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# Active bond-fund excess returns: Is it alpha . . . or beta?

Vanguard research

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**Executive summary.** Active U.S. bond funds have, on average, performed exceptionally well over the past four years. This has been especially true of taxable bond funds with broad mandates; indeed, according to Morningstar, Inc., 86% of those funds outperformed their benchmark through December 31, 2012, as measured by the Barclays U.S. Aggregate Bond Index. Some investors have interpreted this recent outperformance as reflective of manager skill (i.e., *alpha*)<sup>1</sup> captured within a broad bond universe and have voiced their view that more bond investors should focus on such active mandates. But is that the appropriate interpretation?

This study contends that persistent, long-term bets on risk factors such as credit risk have accounted for the performance differences between active fixed income funds and their benchmarks, including the funds' out-performance over the past four years. To demonstrate this, we studied the

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<sup>1</sup> We define *alpha* (or manager skill) as the production of excess return via dynamic market timing (across asset classes or sectors) or successful security selection. We do not consider static overweights to riskier asset classes or sectors (which would be expected to produce better returns in the long run) an indication of manager skill.

performance of active bond mutual funds benchmarked to the Barclays U.S. Aggregate Bond Index from 1998 through 2012. We found that: (1) Performance was strongly influenced by the results of the corporate bond sector; and (2) The universe of actively managed funds has employed a significant and persistent overweighting to corporate bonds (i.e., credit risk, a form of beta)<sup>2</sup> over the 15 years.

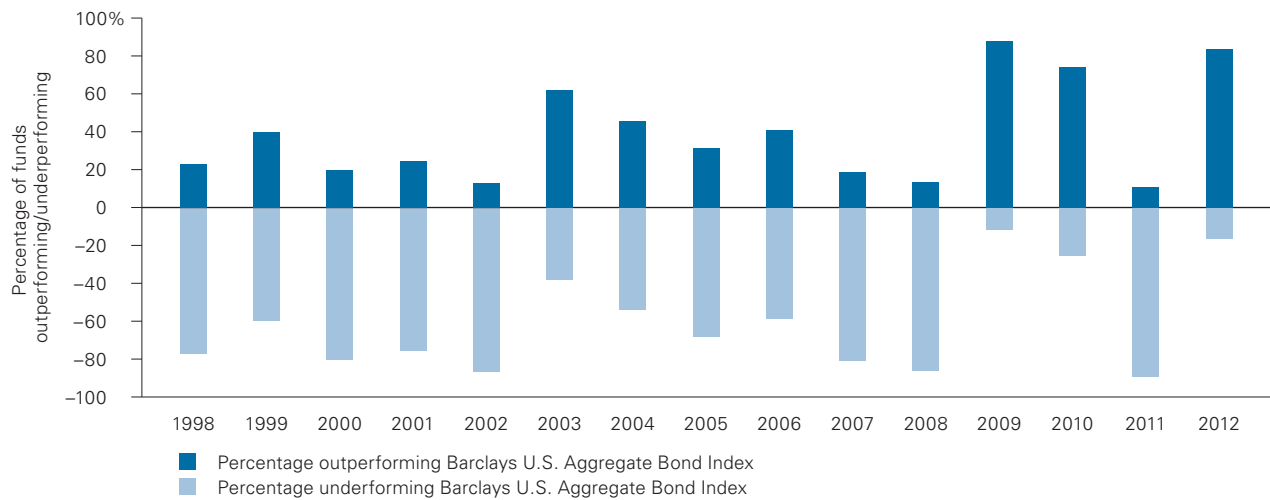
This *persistent* overweighting to corporate credit risk, and not dynamic or tactical portfolio management (i.e., alpha, or manager skill), has been the primary driver of performance for funds benchmarked to the Barclays U.S. Aggregate Bond Index. These results have meaningful implications for investors: Paying for alpha while receiving beta is information worth knowing; and investing for broad-market beta (per the funds' stated benchmark) while receiving a potentially riskier exposure is likewise important knowledge. This paper proposes that for investors interested in greater credit-risk exposure, a more efficient solution—that is, combining a low-tracking-error/low-cost corporate bond fund with a low-cost Barclays U.S. Aggregate Bond Index fund—is available and may be preferable.

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*Notes on risk: All investing is subject to risk, including possible loss of principal. Past performance does not guarantee future results. Bond funds are subject to interest rate risk, which is the chance bond prices overall will decline because of rising interest rates, and credit risk, which is the chance a bond issuer will fail to pay interest and principal in a timely manner or that negative perceptions of the issuer's ability to make such payments will cause the price of that bond to decline. 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. U.S. government backing of Treasury or agency securities applies only to the underlying securities and does not prevent share-price fluctuations. Diversification does not ensure a profit or protect against a loss.*

<sup>2</sup> We define *beta* as static exposure to a given market—in this case, the corporate bond market.

**Figure 1.** Percentage of funds outperforming/underperforming Barclays U.S. Aggregate Bond Index, 1998–2012



Note: Calculations include all funds existing for at least 36 months from 1998 through 2012 whose stated benchmark was the Barclays U.S. Aggregate Bond Index. Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc.

During 2012, cash flows into passive U.S. bond funds and ETFs fell to 15% of total cash flows into all bond funds, versus the longer-term trend of close to 25% for the three-, five-, and ten-year periods ended December 31, 2012. This, despite active funds' higher average cost (expense ratio of 0.69% versus 0.26% for index funds).<sup>3</sup> Investors have seemingly subscribed to the theory that active management is superior to passive management in the fixed income universe. In other words, some investors are looking for alpha (excess returns), not just beta (the market return) with the expectation of potentially enhancing returns in a low-return environment.

