Deficits, the Fed, and rising interest rates: Implications and considerations for bond investors

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Executive summary. This paper addresses three related questions:

- Why are long-term U.S. interest rates, such as the 10-year Treasury yield, below 4%, given the expected future path of U.S. government debt levels and the Federal Reserve's "exit strategy"? More pointedly, don't long-term rates *have* to rise dramatically?
- How might bond funds perform in the event that rates do rise over the next several years?
- Is it not prudent to re-allocate one's bond portfolio defensively into shorter-maturity funds before rates start rising?

We begin by deconstructing the yield on a 10-year Treasury bond into its components, including inflation expectations, anticipated Fed policy, and the effects of changes in bond supply (i.e., deficits) and demand. Our deconstruction reveals that the expected upward pressure from the fiscal deficit on long bond rates has been offset so far by increased bond demand arising from a higher domestic savings rate.

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Our interest-rate deconstruction also provides a basis for assessing the *future* economic scenario that is "priced into" today's bond valuations (and hence into the forward yield curve). On the basis of this analysis, we discuss why expectations for future interest-rate movements seem generally plausible.

That said, history suggests that rates will likely evolve quite differently from what is expected today, as the forecasting track record of the futures market is notoriously poor. Consequently, we calculate implied future returns for Treasury and corporate bond benchmarks over 1-, 5-, and 10-year investment horizons based on alternative but plausible macroeconomic, fiscal, and Fed policy scenarios. We find that, most broadly, those scenarios that produce the highest relative returns in the short run (such as a double-dip recession scenario) would be expected to produce the lowest relative returns over the long run. Conversely, scenarios in which rates rise more than is currently expected (such as from a fiscal crisis or a run-up in inflation) could actually produce the highest relative nominal returns over a 10-year period.

The results of our scenarios, together with the performance of various bond segments over the past several years, underscore the benefits of a broadly diversified fixed income portfolio regardless of the future direction of interest rates. A key lesson of the global financial crisis is that implementing a too narrow or "surgical" bond allocation (such as by shortening duration or investing solely in riskier bond instruments) involves important trade-offs that may expose investors to unintended yield-curve or credit risks, while potentially depriving them of a higher or less volatile future income stream. The high uncertainty surrounding the future direction of economic growth, the deficit, inflation, and interest rates would seem to support greater fixed income diversification, not less.

Introduction

Recent cash flows into bond mutual funds and ETFs have been very strong. According to Morningstar, through the first three quarters of 2009 these flows were fairly well diversified across shorter-maturity and longer-maturity bond funds in both the taxable and municipal categories (see **Figure 1**, on page 4). More recently, a slightly higher percentage of bond cash flows has gone to short-term funds. This is fairly atypical for an environment of extremely low short-term yields.

One of the likely catalysts for this trend has been increased demand from money market investors in search of higher yields. With the Federal Reserve maintaining its federal funds rate target close to 0%, monetary policymakers have made it extremely difficult for many savers to generate sufficient income from their money market accounts. In this sense, savers unfortunately remain the "sacrificial lambs" of U.S. monetary policy as the Federal Reserve attempts to stimulate other segments of the economy.

Another probable influence is increasing concern among bond investors that mounting government debt levels will eventually drive up longer-term U.S. interest rates, which at present are below their historical averages (see **Figure 2**, on page 4). In addition, the futures market expects the Federal Reserve to begin raising short-term rates before the end of 2010 as the U.S. recovery strengthens.

A note on the charts

The charts in this paper are based on market forward rates generated by use of a formula commonly cited in textbooks and other sources.* Forward rates are not projections; rather, they are mathematically derived from the current market valuations for bonds of different maturities. Forward rates do not represent any individual's or organization's views about future interest rates. Instead, they are normally interpreted as a collective expectation of the entire bond market. (As the paper points out, that collective expectation is frequently wrong.)

Important notes about risk

All investments are subject to risk. Past performance is no guarantee of future results. Investments in bonds are subject to interest rate, credit, and inflation risk. While U.S. Treasury or government agency securities provide substantial protection against credit risk, they do not protect investors against price changes due to changing interest rates. Foreign investing involves additional risks including currency fluctuations and political uncertainty. Diversification does not ensure a profit or protect against a loss in a declining market.

An investment in a money market fund is not insured or guaranteed by the Federal Deposit Insurance Corporation or any other government agency. Although a money market fund seeks to preserve the value of your investment at $1 per share, it is possible to lose money by investing in such a fund.

*This is the formula for forward rates employed on the Bloomberg website:

