Are Long-Duration Treasuries the Best Hedge for Equities?

SUNDER RAMKUMAR AND ANDREW BATES

SUNDER RAMKUMAR
is a senior vice president at Capital Research and Management Company, a part of Capital Group, in New York, NY.
sndr@capgroup.com

ANDREW BATES
is a senior client analytics specialist at American Funds Distributors, Inc., a part of Capital Group, in Los Angeles, CA.
arwb@capgroup.com

KEY FINDINGS

- Yield-curve dynamics can vary considerably across episodes of stock-market stress. Although all interest rates tend to fall during sharp market crashes, US, German, and UK yield curves steepened considerably over prolonged downturns, and the Japanese yield curve flattened.
- Long-maturity bonds have offered mixed incremental diversification benefits. Twenty-year bonds had estimated returns similar to 10-year bonds during equity downturns in the United States and Germany, were 26% lower in the United Kingdom, and outperformed only in Japan.
- Diversification gains of maturity extension are linked to monetary policy. Yield curves tend to decline most during conventional easing but steepen considerably, whereas quantitative easing can instead flatten yields. This suggests that duration management should be an active investment discipline.

ABSTRACT: *The authors study the link between bond maturity and equity diversification in developed economies across the past 6 decades. Although correlations between equities and interest rates have been largely similar for different bond maturities, yield-curve dynamics have varied considerably across episodes of stock-market stress. All interest rates tend to fall during sharp market crashes, but US, German, and UK yield curves steepened over prolonged downturns, and the Japanese yield curve flattened. As a result, 20-year bonds had estimated returns similar to 10-year bonds during equity downturns in the United States and Germany, were 26% lower in the United Kingdom, and outperformed only in Japan. The diversification gains of maturity extension are linked to macroeconomic factors, including monetary policy, expected inflation, and the shape of the yield curve. Yield curves tend to decline most during conventional easing but steepen considerably, whereas quantitative easing can instead flatten yields. These findings suggest that duration management may be best as an active investment discipline.*

TOPICS: ***Developed markets, financial crises and financial market history****

Many institutional investors have incorporated long-duration bonds as a tail-risk hedge against falling equity markets. Four of the largest 10 US public pension plans have incorporated dedicated allocations to long-duration Treasuries, as have three of

*All articles are now categorized by topics and subtopics. **View at PM-Research.com.**

the largest 10 target-date series.[1] Long-duration bonds are clearly appealing to liability-driven investors seeking to immunize long-dated, contractual obligations. Are they just as attractive to those investors focused on asset growth and seeking to diversify equity risk?

Several researchers have studied stock–bond diversification. Early work focused on long-term estimates of stock–bond correlations and reported positive co-movement. For example, Shiller and Beltratti (1992) reported annual correlations of +0.4 between US stocks and bonds from 1891 to 1989, whereas Campbell and Ammer (1993) reported lower, but still positive, monthly correlations from 1952 to 1987. Subsequent research has highlighted time-varying correlations with extended regimes of both positive and negative correlation. Li (2002), Ilmanen (2003), and Andersson, Krylova, and Vähämaa (2008) are among those who have linked stock–bond correlation regimes to inflation expectations; Gulko (2002) and Connolly, Stivers, and Sun (2005) focused on the impact of stock-market uncertainty; Campbell, Sunderam, and Viceira (2009) considered linkages with term premiums; and Dopfel (2003) discussed asset allocation implications.

Whereas most research simply focuses on 10-year Treasuries as a proxy for the bond market, we study the characteristics of 5-, 10-, and 20-year Treasuries and evaluate the link between bond maturity and equity diversification across developed economies over the past 6 decades. Although correlation between equities and interest rates has been largely similar across different bond maturities, yield-curve dynamics have varied considerably across episodes of stock-market stress. All interest rates tend to fall during sharp market crashes, but US, German, and UK yield curves steepened considerably over prolonged downturns, and the Japanese yield curve flattened. As a result, 20-year bonds had estimated returns similar to 10-year bonds during equity downturns in the United States and Germany, were 26% lower in the United Kingdom, and outperformed only in Japan.

We find that the diversification gains of maturity extension are linked to macroeconomic factors, including monetary policy, expected inflation, and the shape of the yield curve. For example, conventional monetary easing has often led to the highest diversification gains from Treasuries because bonds rally when central banks cut interest rates. However, large reductions in short-term policy rates also portend increasingly steep yield curves, limiting the benefits of maturity extension. In contrast, quantitative easing (QE) has tended to flatten yields, boosting the value of long-duration bonds. These findings suggest that duration management may be best as an active investment discipline.

We make three main contributions to existing research. First, we add to research on stock–bond diversification by studying the diversification profile of Treasuries with different maturities. Second, whereas most research focuses on correlation characteristics, we take an event-study approach and highlight unique yield-curve dynamics in episodes of stock-market stress. Finally, we present novel results on stock–bond co-movement in different regimes, which provides practical guidance to investors seeking diversification in a high-correlation world.

The outline of our article is as follows. We begin by studying the diversification profile of constant-maturity Treasuries in the United States from 1962 to 2019, reporting correlations and stress period results. Next, we extend our analysis to Germany, the United Kingdom, and Japan and compare the incremental diversification benefits of longer-duration bonds in each country over the past 20 years. We then evaluate the impact of monetary policy on yield-curve dynamics and conclude with a summary of key implications for investors.

DIVERSIFICATION PROFILE OF CONSTANT MATURITY US TREASURIES

Correlation Profiles

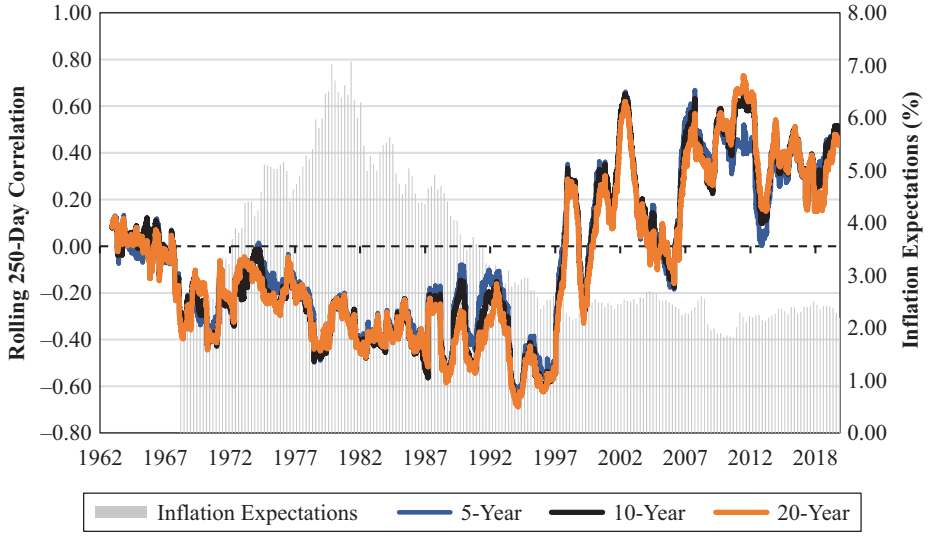
We study stock–bond diversification using daily historical yields of 3-month, 5-year, 10-year, and 20-year constant maturity Treasuries. Our data span the 6-decade period from 1962 to 2019 and include two distinct subperiods with a tent-shaped pattern. Rates rose in the first part of the data sample, 1962 to 1981, and then declined consistently over the following 4 decades. We calculate daily returns for each of the Treasury securities, assuming par-bonds, as described in the online appendix.

Exhibit 1 presents rolling 250-day correlations between returns of the US stock market, represented by the S&P 500, and changes in yield for constant-maturity Treasuries. Stocks and yield changes have

[1] Source: Pensions and Investments, Morningstar, and authors' analysis.

EXHIBIT 1

Correlation of US Constant-Maturity Treasury Yields and Equities



	5-Year	10-Year	20-Year
1962–2019	–0.02	–0.03	–0.04
1962–1999	–0.23	–0.26	–0.27
2000–2019	0.36	0.36	0.35

Notes: Inflation expectations (right-hand side) are long-term expectations taken from US Federal Reserve Board forecasting model. Differences in correlations across 1962–1999 and 2000–2019 are statistically significant at 99% confidence based on the Jennrich (1970) test.