At first blush, the preference for active management seems reasonable. Among funds benchmarked to the Barclays U.S. Aggregate Bond Index, active bond-fund managers produced remarkable out-performance in three of the four years through December 31, 2012 (Figure 1). And, over the last four years, 86% of active bond-fund managers outperformed.<sup>4</sup> The period 2009–2012 represents a sea change from the 11 previous years in terms of active bond-fund managers' performance. As a result, two questions arise: (1) Why has the ratio of outperformers to underperformers become so volatile; and (2) Is fixed income now a market in which alpha is more easily achieved than in the past?

<sup>3</sup> Sources: Cash-flow percentages were calculated using data from Morningstar, Inc., for all funds in the intermediate-term bond, multisector bond, and nontraditional bond categories. Expense ratios were calculated using data from Morningstar, Inc., for all active and passive bond funds benchmarked to the Barclays U.S. Aggregate Bond Index. All data are as of December 31, 2012.

<sup>4</sup> Sources: Vanguard calculations, using data from Morningstar, Inc.

## Analyzing active funds benchmarked to Barclays U.S. Aggregate Bond Index

To answer these questions, we examined the composition and performance of active funds benchmarked to the Barclays U.S. Aggregate Bond Index over the 15 years through December 31, 2012. Using Morningstar's database, we narrowed our analysis to open-end mutual funds with at least 36 months of performance history over the past 15 years (ended December 31, 2012), resulting in 312 active bond funds used in this study.<sup>5</sup> We specifically chose funds benchmarked to the Barclays U.S. Aggregate Bond Index, owing to its makeup and popularity among active bond fund managers. As a broad, market-capitalization weighted benchmark of the U.S. bond market, the index is also the most commonly used fixed income benchmark in the United States (see accompanying textbox on this page).

## A clear and present bias

The first step in our analysis was to compare the composition of the Barclays U.S. Aggregate Bond Index with that of the active-fund universe. For simplicity we assigned index constituents to one of three categories: U.S. government, corporate, or securitized (inclusive of both mortgage-backed and asset-backed).<sup>6</sup> The weighting of each category over time was based on the market size of each sector over time. For the active bond-fund universe, we separated the sector exposures into the same three categories using a 36-month rolling style regression analysis.<sup>7</sup>

## Why are so many bond funds benchmarked to Barclays U.S. Aggregate Bond Index?

*Comprehensiveness*—The Barclays U.S. Aggregate Bond Index is a comprehensive representation of the U.S. bond market, including market-cap-weighted allocations across government and corporate bonds as well as mortgage-backed securities (MBS) and asset-backed securities (ABS).

*Familiarity*—Given the index's popularity, investors are usually more familiar with it versus other benchmarks. Funds linked to the Barclays index may appear more frequently in fund searches or may be considered more "mainstream" than funds benchmarked to other indexes.

*Accessibility*—Data for the index are generally easy to find, helping to make fund discussions with investors simpler and more understandable, versus discussions about funds with more obscure benchmarks.

Figure 2 displays the Barclays Aggregate Index bond weightings versus our estimates for active bond funds.<sup>8</sup> To deliver results that differ from those of a benchmark, an active manager must construct a portfolio that diverges from that benchmark. In fixed income, the two primary differentiators are sector (U.S. government, credit, and securitized) and duration (long or short versus the benchmark).<sup>9</sup> As a result, we would expect deviations from the benchmark within the active universe across time.

5 This paper's analysis of bond funds used an equal-weighted methodology for purposes of simplicity. We also performed key portions of the analysis using an asset-weighted methodology and found almost identical results. An equal-weighted approach gives all funds in the analysis the same importance, while an asset-weighted approach places more emphasis on larger funds based on their assets under management.

6 For the style analysis of corporate bonds, we used the Barclays U.S. Credit Bond Index. Although the index includes bonds issued by corporations (79% of the index weighting) as well as non-U.S. corporate issuers (21%) such as supranationals, sovereigns, foreign agencies, or foreign local governments, both spreads (correlation of 0.91) and excess returns (correlation of 0.78) versus U.S. Treasury bonds are highly correlated. As a result, from this point forward in this paper we refer to the collective exposure as "corporate."

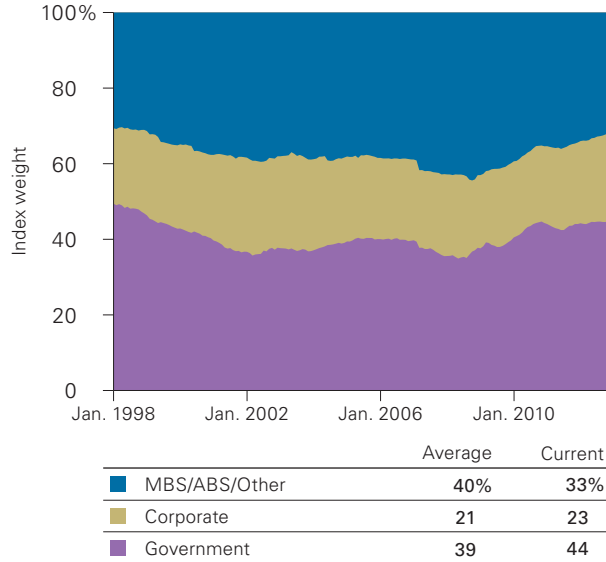
7 The 36-month rolling style regression analysis uses the general methodology developed by William F. Sharpe (see Sharpe, 1992). We used the following four Barclay indexes as the "sector styles" in our analysis: the U.S. Credit Bond Index, the U.S. Government Bond Index, the Mortgage-Backed Securities Index, and the U.S. Asset-Backed Securities Index.

8 In addition to using the 36-month rolling style regression analysis, we compared sector weightings for each fund as reported by Morningstar. This holdings-based evaluation confirmed the active managers' overweighting of corporate bonds and underweighting of U.S. government bonds. (See Appendix Figure A-1.)