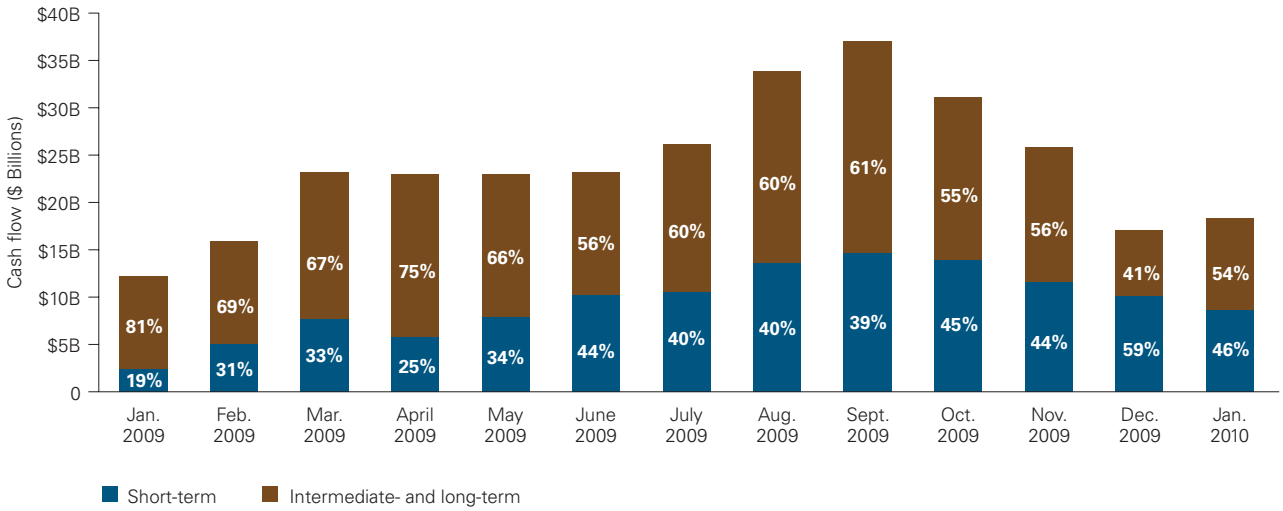
f = [(FV-1) / (d2-d1)] * 360

where:
f = forward rate (simple interest, ACT/360)
d1 = number of days from the settlement date to the start date of the forward period
d2 = number of days from the settlement date to the end date of the forward period
FV = future value. The formula is: (1 + [(r2*d2)/360]) / (1 + [(r1*d1)/360])

where:
r1 = the spot rate for d1 days (simple interest)
r2 = the spot rate for d2 days (simple interest)

Figure 1. Monthly bond fund and ETF cash flows, January 2009–January 2010

Morningstar monthly municipal, government, and investment-grade fund and ETF cash flows

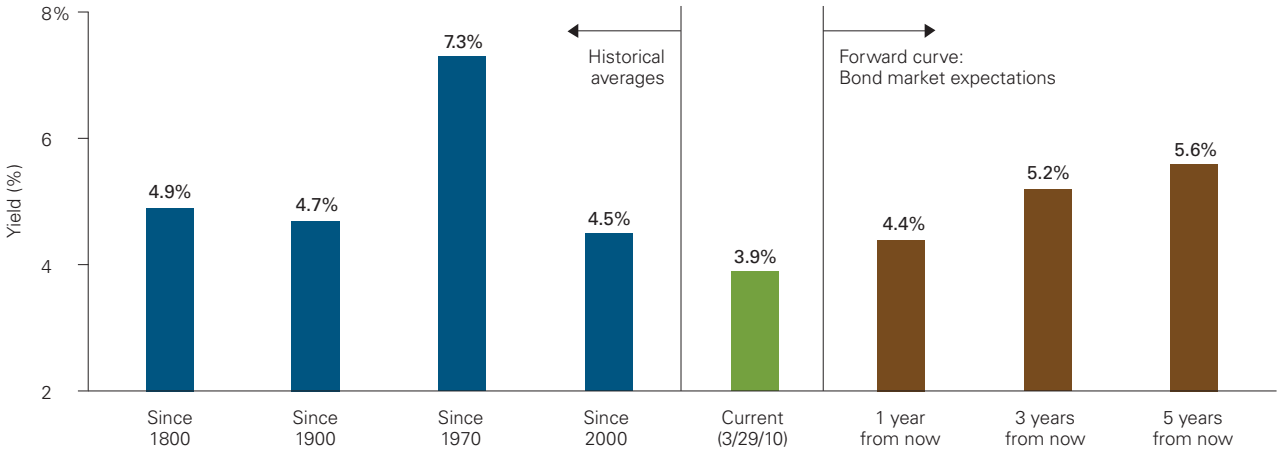


Note: **Short-term funds and ETFs** include the following Morningstar categories: Muni Single State Short, Muni National Short, Short Government, and Short-Term Bond. **Intermediate- and long-term funds and ETFs** include the following Morningstar categories: Muni California Intermediate/Short, Muni Massachusetts, Muni Minnesota, Muni National Intermediate, Muni New Jersey, Muni New York Intermediate/Short, Muni Ohio, Muni Pennsylvania, Muni Single State Intermediate, Muni New York Long, Muni California Long, Muni National Long, Muni Single State Long, Intermediate Government, Long Government, Intermediate-Term Bond, and Long-Term Bond.

Sources: Morningstar and Vanguard.

Figure 2. A source of consternation

The current, historical average, and implied future yield on the 10-year Treasury bond

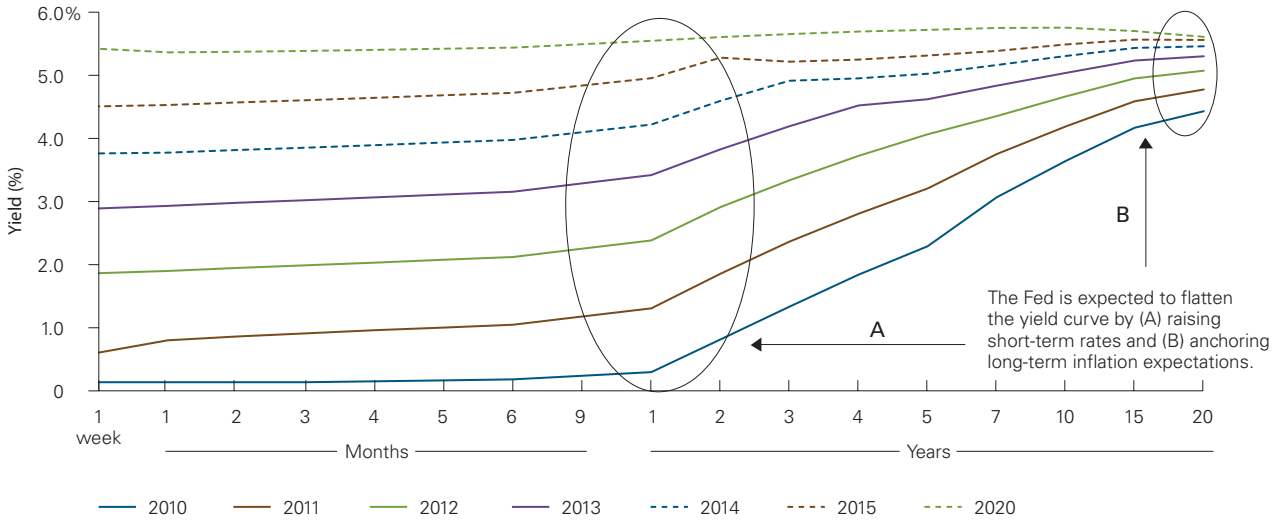


Note: Calculations are based on data available as of March 29, 2010.

