

Some patience required: Outperformance in active fixed income

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- Patience in investing is the capacity to endure periods of underperformance in hopes of achieving an investment objective. Some investors use fixed income as a ballast against equity risk. Others seek to use it to capture additional return or yield through active management, increased exposure to risk premia, or both—a goal that can require significant patience to reach.
- In this paper, we look at the wide range of frequencies, durations, and magnitudes of underperformance that active fixed income funds experienced on their way to long-term outperformance. Our analysis is similar to that set forth in Tidmore and Hon (2021), and the findings share some similarities. However, noticeable differences did emerge, especially across investment strategies.
- Almost all investors who have selected an outperforming active fixed income manager can expect to experience one-year drawdowns at some point; such drawdowns occur only slightly less often with fixed income than they do with active equity. However, only half of outperforming fixed income funds will likely experience bottom-quartile performance for any five-year period, compared with almost 80% of outperforming equity funds.

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Introduction

As with most things in life, success in investing requires patience; investing, in fact, probably requires more patience than most endeavors.¹ You need patience when what you are invested in is performing poorly—and you need it when what you haven't invested in is performing well. At any given time, you might need to have extra patience with the market, a sub-asset class, a particular region, a strategy, an individual manager, or even the cash you have on the sidelines. As Benjamin Graham once said, "The investor's chief problem—even his worst enemy—is likely to be himself."

Unfortunately, patience can easily wear thin if you aren't benefiting from the current trend of an investment. A lack of patience can ultimately lead to bad decision-making if you give in to anxiety and deviate from the course that you initially intended. The truth is, patience plays out differently for every investor. It's ultimately rooted in your investment philosophy, conviction, and emotional fortitude. Investors aligned with a strategic asset allocation may need patience when a certain asset class is performing poorly. Other investors may need patience when a style or strategy is underperforming. Those in an actively managed fund will need patience with both the manager and the strategy.

However, there is good news: Research shows that patience can be shored up by education that gives investors a full understanding of the risks and opportunities involved. Knowing what is reasonable to expect—and how often to expect it—can improve an investor's ability to have patience when they need it. An investor must have a firm grasp of their current path and why sticking to it will help them reach their long-term goals. For many investors, an advisor is the invaluable source of information and education. One of the major benefits of professional financial advice is behavioral coaching, which includes helping investors manage their expectations and thereby increase their patience with their investment choices. In fact, Kinniry et al. (2019) were able to quantify the potential value of behavioral coaching for the typical advised client.

Most research around this topic addresses investors' patience with an investment manager who is overseeing the overall portfolio (Goyal and Wahal, 2008) or when investing in equities or the equity market. We look to build on this research because we know that patience is a key factor in active success (Wallick, Wimmer, and Balsamo, 2015) and that active investors have tended to sell active investments when they are underperforming over relatively short periods.² Hsu, Myers, and Whitby (2016) found that this impatience leads to the average investor failing to benefit from a fund's long-term outperformance. While the focus of this research has generally been on equity funds, Kinnel et al. (2019) notably found that over the ten years ended December 31, 2018, the returns that investors in U.S active fixed income funds actually realized were 55 basis points (bps) below the total returns of the funds themselves.

An investor's level of conviction in a manager and their level of active risk tolerance will directly affect how much patience they are likely to have with the manager during periods of underperformance; the higher their conviction and risk tolerance, the more patience they are likely to have. Additionally, investors may have difficulty defining their level of conviction or active risk tolerance—which makes it difficult for them to define how much patience they might need to have in the future.³

We look at the patience investors would have needed if they had invested in a historically outperforming traditional active manager. There is no guarantee, of course, that a historically outperforming traditional active manager will be successful in the future—but if an investor does believe the manager will outperform, our analysis shows the levels of patience needed for success.^{4,5}

As in Tidmore and Hon (2021), we build on the existing literature by quantifying the levels of "pain" investors might experience and providing insights investors can use when making time-dependent decisions in their portfolios across various active strategies and managers. We intentionally avoid a discussion of when to stop having patience and exit an investment; rather, we look

¹ Aside from parenting, marriage, family holidays, and (as we now know) pandemic lockdowns.

² Some of the key research related to these topics can be found in Zweig (2002), Goyal, Ilmanen, and Kabiller (2015), Hsu, Myers, and Whitby (2016), Cornell, Hsu, and Nanigian (2017), Kinniry et al. (2019), and Tidmore and Hon (2021).

³ Although the two terms are similar, *conviction* is more about someone's certainty of their belief in a specific investment to achieve an outcome, while *active risk tolerance* is the degree to which an investor can tolerate active performance uncertainty.

⁴ One must also be aware that the patience necessary across fund categories will most likely be different. For example, a fund may not have a large drawdown relative to its peer group—but that peer group as a whole can have a large drawdown relative to a broader benchmark.

⁵ There is also the question of the relationship between the various drawdown metrics and the absolute volatility of the category beta. Further exploration could involve looking at the potential clustering of fund drawdowns across different parts of the market and credit cycle to see whether the propensity to underperform is random or if it occurs more in certain parts of the cycle.

to help investors and those who advise them understand what they might expect when investing in active strategies. We consider the necessary levels of patience across three dimensions of underperformance: frequency, magnitude, and duration.

