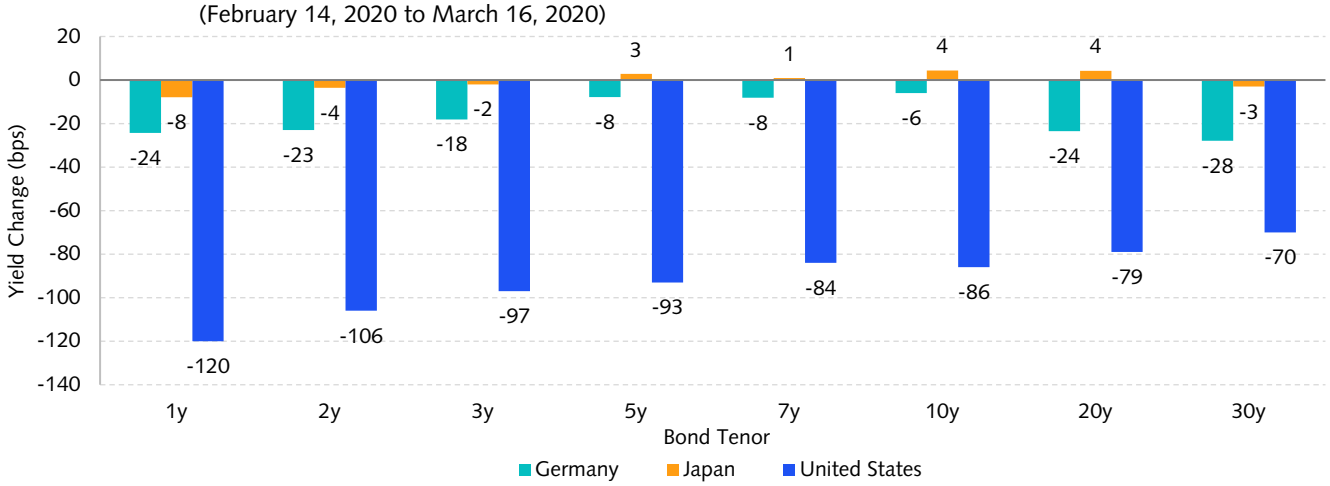
In Germany, the 10-year bund yield was -40 basis points (bps) in mid-February, compared to the central bank deposit rate of -50 bps; in Japan, the 10-year JGB yield was -5 bps, compared to the central bank deposit rate of -10 bps. Moreover, the Bank of Japan had implemented a yield curve control regime in which it explicitly targets a level for the 10-year yield, thereby limiting movement in that rate (absent a decision to change that target).

Given those circumstances, it is not surprising that in the February–March market crisis period, the 10-year yields in Germany and Japan moved to a much more limited degree than U.S. yields, as shown in Figure 6.[8]

U.S. yields simply had more room to decline coming into the crisis. Even over the ensuing period from April through December, the 10-year U.S. Treasury yield remained at an average level of about 75 bps, still leaving a substantial cushion above its lower bound compared to the more constrained yields in Germany and Japan.

Nevertheless, it is hard to rule out the possibility that the United States could evolve in the direction of those other countries, eroding the hedging properties of Treasury securities, even at longer maturities. Although extending the duration of Treasury holdings appears to provide investors a hedging approach in U.S. markets under current circumstances, that approach might not remain viable if the U.S. yield curve declines further.

Figure 6: Changes in Government Bond Yields during Equity Drawdown in Early 2020
(February 14, 2020 to March 16, 2020)



Source: Bloomberg (German bund, Japanese Government Bond, and U.S. Treasury yield data); the D. E. Shaw group. Applicable data are used with permission of Bloomberg.

[8] The German bund yield demonstrated volatility over the first half of March that makes the changes reported in Figure 6 sensitive to the exact window chosen. However, it is clear that German yields did not demonstrate the substantial decline observed in U.S. yields through the middle of the year.

The Path Forward

In hindsight, for those who entered the year concerned about the hedging properties of U.S. Treasury securities, the 2020 test offered both comfort and caution. Treasury yields fell sharply during the market crisis, passing this test and validating their utility as haven assets. However, the resulting decline in yields may make it all the more challenging for Treasury securities to provide similar utility in the future.

Our view is that the hedging capacity of Treasury securities is still effective at this time, at least with the right adjustments. In particular, to maintain the hedging properties of their Treasury holdings, investors may need to push out the duration of those instruments, perhaps to 10-year maturities or longer. We believe that the Treasury market has the supply of duration risk needed to facilitate such a shift, and that this approach has advantages over turning to other types of assets to serve that function.[9]

Of course, the situation could change in other ways that might alter this conclusion. If Treasury yields grind lower over time, then the deterioration of Treasury securities' hedging capacity already observed at shorter maturities would likely extend further out the curve, resembling what we have seen in Germany and Japan.[10] Alternatively, a meaningful shift to a less stable inflation environment could impair those hedging properties by shifting the correlation between Treasury yields and equity prices.

For now, however, we believe that this approach—moving out the curve to ensure that Treasury holdings have sufficient capacity to rally during a downturn—is a viable one.

[9] In our view, there are no obvious substitutes for high-quality government securities as canonical haven assets. Various market participants have proposed a range of alternatives—from corporate credit, to emerging market bonds, to active strategies of various stripes—but we believe that such proposed alternatives have meaningful drawbacks in this regard.

[10] In the other direction, yields could move higher over time, which would help to maintain the hedging function of Treasury securities and possibly restore it at shorter maturities. Moreover, although the Fed has largely ruled out negative interest rates for now, the market has not dispelled that possibility, and any further loosening of that policy constraint perceived by investors would benefit the hedging properties of Treasury securities. By our estimates, the market's perception that negative rates are possible accounted for at least 25 basis points of the roughly 100 basis point decline in the 3y1y swap rate observed through the middle of 2020.

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