Sources: Bloomberg, Federal Reserve, and Global Financial Data.

Figure 3. The implied evolution of the U.S. Treasury yield curve—a bear flattening

Spot curve as of February 28, 2010, and selected forward curves



Source: Bloomberg.

Viewing these concerns together, some bond investors may hope that the total returns on shorter-duration funds will be relatively insulated in the event that *both* short and long rates rise by the same amount (that is, a parallel upward shift in interest rates).

In light of these uncertainties, it's natural for bond investors to wonder whether they should act defensively by reshaping their fixed income allocation with a narrow or "surgical" focus on mitigating risk. To provide better perspective and grounds for discussion, we begin by examining how the market expects interest rates to move and how various government bond indexes might perform if those expectations were met.

How might interest rates evolve in the years ahead?

Figure 3 shows the bond market's expectations for future interest rates along the entire yield curve. These implicit expectations—often referred to as the forward yield curve or simply *forward rates*—can be derived from current U.S. Treasury bond prices. In essence, the forward curve can be considered the set of "break-even" yields that equalizes the rates of return from Treasury bonds across the entire maturity spectrum. An important—and often misunderstood—implication of Figure 3 is that if the yield changes of the forward curve are realized, then all Treasury bonds—*regardless of their maturity*—will earn the same holding-period return.[1]

1 For a more detailed and technical discussion of forward rates and yield-curve dynamics, see Ilmanen (1996) and Davis and Aliaga-Díaz (2007).

Given the dramatic steepness of today's yield curve (as measured by the difference between the 10-year Treasury yield and the yield on the 3-month T-bill), the bond market expects the yield curve to flatten significantly in the years ahead. The "bear flattening" scenario in Figure 3 shows that the majority of the interest rate adjustment is expected to occur in short rates, not long rates. As an example, the 2-year Treasury yield is expected to rise strongly over the next five years as the Federal Reserve normalizes monetary policy, driving the 2-year note from its February 2010 spot yield of 0.81% to 5.28% in February 2015. The yield on a 20-year constant-maturity Treasury bond is expected to rise less dramatically, from the February 2010 spot yield of 4.43% to 5.56% in February 2015.

In short, the Treasury security market has already "priced in" a Fed tightening cycle that flattens the yield curve in such a manner that the expected return on, say, a short-term Treasury portfolio would be approximately the same as for a longer-duration Treasury portfolio.

As illustrated in **Figure 4**, this flattening of the yield curve would be similar to what occurred following the end of the last low-rate environment (2003–2004). Starting in 2004, the Federal Reserve raised short-term rates in stages from 1.00% to 5.25%, while the yield on the 10-year Treasury hardly changed. The Fed chief then, Alan Greenspan, called this situation a "conundrum" because it differed from other Fed rate-tightening cycles, such as that of 1994, when longer-term yields rose almost in tandem with the rise in the federal funds rate. However, others have argued that the conundrum episode was precisely how a tightening cycle should operate under a credible central bank that effectively anchors long-term inflation expectations—the primary driver of long bond yields.

Are the market's current expectations reasonable?

A natural question, of course, is whether the bond market's expectations for future long Treasury bond yields are reasonable. In light of the concerns over U.S. fiscal deficits and the Fed's exit strategy, many investors may find it perplexing that a 10-year Treasury bond yields less than 4% today and is expected to yield only about 5.5% in 2015 (recall Figure 2). More pointedly, don't long-term rates *have* to rise more dramatically than that in response to the large and growing national debt? In short, the answer is *No, not necessarily*.

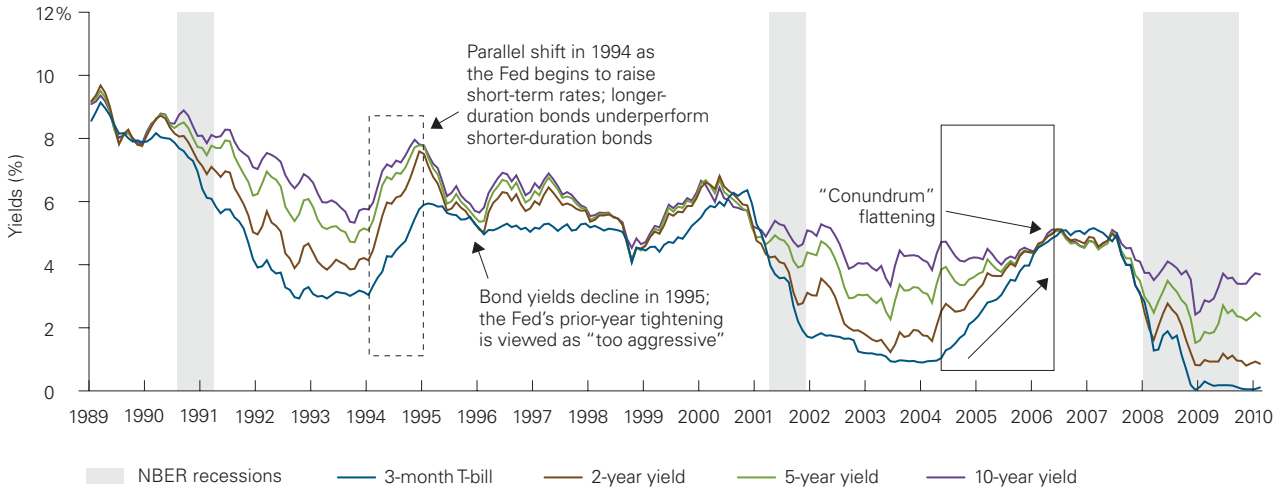
It is important to recognize that the relationship between U.S. government debt levels and long government bond yields is mixed and has varied dramatically over time. **Figure 5** shows the yearly levels of debt and interest rates in the United States since the late 1860s. As is evident visually, the average correlation between long bond yields and federal debt levels has been *zero*.

