

EVALUATING RISK-ADJUSTED PERFORMANCE WITH THE SHARPE RATIO

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THE ADVANTAGE OF DIVERSIFICATION

In Article No.6, I introduced the Sharpe ratio and how we can evaluate an asset's returns. However, what happens when we introduce this idea to a portfolio. Consider two assets, with equal Sharpe ratios, they have equal returns and volatility over a given time period but a different path. How do we know which asset to choose? We could leave it to chance of probability and randomly choose. However, there is an answer to this scenario. We can combine the two investments, reducing risk and obtaining a higher Sharpe ratio. Depending on what the paths are, to maximise the Sharpe ratio we might have 80% in asset A and 20% in asset B, or a 50/50 portfolio split. This will allow us to reduce the standard deviation of returns and have smoother continuous gains. When people talk about trying to diversify or hedge their portfolio, this is exactly what they are referring too. They are trying to create a continuous return profile with small deviations, to do so, they combine investments that move in the opposite path. Sharpe ratios are one way to gauge how effectively we have diversified a portfolio.

WHEN STABLE RETURNS BEAT VOLATILE ONES – WITH A LITTLE HELP

Which investment should we prefer: higher returns or a higher Sharpe ratio? Consider two assets, Asset C with high Sharpe ratio and stable returns, and Asset D, where the asset is incredibly volatile but at the end of the given time period, has higher returns. While a high Sharpe ratio is nice, in the end, we will have more money with Asset D. Does this mean the Sharpe ratio is not as useful as we first think?

Let us introduce the idea of utilising leverage; leverage allows an investor to borrow capital to scale up a position, increasing both returns and volatility while keeping the Sharpe ratio unchanged. A strategy with a high Sharpe ratio can therefore be levered to target higher returns without sacrificing its risk-adjusted efficiency. In our example, we could apply leverage to Asset C and achieve returns that exceed those of Asset D, all while maintaining the same Sharpe ratio. Note, leverage does come with risks associated and if it is used excessively, it could lead to large losses.

THE T-STATISTIC BEHIND THE SHARPE RATIO

We can also view the Sharpe ratio through a statistical lens. In fact, the Sharpe ratio is closely related to the t-statistic and is used to evaluate whether average returns are statistically different from zero. In general, the formula of the t-statistic is:

$$t = \frac{\hat{\beta}_k - \beta_k}{se(\hat{\beta}_k)} \sim t_{N-K}.$$

Here, $se(\hat{\beta}_k)$ refers to the standard error of the estimate. Note that some mathematicians use the notation where $b_k = \hat{\beta}_k$.

To connect this to the Sharpe ratio, consider the hypothesis test where we ask whether the mean return differs from zero. Thus, in this case, $\beta_k = 0$, $\hat{\beta}_k$ = average return and the standard error is:

$$se(\hat{\beta}_k) = \frac{\sigma}{\sqrt{n}},$$

where n is the number of observations. Substituting into the t-statistic yields:

$$t = \frac{\hat{\beta}_k}{\left(\frac{\sigma}{\sqrt{n}}\right)}.$$

Rearranging, we see that the Sharpe ratio is simply the t-statistic scaled by the square root of the sample size:

$$\text{Sharpe Ratio} = \frac{t}{\sqrt{n}}.$$

This perspective highlights that the Sharpe ratio is essentially a measure of how statistically significant the average return is once volatility, σ , and sample size, n , are taken into account.

THE PORTFOLIO EVERY RATIONAL INVESTOR SHOULD HOLD

Rational investors who are anxious about risk and volatility but want higher returns should ultimately hold one optimal portfolio: the tangency portfolio, also known as the maximum Sharpe ratio portfolio. This portfolio delivers the highest possible return per unit of risk, which means it maximises the investor's expected utility. In other words, if your preferences are "more return, less risk," then striving to maximise the Sharpe ratio is the logical outcome.

Figure (1) illustrates this idea. The curve represents the efficient frontier, and the straight line tangent is the capital allocation line (CAL). The point of tangency, shown in yellow, is the portfolio with the highest Sharpe ratio. The point where the CAL intersects the y-axis corresponds to the risk-free rate.

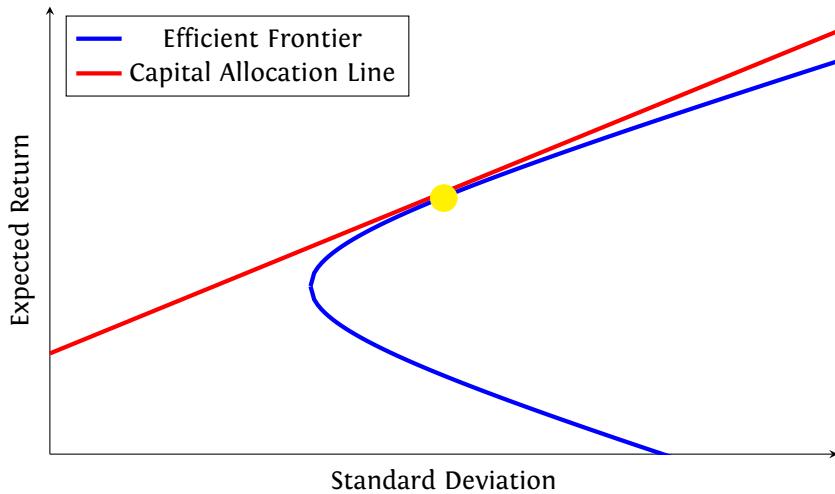


Figure 1: Tangency Portfolio

CONCLUSION

In conclusion, effective investing requires risk management. The Sharpe ratio provides a clean, intuitive way to evaluate performance on a risk-adjusted basis, allowing you to compare portfolios and individual investments. Sometimes, the best opportunities aren't just those with the highest returns, but those that deliver those returns efficiently and consistently.

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