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"Expect everything so that nothing comes unexpected."
— Norton Juster

An investor in hedge funds recently told me that he only invests in funds with a Sharpe ratio greater than 2.0. In addition, he cuts his capital allocation to a fund if it has a drawdown greater than 5%. He has a serious problem. Even with great managers and a strict drawdown control, he was losing money. Why?

His drawdown risk control is mismatched with the Sharpe ratio hurdle. He was cutting positions far too soon. While attempting to "let his profits run and cut his losses short," he was inadvertently allowing for neither.

Given a Sharpe ratio of 2.0, how many months per year should the investor expect to lose money? What is the worst expected drawdown each year? What are reasonable expectations for downside risk?

The answers may be surprising.

Most investors are very excited about a strategy that targets 20% annual return with a volatility of 10% (i.e. a Sharpe ratio of 2.0), as it far exceeds the benchmark averages. Given such a strategy, what should the investor expect about the annual downside?

Assuming the strategy returns are normally distributed, we simulate year-long samples and analyze the resulting data.[1] The results show the following return characteristics:

Expected number of down months per year	**3.4**
Probability of 3 or more down months per year	**70%**
Expected number of drawdowns worse than 3% per year	**2.5**
Expected worst drawdown amount per year	**-6.5%**

Figure 1: Data are calculated using 50,000 simulations of 252 trading days (i.e. year-long samples). The expected annual return is 20% with an annual standard deviation of 10% (i.e. a Sharpe ratio of 2.0 assuming a 0% risk-free rate). Cumulative return data computed using simple returns (i.e. fixed booksize without compounding). Drawdowns are calculated at a daily (not monthly) frequency.

[1] It is worth noting that many strategies with a Sharpe ratio of 2.0 have return distributions that are not normal. Instead, they tend to be negatively skewed with fat tails. The statistics for such distributions often result in deeper and longer drawdowns.

A strategy with a Sharpe ratio of 2.0, targeting 20% return on average, is expected to have more than three down months and a -6.5% drawdown in a given year. This is just a base case expectation. It could certainly be down more than three months and have a deeper drawdown.

Not knowing these figures in advance could result in a terrible outcome for both the investor and the manager. The investor could be too quick to pull money or cut positions because the expectations were misaligned or not understood.

We can calibrate our drawdown expectations in advance if we fix the target returns but allow the Sharpe ratio (and thus the volatility) to vary. The chart below illustrates the expected worst drawdowns per year for investments targeting either a 10% or 20% return with different Sharpe ratios.

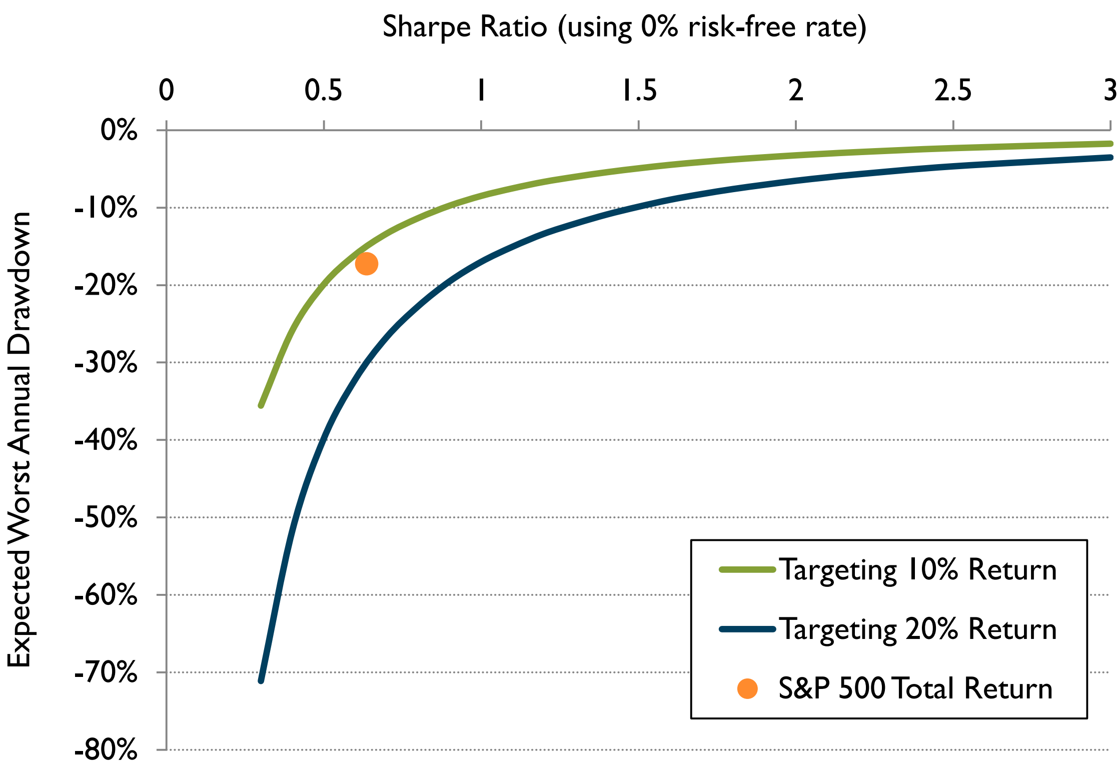

Figure 2: Data are calculated using 50,000 simulations of 252 trading days (i.e. year-long samples). Sharpe ratios are calculated assuming a 0% risk-free rate. Cumulative return data computed using simple returns (i.e. fixed booksize without compounding). Drawdowns are calculated at a daily (not monthly) frequency.

For reference, the S&P 500 Total Return has a Sharpe ratio of about 0.6 and an average annual return of 11.4%, using data for the past 25 years. Using our simulated data, the expected worst drawdown per year for the S&P 500 is about 17% and is plotted in the above chart.

Similarly, most hedge fund strategies have Sharpe ratios of about 1.0, which implies expected worst drawdowns per year of about 17% if they target a 20% return. In other words, the drawdown expectations are similar between many hedge fund strategies and the broader equity market!

These drawdowns, while painful, are completely "reasonable" if one uses the Sharpe ratio as an investing metric.

It all comes back to calibrating expectations correctly. Having a fair estimate for returns, volatility and Sharpe ratio is important, but making sure they are within reason as they relate to each other is critical.

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