In fact, were one to graph the current relationship between debt-to-GDP ratios and long government bond yields *across countries*, it would show a strikingly similar correlation of zero. The reason for the general absence of a close association between debt and interest rates is that there is only a weak link between deficits and inflation, at least in developed markets (Catao and Terrones, 2003). The weakness of the link is attributed in part to cross-country differences in central-bank credibility, economic size, domestic private savings rates, and perception of *future* fiscal prudence.

Japan, for instance, has one of the lowest long-bond yields in the world despite having the highest debt-to-GDP ratio. An explanation is that Japan's long-term inflation expectations remain close to 0% (if not outright deflationary), and investors (mostly Japanese private citizens) have been willing to fund the government debt.

Figure 4. The yield curve tends to flatten when the Fed sufficiently tightens policy

Various constant-maturity Treasury yields since January 1989



Sources: Federal Reserve and National Bureau of Economic Research.

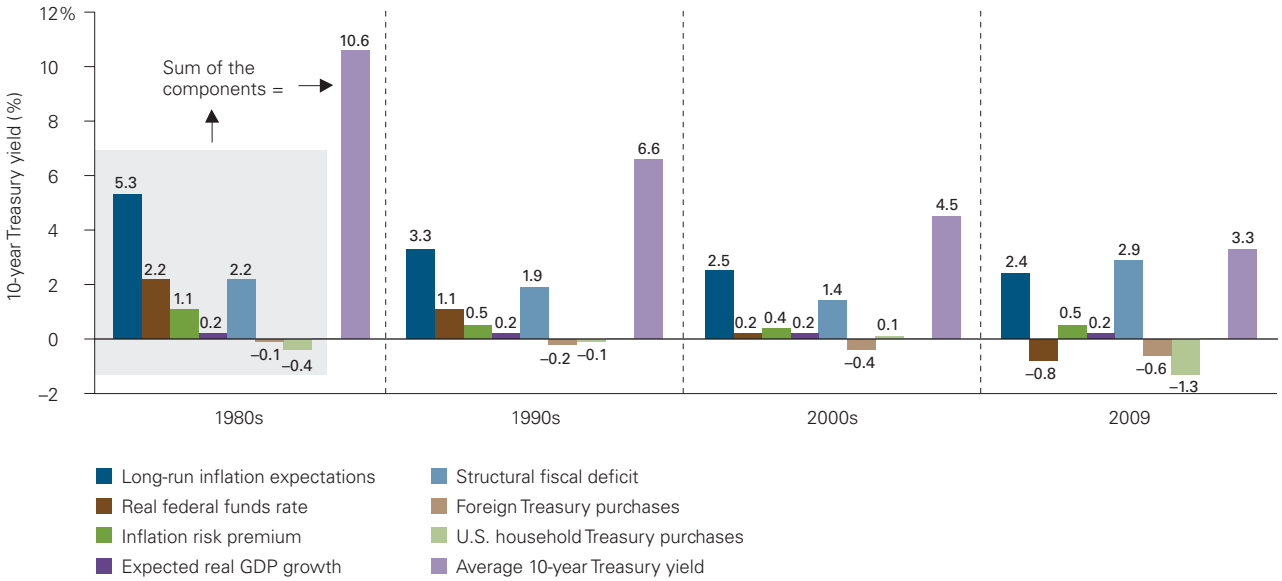
Figure 5. Government debt and government bond yields

U.S. gross debt-to-GDP ratio and U.S. long-term interest rates, 1869–2009

Sources: Vanguard calculations based on annual data from Global Financial Data, the Federal Reserve Board, the U.S. Census Bureau, and the U.S. Bureau of Labor Statistics.

Figure 6. Decomposing the 10-year Treasury yield

Average decomposition in percentage points by decade and in 2009



Note: The 10-year yield decomposition is based on the coefficients for the variables listed above that were estimated from a multivariate regression on quarterly data, imposing a long-run co-integrated relationship among long-run inflation expectations, the 10-year Treasury yield, and the federal funds rate. For details of a similar methodology used by the Federal Reserve, see Warnock and Warnock (2009). To minimize potential reverse-causality bias in the response of domestic Treasury purchases to changes in interest rates, we have implemented a two-stage least squares (2SLS) estimator that uses the U.S. household savings rate and lags of the other independent variables as instruments.

Sources: Vanguard calculations based on data from the Congressional Budget Office, the Federal Reserve, the Federal Reserve Bank of Philadelphia, the U.S. Bureau of Labor Statistics, and the U.S. Census Bureau.

What explains the current level of yields? Deconstructing the yield curve

To better understand both the current level of long rates and the market's expectation for these rates, we deconstruct the yield on a constant-maturity 10-year Treasury bond into its various components. These include:

- Long-term inflation expectations.
- Uncertainty over those inflation expectations (i.e., an inflation risk premium).
- Expected future Fed policy, as expressed in the inflation-adjusted federal funds rate.
- Expected real GDP growth.
- The effects of changes in bond supply (i.e., the structural deficit[2]).
- The effects of changes in bond demand (especially from foreign central banks and U.S. investors).

2 The model focuses on the *structural* budget deficit as calculated by the Congressional Budget Office. The structural deficit measures the financing needs the government faces using the assumption that the economy is permanently at full employment. While in theory *any* deficit financing should depress bond prices and *increase* bond yields, periods of rising deficits usually coincide with periods of economic weakness and loose monetary policy, both of which tend to *decrease* yields. Thus, the correlation between regular budget deficits and interest rates can be misleading, as it does not factor in the stance of monetary policy.