Source: Bloomberg, Federal Reserve, and authors' calculations.

been uncorrelated over the full data sample; however, correlations have fluctuated meaningfully over time. Yield changes exhibited consistent negative correlations with equities from the 1960s through the late 1990s but turned positive starting in the late 1990s, enhancing the diversification benefits of Treasuries. For example, the average correlation between changes in 10-year Treasury yields and the S&P 500 was −0.26 from 1962 to 1999 and 0.36 from 2000 to 2019.[2] As discussed in the introduction, several researchers—for example, Li (2002); Ilmanen (2003); and Andersson, Krylova, and Vähämaa (2008)—have documented similar findings and attribute correlation patterns to changing inflation expectations. Exhibit 1 also plots long-term US inflation expectations taken from the Federal Reserve's US-FRB forecasting model (right-hand scale) and illustrates a clear association. Inflation expectations kept rising through the 1960s and 1970s, remained high but began to fall in the 1980s, and have been stable at about 2.5% since the mid-1990s.

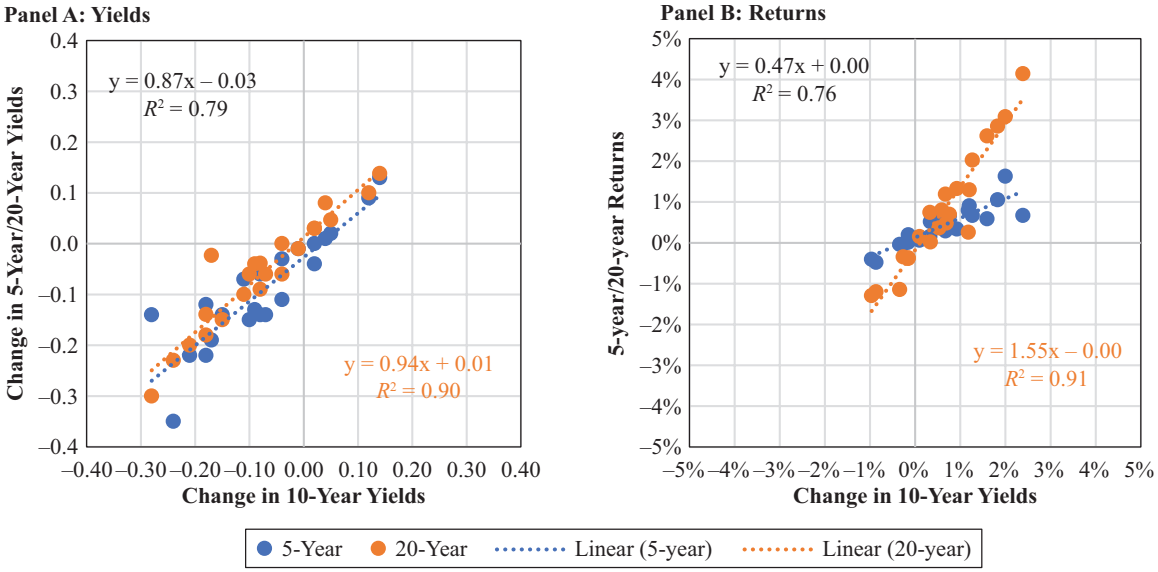
Important for our research, equity correlations seem essentially identical at different points in the yield curve. Correlations of 5-, 10-, and 20-year yields with the S&P 500 were indistinguishable at −0.02, −0.03, and −0.04 over the full sample. Correlations were also indistinguishable in the negative and positive stock–bond correlation regimes. It is therefore no wonder that researchers have tended to simply focus on 10-year yields in studying stock–bond co-movement.

Results during Single-Day Equity Crashes

Although correlation statistics provide a summary view of stock–bond co-movement, they can also be

[2] A formal Markov-switching model for 10-year Treasury yields and equities (as used by Hamilton 2010) suggests three correlation regimes anchored around values of −0.36, −0.03, and 0.43, respectively, with a clear move to higher correlations in the first quarter of 2000.

EXHIBIT 2
Beta to US 10-Year Treasury in Equity Crashes



	Yield Beta			Return Beta		
	5-Year	20-Year	Difference	5-Year	20-Year	Difference
All Periods	0.87	0.94	0.07 (0.46)	0.47	1.55	1.07 (7.30)**
Pre-2000	1.09	0.67	–0.42 (–2.40)	0.66	0.92	0.26 (1.09)
Post-2000	0.77	1.04	0.26 (1.49)	0.42	1.69	1.26 (9.06)**

*Note: t-stats for differences in 20-year versus 5-year betas are included in parentheses. **Statistical significance at 99%.*
Source: Bloomberg and authors' calculations.

somewhat abstract.[3] For a more nuanced perspective, we turn to event studies and analyze bond results across episodes of stock-market stress. We follow Gulko (2002) and tabulate yield-curve changes and constant-maturity bond returns during 22 market crashes, defined as single-day periods in which the S&P 500 fell by 5% or more. The online appendix provides detailed descriptions of each episode, and Exhibit 2 provides a graphical summary.

The data yield two main insights. First—as Gulko (2002) did—we find a flight to quality effect in which yields tend to fall during market crashes. Ten-year yields fell in 16 of the 22 crashes and declined even in the first part of our sample when the general trend of stock-yield correlations was still negative. Second, yield curves have tended to fall in parallel during sharp market declines. Panel A of Exhibit 2 plots changes in 5- and 20-year yields as a function of changes in 10-year yields across the 22 crashes. The yield beta (i.e., sensitivity to changes in 10-year yields) for 20-year Treasuries has been slightly higher (0.94) than that for 5-year Treasuries (0.87), but the difference is not statistically significant. We also observe modest differences in yield betas before and after 2000, but these differences were again not statistically significant.[4]

The combination of flight to quality and parallel yield-curve shifts during market crashes has resulted in

[3] See Phoa (2015) for a discussion of asset correlations in stressed markets.

[4] Interestingly, 20-year Treasuries have had higher yield betas than 5-year Treasuries since the turn of the century. This stands in contrast to the 1962–1999 period, in which the yield beta of 5-year Treasuries was higher, but is consistent with the research of Hanson, Lucca, and Wright (2018), who found markedly greater movement in long-maturity Treasuries since 2000.