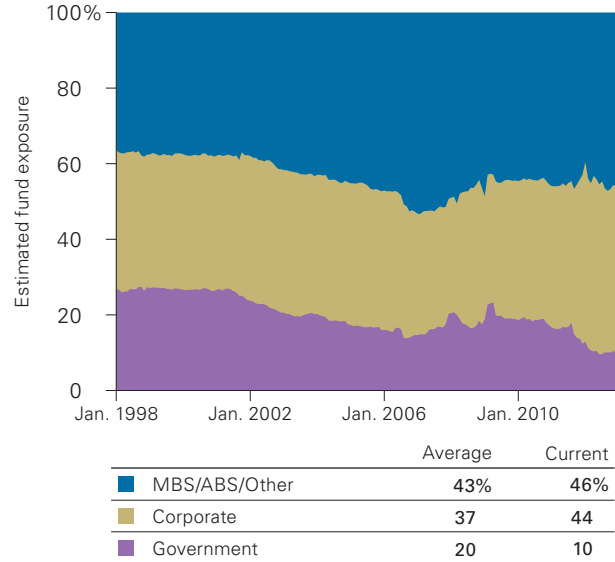
9 Due to the unpredictability of interest rate movements, a duration bias tends to be more challenging to profit from than a corporate-bond bias, even over longer time horizons. Although we have observed that many fund managers attempt to position their portfolios based on views of future interest rate movements, in this analysis we did not find their duration tilts to be highly correlated with the excess returns they produced—hence this paper's primary focus on corporate bond tilts.

**Figure 2.** Composition of Barclays U.S. Aggregate Index and estimated exposures of active bond funds, 1998–2012

**a. Barclays U.S. Aggregate Bond Index weights**



**b. Estimated exposures of funds benchmarked to Barclays U.S. Aggregate Bond Index**



Notes: This figure's style analysis of active funds is summarized using an equal-weighted average of the exposures for all funds existing for at least 36 months at any point during the analysis period. We ran the same analysis for active funds using other fixed income benchmarks and found that, among those funds, the trend of underweighting government securities and overweighting other sectors including corporate and securitized bonds was also common. (See Appendix Figures A-2 and A-3).

Sources: For Barclays U.S. Aggregate Bond Index weightings, we used Barclays Live; fund weightings are based on Vanguard calculations, using a 36-month rolling style regression analysis methodology and data from Morningstar, Inc.

On average, however, we might also anticipate individual bets across all funds to wash out, providing an aggregate exposure that approximates the benchmark. Clearly, this has not been the case, as the universe of actively managed bond funds benchmarked to the Barclays U.S. Aggregate Bond Index demonstrated a consistent bias toward corporate bonds and a shrinking exposure to government bonds over the period studied, therefore exposing themselves to greater credit risk than that of the benchmark.

### Impact of a corporate bond overweight

When an active fund's exposures differ from those of its benchmark, the resulting returns will typically also differ. So, when we see that active bond-fund managers have consistently had greater exposure to corporate bonds and less exposure to government bonds relative to the benchmark, the funds should offer a different pattern of returns. Specifically, we would expect to see active funds reporting greater excess returns when corporate bonds are outperforming government bonds and lower excess returns when the opposite situation occurs.

**Figure 3.** Evaluating the probability of capturing the corporate-bond risk premium, 1998–2012

	Number of periods that corporates outperformed U.S. Treasuries		
	Rolling 1-year periods	Rolling 3-year periods	Rolling 5-year periods
Short-term corporates outperformed Treasuries	10 of 15	12 of 15	14 of 15
Intermediate-term corporates outperformed Treasuries	8 of 15	11 of 15	13 of 15

Notes: Rolling periods ended in each of the 15 years from 1998 through 2012. For the three- and five-year rolling periods, data used started in 1996 and 1994, respectively. Long-term corporate bonds also tend to display a risk premium over Treasuries over long periods of time, but the relationship is less consistent. However, the long-term corporate bond risk premium is less relevant, since the majority of bond mutual fund investors use short-term and intermediate-term funds in their portfolios.

Sources: Vanguard calculations, using data from Barclays.

This is a crucial point in assessing skill among active fund managers. When one examines different risk premia across asset and sub-asset classes, the corporate bond-risk premium is one of the more reliable (at least with respect to investment-grade corporate bonds).<sup>10</sup> For example, **Figure 3** shows the number of years in which corporate bonds outperformed government bonds and vice versa. In both the intermediate- and short-term indexes, the probability of capturing the corporate premium was significant and increased as the time period increased from one year to five years. Given that this risk premium will typically be earned over a full economic/policy cycle, it's not surprising that many managers attempt to earn it.

**Figure 4** tests our hypothesis of a systematic attempt by fund managers to capture the corporate premium. The figure compares the excess returns of a U.S. corporate bond index versus a U.S. government bond index with the excess returns of active bond funds versus their benchmark. Both sets of excess returns follow a very similar pattern, as confirmed by the calculated R-squared of 89%. The difference in performance

between corporate bonds and government bonds explained 89% of the pattern of excess returns (both positive and negative) produced by actively managed bond funds over the past 15 years.<sup>11</sup> In other words, we found that active fixed income funds benchmarked to the Barclays U.S. Aggregate Bond Index were, indeed, overweighting corporate bonds to capture the sector's risk premium, and therefore outperformed relative to their stated benchmark.<sup>12</sup>

### Style-adjusted excess returns are less dramatic

To examine corporate bond overweighting from a slightly different perspective, we recalculated the excess returns of the actively managed bond funds by comparing their excess returns with the results of a style-adjusted benchmark based on their observed style over time, instead of with those of the Barclays U.S. Aggregate Bond Index (see **Figure 5**).<sup>13</sup> As expected, these "adjusted" excess returns were much less dramatic, reinforcing the point that style

