Analysis of a Long/Short Global Macro Strategy: Sensitivity to Target Betas and Look-back Periods

FRE6711 Quantitative Portfolio Management

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Overview

This report presents an exhaustive analysis of a Long/Short Global Macro Strategy, focusing on its sensitivity to target betas (βT) and different look-back periods used for estimating the sample mean and covariance. The study's objective was to investigate how these parameters affect the strategy's performance and risk profile, particularly under varying market conditions, including crisis periods like the subprime mortgage crisis and the COVID-19 pandemic. Utilizing a dataset spanning from March 2007 to February 2024, the strategy was backtested across six scenarios, combining three look-back periods (short-term, medium-term, and long-term) with two target beta values (0 and 1). The analysis leveraged the Quadratic Solver CVXOPT in Python for portfolio optimization and Yahoo Finance for data acquisition.

1. Introduction

The motivation behind this analysis lies in the critical understanding that the performance and risk profiles of portfolio strategies, particularly those aiming for long/short global macro positioning, can significantly vary with changes in target beta and the historical window size used for risk and return estimations. Given the complex interplay between market sensitivity (as indicated by beta) and the accuracy of risk-return forecasts (influenced by the look-back period), this study seeks to elucidate the strategic implications of these factors on portfolio outcomes.

2. Methodology

2.1 Investment Strategy Framework

The investment strategy under scrutiny adheres to a portfolio optimization problem aiming to minimize the objective function:

$$\omega^T \Sigma \omega - \rho^T \omega$$

subject to constraints on portfolio target beta and holding limits. The strategy's performance is assessed against varying target betas ($_T$) and look-back periods for estimating sample covariance (Σ) and expected returns (ρ).

3 Assumptions and Setup

To streamline analysis, these assumptions were made:
- Weekly portfolio reallocation from March 2007 to February 2024.
- Consideration of three look-back periods for input construction: Short-Term (40 data points), Medium-Term (90 data points), and Long-Term (120 data points).
- Analysis under two target beta values: 0 and 1.

4. Results and Discussion

4.1 Performance Metrics

Key performance indicators included cumulated PnL, mean return, volatility, Sharpe ratio, max drawdown, skewness, kurtosis, and VaR/CVaR. These metrics were calculated for each of the six scenarios, providing a nuanced view of the strategy's performance across different configurations.

BETA = 1

	S40	S90	S120	SPY
Cumulative PnL	5.6007	1.8462	1.83	5.0167
Daily Mean Return	0.05%	0.02%	0.02%	0.05%
Daily Min Return	-7.79%	-4.46%	-4.21%	-10.94%
Max 10 Days Drawdown	12.00%	8.38%	5.66%	24.95%
Sharpe Ratio	5.97	-1.16	-1.81	4.47
Volatility	1.07%	0.52%	0.41%	1.27%
Skewness	0.14	-0.16	-0.16	-0.06
Kurtosis	5.77	7.00	6.39	13.84
Modified VaR	-0.0160	-0.0076	-0.0061	-0.0191
CVaR	-0.0235	-0.0117	-0.0092	-0.0310

BETA = 0

	S40	S90	S120	SPY

Cumulative PnL	5.5060	1.8149	1.7718	5.0167
Daily Mean Return	0.05%	0.02%	0.01%	0.05%
Daily Min Return	-7.81%	-4.46%	-4.21%	-10.94%
Max 10 Days Drawdown	12.02%	8.40%	5.66%	24.95%
Sharpe Ratio	5.87	-1.36	-2.06	4.47
Volatility	1.07%	0.52%	0.41%	1.27%
Skewness	0.14	-0.15	-0.15	-0.06
Kurtosis	5.79	7.05	6.45	13.84
Modified VaR	-0.0160	-0.0077	-0.0061	-0.0191
CVaR	-0.0235	-0.0117	-0.0092	-0.0310