EXHIBIT 3
US Yield-Curve Dynamics in Equity Downturns

Date			Change in Yields (%)				Bond Returns		
Peak	Trough	S&P 500 Return	Policy Target	5-Year	10-Year	20-Year	5-Year	10-Year	20-Year
January 2, 1962	June 26, 1962	–26.3%	0.3	–0.17	–0.09	–0.06	2.7%	2.7%	2.8%
August 22, 1962	October 23, 1962	–10.5%	–0.1	0.01	–0.01	–0.03	0.6%	0.8%	1.1%
February 9, 1966	October 7, 1966	–22.2%	1.4	0.29	**0.28**	0.22	2.3%	1.2%	0.5%
September 25, 1967	March 5, 1968	–10.1%	0.9	0.13	**0.21**	0.21	2.1%	1.0%	0.0%
November 29, 1968	May 26, 1970	–36.1%	1.3	2.32	**2.44**	2.07	1.4%	–6.4%	–11.9%
April 28, 1971	November 23, 1971	–13.9%	–0.8	–0.09	–0.10	–0.16	4.2%	4.6%	5.6%
January 11, 1973	October 3, 1974	–48.2%	3.5	1.83	**1.61**	1.74	5.8%	1.7%	–3.9%
November 7, 1974	December 6, 1974	–13.6%	0.0	–0.34	–0.15	–0.06	2.0%	1.7%	1.3%
July 15, 1975	September 16, 1975	–14.1%	0.0	0.74	**0.61**	0.61	–1.5%	–2.5%	–4.2%
September 21, 1976	March 6, 1978	–19.4%	1.6	0.81	**0.54**	0.52	7.6%	7.9%	6.8%
September 12, 1978	November 14, 1978	–13.6%	1.4	0.49	**0.53**	0.41	–0.4%	–1.9%	–2.3%
October 5, 1979	November 7, 1979	–10.2%	4.0	1.61	**1.40**	1.23	–4.9%	–7.3%	–9.1%
February 13, 1980	March 27, 1980	–17.1%	6.0	1.89	**1.11**	0.79	–4.9%	–4.5%	–4.2%
November 28, 1980	August 12, 1982	–27.1%	–7.0	0.36	**0.83**	0.97	26.7%	22.0%	18.8%
October 10, 1983	July 24, 1984	–14.4%	1.5	2.12	**1.98**	1.76	2.4%	–0.9%	–2.5%
August 25, 1987	December 4, 1987	–33.5%	0.1	0.03	**0.21**	0.14	2.4%	1.3%	1.5%
October 9, 1989	January 30, 1990	–10.2%	–0.8	0.42	**0.48**	0.49	0.9%	–0.6%	–2.1%
July 16, 1990	October 11, 1990	–19.9%	0.0	0.20	**0.48**	0.62	1.3%	–0.9%	–3.4%
October 7, 1997	October 27, 1997	–10.8%	0.0	–0.03	–0.03	0.00	0.5%	0.6%	0.4%
July 17, 1998	August 31, 1998	–19.3%	0.0	–0.58	–0.46	–0.40	3.2%	4.3%	5.6%
July 16, 1999	October 15, 1999	–12.1%	0.3	0.42	**0.41**	0.48	–0.3%	–1.5%	–3.6%
March 24, 2000	October 9, 2002	–49.1%	–4.3	–3.86	–2.59	–1.64	34.5%	40.0%	41.1%
November 27, 2002	March 11, 2003	–14.7%	0.0	–0.80	–0.66	–0.59	4.6%	6.7%	9.2%
October 9, 2007	March 9, 2009	–56.8%	–4.5	–2.48	–1.78	–1.10	16.6%	21.6%	22.3%
April 23, 2010	July 2, 2010	–16.0%	0.0	–0.79	–0.84	–0.74	4.2%	8.0%	11.3%
April 29, 2011	October 3, 2011	–19.4%	0.0	–1.10	–1.52	–1.64	6.0%	15.5%	28.4%
May 21, 2015	August 25, 2015	–12.4%	0.0	–0.05	–0.07	–0.17	0.7%	1.2%	3.3%
November 3, 2015	February 11, 2016	–13.3%	0.3	–0.48	–0.60	–0.59	2.8%	6.2%	10.5%
January 26, 2018	February 8, 2018	–10.2%	0.0	0.10	**0.19**	0.24	–0.4%	–1.5%	–3.4%
September 20, 2018	December 24, 2018	–19.8%	0.5	–0.38	–0.33	–0.27	2.6%	3.7%	5.0%

Notes: Bold font indicates periods in which 10-year yields increased. Policy target rate is the Fed funds rate.
Source: Bloomberg and authors' calculations.

significant diversification gains from longer-maturity bonds. Panel B of Exhibit 2 plots 20-year and 5-year Treasury returns as a function of 10-year Treasuries and illustrates a crash beta of 1.55 for 20-year Treasuries relative to 10-year Treasuries, roughly consistent with the magnitude of incremental duration.

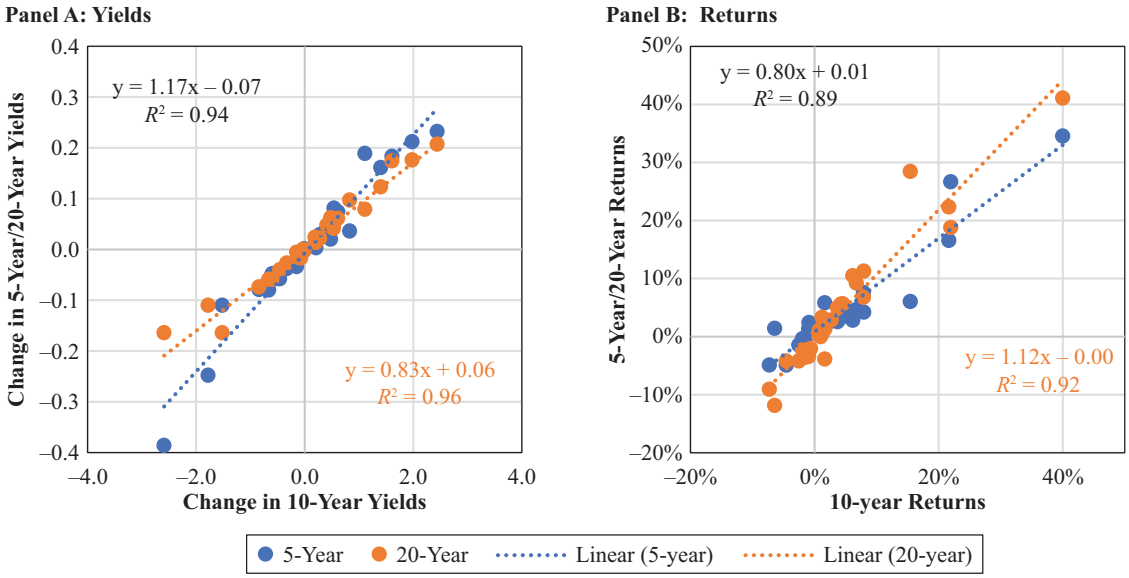
Results over Prolonged Equity Downturns

Market crashes are often not just isolated events and are instead usually symptomatic of market turbulence. Ten of the 22 crashes were clustered around the Lehman bankruptcy during the global financial crisis, and four crashes occurred in the late part of 1987 into early 1988. Therefore, we expand our analysis from single-day events to extended market downturns. Exhibit 3 tabulates 30 periods in which the S&P 500 declined by 10% or more from peak to trough, reporting both changes in yields across the curve and the return of constant-maturity Treasuries.

A comparison of single-day crashes and prolonged downturns reveals several differences in equity results

EXHIBIT 4

Beta to US 10-Year Treasury in Equity Downturns



	Yield Beta			Return Beta		
	5-Year	20-Year	Difference	5-Year	20-Year	Difference
All Periods	1.17	0.83	–0.34 (–4.17)**	0.80	1.12	0.31 (2.84)**
Pre-2000	1.10	0.89	–0.21 (–2.21)*	0.99	1.01	0.02 (0.15)
Post-2000	1.37	0.67	–0.70 (–2.76)*	0.84	1.03	0.19 (1.01)

Note: t-*stats for differences in 20-year versus 5-year betas are included in parentheses. * and ** represent statistical significance at 95% and 99%, respectively.*

Source: Bloomberg and authors' calculations.

and yield-curve dynamics depending on the duration of equity stress. First, bear markets and corrections tend to be quite prolonged and painful. The average episode lasted 204 days, and the most prolonged correction—the dot-com crash—persisted for almost 3 years. Our sample includes 22 periods in which the market declined by 10% to 20% and includes eight bear markets in which the losses exceeded 20%. Investors would have lost as much as 48.2% of their savings in 1973–1974 and 56.8% during the financial crisis in 2007–2009. These periods are therefore critical to evaluating diversification potential.