Our statistical decomposition is based on a model following the work of various Federal Reserve researchers, including Laubach (2007) and Warnock and Warnock (2009). **Figure 6** presents the decomposition of the average yield on the 10-year Treasury bond for the decades of the 1980s, the 1990s, and the 2000s, as well as for the year 2009.

A significant finding shown in Figure 6 is that the expected upward pressure from the fiscal deficit on long bond rates in 2009 has been offset (at least thus far) by increased bond demand arising from a *higher domestic savings rate*. By our estimates, this recent suppressant of long bond yields has been as powerful as the so-called "global savings glut" that Fed Chairman Ben Bernanke and others believe helped to keep long yields low throughout the past decade. According to the Federal Reserve's Flow of Funds data, households and U.S. mutual funds owned approximately 20% of all U.S. Treasury securities outstanding in the third quarter of 2009, versus 14% in 2007 before the crisis.

If the U.S. savings rate stays elevated in the years ahead, future long bond yields may not rise as strongly as some investors now fear. The behavior of Japanese interest rates today and of U.S. rates during World War II is a reminder of the powerful influence that a higher domestic savings rate can have on a government's borrowing costs. Another critical factor going forward will be the effectiveness of future monetary *and fiscal* policies in maintaining stable long-term inflation expectations. As is clear from Figure 6, inflation expectations are the largest single component of long-term interest rates.[3]

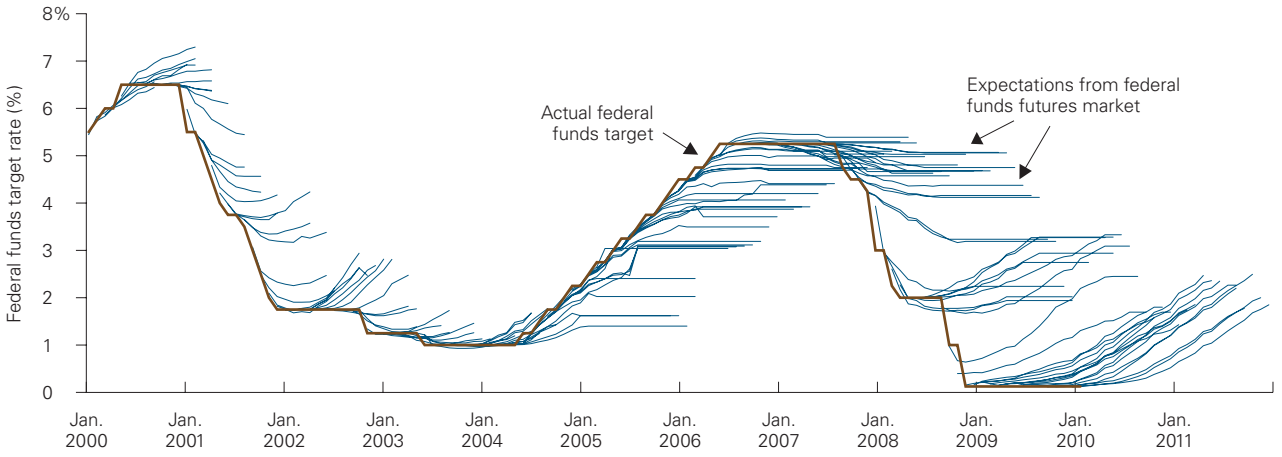
Bond market expectations seem reasonable, but they are often wrong

Our interest rate decomposition not only sheds more light on the factors influencing the *current* level of long Treasury bond yields but also provides a basis for assessing the *future* economic scenario that is priced into today's bond valuations (and hence into the forward yield curve). By combining the decomposition in Figure 6 with the market's expectation that the 10-year Treasury yield will rise to approximately 5.5% in 2015 (recall Figure 2), it can be shown empirically that the anticipated bear flattening is consistent with the following scenario over the next five years:

1. The Federal Reserve raises the fed funds rate to a more "neutral" level of approximately 4% by 2015. This is the current expectation in the fed funds futures market.
2. GDP growth expectations rise modestly though 2015 as the nascent economic recovery becomes self-sustaining.
3. The expected rate of long-term CPI inflation remains anchored at 2.5%, although the uncertainty surrounding that expectation (i.e., the inflation risk premium) rises modestly over time.
4. Foreign central banks continue to purchase U.S. Treasuries, but their share decreases as they continue to diversify their reserve holdings.
5. Domestic investors help to finance the high structural deficit through an elevated savings rate of approximately 5%, thereby alleviating some (but not all) of the pressure on long-term rates.

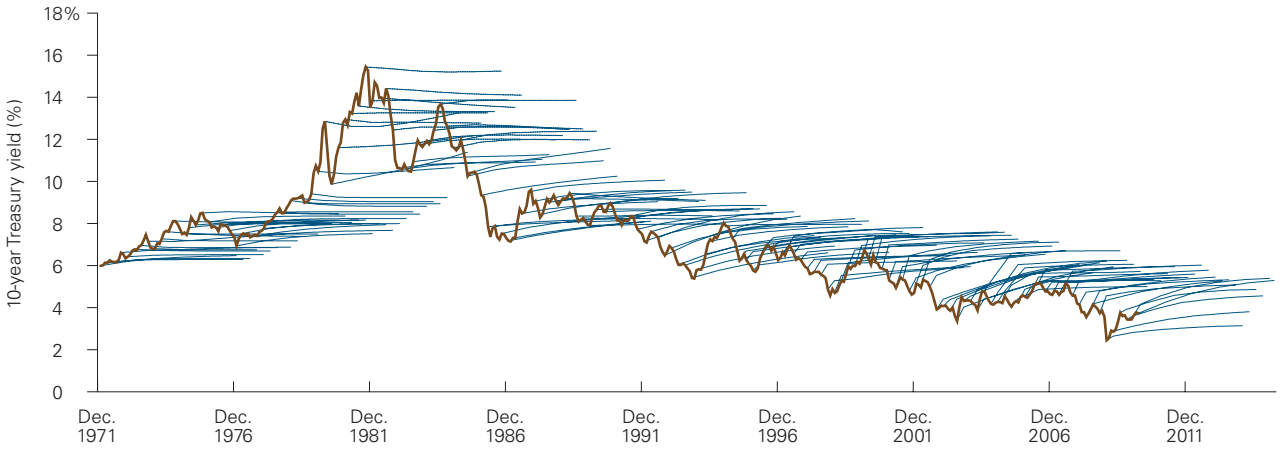
3 See Vanguard white papers by Davis (2007) and Davis and Cleborne (2009) for additional comments on the importance of—and future risks to—U.S. inflation expectations.

