Key Takeaways

• In volatile markets, having a lower downside capture ratio is more important than having a higher upside capture ratio of the same magnitude.

• Mutual funds with lower downside capture ratios tend to exhibit lower overall risk.

• The upside and downside capture ratios can be an important consideration when evaluating a mutual fund’s performance.

• Investments with lower downside capture ratios can be more attractive to investors due to natural loss aversion and its behavioural consequences.

The S&P/TSX Composite Price Index peaked on June 18, 2008. Shortly after, what has since been called the “global financial crisis” took hold, and in a little under five months the index lost 49% of its value. It wasn’t until June 2014, five and a half years later, that the Index would finally recover from its bottom.

If an investor had realized only 50% of the loss of the S&P/TSX Composite Price Index during that timeframe (about 24%), and only participated in 50% of the positive return during the recovery, it would have taken only two years to recoup all of the market’s losses, not five and a half years.

The global financial crisis and the market’s path to recovery is a stark reminder of how quickly and painfully investment losses can mount and how long it can take to recoup those losses. Recognizing the effect of loss aversion, many investment managers have committed to mitigating downside risk by constructing portfolios with an objective of losing less than the market when it is falling.
This is because protecting from losses in falling markets leaves more capital to grow when markets rise again, contributing to faster recoveries and the potential to generate significant market outperformance through the power of compounding forward.

There are varying degrees to which downside protection can affect long-term market outperformance. In a rising market, downside protection doesn’t matter but in a sharp correction, limiting losses does. However, our analysis suggests that limiting losses is important even in a market that is trending higher with volatility, that is, when there are oscillating periods of gains and losses. This is generally the norm for equity markets.

The research summarized in this paper indicates that downside protection can be highly correlated with long-term market outperformance, an insight that can be helpful in manager evaluation and investment selection.

In this paper, we will explain:

1. why downside protection can be a powerful contributor to market outperformance and long-term wealth generation
2. an approach to measuring downside protection attributes over time
3. what downside protection can tell investors about the potential for an investment fund to outperform a passive market benchmark, particularly in periods of market volatility
4. the correlation between downside protection and other desirable risk and return attributes
5. the limitations of downside capture analysis and considerations for assessing the validity of downside protection claims

The math

A benchmark gains 2% in a month and then loses 2% the following month, resulting in a market that is consistently drifting lower. Why? Because a 2% loss more than offsets the gains realized from the positive 2% return. For example, an investment of $1,000 would rise to $1,000*(1+2%) = $1,020 after the first month. But the following month it would end with $1,020*(1–2%) = $999.60. Suppose there are three investment funds as follows:

- Fund A: Upside capture ratio of 100%, downside capture ratio of 100%
- Fund B: Upside capture ratio of 120%, downside capture ratio of 100%
- Fund C: Upside capture ratio of 100%, downside capture ratio of 80%

Based on these numbers alone, one might be inclined to believe that Fund B would outperform the others, based on its higher upside capture ratio. But if each fund invests $1,000 for a 20-year period in this market,

- Fund A would have an ending value of $953
- Fund B, with a stronger upside capture ratio, would have an ending value of $1,524
- Fund C, with a superior downside capture ratio, would end the period with $1,554

If you initially thought Fund B would have had the best results, this example demonstrates that despite equal changes in the upside and downside capture ratios, the improvement in the downside capture ratio produces better results.

Why downside risk mitigation matters

Due to the asymmetry of gains and losses, protecting capital in periods of falling markets can have a large impact on the total return of an investment, especially over the long term. For example, a loss of 10% during a period would require a subsequent 11.1% gain to break
WHY PROTECTING CAPITAL MATTERS

even and recover all of the value that was initially lost. This asymmetry increases at a parabolic rate as the loss increases; for example, a 50% loss would require a subsequent 100% gain to break even. The asymmetrical relationship between gains and losses immediately suggests that limiting losses would have a more powerful effect on long-term growth potential than achieving an equivalent nominal positive return.

Quantifying downside protection and upside participation

Downside and upside capture ratios are a simple pair of ratios that quantify what percentage gain or loss, on average, an investment achieves in a falling or rising market, respectively. The “market,” in this case, is defined by the return of a selected benchmark that should be as closely representative of the fund’s investment universe as possible.

The downside capture ratio is calculated by taking a fund’s monthly return when the benchmark had a negative return, dividing it by the benchmark return for that month, and annualizing the amount over a sufficiently long time period.