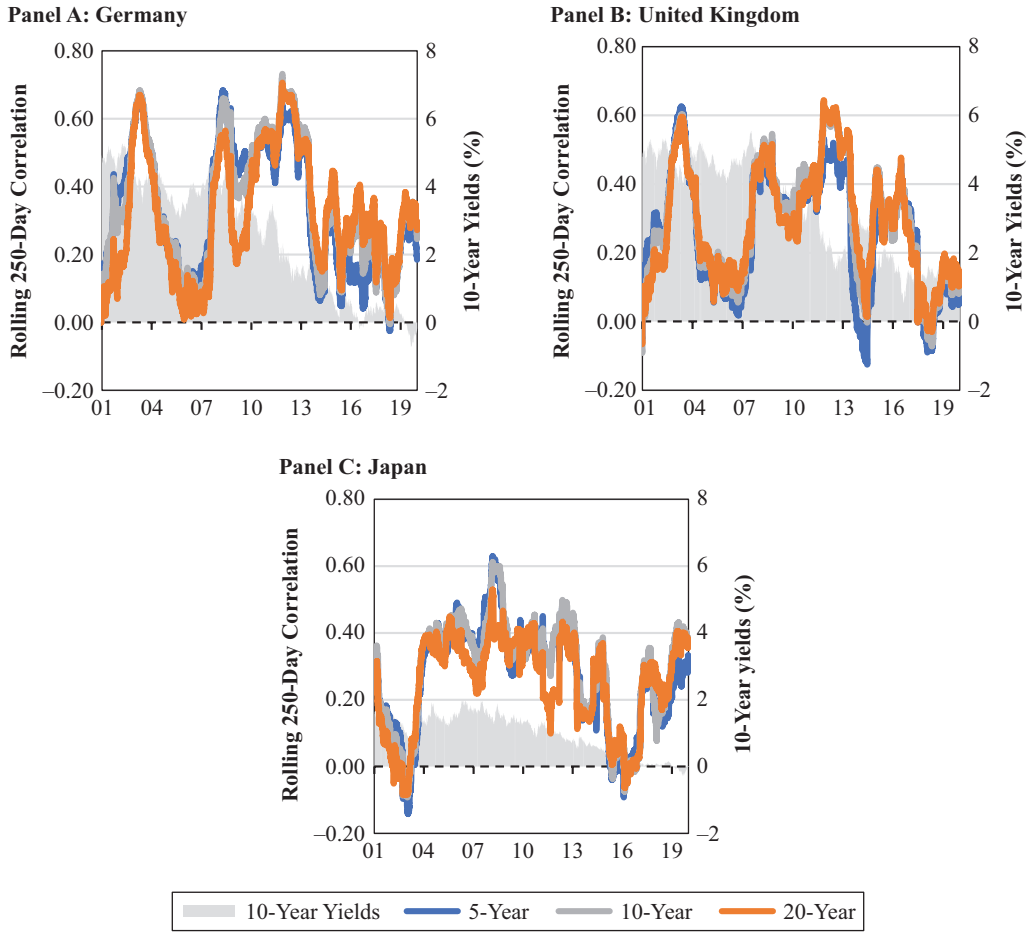
Second, although yields typically declined during sharp single-day crashes, the pattern of yield movements over prolonged corrections closely matched the stock–bond correlation regime. Ten-year yields rose in 16 of the 30 prolonged declines and only began to decline consistently during in the post-2000 period.

Third, the yield sensitivity of long-duration bonds has been far less over longer stress periods than during a single-day crash. Panel A of Exhibit 4 finds 10-year yield betas of only 0.83 for 20-year Treasuries, compared with 1.17 for 5-year bonds. We observe similar differences in yield betas in the pre- and post-2000 data, and all differences are statistically significant at 95% confidence. This implies that the yield curve tends to steepen during periods of falling rates (20-year yields fall less than 5-year yields) and flatten in periods of rising rates (in which 20-year yields increase less than 5-year yields).

The steepening yield curve has significantly reduced the strategic diversification from long-duration bonds in episodes when investors might need it most. Panel B of Exhibit 4 reveals only marginally higher

EXHIBIT 5

Basic Features of Constant-Maturity Government Bonds in Germany, the United Kingdom, and Japan



	Germany			UK			Japan		
2000–2019	5-Year	10-Year	20-Year	5-Year	10-Year	20-Year	5-Year	10-Year	20-Year
Equity Correlation	0.39	0.39	0.34	0.31	0.32	0.30	0.28	0.28	0.23

Note: The 10-year yields are plotted on the right-hand side.

Source: Bloomberg and authors' calculations.

return betas of 1.12 for 20-year Treasuries in comparison with 10-year bond returns across the market downturns.

STOCK–BOND DIVERSIFICATION IN GERMANY, THE UNITED KINGDOM, AND JAPAN

Although US markets provide long-term data to evaluate diversification, we evaluate yield-curve dynamics in Germany, the United Kingdom, and Japan to strengthen our insights. As before, we evaluate diversification profile of 5-, 10-, and 20-year constant maturity government bonds in each country relative to the local equity market (represented by the DAXK, FTSE 100, and TOPIX indexes in Germany, the United Kingdom, and Japan, respectively).

Exhibit 5 describes the evolution of yields and stock–bond correlations over the past 20 years (2000–2019), for which we have a consistent data set available

across countries. The chart suggests several similarities with US Treasury dynamics described earlier.

First, each market has exhibited substantial yield compression (right-hand scale), resulting in high returns for long-duration bonds. Ten-year yields fell most in Germany but also fell in Japan, despite much lower starting levels, and have been negative in both economies since 2019. Second, yield changes have been positively correlated with equities in each country, suggesting similar and significant diversification benefits from government bonds. Correlations between 10-year bonds and equities have been 0.39 in Germany, 0.32 in the United Kingdom, and 0.28 in Japan. Finally, the correlations between yields and equity returns have been almost indistinguishable across the curve in all countries. The difference in equity correlations between 10-year and 20-year bonds ranged from 0.05 in Germany and Japan to 0.02 in the United Kingdom.

We isolate bear markets (20% or greater loss from peak to trough) and corrections (10%–20% loss) for investors in local equities in each country. Details are provided in the online appendix. We report 21 such downturns in Germany, 12 in the United Kingdom, and 14 in Japan; these were often synchronized across markets. This was evident during the major market dislocations, such as the dot-com crash and the credit crisis in 2010, 2015, and the fourth quarter of 2018. The former two episodes, of course, stand out with losses of 50% or higher, but German, Japanese, and UK investors would have experienced four, three, and one additional bear corrections in local markets, respectively. These episodes of extreme stock-market volatility illustrate the importance of thoughtful diversification strategies.

Exhibit 6 reveals substantial diversification benefits from government bonds over the past 20 years. Yields have almost always declined during market downturns; 10-year yields increased by more than 0.1% only once in the United Kingdom and Germany, respectively, and never increased in Japan. Second, yield declines have been quite substantial; particularly in Germany and the United Kingdom, 10-year rates declined by over 1.0% on three occasions in each country—2000–2001, credit crisis, and 2011—leading to double-digit gains in each episode. Interestingly, although Japanese yields have been positively correlated to equities, yields have fallen by far less than in other countries. The decline in 10-year yields averaged 0.23% across all episodes, compared with 0.44% and 0.62% for Germany and the United Kingdom, respectively. This again highlights the importance of going beyond correlations in evaluating diversification.

Despite high-level similarities in the level of interest-rate changes, Panel A of Exhibit 6 illustrates important differences in slope changes across countries.

EXHIBIT 6

Beta to 10-Year Bonds in Equity Downturns (Germany, United Kingdom, Japan)