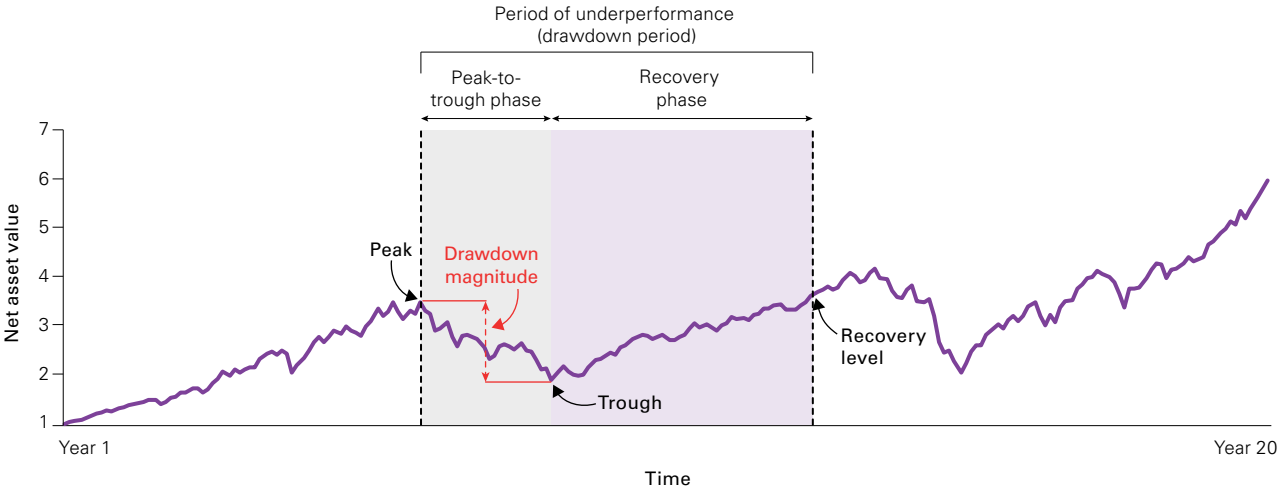
Data and methodology

First, a few key terms. *The period of underperformance, or drawdown period,* is the length of time (usually measured in months) that a portfolio declines in value relative to a benchmark. Measured from a peak until the value recovers to the peak level at which the decline began, each drawdown period consists of a *peak-to-trough phase* and a *recovery phase*. The peak-to-trough phase is the number of months it takes for the *drawdown magnitude* to be realized (that is, the number of months from the peak to the trough). The drawdown magnitude is the cumulative peak-to-trough loss in portfolio value

relative to a benchmark that occurs during the drawdown period. The recovery phase is the number of months it takes to offset the drawdown magnitude. **Figure 1** illustrates these relationships. Traditional active funds usually have multiple drawdowns over time.

We begin our analysis by identifying the oldest share class for all U.S.-domiciled actively managed open-ended fixed income funds in the Morningstar Direct database (including not only surviving but also obsolete funds) during the 27 years ended December 31, 2020.⁶ We then remove any fund with fewer than ten holdings or less than ten years of returns, along with any fund not categorized as U.S. corporate, U.S. intermediate government, U.S. intermediate core, U.S. intermediate core plus, U.S. high yield, multisector, or global world bond (hedged or unhedged) during our sample period. This produces an initial sample of 693 funds.

Figure 1. Key terms



Notes: Figure is for illustrative purposes only. Note that hypothetical illustrations are not exact representations of any particular investment. Net asset value indicates the cumulative value of one U.S. dollar invested at the beginning of the period.
Source: Vanguard, 2021.

⁶ Henceforth referred to as *funds*.

Next, using the relevant style benchmark, we calculate each fund's cumulative net excess return over our sample period. Because of the lack of homogeneity across many of the fixed income strategies, selecting the relevant benchmark was not as straightforward a process as it would be for equity funds. We attempted to focus on relevancy of the benchmark to a majority of the funds, and in most cases we used the style benchmark selected by Morningstar. (The complete choice of benchmarks is shown in **Appendix 1**.) Funds with a positive cumulative excess return net of expense ratio are labeled outperformers. Our final sample of 203 outperforming funds has 4,029 total years of performance and an average life of 20 years.

Looking at the sample in terms of fund category, we calculate the monthly cross-sectional net excess returns for each of the 324 months, then annualize the results to show what an investor might have received for having patience. We also calculate each fund's net excess returns for each overlapping one-, three-, and five-year period and use this data to analyze various drawdown metrics for each outperforming fund. Most of these metrics involve one of the three dimensions of underperformance mentioned earlier:



Frequency—how likely and often there were periods of underperformance relative to the fund's style benchmarks, median peer, and 25th-percentile peer.



Magnitude—the worst underperformance for each fund over various time periods, and whether funds experienced drawdowns of various magnitudes.



Duration—the duration of the longest period of underperformance as measured by the length of time between a fund's peak and its subsequent return to that peak.

Historical patience results

After applying various filters on the funds, we end up with an initial sample of 693 funds, of which 203 (29.3%) were outperforming. What are patient investors getting for what they might endure? As **Figure 2** shows, the median annualized net excess return generated by the funds in our final sample is 0.41%; across categories, the median ranges between 0.11% and 0.88%.⁷

As noted earlier, success in traditional active investing requires both conviction that the manager will outperform in the future and active risk tolerance to stay invested through the underperforming or drawdown periods. Outperforming active managers, by definition, have historically generated positive net excess returns relative to the market. An investment with an active manager requires the investor to not only have patience but to believe that the manager has the talent, skill, or edge to outperform after a period of underperformance.

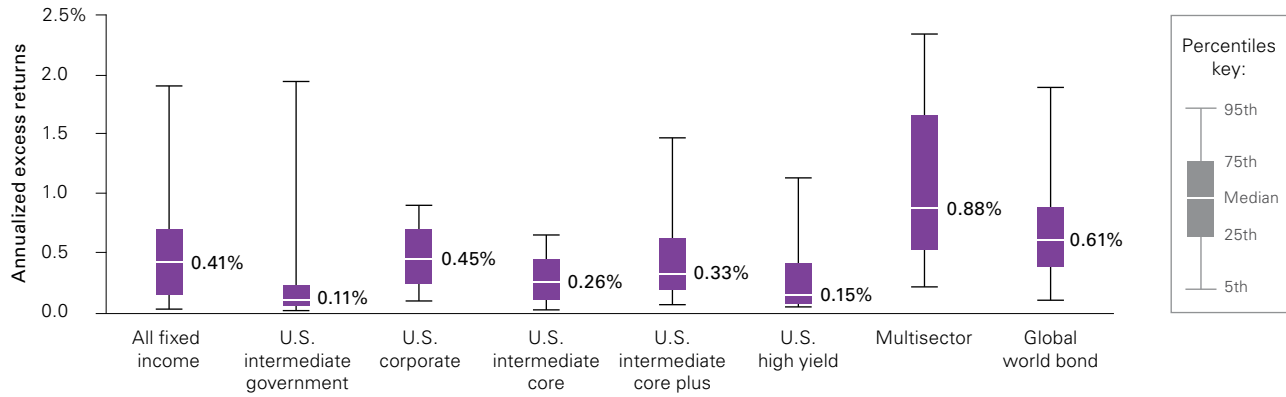
We analyze historically outperforming funds to illustrate, using several different metrics, the kind of patience that has been necessary to succeed with active strategies. We first test to see whether the funds in our sample experienced a one-, three-, or five-year drawdown relative to their style benchmark, their median peer group, or the bottom quartile of their peer group. Just as we found with active equity, close to 100% of outperforming active fixed income managers experience one-, three-, and five-year periods of underperformance relative to their style and peer benchmarks.⁸

Where we see a significant difference between equities and fixed income is in their likelihood of spending a three- or five-year period in the bottom quartile of performance. As **Figure 3** shows, only 56% of outperforming active fixed income managers were ever bottom-quartile performers over a five-year period, where the number of outperforming active equity managers experiencing the same thing was significantly higher at 80%. Another important takeaway: the lack of homogeneity in the likelihood of active fixed income funds experiencing three- or five-year bottom-quartile performance with disparate results across the categories. This deviates from the equities space, where we found more homogeneity across strategies.