Figure 7. Actual federal funds target rate versus market expectations



Sources: Monthly Federal Reserve and Bloomberg data for the federal funds futures market since January 2000.

Figure 8. Actual 10-year Treasury yield versus implied forward rate



Sources: Monthly data since January 1971 provided by Bloomberg, the Federal Reserve, and Vanguard.

As such, the bond market's expectations for the future shape of the yield curve seem reasonable. Of course, history suggests that rates will likely evolve differently from what is expected today. Indeed, we show that the Treasury forward yield curve—as with other interest rate forecasts—has been a poor predictor of actual future rates.[4] This has been the case for both short rates (**Figure 7**) and long rates (**Figure 8**).

In light of this information, how should bond investors think about the risks to current market rate expectations?

Implied bond index performance under various future interest rate scenarios

Figure 9, on page 12, presents *hypothetical* future annualized total returns over 1-, 5-, and 10-year investment horizons for four short- and intermediate-term indexes commonly used as benchmarks by taxable bond funds:

- Barclays Capital U.S. 1–5 Year Treasury Index.
- Barclays Capital U.S. 5–10 Year Treasury Index.
- Barclays Capital U.S. 1–5 Year Credit Index.
- Barclays Capital U.S. 5–10 Year Credit Index.

Recognizing that the number of distinct future yield-curve scenarios is nearly infinite, we chose five potential scenarios from 10,000 simulations generated by the Vanguard Capital Markets Model for a calculation of implied returns. Figure 9 presents the results. For simplicity, the return calculations were based on yield changes only at 12-month intervals, while the maturities used to calculate future index durations were chosen based on the closest available constant-maturity Treasury yield. Details of the scenario assumptions are listed with Figure 9.

These simulations have several important implications for long-term bond investors.

Most broadly, *the scenarios that produce the highest short-run returns would be expected to produce the lowest long-run returns*. A good example is the so-called double-dip scenario; for long-term investors, Scenario 4 would likely be the most troubling. In this scenario, the present low-rate environment persists indefinitely as the economy falls back into recession and suffers from a decade-long malaise similar to what Japan has experienced for the past two decades. Indeed, it is this very outcome that the Federal Reserve has endeavored to avoid.

Conversely, scenarios in which rates rise more in 2011 than is currently expected actually produce the highest relative nominal 10-year returns. For instance, short-term bond indexes have lower returns in Scenario 3 than in Scenario 1 because the Fed raises rates more quickly and aggressively than is presently expected by the market. Yet in Scenario 3, long-run inflation expectations remain well anchored, and thus intermediate-term bond indexes have similar 10-year returns in both scenarios.

Indeed, the scenario that is perhaps the most feared by many bond investors (Scenario 5) is also the one with the highest expected return over a 10-year horizon. Naturally, under this "fiscal crisis" scenario all bond indexes would be expected to suffer significantly negative returns in the short run as interest rates rise sharply. However, over time the higher Treasury and corporate yields would provide a higher absolute income stream, as many fixed income investments eventually did in the 1970s and early 1980s.

4 For a more detailed and technical discussion of interest rate predictability, again please see Ilmanen (1996) and Davis and Aliaga-Díaz (2007), as well as the citations therein.

Figure 9. Implied Treasury and corporate bond returns under alternative scenarios

Barclays Capital Treasury and Credit Index benchmarks

	Implied future annualized returns		
	1 year (ending 2/2011)	5 years (ending 2/2015)	10 years (ending 2/2020)
Scenario 1: Treasury forward yield curve is realized			
1–5 Year Treasury Index	–0.6%	1.2%	3.1%
5–10 Year Treasury Index	–1.8	1.2	3.2
1–5 Year Credit Index	–0.5	1.4	4.0
5–10 Year Credit Index	0.9	2.3	4.0
Scenario 2: Federal Reserve on hold for longer than expected			
1–5 Year Treasury Index	0.7%	1.0%	3.1%
5–10 Year Treasury Index	2.8	1.6	3.3
1–5 Year Credit Index	3.1	1.0	4.2
5–10 Year Credit Index	6.2	3.6	5.5
Scenario 3: "Preemptive" Federal Reserve is more aggressive than expected			
1–5 Year Treasury Index	–1.1%	3.4%	3.7%
5–10 Year Treasury Index	–4.2	1.8	3.2
1–5 Year Credit Index	–2.3	3.4	4.0
5–10 Year Credit Index	0.8	3.5	5.4
Scenario 4: Double-dip scenario in 2011; Japan-type economic stagnation thereafter			
1–5 Year Treasury Index	1.4%	2.0%	2.1%
5–10 Year Treasury Index	11.9	4.0	2.5
1–5 Year Credit Index	0.5	2.4	3.2
5–10 Year Credit Index	8.5	6.4	5.1
Scenario 5: Fiscal and inflation concerns accelerate dramatically; all rates rise			
1–5 Year Treasury Index	–1.4%	2.6%	3.9%
5–10 Year Treasury Index	–12.1	0.8	4.5
1–5 Year Credit Index	–2.9	3.0	4.7
5–10 Year Credit Index	–12.4	1.8	6.5

Sources: Barclays Capital, Bloomberg, Federal Reserve, and Vanguard.

IMPORTANT NOTES: These hypothetical data do not represent the returns on any particular investment. The projections or other information generated by Vanguard Capital Markets Model® simulations regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results from the model may vary with each use and over time.