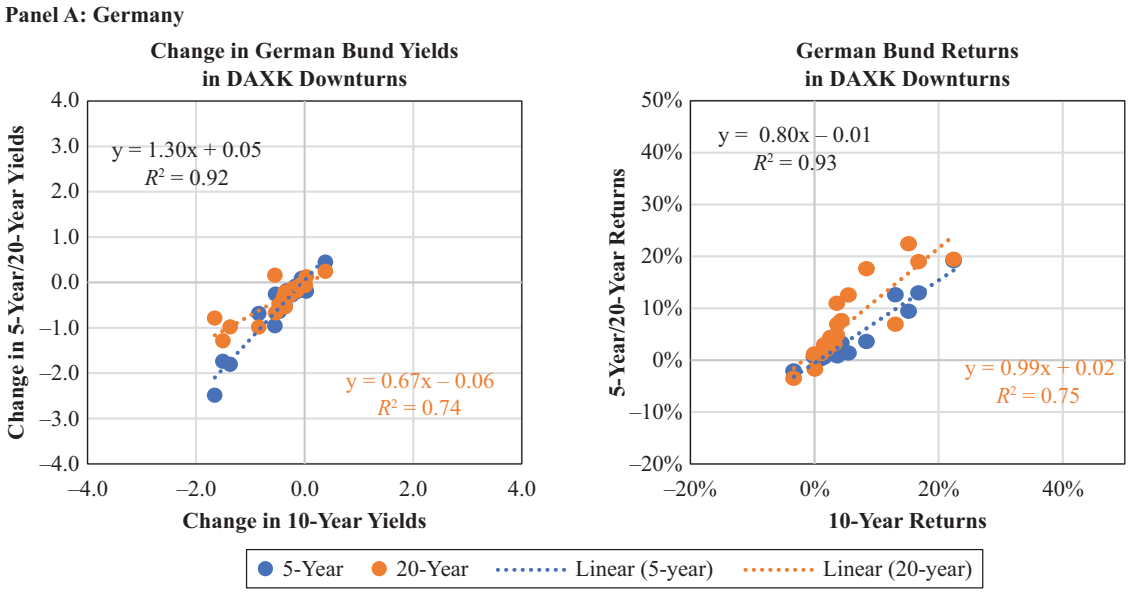


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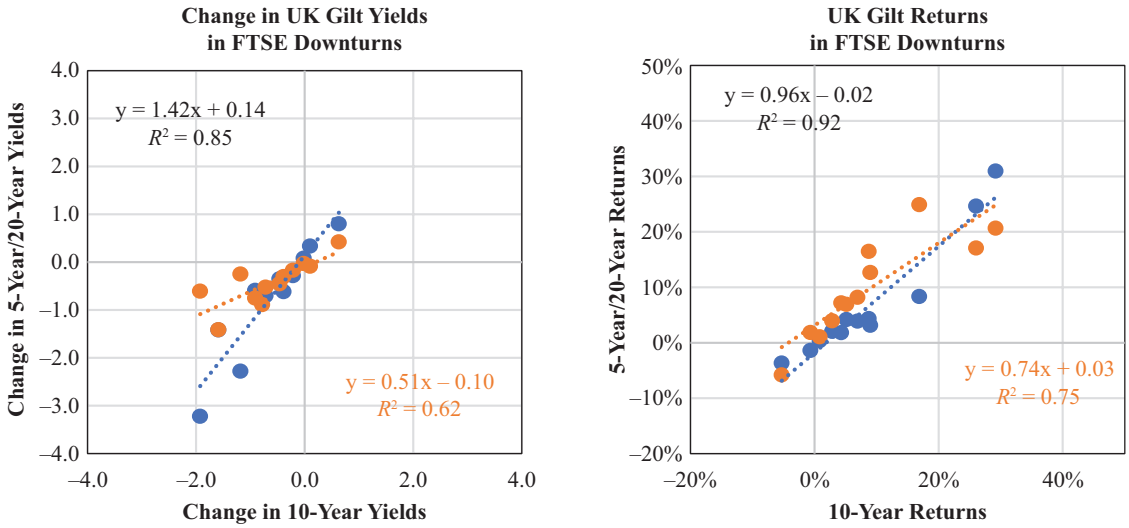
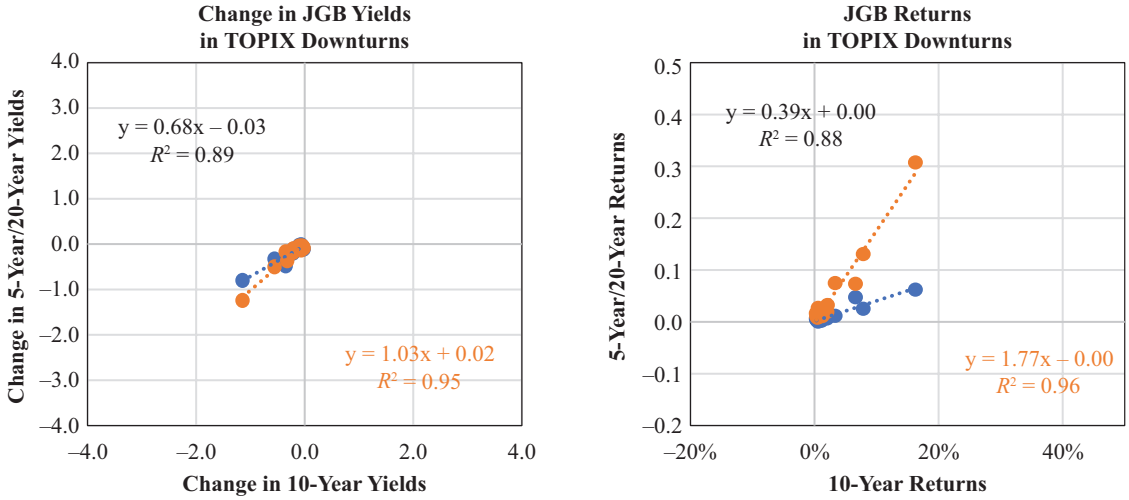
EXHIBIT 6 *(continued)*

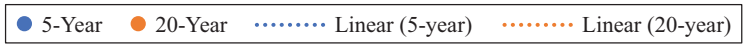
Beta to 10-Year Bonds in Equity Downturns (Germany, United Kingdom, Japan)

Panel B: United Kingdom



Panel C: Japan





	Yield Beta			Return Beta		
	5-Year	20-Year	Difference	5-Year	20-Year	Difference
Germany	1.30	0.67	–0.63 (–3.62)**	0.80	0.99	0.19 (1.09)
UK	1.42	0.51	–0.91 (–2.92)*	0.96	0.74	–0.22 (–0.98)
Japan	0.68	1.03	0.36 (3.05)*	0.39	1.77	1.39 (10.02)**

Note: t-*stats for differences in 20-year versus 5-year betas are included in parentheses. * and ** represent statistical significance at 95% and 99%, respectively.*

Source: Bloomberg and authors' calculations.

Yield curves steepened during market downturns in Germany and the United Kingdom—as they did in the United States—but instead flattened in Japan. Twenty-year yields had betas of 1.03 to 10-year yields in Japan, as compared with 0.67 in the Germany and only 0.51 in the United Kingdom. The Japanese yield curve flattened substantially in the 2000–2003 period, but even excluding this episode, yield betas for 20-year bonds exceeded those for 5-year securities. The differences in yield betas between 5-year and 20-year bonds exhibit a high degree of statistical significance in each country, with *t*-stats around 3 or higher.

As in the case of the United States, these differences in yield-curve dynamics have important implications for diversification potential. Panel B of Exhibit 6 suggests the estimated improvement in return for 20-year bonds over 10-year bonds—as measured by best-fit linear regression—was 77% in Japan but about neutral in Germany (return beta of 0.99) and provided 26% lower estimated returns in the United Kingdom. In fact, 20-year bonds in the United Kingdom substantially underperformed both 5- and 10-year bonds in both the dot-com crash and the credit crisis.

IMPACT OF MONETARY POLICY

Our results suggest a weak strategic case for maturity extension because the average incremental benefits have been low, particularly in comparison to risks, if stock–bond correlations were to turn positive. Yield curve steepening has also resulted in the weakest incremental benefit in periods with the steepest market declines, where investors need diversification most. At the same time, we observe a wide range of potential outcomes from longer-maturity bonds and several episodes with notable improvements when the yield curve moved lower in parallel or even flattened. What explains these differences?

Theory suggests that monetary policy is a key determinant and can influence yield curves through a variety of channels. For example, central banks traditionally seek to ease monetary policy by lowering overnight policy rates. Although the expectations hypothesis states that long-term rates are simply an average of expected future short-term rates, easy monetary conditions can drive up future inflation, and market participants might anticipate that policy tightening will follow. As a result, long-term yields often fall less than short-term rates during monetary expansions, resulting in a steeper yield curve. See Cook and Hahn (1989) and Kuttner (2001) for empirical studies of monetary policy and yields and Goodfriend (1993) for a narrative of inflation scares in the 1980s and 1990s that caused long-term and short-term yields to diverge.

Recently, of course, as policy rates have moved toward an effective lower bound, many central banks have turned to large-scale asset purchase programs or QE as their primary tool of monetary policy. The Bank of Japan instead introduced QE from 2001 to 2006. The Federal Reserve and Bank of England followed suit in the aftermath of the 2008–2009 credit crisis and introduced QE in March 2009. Japan reintroduced QE in April 2013 and continued asset purchases through 2019, and the European Central Bank engaged in QE from March 2015 to January 2019. The online appendix provides a detailed description of central bank actions over the last 20 years.