⁷ The average annualized net excess return generated by the funds in our sample is 0.59%; across categories, the average ranges between 0.32% and 1.08%.

⁸ Keep in mind that the median excess return of the sample of outperforming fixed income funds was 41 bps versus 90 bps for outperforming equity funds (Tidmore and Hon, 2021). That differential might justify having more patience with equity funds.

Figure 2. Annualized net excess returns of outperforming funds (1994–2020)



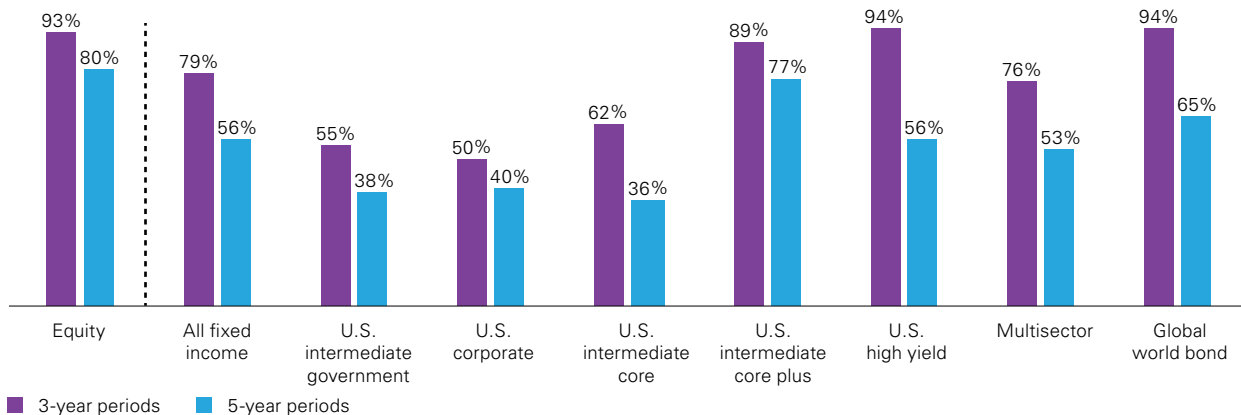
	All fixed income	U.S. intermediate government	U.S. corporate	U.S. intermediate core	U.S. intermediate core plus	U.S. high yield	Multisector	Global world bond
95th percentile	1.92%	1.96%	0.92%	0.66%	1.48%	1.15%	2.36%	1.91%
75th percentile	0.72	0.24	0.71	0.46	0.64	0.43	1.67	0.89
Median	0.41	0.11	0.45	0.26	0.33	0.15	0.88	0.61
25th percentile	0.17	0.06	0.25	0.12	0.20	0.08	0.54	0.39
5th percentile	0.04	0.03	0.11	0.03	0.08	0.06	0.23	0.11

Notes: Data are for the period from January 1, 1994, to December 31, 2020. Past performance is not a guarantee of future results. We calculated the annualized net excess return of each outperforming fund relative to their relevant benchmark for each of the Morningstar categories over the period. The sample of outperforming funds totals 203 funds. For full descriptive statistics, including benchmarks used, see Appendix 1.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

Figure 3. The likelihood of bottom-quartile performance for many categories of active fixed income is much lower than it is for active equity

Percentage of funds with at least one period of bottom-quartile performance during sample period



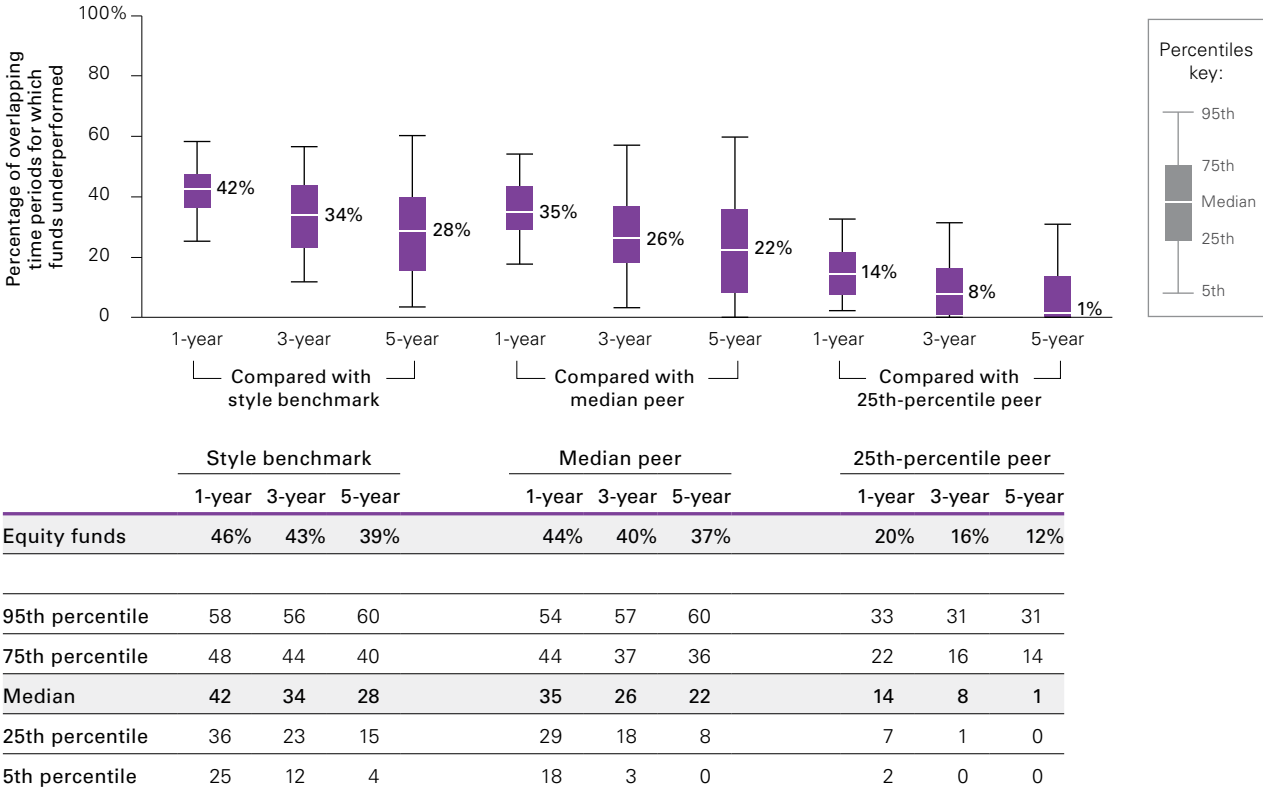
Notes: We evaluated U.S.-domiciled, active fixed income funds with a minimum of ten years of performance data over the period relative to the style benchmark and identified all net outperforming funds. For each group, we calculated overlapping three- and five-year performance for each year of the period and measured it relative to the 25th-percentile peer returns over the same period. The data presented are the percentage of the outperforming funds in each category that experienced at least one three- or five-year period of bottom-quartile performance. For fixed income, data are for the period from January 1, 1994, to December 31, 2020; for equity, data are for the period January 1, 1995, to December 31, 2019. Past performance is not a guarantee of future results. Data for the equity category are from Tidmore and Hon (2021). For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021 (fixed income) and May 2020 (equity), based on data from Morningstar, Inc.