Description of investment simulation tool: The Vanguard Capital Markets Model (VCMM) is a proprietary financial simulation tool. Part of the tool is a dynamic module that employs vector autoregressive methods to simulate forward-looking return distributions on a wide array of broad asset classes, including stocks, taxable bonds, and cash. For the VCMM simulations in Figure 9, we used market data available through February 28, 2010, for the Treasury spot yield curves. The VCMM then created projections based on historical relationships of past realizations among the interactions of several macroeconomic and financial variables, including the expectations for future conditions reflected in the U.S. term structure of interest rates. The projections were applied to the following Barclays Capital U.S. bond indexes: 1–5 Year Treasury Index, 1–5 Year Credit Index, 5–10 Year Treasury Index, and 5–10 Year Credit Index. Importantly, taxes are not factored into the analysis.

Limitations: The projections are based on a statistical analysis of February 2010 yield curves in the context of relationships observed in historical data for both yields and index returns, among other factors. Future returns may behave differently from the historical patterns captured in the distribution of returns generated by the VCMM. It is important to note that our model may be underestimating extreme scenarios that were unobserved in the historical data on which the model is based.

Scenario details: For simplicity, the return calculations were based only on yield changes at 12-month intervals. Specifically, the formula for the implied hypothetical return = Starting Yield - (Starting Duration * (Ending Yield – Starting Yield)), where Duration = ((1–(1+Yield)^(-Maturity))/(1 – (1+Yield)^(–1))). The index maturities used to calculate future index durations were chosen based on the closest available constant-maturity Treasury yield as follows: the 3-year Treasury constant-maturity yield for the Barclays 1–5 Year Credit Index (3.1 years maturity), and the 7-year Treasury constant-maturity yield for the Barclays 5–10 Year Credit Index (7.7 years maturity).

Details on Scenario 1: The 3-year and 7-year Treasury yields rise at a pace similar to that currently implied by the forward curve. Of course, the simulated interest rate paths in this scenario possess more year-to-year volatility than that implied by the forward curve. As a result, the expected returns of the Barclays 1–5 Year Treasury Index and the Barclays 5–10 Year Treasury Index are similar over the intermediate and long run. Overall, this scenario ranks in the 30%–40% percentile of the VCMM projected average return distribution at a one-year horizon, and ranks near the median 50% percentile of the return distribution on a 10-year investment horizon.

Details on Scenario 2: The 3-year and 7-year Treasury yields rise less than currently implied by the forward curve through 2012 as the Federal Reserve raises short-term rates less than is currently expected. However, Treasury yields rise more quickly over the intermediate term as inflation expectations rise. Over the entire simulation horizon, the averages for the 3-year and 7-year Treasury yields are slightly below the average annual yields reflected in the current forward curve given the delayed monetary-policy response. Overall, this scenario ranks in the 75%–85% percentile of the VCMM projected average return distribution at a one-year horizon, and ranks in the 55%–65% percentile of the return distribution on a 10-year investment horizon.

Details on Scenario 3: The 3-year and 7-year Treasury yields both rise more quickly than they do under the current market forward curve, with the Treasury yield curve almost inverting in 2011 based on the unexpectedly aggressive actions of the Federal Reserve. Over the entire simulation horizon, however, the averages for the 3-year and 7-year Treasury yields are very similar to the average annual yields reflected in the current forward curve. Overall, this scenario ranks in the 15%–25% percentile of the VCMM projected average return distribution at a one-year horizon, and ranks in the 55%–65% percentile of the return distribution on a 10-year investment horizon.

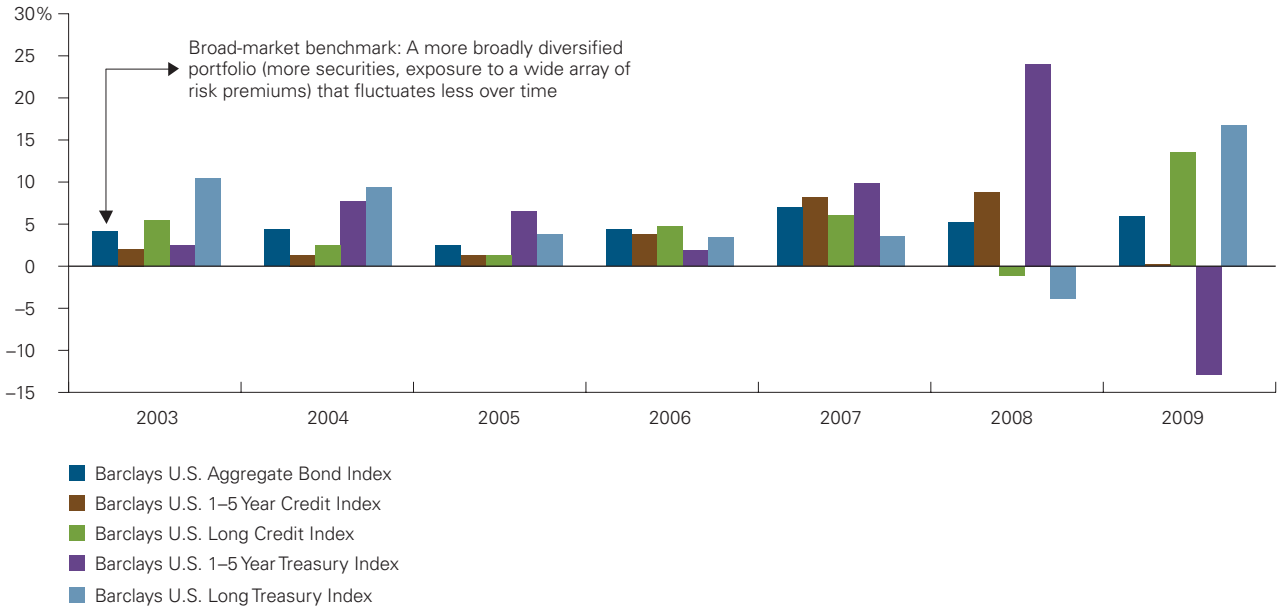
Details on Scenario 4: The 3-year and 7-year Treasury yields both decline in 2011 as the economy falls back into recession. Throughout the simulation horizon, Treasury rates remain below those implied by the current forward curve as both economic growth and inflation expectations remain below current market expectations. For a time, corporate bonds underperform Treasury bonds as credit spreads widen during the double-dip recession. Overall, this scenario ranks in the 70%–80% percentile of the VCMM projected average return distribution at a one-year horizon, and ranks in the 30%–40% percentile of the return distribution on a ten-year investment horizon.

