Checkpoint Report

Introduction

This project investigates how to construct an actively managed ETF using data-driven quantitative strategies. The aim is to explore whether systematic rules—built on transparent logic and driven by historical signals—can outperform traditional, static allocation approaches. I intend to create a portfolio model that is not only robust across different market conditions, but also easily updated and managed through code. The end product will appeal to both institutional investors and tech-savvy individuals interested in algorithmic investing. The final tool will be hosted on GitHub for transparency, reproducibility, and further extension by others.

Literature Review

This research draws from a broad spectrum of academic and practitioner insights. The foundational theory stems from Markowitz's modern portfolio theory and the CAPM framework, which emphasize the trade-off between risk and return. In the context of ETFs, recent studies such as those by Gray and Harris delve into the operational mechanics of ETF construction, while practitioners like Antonacci, Asness, and Velissaris have explored factor-based strategies, momentum trading, and the integration of mean reversion techniques. Grinold and Kahn's active portfolio management principles, as well as the work of Carver and Covel on risk parity and trend-following, provide conceptual support for constructing dynamic, rules-based portfolios. These sources collectively inform a strategy that blends empirical financial theory with modern computation.

Methods

The research involves identifying a universe of ETF instruments across asset classes such as equities, fixed income, and commodities. I use Python and yfinance to retrieve daily market data covering up to 25 years, including key periods like the 2008 crisis and COVID-19. Technical indicators such as moving averages, RSI, and volatility filters are calculated and serve as inputs for rule-based trading logic. Portfolio rebalancing is simulated biweekly to reflect a realistic trading frequency. I perform backtests on these rules using historical data, adjusting for transaction costs and simulating reinvestment. A Monte Carlo simulation framework is being developed to stress-test the strategy under thousands of synthetic market conditions, following guidance from López de Prado and Trivedi & Kyal. The trading model is modular and implemented for walk-forward testing. I do not rely solely on fixed return assumptions but model returns as distributions, recognizing the randomness inherent in financial markets.

Results

Initial results suggest that combining momentum and trend-following indicators improves the Sharpe ratio relative to a passive benchmark. For instance, ETFs that follow sector trends (like XLK or XLF) show higher cumulative returns when entering positions on 50/200-day moving average crossovers, particularly when combined with volume-based confirmations. Additionally, incorporating a stop-loss mechanism and volatility filter helps reduce drawdowns. Simulations indicate that diversifying across ETFs—including commodities and REITs—reduces portfolio beta and helps stabilize returns during bear markets. While some strategies appear promising on historical data, they also highlight the importance of stress-testing through Monte Carlo methods to ensure robustness under uncertain future conditions.

Conclusions

The checkpoint phase confirms that a data-driven approach to ETF portfolio design is feasible and valuable. It also highlights several implementation challenges ahead. Among them are the need to efficiently process large-scale time series, ensure real-time responsiveness in live trading scenarios, and remain compliant with financial regulations. I will need to further refine the balance between interpretability and complexity of the model, especially as I move toward packaging the strategy into an automated, user-facing GitHub repository. Despite these challenges, I remain confident in the direction of the project. The results so far indicate strong potential for constructing a transparent, adaptive ETF strategy that can be deployed as a low-cost alternative to traditional mutual funds.