After looking at the likelihood of experiencing various drawdowns, we explore the frequency of experiencing various drawdowns, defining frequency as the percentage of time periods where the manager underperformed one of the three defined benchmarks. We can see in **Figure 4** that outperforming active fixed income funds as a whole underperform their peer median less frequently than they underperform their style benchmark. As you can see in the data at the bottom of the figure, this difference does not exist with active equity managers. Active fixed income funds also experience three- and five-year bottom-quartile performance less frequently than active equity funds do, which would seem to imply that outperforming active fixed income funds are better than their equity counterparts at avoiding long drawn-out periods of significant underperformance.

To see if there is a difference in the frequency of underperformance across strategies, we test the difference of the means across the fixed income style categories for each of the three evaluation periods and the style, median peer, and 25th-percentile peer benchmarks. We find—strikingly, and in contrast with equities—that many of the differences are statistically significant to 1% and economically significant across the strategies. Testing for differences across style and median peer benchmarks, we find that the means of the paired differences are greater than zero at a 1% level of significance. This last point lets us conclude that one should be aware of the benchmark being used when discussing the frequency of drawdown to potentially expect. This result was different than what was found

Figure 4. Compared with equities, fixed income’s frequency of underperformance varies more with type of benchmark used



Notes: We evaluated U.S.-domiciled, Morningstar active fixed income funds with a minimum of ten years of performance data over the period, relative to their style benchmark and identified all net outperforming funds. For each fund, we calculated overlapping one-, three-, and five-year performance for each year and measured it relative to that of the relevant style benchmark, median peer, and 25th-percentile peer returns. **For fixed income, data are for the period from January 1, 1994, to December 31, 2020; for equity, data are for the period January 1, 1995, to December 31, 2019. Past performance is not a guarantee of future results.** The data presented are each group’s 5th-, 25th-, 50th-, 75th-, and 95th-percentile fund returns. Data for the equity category are from Tidmore and Hon (2021). For benchmarks used for style categories, see Appendix 1.

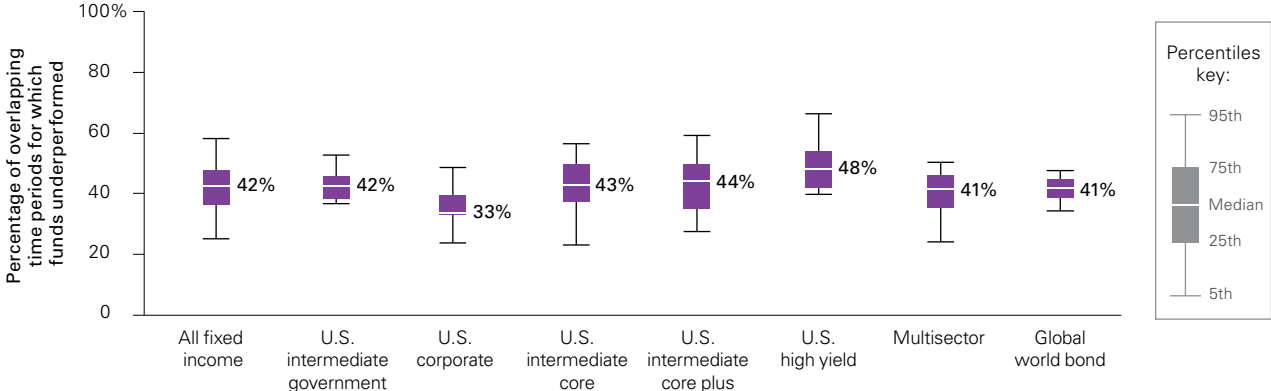
Sources: Vanguard calculations as of May 2021 (fixed income) and May 2020 (equity), based on data from Morningstar, Inc.

when evaluating the various equity styles and across equity style and peer benchmarks, where there was homogeneity in the results. Similar to what was found with equities, we do find that individual managers within each style box had a broad range of levels of frequency of underperformance (see **Figure 5**). Additionally, as shown in **Appendix 2**, we find a significant negative relationship between the frequency of drawdowns and the magnitude of a fund’s annualized excess returns.

While some investors may lose patience with frequent drawdowns, other investors may lose patience if a manager underperforms by specific amounts. With this in mind, we determine the percentage of outperforming active fixed income funds that had drawdowns relative to style benchmarks greater than various thresholds and find that the likelihood of drawdowns breaching various performance levels differs both for outperforming fixed income funds relative to outperforming equity funds and across the various fixed income strategies.

