Introduction to the Sharpe Ratio

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Why Returns Need Context

Imagine two assets with an equal total return over a given time period, but one fluctuates whilst the other increases steadily. Intuitively, we might recognise that the highly volatile asset is less appealing. These large price movements make the experience of holding the asset painful and uncomfortable; it may be outperforming the other asset at some point but it may underperform at other points, perhaps even into negative returns. That instability will also reduce our confidence in that asset for future performance.

Volatility creates practical problems too. One problem is due to liquidity, if we need cash soon and the asset happens to be down, we would be forced to close that position at a loss. These fluctuations represent a risk when we take on an asset, therefore, the one that fluctuates less is generally more desirable and a better asset to invest in.

Because of this, simply comparing percentage returns isn't always meaningful. We can calculate a way to evaluate performance relative to the risk taken. This metric is the Sharpe Ratio; a metric that captures how much return an asset delivers per unit of risk.

The Sharpe Ratio

In Article No.4, I introduced volatility, σ, representing the market uncertainty. To mathematically represent volatility, this is the standard deviation of market returns. Given a number of observations $R_1, \ldots, R_n$:

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(R_i - \overline{R}\right)^2}$$

where $\overline{R}$ is the average return over a given time period. This formula computes the average of the square deviations from the mean return. Let us first visualise volatility with a graph:

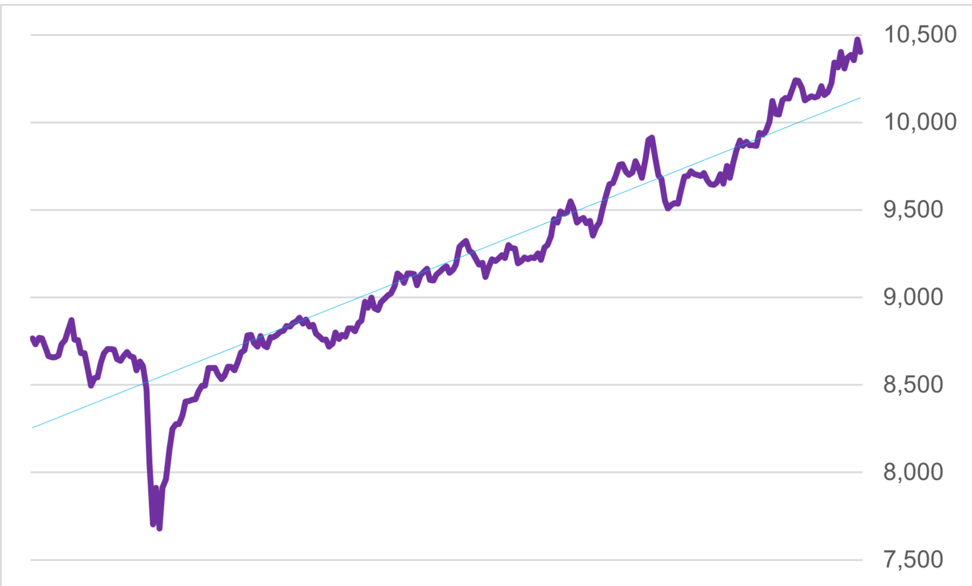

Figure 1: Observed FTSE 100 market performance versus its average return over the past year (£)

If the blue line represents the average return, $\overline{R}$, and the purple line represents the observed market returns, R_i, which is the reflection of the investment. Volatility measures the deviations from the trend line.

The Sharpe ratio is a risk-adjusted measure for performance. It can be calculated by taking the average returns over a given time interval and dividing by the volatility of those returns. To make the comparison more meaningful, we also adjust for the risk-free rate, R_f.

$$\text{Sharpe Ratio} = \frac{\overline{R} - R_f}{\sigma} \tag{1}$$

Note, when calculating the annualised Sharpe ratio, we typically have the data for daily returns and volatility so we multiply by $\sqrt{252}$ (the number 252 reflects the average number of trading days in a year).

By incorporating volatility, the Sharpe ratio tells us how much return an asset will generate per unit of risk. We can clearly see from equation (1) that a higher Sharpe ratio corresponds to returns that deviate less from their average. Extremely high Sharpe ratios, however, would imply near perfect arbitrage opportunities, something which is a little unrealistic in financial markets.

That leads us to think, what would count as a "good" Sharpe ratio? For the FTSE 100 in figure (1), the Sharpe ratio over the past year is 1.09. However, in the last 25 years, the FTSE 100 has only had a Sharpe ratio of 0.23. For context, Warren Buffet, one of the most famous investors in the world, achieved a Sharpe ratio of 0.76 for over 4 decades, while some hedge funds have Sharpe ratios in the 2+ range.

Conclusion

We can now understand why Sharpe ratios are so commonly used in quantitative finance. We know that returns are key for investors, but risk management is fundamental. Sharpe ratios are a risk-adjusted measure of performance that shows how much an investor is rewarded based on the risk they undertake. It captures performance in a clear and intuitive measure that helps us compare assets, evaluate investment approaches, and determine whether the returns achieved are worth the volatility involved.

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