The upside capture ratio is determined by taking the fund’s monthly return when the benchmark had a positive return, dividing it by the benchmark return for that month, and annualizing the amount over the period of analysis.

The formulas for the calculation are as follows:

- **Downside capture ratio:** Only for monthly periods when the benchmark return was negative

  \[ \text{Downside Capture} = \left( \prod_{i=1}^{M_{\text{down}}} (1 + R_{\text{Fund},i}) \right)^{\frac{12}{M_{\text{down}}} - 1} \]

  \[ \prod_{i=1}^{M_{\text{down}}} (1 + R_{\text{BM},i})^{M_{\text{down}}} - 1 \]

  \( M_{\text{down}} \) represents the number of negative monthly periods.

  \( R_{\text{Fund}} \) and \( R_{\text{BM}} \) represent the fund’s and benchmark’s returns, respectively.

- **Upside capture ratio:** Only for monthly periods when the benchmark return was positive

  \[ \text{Upside Capture} = \left( \prod_{i=1}^{M_{\text{up}}} (1 + R_{\text{Fund},i}) \right)^{\frac{12}{M_{\text{up}}} - 1} \]

  \[ \prod_{i=1}^{M_{\text{up}}} (1 + R_{\text{BM},i})^{M_{\text{up}}} - 1 \]

  \( M_{\text{up}} \) represents the number of positive monthly periods.

An upside capture ratio greater than 100% indicates that the investment outperformed the benchmark during positive periods on average. In other words, it achieved a higher return than the benchmark, on average, when the benchmark rose. It does not necessarily mean that the fund outperformed the benchmark in all periods in which the benchmark return was positive.

A downside capture ratio of less than 100% indicates that a fund outperformed the benchmark during negative periods. In other words, the investment lost less than the benchmark, on average, when the benchmark realized a negative return. It does not necessarily mean that the fund outperformed the benchmark in all periods in which the benchmark return was negative.

So a lower downside capture ratio indicates that an investment may be better at protecting capital over the long term.
What does it mean for mutual fund performance?

Consistent with the arithmetical asymmetry of gains and losses, analysis suggests that in most equity market scenarios there is a much stronger relationship between long-term market outperformance and downside capture than between upside capture and market outperformance.

Exhibit 1 compares the ten-year excess return of each fund in the Morningstar Canadian Equity category to the downside capture ratio it realized during the same period. The correlation between the downside capture ratio and excess return in this sample was -0.65, indicating that these two variables were negatively correlated.¹ In other words, lower average downside capture ratios were inversely related to higher excess return. This suggests that during this ten-year period, a fund’s downside capture ratio tended to contribute to both benchmark outperformance and higher total returns.

The chart in Exhibit 2 uses the same group of funds as Exhibit 1, but replaces the downside capture ratio on the vertical axis with the fund’s upside capture ratio. This suggests that during this ten-year period, there was little correlation between a fund’s upside capture ratio and its returns. In fact, the correlation is practically zero, at 0.08.

EXHIBIT 1: This chart shows that there is negative correlation between lower downside capture ratios and higher benchmark outperformance.

Each dot on the chart represents a mutual fund in the Morningstar Canadian Equity category and plots the intersection of its ten-year downside capture ratio (vertical axis) and its ten-year excess return over the S&P/TSX Composite Index (horizontal axis). Funds with higher (weaker) downside capture ratios tended to perform much more poorly than funds with lower (stronger) downside capture ratios.

EXHIBIT 2: There is little evidence to show that upside capture correlates to better long-term returns.

Source: Morningstar Direct, Canadian Equity category, ten-year period ending March 31, 2017. The upside/downside capture ratio measures performance in up/down markets relative to the S&P/TSX Composite Index. It is calculated by compounding and annualizing the monthly returns for a fund and the index in periods when the index was up/down. The annualized return of the fund is divided by the annualized return of the index to produce the capture ratio for corresponding up/down market performance periods. A total of 120 monthly returns were analyzed; of those, 74 were up markets, while 46 were down markets.

### Exhibit 3: Upside/downside capture per quartile

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Median Excess Return (%)</th>
<th>Median Upside Capture (%)</th>
<th>Median Downside Capture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1</td>
<td>96.6</td>
<td>89.1</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>95.0</td>
<td>92.8</td>
</tr>
<tr>
<td>3</td>
<td>-0.7</td>
<td>94.8</td>
<td>98.3</td>
</tr>
<tr>
<td>4</td>
<td>-2.2</td>
<td>94.7</td>
<td>105.7</td>
</tr>
</tbody>
</table>

Source: Morningstar Direct, Canadian Equity category, ten-year period ending March 31, 2017.