Figure 5. The frequency of underperformance is similar across strategies over shorter evaluation periods— but as the evaluation periods increase, so does dispersion across strategies and funds

1-year style



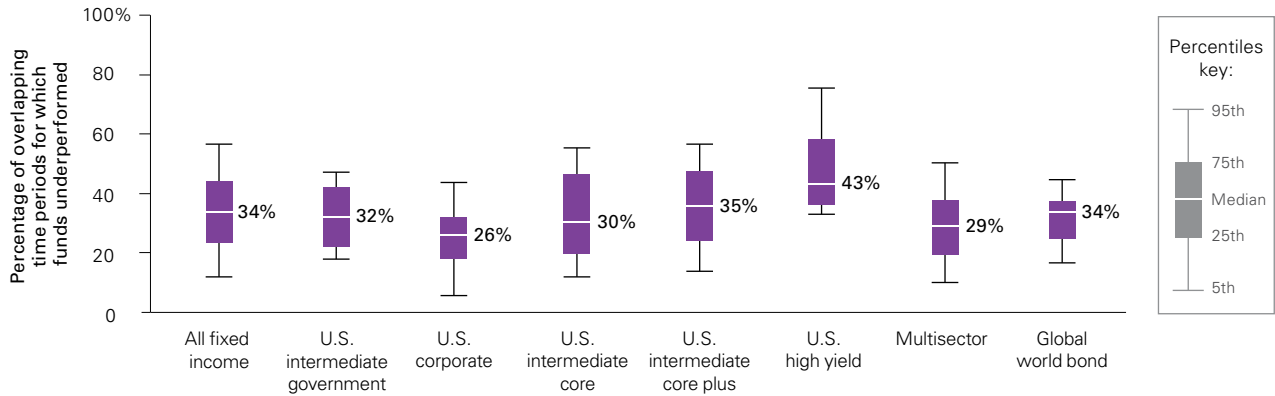
	All fixed income	U.S. intermediate government	U.S. corporate	U.S. intermediate core	U.S. intermediate core plus	U.S. high yield	Multisector	Global world bond
95th percentile	58%	53%	49%	56%	59%	66%	50%	48%
75th percentile	48	46	40	50	50	54	46	45
Median	42	42	33	43	44	48	41	41
25th percentile	36	39	33	38	35	42	35	39
5th percentile	25	37	24	23	27	40	24	35

Notes: We evaluated U.S.-domiciled, Morningstar active fixed income funds with a minimum of ten years of performance data over the period from January 1, 1994, to December 31, 2020, relative to their style benchmark and identified all net outperforming funds. **Past performance is not a guarantee of future results.** For each fund, we calculated overlapping one- three-, and five-year performance for each year of the period and measured it relative to the relevant style benchmark over the various aggregated time periods. The data presented are each group’s 5th-, 25th-, 50th-, 75th-, and 95th-percentile fund returns. For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

Figure 5 (Continued). The frequency of underperformance is similar across strategies over shorter evaluation periods—but as the evaluation periods increase, so does dispersion across strategies and funds

3-year style



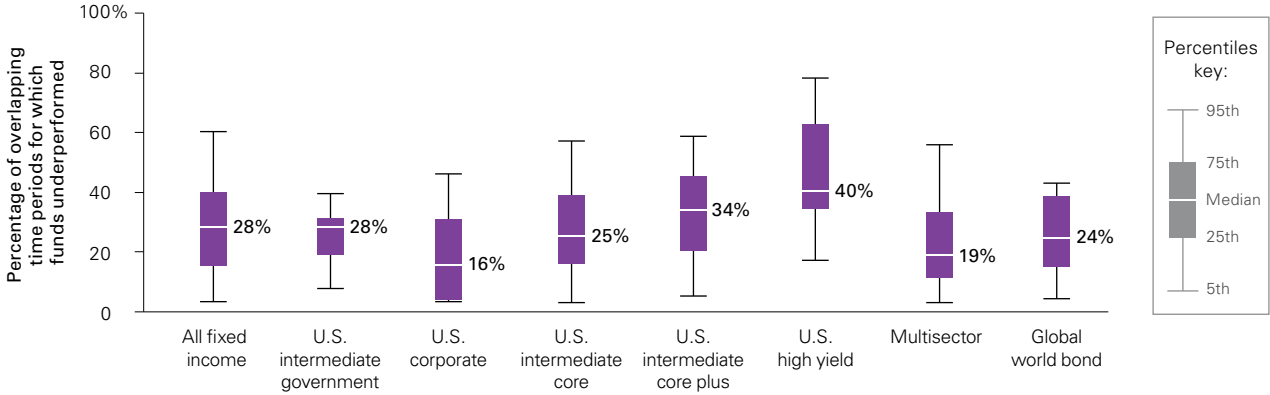
	All fixed income	U.S. intermediate government	U.S. corporate	U.S. intermediate core	U.S. intermediate core plus	U.S. high yield	Multisector	Global world bond
95th percentile	56%	47%	44%	55%	57%	75%	50%	45%
75th percentile	44	42	32	47	47	58	38	37
Median	34	32	26	30	35	43	29	34
25th percentile	23	22	18	20	24	36	19	25
5th percentile	12	18	6	12	14	33	10	17

Notes: We evaluated U.S.-domiciled, Morningstar active fixed income funds with a minimum of ten years of performance data over the period from January 1, 1994, to December 31, 2020, relative to their style benchmark and identified all net outperforming funds. **Past performance is not a guarantee of future results.** For each fund, we calculated overlapping one-, three-, and five-year performance for each year of the period and measured it relative to the relevant style benchmark over the various aggregated time periods. The data presented are each group’s 5th-, 25th-, 50th-, 75th-, and 95th-percentile fund returns. For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

Figure 5 (Continued). The frequency of underperformance is similar across strategies over shorter evaluation periods—but as the evaluation periods increase, so does dispersion across strategies and funds

5-year style



	All fixed income	U.S. intermediate government	U.S. corporate	U.S. intermediate core	U.S. intermediate core plus	U.S. high yield	Multisector	Global world bond
95th percentile	60%	39%	46%	57%	59%	78%	56%	43%
75th percentile	40	32	31	39	45	63	33	39
Median	28	28	16	25	34	40	19	24
25th percentile	15	19	4	16	20	34	11	15
5th percentile	4	8	3	3	5	17	3	4