QE typically involves balance sheet expansion by printing money and a subsequent maturity extension swapping bills for long-maturity bonds. In contrast to conventional easing, QE might be expected to flatten yield curves because the central bank directly intervenes at the long end of the curve.[5] See Bhattarai and Neely (2016), Haldane et al. (2016), or Gagnon (2016) for surveys of QE, describing theoretical models and their impact on asset prices.

To evaluate the impact of monetary policy, Exhibit 7 assigns each of the 77 stock-market downturns across countries into one of three monetary-policy categories.

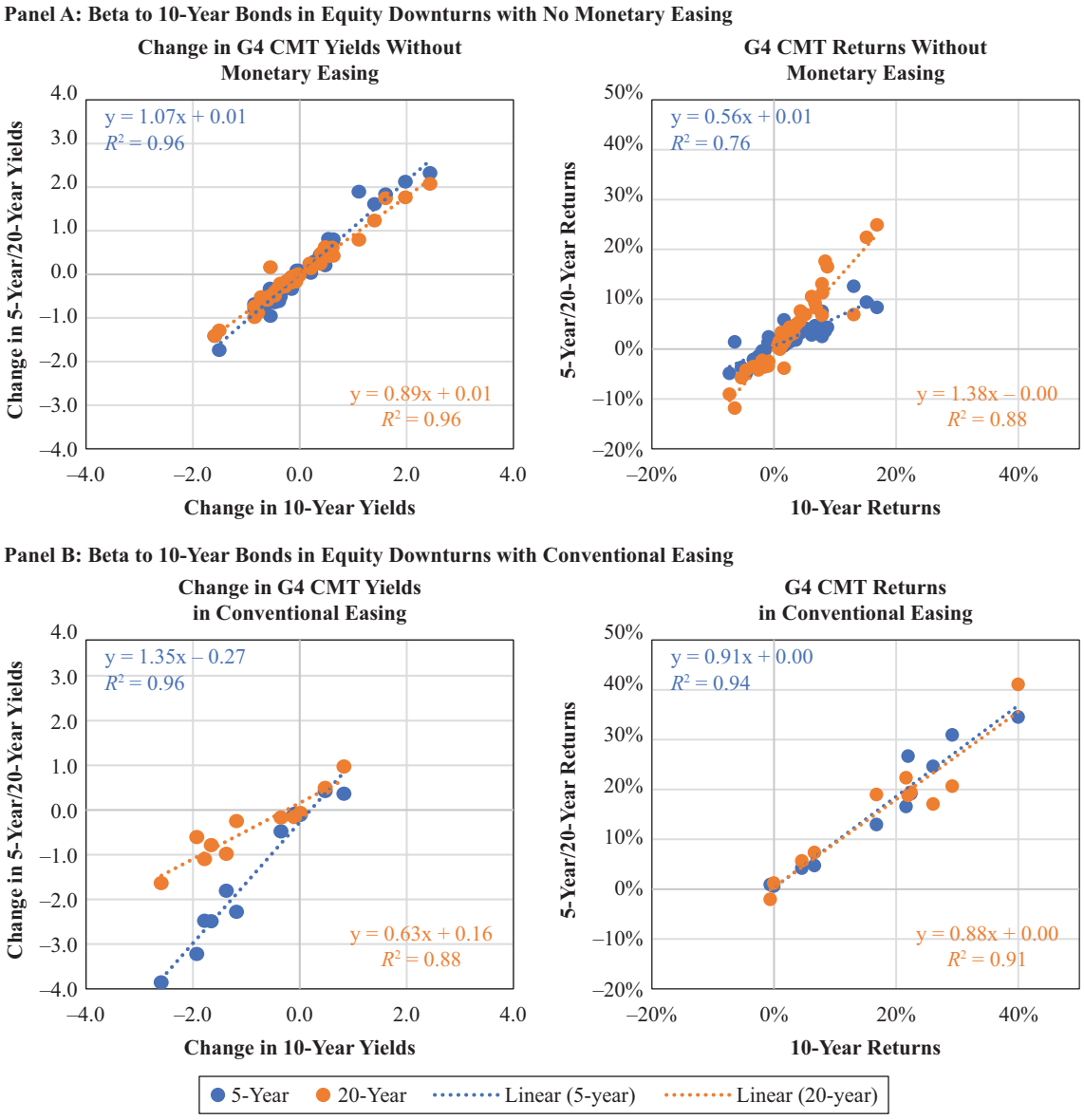
[5] Theory suggests at least three channels for yield-curve flattening. The signaling channel suggests that long-duration bond purchases reflect a credible commitment by the central bank to keep rates low and lower long-term yields by pushing out the path of expected future hikes. Proponents of the duration channel suggest that large-scale bond purchases lower the aggregate duration risk faced by market participants, bringing down the term premium for all duration-bearing assets. Finally, the local supply channel argues that bonds of different maturity are not perfect substitutes for one another (i.e., investors have preferred habitats), and so a reduction in the supply of long-duration bonds (e.g., through central bank purchases) should reduce the term premium on these assets. Both the duration and local supply channels thus suggest reductions in term premium. However, the latter suggests narrow effects, primarily for the assets that are the closest substitutes for central bank purchases. This in turn implies that both the quantity of QE and the maturities of bonds purchased determine impact. See D'Amico and King (2013) or Krishnamurthy and Vissing-Jorgensen (2013) for more discussion.

Conventional easing downturns are those in which the central bank lowered its policy rate by 0.25% or more; QE downturns are those episodes in which the central bank was actively engaged in an asset-purchase program; no-easing downturns are periods without any monetary stimulus. We document 11 downturns with conventional easing, 17 with QE—nine of which were in Japan—and 49 episodes with no monetary easing. The data suggest strong monetary policy influences with several differences depending on the monetary environment.

First, although yields typically fall during monetary easing, in its absence, they have often increased. Barring inflation scares in 1980 and 1990, central banks have successfully used monetary policy to bring down 10-year yields in equity downturns. In contrast, 10-year yields increased in 16 of the 49 downturns in which monetary policy was absent.

EXHIBIT 7

Impact of Monetary Policy on Yields in Equity Downturns (United States, Germany, United Kingdom, Japan)

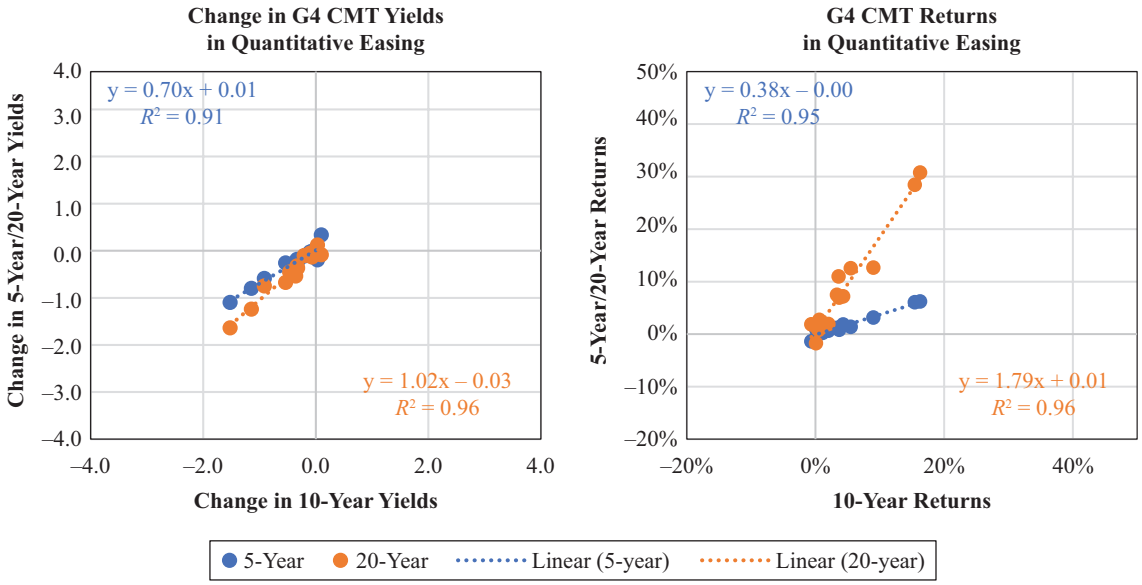


(continued)

EXHIBIT 7 *(continued)*

Impact of Monetary Policy on Yields in Equity Downturns (United States, Germany, United Kingdom, Japan)

Panel C: Beta to 10-Year Bonds in Equity Downturns with Quantitative Easing



	Yield Beta			Return Beta		
	5-Year	20-Year	Difference	5-Year	20-Year	Difference
No Monetary Easing	1.07	0.89	–0.18 (–3.63)**	0.56	1.38	0.82 (7.19)**
Conventional Monetary Easing	1.35	0.63	–0.73 (–4.49)**	0.91	0.88	–0.03 (–0.22)
Quantitative Easing	0.70	1.02	0.32 (3.45)**	0.38	1.79	1.40 (12.84)**

*Note: t-stats for differences in 20-year versus 5-year betas are included in parentheses. **Statistical significance at 99%.*

Source: Bloomberg and authors' calculations.