¹ Source: Morningstar Direct, Canadian Equity category, ten-year period ending March 31, 2017.
In Exhibit 3, we split the category into quartiles (1 being the best and 4 being the worst, ranked by median excess return). Notice that the upside capture ratio between quartiles is similar and that the median of the top-performing quartile does not exceed 100%. However, the downside capture ratio of funds in the first quartile is significantly lower than other quartiles. It should also be noted that the median fund in the top quartile had a positive excess return, which indicates that it had outperformed the broad market benchmark, despite trailing in up markets.

For passive investment vehicles, such as exchange-traded funds (ETFs) that track market indexes, their upside and downside capture ratios will be close to 100% relative to the reference market index. This is due to the fact that passive investment vehicles are meant to simply track the market movements in the reference index. Since actively managed funds have the potential to realize downside capture ratios less than 100%, this trait allows them to outperform passive investment vehicles and potentially generate greater investment wealth over the long-term.

Exhibit 4 shows that funds with lower downside capture ratios also tended to have lower risk, as quantified by the standard deviation of returns. They also had higher risk-adjusted returns, as measured by the Sharpe ratio. Both of these relationships were highly correlated.

However, when the correlations between these risk measures and upside capture ratio is considered, the

**EXHIBIT 4:** Funds that exhibit lower downside capture also have lower volatility and higher risk-adjusted returns.

**EXHIBIT 5:** The higher the upside capture ratio, the more volatile the performance, while there was no correlation between upside capture ratios and risk-adjusted returns.

Source: Morningstar Direct, Canadian Equity category, ten-year period ending March 31, 2017.
relationship was not nearly as compelling. Exhibit 5 shows funds that have a higher upside capture ratio come with more volatility and no clear relationship with risk-adjusted returns.

Other universes analyzed

Morningstar U.S. Large Cap Equity categories (domestic and U.S.-domiciled funds)

The conclusions that were reached can also be extended to other geographies, although the relationships are not as strong as those we observe in the Canadian equity market. For example, protecting capital on the downside for U.S.-domiciled funds in the Morningstar U.S. Large Cap Equity categories is moderately correlated to better excess returns for the ten-year period ended March 31, 2017, with a correlation of -0.34. However, capturing up market returns is also moderately correlated to excess returns, with a correlation of 0.40. The marginally stronger relationship with upside capture can be explained by the multi-year bull market that U.S. equities have experienced since the global financial crisis. The S&P 500 Index has not experienced a negative calendar year return since 2008. However, looking historically, the importance of downside risk mitigation becomes prominent during periods of market volatility, such as during the aftermath of the tech bubble, the global financial crisis, and Greece’s sovereign debt issues in 2015. In fact, post the 1990-2000 bull market, downside capture has been more correlated with excess return than upside capture approximately 62% of the time, despite the current bull market which began in 2009.

In addition, the U.S. universe comprises a larger number of growth-oriented investment strategies, as represented by the Morningstar Large Cap Growth category, which have generally outperformed value-oriented (Morningstar Large Cap Value) and blend-oriented (Morningstar Large Cap Blend) strategies over the past ten years. Broadly speaking, growth-oriented funds typically place a stronger emphasis on outperformance during up markets. Consequently, this bias softens the prominence of downside protection when viewed at an aggregate level in a sustained and long bull market.

Other factors to consider

Our analysis suggests that downside capture ratios can be a useful tool to aid in evaluating the expected return characteristics of a given investment. However, in order to evaluate the validity of a fund’s downside capture ratio, a number of factors must be evaluated and considered.

Time period

Because downside capture ratio calculations require that negative returns be isolated from positive returns, the analysis generally requires a relatively long performance timeframe to collect sufficient data points to establish a relationship of some statistical strength and validity. This is critical. A period that is too short and that occurs in the midst of a trending market can lead to a disproportionate number of up periods or down periods. If the number of months used to calculate either the upside capture or downside capture is too low, the ratios would not provide an accurate representation of the fund’s performance in up or down markets. For example, a strong rally in equity markets can create a significantly larger number of up market periods than down periods. This has been the predominant market scenario for U.S. equities for the 10-year period ended March 31, 2017, and why the downside capture “signal” is more muted. Accordingly, in this type of situation, the downside capture ratio may not reflect the fund’s down market performance. A longer timeframe is recommended in order to achieve a more significant number of up and down market periods.