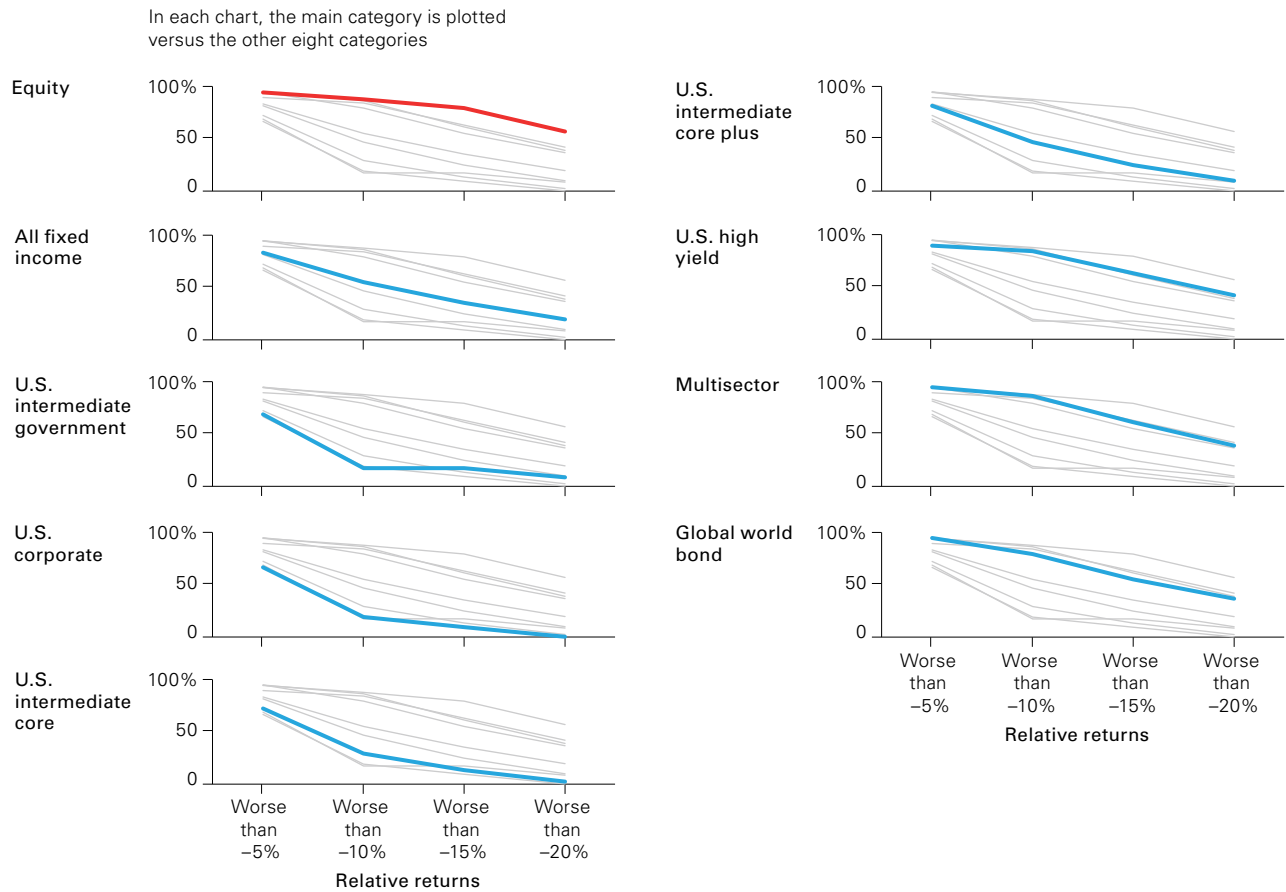
Notes: We evaluated U.S.-domiciled, Morningstar active fixed income funds with a minimum of ten years of performance data over the period from January 1, 1994, to December 31, 2020, relative to their style benchmark and identified all net outperforming funds. **Past performance is not a guarantee of future results.** For each fund, we calculated overlapping one-, three-, and five-year performance for each year of the period and measured it relative to the relevant style benchmark over the various aggregated time periods. The data presented are each group’s 5th-, 25th-, 50th-, 75th-, and 95th-percentile fund returns. For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

Figure 6 shows that some fixed income strategies are as likely as equity funds to see drawdowns of 5 or 10 percent; however, as the drawdown threshold increases, even those fixed income strategies are less likely to experience the higher drawdown levels typical for equity funds.⁹ Additional analysis found that—on average and

across categories—when median peer benchmarks were used rather than style benchmarks, roughly 20% fewer fixed income funds breached each of the return thresholds shown in Figure 6. The difference between style and median peer benchmark was markedly smaller for equity funds (5%).

Figure 6. Some strategies experience much larger drawdowns than others



Notes: We evaluated U.S.-domiciled, active fixed income funds with a minimum of ten years of performance data for the period, relative to their style benchmark and identified all net outperforming funds. We calculated the magnitude of every drawdown of each fund over the sample period relative to the relevant style benchmark and used each outperforming fund's worst drawdown by magnitude. For fixed income, data are for the period from January 1, 1994, to December 31, 2020; for equity, data are for the period January 1, 1995, to December 31, 2019. Past performance is not a guarantee of future results. Data for the equity category are from Tidmore and Hon (2021). For benchmarks used for style categories, see Appendix 1.