Second, yields have moved most during conventional easing. Ten-year yields fell by over 1% in 6 of 11 conventional easing episodes, compared with only two instances each, in periods of QE (United States in 2011 and Japan in 2000) and no monetary easing (Germany in 2011 and the United Kingdom in 2011[6]), respectively. As a result, the biggest diversification gains from bonds came in periods of conventional easing, with returns greater than 20% in half the episodes.

Third, and most important, the slope of the yield curve changed markedly across the different monetary policy regimes. Twenty-year bonds exhibited the greatest sensitivity to 10-year yields in periods of QE, with a yield beta of 1.02, compared with 0.89 without any monetary easing and only 0.63 in periods of conventional easing. We observe similar variation in 5-year yields but with opposite sensitivities: Five-year yields moved the least during periods of QE (yield beta of 0.70) but over two times as much as 20-year bonds during conventional monetary easing (yield beta of 1.35). The differences in 5-year and 20-year yield beta were significant at 99% confidence in all three monetary policy regimes. As a result, the yield curve steepened significantly in periods of conventional easing, flattened modestly in periods of QE, and fell more or less in parallel when policy easing was absent.

Exhibit 8 formally evaluates the drivers of yield-curve dynamics using regressions that relate changes in 20- versus 5-year term spreads to changes in 10-year yields.

[6] Although the European Central Bank and the Bank of England were not explicitly easing in these episodes, the US Federal Reserve was actively engaged in QE and may have exerted global pressures. See Haldane et al. (2016).

EXHIBIT 8

Regression Analysis of Term Spreads in Equity Downturns (United States, Germany, United Kingdom, Japan)

	Model 1	Model 2	Model 3	Model 4
Intercept α	0.04	0.04	0.02	0.05
	(0.68)	(0.96)	(0.36)	(1.34)
Δ $yield_{10y}$	–0.40	–0.18	–0.13	–0.25
	(–5.87)**	(–2.95)**	(–1.88)	(–3.52)**
Δ $yield_{10y}$ × Conventional Easing		–0.73	–0.70	–0.47
		(–7.55)**	(–7.47)**	(–4.30)**
QE		0.58	0.55	0.26
		(3.65)**	(3.31)**	(1.49)
Germany			–0.06	–0.25
			(–0.50)	(–1.95)
UK			–0.31	–0.53
			(–2.57)*	(–4.20)**
Japan			0.05	–0.07
			(0.21)	(–0.30)
Low Policy Rates				0.56
				(3.65)**
R^2	31.5%	70.3%	73.1%	77.4%

Notes: $\Delta(yield_{20y} - yield_{5y}) = \alpha + \beta_0 \times \Delta yield_{10y} + \Sigma_i \beta_i \times z_i \times \Delta yield_{10y}$, *where* z_i *represent dummy variables. We run four sets of pooled regressions evaluating changes in 20-year versus 5-year term spreads during stock market downturns against changes in 10-year yields and dummy variables for countries and monetary policy regimes.* t-*stats are included in parentheses. * and ** represent statistical significance at 95% and 99%, respectively.*

Source: Bloomberg and authors' calculations.

Model 1 simply regresses term spreads on changes in 10-year yields, while Model 2 includes dummy variables for monetary policy. Each dummy variable (z_i) takes on a value of one (zero otherwise) for stress periods associated with conventional easing and QE, respectively, and interacts with changes in 10-year yields to determine changes in slope, as summarized in Equation 1.

$$\Delta(yield_{20y} - yield_{5y}) = \alpha + \beta_0 \times \Delta yield_{10y} + \sum_i \beta_i \times z_i \times \Delta yield_{10y} \quad (1)$$

The data reveal several interesting insights. First, changes in slope (i.e., 20- vs. 5-year term spreads) display a statistically significant and negative relationship with changes in level (i.e., 10-year yields). The regression in Model 1 suggests that a 1% decline (increase) in 10-year yields should result in a steepening (flattening) of 0.4%. It also predicts that more aggressive central bank intervention—as might be expected during major market crises—should cause more substantial steepening.

Second, our monetary easing dummy variables pick up highly significant *t*-stats in Model 2, and their inclusion more than doubles the explanatory power of the regressions (70.3% compared with 31.5%). Regression loadings on 10-year yields remain negative and statistically significant but slightly lower, such that a 1% decline in 10-year yields is associated with only 0.18% of steepening in the absence of any monetary easing. Consistent with depictions in Exhibit 7, the regression suggests that conventional easing will exaggerate yield curve steepening, whereas QE counterbalances this tendency. In particular, a 1% decline in rates predicts 0.91% (−0.18% − 0.73%) steepening in periods of conventional easing and a 0.4% (−0.18% + 0.58%) flattening effect if the central bank instead employs QE.

We consider two additional regression specifications in Exhibit 8 to evaluate the robustness of monetary policy impact. First, Model 3 includes country dummy variables that take a value of one (zero otherwise) for stress periods that occur in Germany, the United Kingdom, and Japan and interact with changes in 10-year yields. Regression loadings on conventional easing and QE remain statistically significant and largely the same as before. Interestingly, the regression predicts a statistically significant bias toward yield-curve steepening for stress periods in the United Kingdom. For example, the model predicts that a 1% decline in rates will steepen yield curves by 0.31% more in the United Kingdom than in other countries. This may be a function of inflation expectations. Because inflation has been higher and more variable in the United Kingdom than in the other countries in our sample, monetary easing could plausibly lead to a greater rise in long-term inflation expectations, causing long-term rates to fall to a lesser extent. As an illustration, 5-year breakeven inflation averaged 2.7% in the United Kingdom from 2009 to 2019, compared with 1.8%, 1.0%, and 0.3%, respectively, in the United States, Germany, and Japan.

Second, because global rates have been at very low levels over recent history, we test whether the level of policy rates drives observed yield-curve dynamics. Specifically, Model 4 includes an additional dummy variable that takes a value of one for stress periods that occur

when policy rates are near zero, defined as 0.5% or less. Indeed, low policy rates matter and predict statistically significant yield-curve flattening. Interestingly, the statistical significance of QE declines once low policy rates are included as a variable. This suggests that perhaps the market anticipates unconventional monetary policy as rates approach an effective lower bound.

The structure of yield dynamics in Exhibit 8 can explain our primary results. The largest market downturns have been associated with conventional monetary easing, resulting in a steepening yield curve and thus only marginal gains for longer-duration bonds. The significant returns to 20-year Japanese bonds in the early 2000s seem anomalous at first blush but came in an environment of unconventional monetary policy and so, in retrospect, should have been expected. Finally, in periods without any monetary easing—whether single-day crashes or prolonged downturns—yield curves might be expected to move in parallel, even rising if inflation expectations increase.