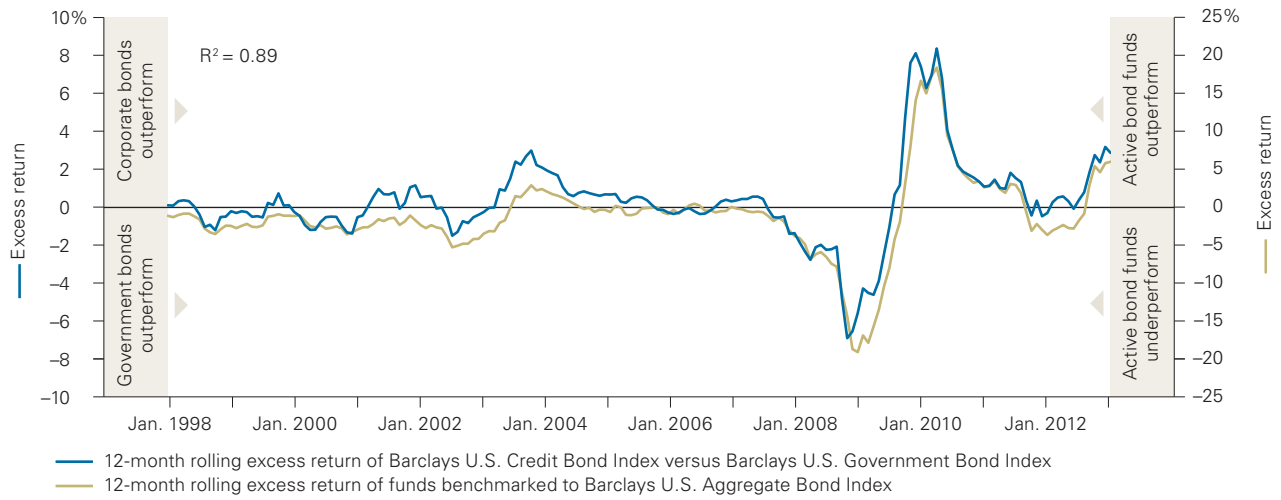
10 A risk premium is the additional return investors expect to earn for bearing risk relative to the risk-free asset.

11 We also analyzed the impact on the excess returns of active bond funds of other factors such as duration and foreign-currency exposure, but we found that corporate-bond exposure clearly had the strongest influence.

12 We also found that funds with higher expense ratios tended to have greater corporate-bond exposure—perhaps an attempt by some managers to increase returns (by taking on additional risk) to compensate for the higher expense ratios.

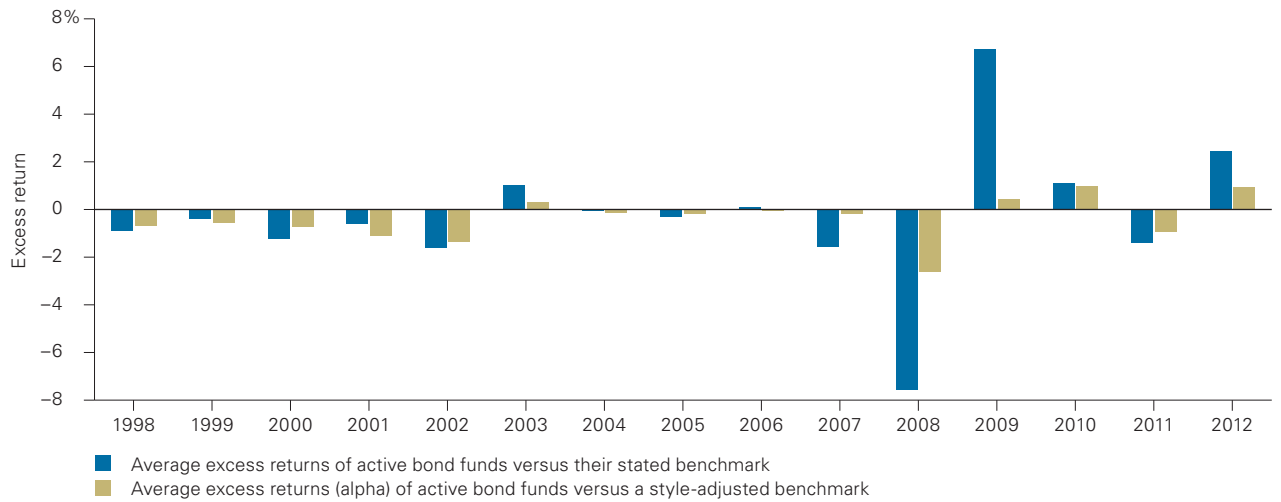
13 A style-adjusted benchmark is a custom benchmark that uses historical fund data to account for any significant style deviations of a fund versus its benchmark through time. Fund returns can then be compared to the custom style-adjusted benchmark to help an investor understand how much of the reported excess returns are due to style tilts made by the fund manager.

**Figure 4.** Excess returns (12-month rolling) of corporate versus government bonds and of active bond funds versus Barclays U.S. Aggregate Bond Index, 1998–2012



Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc.

