**Risk Metrics from Historical Returns**

Risk is an inherent aspect of investing, and understanding it is crucial for evaluating the performance and resilience of mutual funds and ETFs. In this section, we introduce and calculate core risk metrics that quantify a fund's potential downside and variability in returns. These metrics – volatility, drawdowns, and Value-at-Risk – are widely used in portfolio management to assess risk and make informed investment decisions.

We demonstrate the computation of these risk metrics using the SPY ETF, which tracks the S&P 500 index and serves as a benchmark for U.S. equity performance. The metrics are calculated based on historical data, and their implications for fund risk are discussed. To provide a broader perspective, the appendix extends the analysis to 10 additional funds, enabling a comparative evaluation of risk across different investment strategies and asset classes.

**1. Volatility**

Volatility measures the variability or dispersion of a fund's returns over time. It reflects the level of uncertainty or risk associated with the fund's performance. Volatility is calculated as the standard deviation of the fund’s historical daily returns. The graph below shows the rolling volatility of the SPY ETF using a 20-day window.

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**2. Drawdowns**

Absolute drawdown quantifies the decline in the Net Asset Value (NAV) of a fund from its historical peak. It measures the worst-case loss in absolute terms. Relative drawdown represents the percentage decline from the historical peak NAV. It normalizes drawdowns for easier comparison across funds. The following graphs show the absolute and relative drawdowns of the SPY ETF.

A graph with red lines

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A graph with blue lines

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**3. Frequency, Duration, and Magnitude of Drawdowns**

Drawdown frequency counts the number of distinct drawdown events where the fund’s NAV drops below a predefined threshold. It reflects how often a fund experiences significant declines. Drawdown duration measures the length of time (in days) that the fund remains in a drawdown state, from peak to recovery. Finally, drawdown magnitude quantifies the severity of each drawdown, typically expressed as the average or maximum relative drawdown over all observed periods.

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**4. Value-at-Risk**

VaR estimates the maximum expected loss at a given confidence level over a specific time horizon. It is widely used to assess the potential downside risk. For example, at 95% confidence, the 5th percentile of the return’s distribution represents the VaR.

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