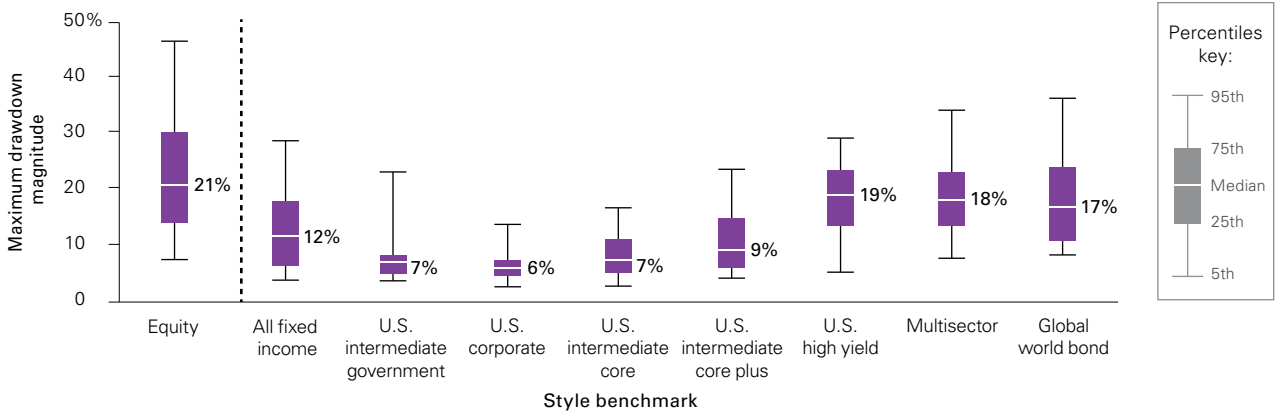
Sources: Vanguard calculations as of May 2021 (fixed income) and May 2020 (equity), based on data from Morningstar, Inc.

⁹ The fact that some fixed income categories are as likely as equity funds to experience drawdowns of 5 or 10 percent should not be unexpected, as some of these fixed income categories, such as U.S. high yield, tend to exhibit strong correlations to equity markets, especially during equity bear markets (Stockton, Donaldson, and Chen, 2019).

We next consider the magnitude and length of the maximum drawdown period. In **Figure 7** we see that the median maximum drawdown magnitude of all outperforming fixed income funds relative to their style

benchmark is 12%, or about half of what Tidmore and Hon (2021) found for outperforming equity funds. We also note the large range of maximum drawdowns by funds and by fund category.

Figure 7. The maximum drawdown of outperforming fixed income funds is significantly different across categories



	Equity	All fixed income	U.S. intermediate government	U.S. corporate	U.S. intermediate core	U.S. intermediate core plus	U.S. high yield	Multisector	Global world bond
95th percentile	47%	29%	23%	14%	17%	24%	29%	34%	36%
75th percentile	30	18	8	7	11	15	23	23	24
Median	21	12	7	6	7	9	19	18	17
25th percentile	14	7	5	5	5	6	14	14	11
5th percentile	8	4	4	3	3	4	5	8	8

Notes: We evaluated U.S.-domiciled active fixed income across various categories with a minimum of ten years of performance data over the period from January 1, 1994, to December 31, 2020, relative to their style benchmark and identified all net outperforming funds. We calculated the magnitude of every drawdown of each fund over the sample period relative to their style benchmark and median peer, using each outperforming fund's worst drawdown in magnitude. **For fixed income, data are for the period from January 1, 1994, to December 31, 2020; for equity, data are for the period January 1, 1995, to December 31, 2019. Past performance is not a guarantee of future results.** Data for the equity category are from Tidmore and Hon (2021). For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

In **Figure 8**, the length of each fund’s maximum drawdown determined by magnitude shows whether a fund has recovered and, if it has, how long it took to go from the peak-to-trough phase through the recovery phase. We see that more than 70% of all outperforming fixed income funds have recovered from their maximum drawdown, while only about 40% of outperforming equity funds have done so. The funds that have not recovered may either still be recovering from a drawdown or were liquidated or merged prior to recovering.

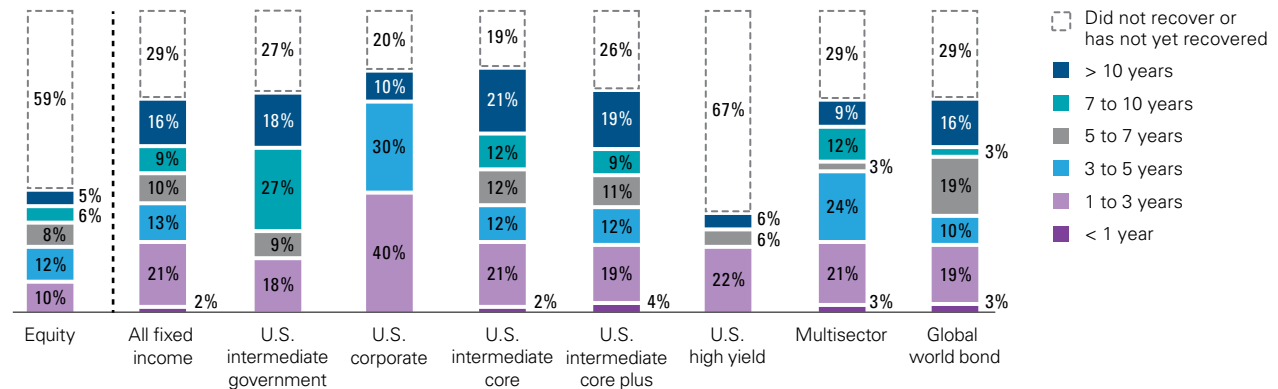
This leads to a question of what is driving the sizeable differences—is it the smaller magnitude of the underperformance, the skill of the managers, or something about how fixed income generates returns? Furthermore, one can’t conclude that there really is an average amount of time it takes for a fixed income fund to recover from its maximum drawdown; the data show that not only do many outperforming funds take one to three years to do this, but many others recover after ten or more years.

Conclusion

All assets and strategies—including outperforming traditional active managers of both fixed income and equity—are prone to periods of underperformance. For outperforming active fixed income funds, we find significant differences in frequency, magnitude, and length of drawdowns across many categories, which was not the case with outperforming active equity funds. Our data and analysis show that, compared with their equity counterparts, many active fixed income strategies are less likely to experience significant drawdowns over long periods. Therefore, patience may be less vital for these strategies than it is for active equity funds.

To be successful, investors will need to appropriately calibrate their level of conviction and active risk tolerance in light of the differing ranges of expected drawdown frequency, magnitude, and length across the various fixed income strategies.

Figure 8. There is a wide range of recovery times from maximum drawdown—and more fixed income funds than active equity funds recover



Notes: We evaluated U.S.-domiciled active fixed income across various categories with a minimum of ten years of performance data over the period relative to their style benchmark and identified all net outperforming funds. We calculated the magnitude and length of every drawdown of each fund over the sample period relative to their style benchmark, using each outperforming fund’s worst drawdown in magnitude. For fixed income, data are for the period from January 1, 1994, to December 31, 2020; for equity, data are for the period January 1, 1995, to December 31, 2019. Past performance is not a guarantee of future results. Data for the equity category are from Tidmore and Hon (2021). For benchmarks used for style categories, see Appendix 1.