**Figure 5.** Average annualized excess returns versus stated benchmark and style-adjusted benchmark, 1998–2012

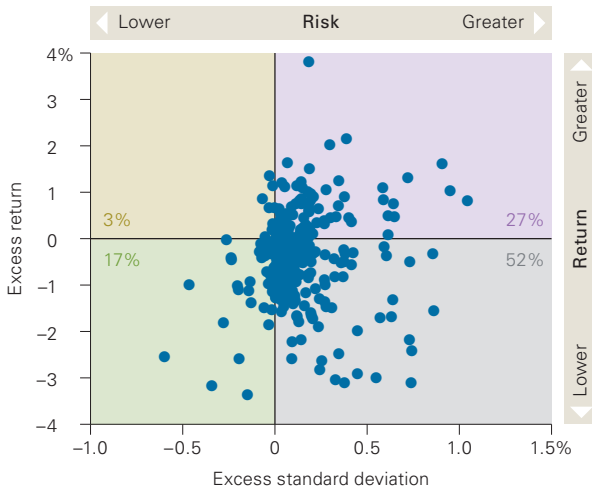


Note: Style-adjusted benchmarks and alpha were calculated using a 36-month rolling regression analysis methodology.

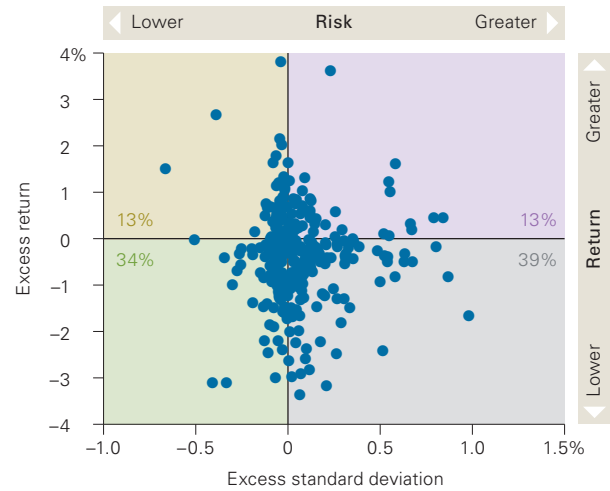
Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc.

**Figure 6.** Seventy-nine percent of active funds benchmarked to Barclays U.S. Aggregate Bond Index have experienced greater volatility than the index, 1998–2012

**a.** Relative performance of active bond funds versus Barclays U.S. Aggregate Bond Index



**b.** Relative performance of active bond funds versus 80% Barclays U.S. Aggregate Bond Index/ 20% Barclays U.S. Credit Bond Index



Note: Excess returns and excess standard deviations were calculated for all funds with at least 36 months of performance history during the period.

Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc.

differences from the benchmark were driving a large portion of the positive and negative swings in excess returns from year to year over the analysis period.

### A more practical index for active bond funds

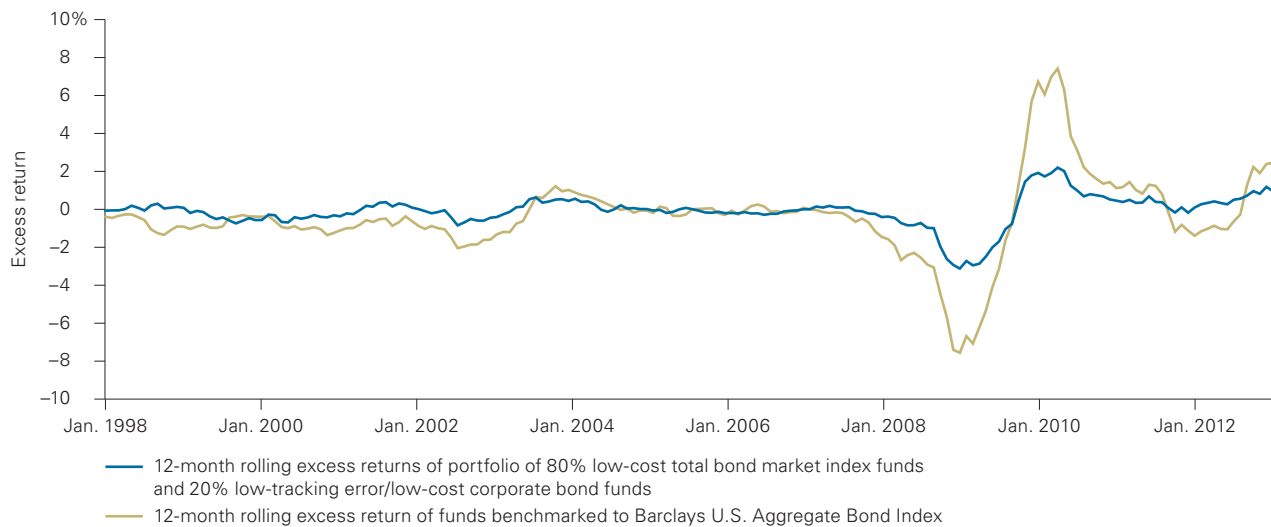
Although a style-adjusted benchmark is relevant and useful for analytical purposes, it may not be as helpful for investor decision-making, given its complexity and the amount of data needed to create it. The Barclays U.S. Aggregate Bond Index, as we have established, may not be a helpful benchmark either, given the notably different underlying exposures, and hence different performance characteristics, of the active bond-fund universe. So what is a reasonable benchmark?

Referring again to the sector exposures over time in Figure 2, we are reminded that there has been an approximate 20% underweighting to government bonds offset primarily by an overweighting to corporate bonds over time. Therefore, a benchmark composed of 80% Barclays U.S. Aggregate Bond Index and 20% Barclays U.S. Credit Bond Index may be a simple and effective solution.

To examine the suitability of this benchmark, we plotted the excess returns and excess standard deviations of our universe of active bond funds versus their stated benchmark (the Barclays U.S. Aggregate Bond Index—see Figure 6a) and versus the 80%/20% benchmark (in Figure 6b). As the figure shows, the distribution of the funds versus their stated benchmark confirms the mismatch.



