

## Part 1: Pitching a Metric

I propose a new metric for measuring portfolio risk, which I call the "Return-to-Drawdown Ratio" (RDD Ratio). The RDD Ratio is defined as the ratio of the annualized return of a portfolio to its maximum drawdown over the same period. The purpose of this metric is to provide a more complete assessment of portfolio risk by capturing the potential downside risk.

The RDD Ratio addresses the limitations of the Sharpe ratio, which assumes that returns are normally distributed and does not account for the skewness and kurtosis of returns.

The RDD Ratio is calculated by dividing the annualized return of a portfolio by its maximum drawdown over the same period. Maximum drawdown is the percentage decline from the portfolio's peak value to its lowest point. It indicates the largest loss an investor could have experienced if they bought at the peak and sold at the lowest point. The annualized return is the measure for the average rate of return per year.

Pros:

- Gives a more comprehensive assessment of portfolio risk by capturing the potential downside risk that is not reflected in other metrics.
- Easy to calculate and interpret.
- Addresses the limitations of other metrics such as Sharpe ratio.

Cons:

- May not be good for comparing portfolios with significantly different investment strategies.
- Assumes that investors are more concerned with potential loss of capital than the level of volatility.

## Part 3: Evaluate Metric Correlation

I chose to track the RDD ratio and Sharpe ratio against each other by creating a pandas DataFrame with two columns, one for each ratio. For each volatility value, I computed the Sharpe ratio using the `compute_sharpe_ratio()` method and added the RDD ratio and Sharpe ratio to the DataFrame. We can observe how changing the volatility parameter affects both the Sharpe ratio and RDD ratio and see the trade-off between risk and return.

The correlation coefficient measures the strength and direction of the linear relationship between two variables. In the case of our portfolio, it measures the extent to which changes in the Sharpe ratio are associated with changes in the RDD ratio. If the correlation coefficient is close to 1, it suggests that the Sharpe ratio and RDD ratio are aligned with each other and both are providing similar information about the portfolio's risk and return characteristics. However, if the correlation coefficient is far from 1, it suggests that the Sharpe ratio and RDD ratio are not closely related. So, the Sharpe ratio may not fully provide the risk of drawdowns, while the RDD ratio may not fully provide the volatility on the portfolio's returns. In such cases, it may be important to use both metrics to gain proper knowledge of the portfolio's risk/returns.