Return Plots

For target beta = 1 and 120 days lookback
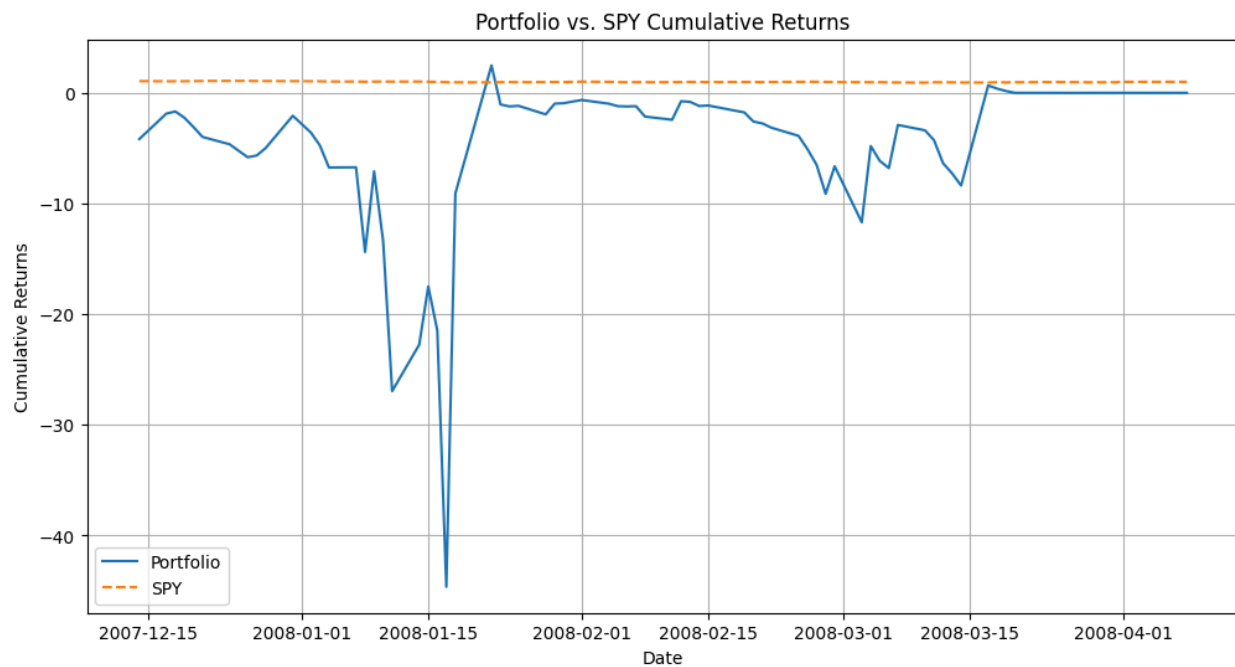
Portfolio vs. SPY Cumulative Returns