**Figure 7.** Average excess returns (12-month rolling) of active bond funds versus a portfolio of 80% low-cost total U.S. bond market index funds and 20% low-tracking-error/low-cost corporate bond funds, 1998–2012



Notes: This figure represents a hypothetical portfolio. Low-cost total bond market index funds represent an equal-weighted average of all index funds benchmarked to the Barclays U.S. Aggregate Bond Index during the analysis period that had at least 36 months of history and an expense ratio of less than 25 basis points. The low-tracking-error/low-cost corporate bond funds represent an equal-weighted average of all intermediate-term investment-grade U.S. corporate bond funds available during the period that had an annualized tracking error of less than 4% and an expense ratio of less than 50 basis points.

Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc.

However, in Figure 6b, a more balanced distribution around the crosshairs of the X- and Y-axes is apparent—indicating a much more appropriate benchmark for the active fixed income funds.

### Accessing corporate bond ‘beta’ exposure at a lower cost

Although the corporate bond overweighting clearly differs from the weighting of the Barclays U.S. Aggregate Bond Index, we are not implying that all investors should avoid additional exposure to corporate bonds. As when investing in any other asset class or sector, investors considering overweighting corporates in their U.S. fixed income allocation should understand the risk–return trade-offs inherent in investing in this type of security versus another. As the term *risk premium* implies,

the potential for higher return goes hand in hand with the potential for greater risk (in this case, relative to the Barclays U.S. Aggregate Bond Index), as Figures 6 and 7 demonstrate. For investors willing to take on this additional corporate bond risk—specifically, the probability for under-performance in periods of risk aversion and an increased correlation to equities—a fixed income portfolio with a corporate bond overweighting may make sense.<sup>14</sup>

There are two ways to implement a corporate bond overweighting. First, an investor can purchase an actively managed bond fund(s) with a sizable corporate bond allocation. In this case, the portfolio’s exposure to corporate and other sectors has the potential to shift (sometimes dramatically) over time,

14 For more details on the risks associated with corporate bonds relative to government bonds, see Philips, Walker, and Kinniry (2012).

based on the manager's views of the market, which may not be known in advance. In addition, an investment in an actively managed bond fund may mean a higher expense ratio,<sup>15</sup> and therefore a greater cost drag (and return drag) on the portfolio's performance.

A second, and perhaps more efficient way (often because of lower portfolio turnover and thus lower cost) to replicate the performance of active bond funds that have corporate bond overweights is to purchase a low-cost Barclays U.S. Aggregate Bond Index fund or an exchange-traded fund (ETF) and then supplement it with an allocation to a low-tracking-error/low-cost U.S. corporate bond fund (either active or passive).<sup>16</sup> This approach gives the end investor greater visibility and control over the size of the corporate bond overweighting and, in turn, the portfolio's risk level. Furthermore, using this method, investors can likely obtain market exposures similar to that of a broad-market active bond fund, but at a lower cost. As an example, Figure 7 displays the excess returns generated by active bond funds versus a hypothetical bond portfolio with 80% invested in low-cost Barclays U.S. Aggregate Bond Index funds and 20% invested in low-tracking-error/low-cost corporate bond funds over the past 15 years. The exposures of the two portfolios, and therefore the patterns of excess returns (though not the magnitudes), are remarkably similar.

The ability of a hypothetical low-cost portfolio containing 80% low-cost Barclays U.S. Aggregate Bond Index funds and 20% low-tracking-error/low-cost corporate bond funds to closely approximate the performance of active bond funds benchmarked to the Barclays U.S. Aggregate Bond Index is further

### Know what you're buying

Regardless of what fund an investor chooses for the bond portion of his or her portfolio, it is critical to clearly understand what type of market exposure the fund offers. As this paper has discussed, fund holdings may differ significantly from the benchmark, and therefore, fund risk–return characteristics may also differ from those of the benchmark. At a minimum, investors should consider the following questions before investing in any actively managed bond fund:

- Does the fund currently overweight any sectors relative to the benchmark?
- Have those overweights changed frequently over time?
- How diversified are the fund's holdings?
- How robust are the fund management firm's credit-research capabilities?
- Am I comfortable taking on the risks this fund may expose me to?
- Does the risk–return profile of this fund align with the goals of my broader portfolio?
- Is there a more efficient way to obtain similar exposures?

substantiated in **Figure 8**, which shows that the 80%/20% combination has offered similar total returns as well as similar exposure (as measured by the R<sup>2</sup> values). Over each time period we analyzed, this static overallocation to corporate bonds produced comparable results—and did so more efficiently and transparently.

15 The average expense ratio of *active* funds benchmarked to the Barclays U.S. Aggregate is 0.69%, the average expense ratio of *index* funds benchmarked to the Barclays US Aggregate is 0.26%, and the average expense ratio of a portfolio with an 80% allocation to a Barclays U.S. Aggregate Bond Index fund and a 20% allocation to a low-tracking-error/low-cost corporate bond fund is 0.27%.

16 In this paper, we define low-tracking-error/low-cost corporate bond funds as intermediate-term investment-grade corporate bond funds with annualized tracking error versus their benchmarks of less than 4% and an expense ratio of less than 50 basis points. For some readers, 4% tracking error for a bond fund may seem high, and in "normal" market environments it is. But, given our inclusion of the 2008–2010 period as part of our tracking-error calculations (during which time the returns of many of these funds deviated dramatically from their benchmarks), the tracking errors over the full time period are substantially elevated. The average annualized tracking error for all intermediate-term investment-grade corporate bond funds over the full 15-year period was approximately 5%. Reported turnover in bond funds accounts for bonds that are sold as well as those that simply mature. Active funds tend to have a greater proportion of bond sales, which are accompanied by transaction costs, while index bond funds tend to have a greater proportion of maturing bonds, which do not result directly in transaction costs. Therefore, even when an active bond fund and an index bond fund display similar reported turnover, the index fund generally incurs fewer costs related to turnover.