IMPLICATIONS FOR INVESTORS

Our results suggest that investors should be judicious in extending the maturity of their portfolio. Because the incremental benefit of maturity extension is strongly linked to the macroeconomic environment, duration management may be best as an active investment discipline. Although much existing research has emphasized the role of inflation expectations in driving changes in the level of rates, our work illustrates how expectations of monetary policy influence the shape of the yield curve. Longer-maturity bonds may be best in periods in which inflation uncertainty is low and there is little expectation of conventional monetary easing.

The design of an active trading strategy is beyond the scope of this article, yet we might offer three practical suggestions for investors seeking to enhance portfolio diversification. First, our research is focused on stock–bond co-movement, yet any choice of long-duration versus intermediate-duration bonds must also incorporate an evaluation of expected future return. Long-duration bonds have materially outperformed intermediate-duration bonds over the past 20 years because QE has compressed long-term yields. Yet many market participants expect long-duration bonds to underperform intermediate bonds in the future, as illustrated in surveys of capital market projections (see, e.g., Horizon Actuarial 2019).

Second, a vast collection of research suggests that the yield curve itself contains useful information to aid investors in managing duration. Campbell (1995) found that steep yield curves are associated with higher bond returns; Estrella (2005) suggested links between the slope of the yield curve and inflation/output/monetary policy; and Ang, Piazzesi, and Wei (2006) highlighted the importance of short rates for business cycle turning points. Exhibit 9 graphs the slope of the yield curve (measured as the difference between 10-year and 3-month yields) in relation to the Fed funds rate and illustrates a remarkable relationship: A flat yield curve (lower slope) is often suggestive of weaker output and inflation and has typically been followed by monetary easing.[7] This in turn has resulted in subsequent yield-curve steepening and weaker relative returns from longer-duration bonds. Steeper yield curves have thus portended higher returns for longer-maturity bonds and more favorable environments for maturity extension.

Finally, investors need not constrain themselves to simply choosing between long- and intermediate-maturity bonds. Derivatives can help investors select both the appropriate degree of interest rate exposure and the desired exposure to specific parts of the yield curve. For example, 10-year Treasury futures are one of the most liquid instruments and offer the opportunity to extend duration without investing in the ultra-long end of the yield curve. Similarly, investors can profit from expectations of yield-curve steepening without increasing duration by purchasing 2-year Treasury futures and selling a duration-equivalent amount of 10-year futures.

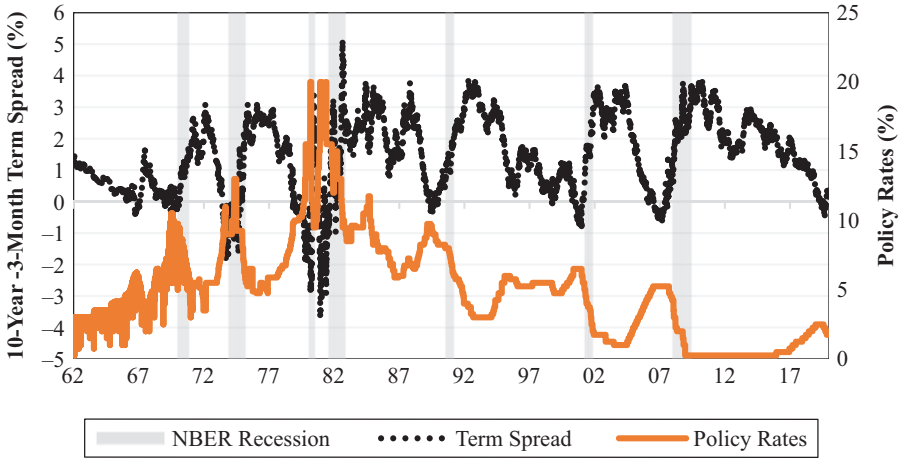
CONCLUSION

Existing research on stock–bond diversification focuses on correlations and suggests that inflation expectations are an important driver. Because inflation expectations have stabilized and stock–bond correlations have turned consistently negative across all

[7] We observe similar results from other recession gauges. For example, Chauvet and Piger (2008) recession probabilities—calculated using a Markov switching model applied to nonfarm payrolls, industrial production, real personal income, and real manufacturing—were also at elevated levels during each of the largest monetary easing episodes in our sample.

EXHIBIT 9

Term Spreads and Policy Rates in the United States



Source: Bloomberg and authors' calculations.

maturities, it is natural that many investors have been drawn to long-duration bonds as an equity hedge.

Our research uses event studies to evaluate bond returns in periods of equity stress and highlights the role of yield-curve dynamics in determining incremental gains from maturity extension. Our findings suggest a more judicious approach to duration and curve management and offer three important insights.

First, we document significant variation in yield-curve dynamics across episodes of stock-market stress. Although all rates tend to fall during sharp equity crashes, US, German, and UK yield curves steepened considerably over prolonged downturns, whereas Japanese yields flattened.

Second, long-duration bonds have offered mixed diversification benefits. Despite greater interest-rate sensitivity, 20-year bonds had estimated returns similar to 10-year bonds during equity downturns in the United States and Germany, were 26% lower in the United Kingdom, and only outperformed in Japan.

Third, yield-curve dynamics are linked to factors including monetary policy, expected inflation, and the shape of the yield curve. For example, conventional monetary easing has often led to the highest diversification gains from Treasuries because bonds rally when central banks cut interest rates. However, large reductions in short-term policy rates also portend increasingly steep yield curves, limiting the benefits of maturity extension. In contrast, quantitative easing has tended to flatten yields, boosting the value of long-maturity bonds. These findings suggest that duration management may be best as an active investment discipline.

ACKNOWLEDGMENTS

We benefited greatly from discussions with our colleagues at Capital Group—particularly Negar Golkari Hagh, Wesley Phoa, Fergus Macdonald, and Joyce Lang—and are grateful for suggestions from our anonymous reviewer.

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ADDITIONAL READING

Extreme Correlations and Optimizing for Stress

Wesley Phoa

The Journal of Portfolio Management
https://jpm.pm-research.com/content/41/2/71

ABSTRACT: *Asset correlations often change significantly during periods of financial market dislocation. This article describes a rigorous way of deriving a covariance matrix for use in stressed market environments. This lets investors apply standard mean–variance techniques to analyze investment strategy under extreme conditions. Applications include risk management and constructing optimally defensive portfolios for stressed markets. The method is based on recent advances in multivariate extreme-value theory.*

Stock-Bond Correlations

ANTTI ILMANEN

The Journal of Fixed Income
https://jfi.pm-research.com/content/13/2/55

ABSTRACT: *The correlation between stock market and government bond returns was positive through most of the 1900s, but negative in the early 1930s, the late 1950s, and recently. If the trend is sustained, the shift to a negative correlation should boost government bond valuations owing to bonds' attractive hedging characteristics. This exploration of sources of stock-bond correlation examines asset class behavior in different economic conditions. Growth and volatility shocks tend to push stocks and bonds in opposite directions, while inflation shocks tend to cause common discount rate variation across asset classes. The latter effect dominated in the variable inflation levels of 1960–1990 and kept stock-bond correlations positive. As long as inflation rates remain low, low correlations should prevail. Correlations become even more negative during deflationary recessions, equity weakness, and high-volatility flight to quality periods.*

Asset Allocation in a Lower Stock-Bond Correlation Environment

FREDERICK E. DOPFEL

The Journal of Portfolio Management
https://jpm.pm-research.com/content/30/1/25

ABSTRACT: *The correlation between stock and bond returns plays a critical role in asset allocation decisions and in the effectiveness of stock-bond diversification in reducing portfolio risk. During the last few years, the realized stock-bond correlation has trended lower than historical norms, and the current 36-month rolling estimate is significantly negative, while most analysts still assume a moderately positive equilibrium estimate for expected correlation. Many investors are now questioning their assumptions about correlation and whether lower correlation will continue. This decoupling of stock and bond returns combined with aggressive asset allocation strategies has contributed to deterioration in pension plan funded ratios, producing unfavorable impacts for investors with an economic liability. The various strategic and tactical asset allocation issues related to a continued low correlation environment have an impact on investor welfare in an asset-only and an asset-liability framework. For investors, low stock-bond correlation is beneficial in an asset-only context, but detrimental in the case of a bond-like liability, especially if there is significant underfunding of the liability.*