Details on Scenario 5: The 3-year and 7-year Treasury yields both rise more dramatically than they do under the current market forward curve. The 3-year yield rises as high as the 7-year yield by 2015, with the slope of the Treasury yield curve between the 3-year and 7-year Treasury rates inverting for a time as the Federal Reserve attempts to stabilize long-term inflation expectations through more restrictive short-term rates. For a time, corporate bonds underperform Treasury bonds as credit spreads widen during the crisis. Overall, this scenario ranks in the bottom 10% percentile of the VCMM projected average return distribution at a one-year horizon, and ranks in the 75%–85% percentile of the return distribution on a 10-year investment horizon.

Note: The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Figure 10. U.S. taxable bond market returns, 2003–2009

Annual total returns for Barclays Capital benchmarks



Note: Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Source: Barclays Capital.

Implications for portfolio construction

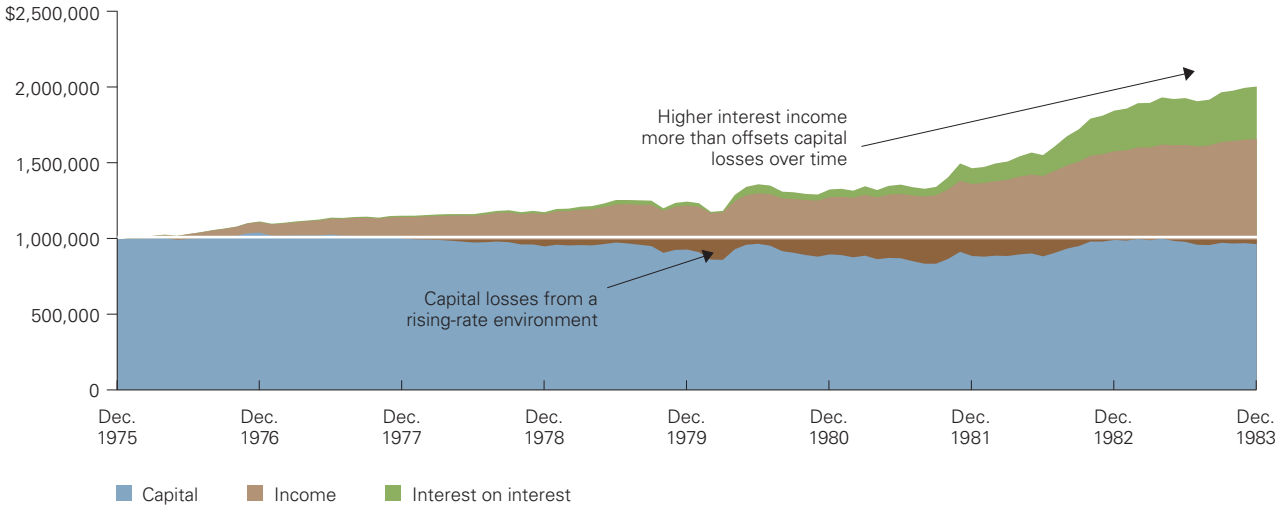
A key lesson of the global financial crisis is that implementing a too-narrow or surgical bond allocation (such as by shortening duration or investing solely in riskier bond instruments) involves important trade-offs that may expose bond investors to unintended yield-curve or market risks while potentially depriving them of a higher future income stream. These trade-offs are clearly evident in the range of potential interest rate scenarios that we have depicted in Figure 9.

These varied—but certainly possible—rate scenarios attest to the high degree of uncertainty surrounding the future direction of economic growth, the deficit, inflation, and interest rates. Indeed, the difficulty of correctly forecasting not only which (if any) of these scenarios will unfold, but also precisely when, is a powerful reminder that focusing on interest rate moves and short-term changes in bond prices can be counterproductive. To us, the range of potential outcomes in Figure 9 would seem to support *greater* fixed income diversification in the years ahead, not less.

As illustrated in **Figure 10**, the performance of various segments of the bond market over the past several years underscores the benefits of a broadly diversified fixed income portfolio *regardless of the future direction of interest rates*.

Figure 11. Bond investing in the 1970s and early 1980s

Growth of a $1 million investment in the Barclay's Capital U.S. Aggregate Bond Index, 1976–1983



Notes: For this example, we assume that an investor fully funds a $1 million investment in the Barclay's Capital U.S. Aggregate Bond Index Index on January 1, 1976. We do not account for any expenses or taxes. Interest-on-interest return is calculated as the remainder after subtracting both income and capital returns from the total return.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Source: Vanguard calculations based on capital, income, and total return data reported by Barclay's Capital.

Over the long term, it's interest income—and the reinvestment of that income—that accounts for the largest portion of total returns for many bond funds. The impact of price fluctuations can be more than offset by staying invested and reinvesting income, even if the future is similar to the rising-rate environment of the late 1970s and early 1980s, as illustrated in Figure 11. According to data provided by the Federal Reserve, the yield on the 10-year Treasury bond more than doubled over this period, rising from approximately 6.9% in December 1976 to as high as 15.3% in September 1981. Yet the hypothetical $1 million investment made in 1976 would have grown to more than $2.0 million by the end of 1983, not necessarily a disastrous outcome given the period's secular rise in interest rates. Moreover, the higher level of interest rates in the early 1980s subsequently fell as inflation expectations declined, setting the stage for even higher bond returns over the following decade.

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