**Figure 8.** Performance of active bond funds versus hypothetical portfolio of 80% low-cost total bond market index funds and 20% low-tracking-error/low-cost corporate bond funds, 1998–2012

	Years ended December 31, 2012			
	3 years	5 years	10 years	15 years
<b>R-squared versus active funds benchmarked to Barclays U.S. Aggregate Bond Index</b>				
Low-cost total bond market index funds	76%	66%	80%	85%
80% low-cost total bond market index funds and 20% low-cost/low-tracking-error corporate bond funds	88	84	90	92
<b>Annualized total returns</b>				
Low-cost total bond market index funds	6.0	5.7	5.0	5.8
Active funds benchmarked to Barclays U.S. Aggregate Bond Index	6.8	5.9	5.1	5.6
80% low-cost total bond market index funds and 20% low-cost/low-tracking-error corporate bond funds	6.7	6.0	5.2	5.9

Notes: This figure represents a hypothetical portfolio. Low-cost total bond market index funds represent an equal-weighted average of all index funds benchmarked to the Barclays U.S. Aggregate Bond Index during the analysis period that had at least 36 months of history and an expense ratio of less than 25 basis points. The low-tracking-error/low-cost corporate bond funds represent an equal-weighted average of all intermediate-term investment-grade corporate bond funds available during the period that had an annualized tracking error of less than 4% and an expense ratio of less than 50 basis points.

Sources: Vanguard calculations, using data from Barclays Live and Morningstar, Inc., as of December 31, 2012.

## Conclusion

When investors select an actively managed mutual fund, often an implicit assumption is that the fund’s stated benchmark accurately represents that fund’s average sector exposure over time. However, this is not always the case, as active managers may permanently shift their exposure to more risky market segments in an attempt to generate better long-term returns for their investors. As this paper has demonstrated, for active bond funds benchmarked to the Barclays U.S. Aggregate Bond Index, this has meant a consistent and sizable overweighting to corporate bonds, on average, over the past 15 years.

When building their investment portfolios, it’s important for investors to understand that this corporate bond bias noticeably alters the risk profile of active bond funds from that of their benchmark. The fixed income component of a portfolio usually

provides diversification for the portfolio and stabilizes overall return. A corporate bond overweighting—which many investors overlook—may lead to higher than intended portfolio volatility. Performance attribution, therefore, is critical when evaluating the source and efficacy of an active manager’s results.

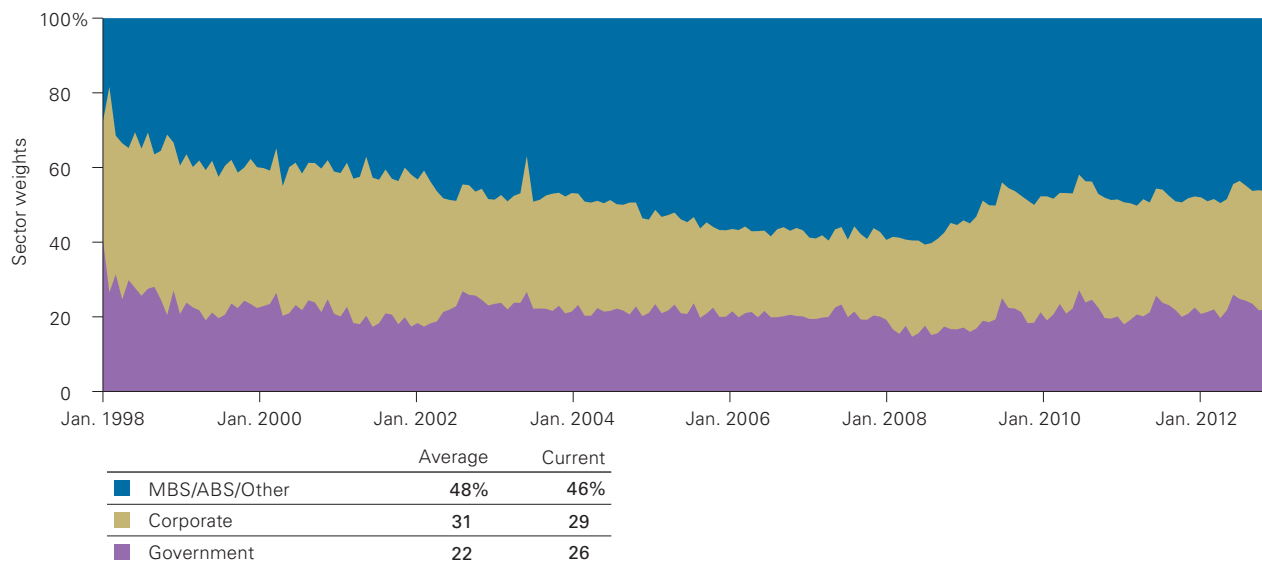
We make this point not to discourage investors from additional exposure to corporate bonds; however, investors should make this decision with their eyes wide open. If such an overweighting is desired, then a transparent way to accomplish it is by directly investing in a corporate bond fund alongside the usual intermediate-term bond index fund. A fixed income portfolio allocation to a low-cost Barclays U.S. Aggregate Bond Index fund combined with a low-tracking-error/low-cost intermediate-term corporate bond fund can offer market exposure similar to that of many Barclays U.S. Aggregate benchmarked active bond funds, but with potentially more clarity, risk control, and lower cost.