Benchmark/market index

The index that the fund is being compared with should be a fair proxy and a similar asset class, as the up
and down market periods are based on the index’s performance. If a fund invests in a different universe, the ratios calculated would not be relevant. Approach blended benchmarks with caution, because they can contain multiple indexes and, as a result, may be naturally diversified. Similarly, due to the lower volatility of fixed-income securities, bond indexes tend to post fewer negative return periods.

**Currency**

Capture ratios could vary depending on the currency they are measured in. For example, for the five-year period ending August 31, 2015, the S&P 500 posted 41 monthly periods of positive returns and 19 monthly periods of negative returns in U.S. dollar terms. In Canadian dollar terms, the S&P 500 had 45 positive periods and 15 negative periods.

**Secular market trends**

The analysis of the U.S. market has revealed that there are specific periods, such as the multi-year bull market following the global financial crisis, when the significance of downside protection becomes muted. Intuitively, this would seem reasonable, as one would not have to be concerned with protecting capital if markets are rising consistently, with fewer periods of material downward corrections. However, it may not be prudent to rely on a permanent bull market. As market conditions normalize, the significance of downside protection quickly returns to the forefront.

**Correlation of downside and upside capture ratios over time**

Exhibit 6 shows the changing strength of relationship between downside capture and upside capture ratios and market returns over time. It plots the rolling ten-year correlation of downside and upside capture ratios to excess return, respectively for the Morningstar Canadian Equity category, as well as the rolling ten-year total return of the S&P/TSX Composite Index. The first data point represents the ten-year period ending March 31, 2007; periods before this lacked a representative number of funds with a ten-year track record in the category. It shows clearly that while the strength of the relationship between downside capture and market outperformance varies over time, there tends to be a much stronger relationship on average. Through these rolling periods, the average correlation between excess return and upside capture was 0.31, while the correlation between excess return and downside capture was -0.52.

In addition, the chart shows that during periods of falling market returns, such as between 2008 and 2010, the relationship between downside capture and excess return strengthens (becomes more negatively correlated). On the other hand, when market returns are rallying, such
as between 2010 and 2013, the relationship between downside capture and excess return weakens, but to a lesser extent. This emphasizes the point that downside protection becomes more prominent when it is needed the most, during market volatility and downturns.

Concluding remarks
The analysis above suggests that favourable downside capture correlates with better excess returns, lower volatility and higher risk-adjusted returns.

Investors should consider incorporating the upside and downside capture ratios into their evaluation of the return attributes that a particular investment manager can achieve. Capture ratios are a useful tool to help evaluate the performance attributes of an investment fund. If a portfolio manager says that his or her investment strategy focuses on downside protection, then these metrics can be used to help validate that claim.

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Endnotes
1 In this analysis, a t-test was also used to determine the statistical significance of the correlation. The t-value, which measures the magnitude of difference relative to the variation in the data, was calculated to be -10.49. The t-value is negative in this case because it is a negative relationship (higher excess return correlated with lower downside capture). The greater the magnitude of the t-value (in absolute terms), the greater the evidence that the sample is statistically significant and not random chance. A 99% confidence level was used as the threshold for determining whether the relationship was statistically significant. The critical value associated with a 99% confidence level is 2.33 (or -2.33 for negative relationships). As the t-value of -10.49 is far less than the critical value of 2.33, the relationship is considered to be statistically significant at the 99% confidence level.

2 The Sharpe ratio is a measure of risk-adjusted returns and is calculated as the ratio between a portfolio’s excess return over the risk-free rate and its standard deviation.

3 The correlation between downside capture and the ten-year standard deviation was 0.86, with a t-value of 20.66. The correlation between downside capture and the ten-year Sharpe ratio was -0.72, with a t-value of -13.00. At a 99% confidence level, the critical value is 2.33.

4 Based on 10-year periods rolled quarterly with the first period ending March 2000 through to March 2017. There were a total of 69 periods of which 43 were instances where the correlation of downside capture to excess return was stronger than the correlation of upside capture to excess return.

Before investing, consider the funds’ investment objectives, risks, charges and expenses. Contact Fidelity for a prospectus or, if available, a summary prospectus containing this information. Read it carefully.

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