Sources: Vanguard calculations as of May 2021 (fixed income) and May 2020 (equity), based on data from Morningstar, Inc.

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Appendix 1

Style benchmarks

The accompanying table shows the benchmark indexes used to define and construct the fixed income categories in our analysis. It also presents some additional descriptive summary statistics.

Style benchmarks used in analysis and key data points

Category	Number of initial funds	Benchmark used	Outperforming funds						
			Number of funds	Median return	Mean return	Percentile			
						95th	75th	25th	5th
U.S. intermediate government	91	Bloomberg Barclays U.S. Government Total Return Unhedged USD Index	11	0.11%	0.45%	1.96%	0.24%	0.06%	0.03%
U.S. corporate	32	Bloomberg Barclays U.S. Corporate Total Return Unhedged USD Index	10	0.45%	0.48%	0.92%	0.71%	0.25%	0.11%
U.S. intermediate core	187	Bloomberg Barclays U.S. Aggregate Total Return Unhedged USD Index	42	0.26%	0.32%	0.66%	0.46%	0.12%	0.03%
U.S. intermediate core plus	111	Bloomberg Barclays U.S. Universal Total Return Unhedged USD Index	57	0.33%	0.49%	1.48%	0.64%	0.20%	0.08%
U.S. high yield	149	Bloomberg Barclays U.S. Corporate High Yield Total Return Unhedged USD Index	18	0.15%	0.37%	1.15%	0.43%	0.08%	0.06%
Multisector	58	Bloomberg Barclays U.S. Universal Total Return Unhedged USD Index	34	0.88%	1.08%	2.36%	1.67%	0.54%	0.23%
Global world bond	65	Combination of Bloomberg Barclays Global Aggregate Total Return Unhedged USD Index and Bloomberg Barclays Global Aggregate Total Return (Hedged) USD Index	31	0.41%	0.59%	1.92%	0.72%	0.17%	0.04%
Full sample	693	Combination of all of benchmarks listed above	203	0.41%	0.59%	1.92%	0.72%	0.17%	0.04%

Note: We calculated the annualized net excess return of each outperforming fund relative to its relevant benchmark as shown for each of style categories over the period from January 1, 1994 to December 31, 2020.

Sources: Vanguard calculations as of May 2021, using data from Morningstar, Inc.

Appendix 2

Regression of fixed income excess returns on the various frequencies of drawdowns

Our goal here is to explore to a small degree the relationship between the frequency of drawdowns across various metrics and excess returns. We regressed the excess returns of the outperforming fixed income funds on various frequencies of drawdown metrics, while controlling for the different fund style categories. The accompanying table shows the results.

Not surprisingly, we find a statistically and economically significant negative relationship between frequency of drawdowns and the magnitude of the excess returns of the outperforming funds in our sample.

For example, an increase in frequency of one-year drawdowns relative to style benchmark by 10% leads to a decrease of 34 bps in annual excess returns (-0.0341×10). This relationship is stronger and more negative when looking at the frequency of drawdowns versus style or median peer benchmarks and when using shorter evaluation periods. From this, one could conclude that the less frequently a fund underperforms its style and peer benchmarks over one-, three-, and five-year periods, the higher the magnitude of its outperformance is likely to be.

Regression of excess returns on the frequency of drawdowns

Dependent variable	Annual excess returns in percentage points									
	Style			Peer			25th percentile			
	1-year	3-year	5-year	1-year	3-year	5-year	1-year	3-year	5-year	
Intercept	2.193 (12.44)	1.414 (12.28)	1.18 (11.51)	1.645 (11.07)	1.282 (12.09)	1.1387 (11.61)	0.839 (6.87)	0.899 (8.64)	0.87 (8.61)	
Frequency	-0.0341 (-9.07)	-0.0202 (-8.18)	-0.0154 (-7.43)	-0.0232 (-7.2)	-0.017 (-8.03)	-0.0147 (-7.75)	-0.0032 (-0.77)	-0.0107 (-3.05)	-0.0092 (-3.03)	
Style	U.S. intermediate government	-0.275	-0.309	-0.340	-0.644	-0.675	-0.604	-0.359	-0.417	-0.406
	U.S. corporate	-0.500	-0.427	-0.396	-0.389	-0.351	-0.409	-0.317	-0.361	-0.371
	U.S. intermediate core	-0.435	-0.432	-0.439	-0.602	-0.584	-0.577	-0.488	-0.534	-0.524
	U.S. intermediate core plus	-0.234	-0.210	-0.188	-0.233	-0.196	-0.200	-0.284	-0.242	-0.256
	U.S. high yield	-0.123	-0.054	-0.097	-0.466	-0.435	-0.453	-0.411	-0.394	-0.413
	Multisector	0.239	0.248	0.253	0.341	0.396	0.405	0.286	0.300	0.284
R-squared (adjusted)	41.05%	37.60%	34.69%	33.78%	37.03%	35.93%	16.44%	20.00%	19.95%	
Number of observations	203	203	203	203	203	203	203	203	203	
Frequency mean	42.30%	33.66%	29.09%	35.90%	28.03%	24.03%	15.56%	10.32%	8.09%	
Standard deviation of frequency	9.17%	14.66%	17.85%	11.58%	16.70%	19.39%	10.00%	11.69%	13.09%	

Notes: We evaluated U.S.-domiciled active fixed income across various U.S. categories with a minimum of ten years of performance data over the period from January 1, 1994, to December 31, 2020, relative to their style benchmark and identified all net outperforming funds, for a final sample of 203 funds. We calculated the length and magnitude of every drawdown of each fund over the sample period. For each fund, we calculated overlapping one-, three-, and five-year performance for each year of the period and measured it relative to the relevant style benchmark over the various aggregated time periods. We regressed the annualized excess returns of each outperforming fund on the various frequencies, controlling for style categories with global world bond as the reference style category. Figures in bold are statistically significant to at least 10%. The t-stats are reported in parentheses for the intercepts and frequency coefficients.

Sources: Vanguard calculations as of May 2021, based on data from Morningstar, Inc.

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