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## Appendix. Active bond funds exhibit a corporate bond overweighting

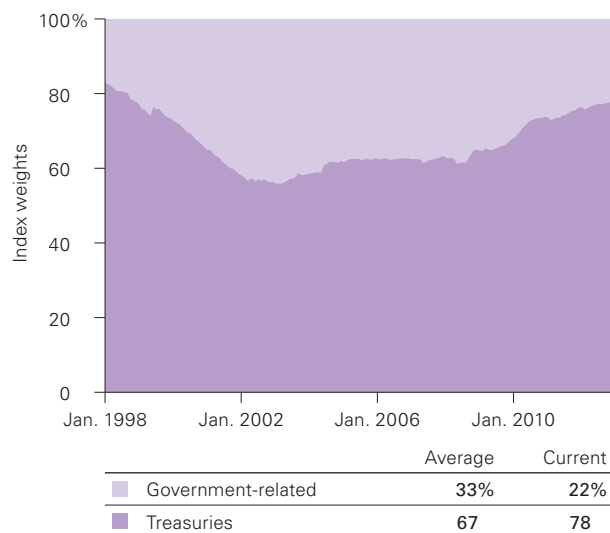
**Figure A-1.** Sector weights for funds benchmarked to Barclays U.S. Aggregate Bond Index, based on Morningstar fund allocation data, 1998–2012



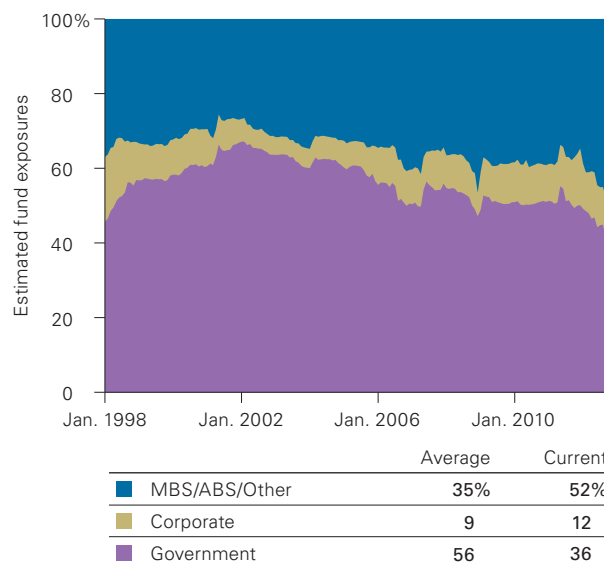
Sources: Vanguard calculations, using fund allocation data from Morningstar, Inc., for fund weights.

**Figure A-2.** Style exposures of active U.S. government bond funds differ from their benchmark, 1998–2012

### a. Barclays U.S. Government Bond Index weights



### b. Estimated exposures of active bonds benchmarked to Barclays U.S. Government Bond Index

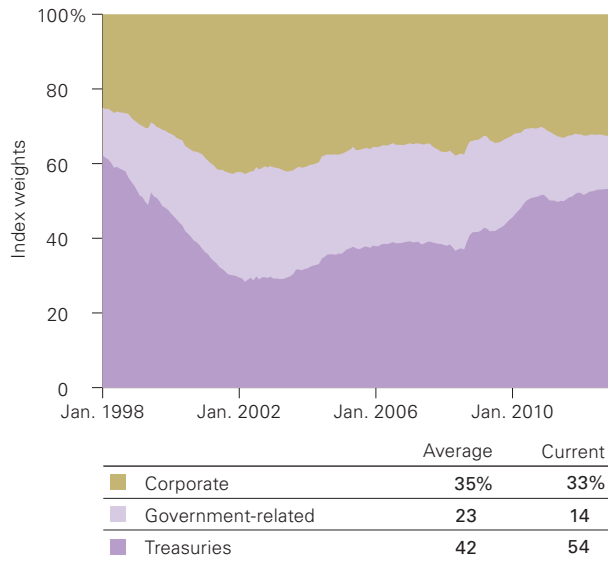


Note: This figure's analysis of active funds uses an equal-weighted average of the exposures for all funds existing for at least 36 months at any point during the analysis period.

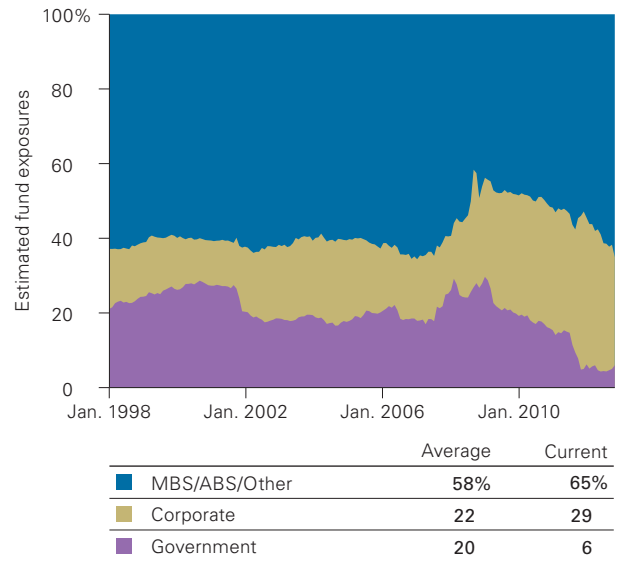
Sources: Vanguard calculations, using data from Morningstar, Inc., for fund weights; Barclays Live for Barclays U.S. Aggregate Bond Index weights.

**Figure A-3.** Style exposures of active U.S. government/credit intermediate bond funds differ from their benchmark, 1998–2012

**a. Barclays U.S. Intermediate Government/Credit Bond Index weights**



**b. Estimated exposures of active funds benchmarked to Barclays U.S. Intermediate Government/Credit Bond Index**



Note: This figure's analysis of active funds uses an equal-weighted average of the exposures for all funds existing for at least 36 months at any point during the analysis period.

Sources: Vanguard calculations, using data from Morningstar, Inc., for fund weights; Barclays Live for Barclays U.S. Aggregate Bond Index weights.



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