90 days target beta 1

Portfolio vs. SPY Cumulative Returns

40 days beta 1

Portfolio vs. SPY Cumulative Returns

Beta 0, 120 days lookback

Portfolio vs. SPY Cumulative Returns

Beta 0 90 days

Portfolio vs. SPY Cumulative Returns
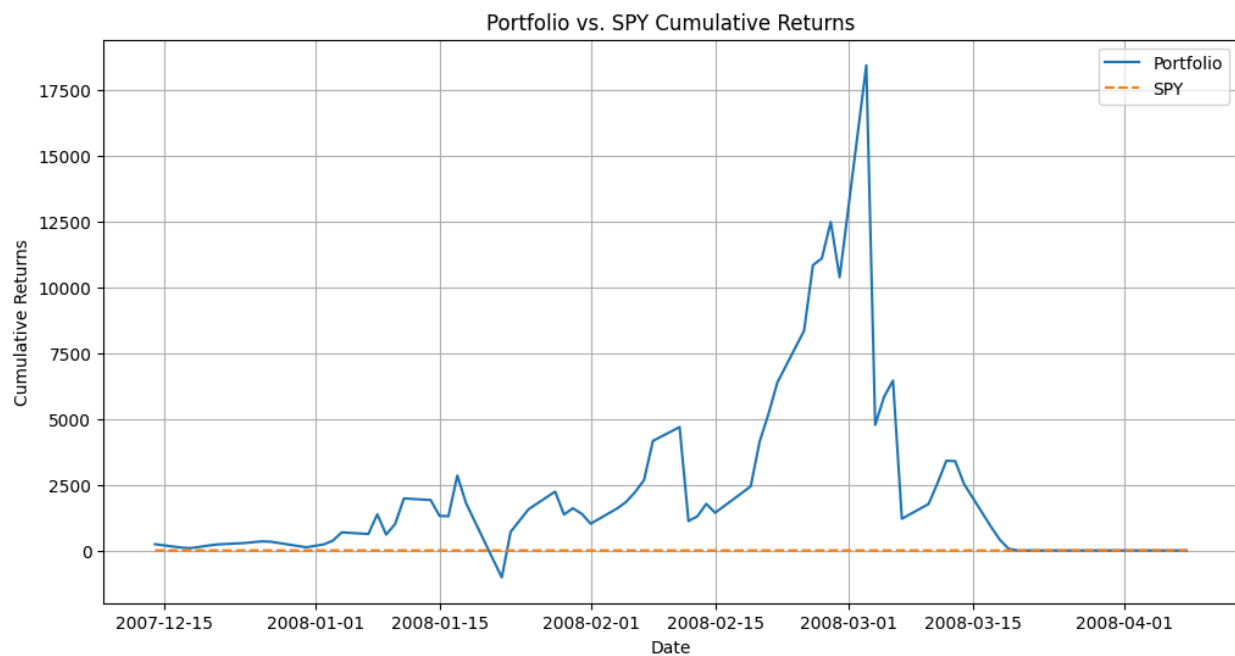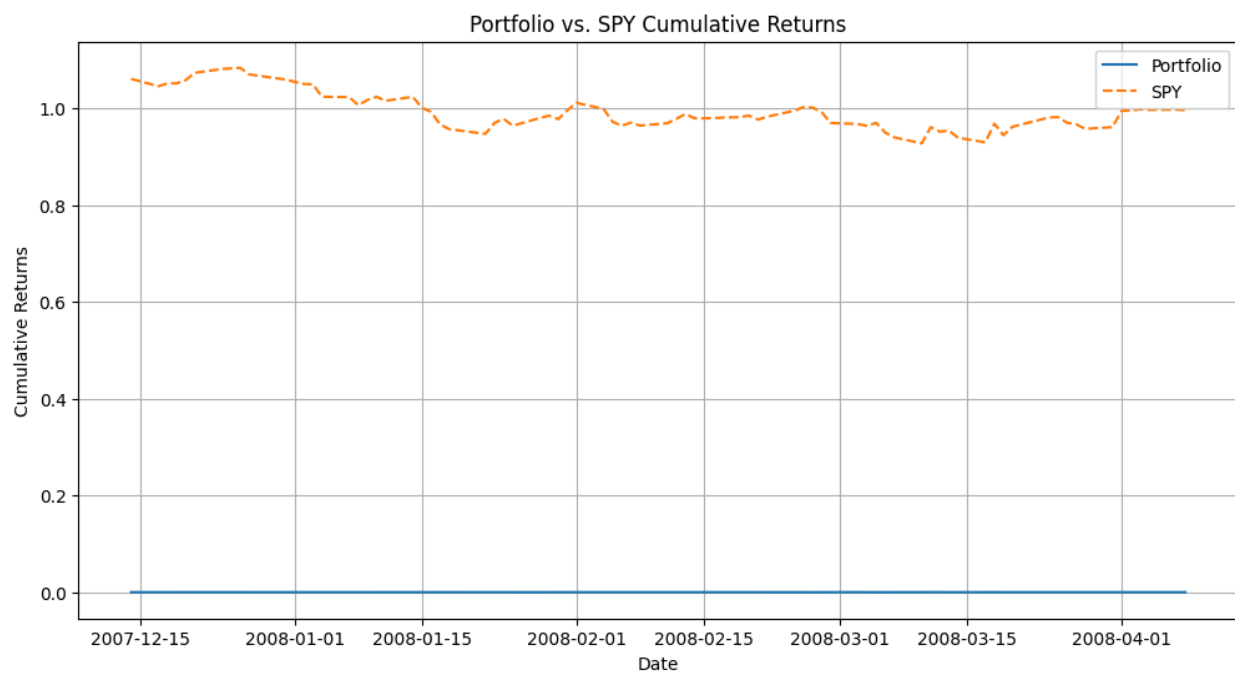
Beta 0 40 days
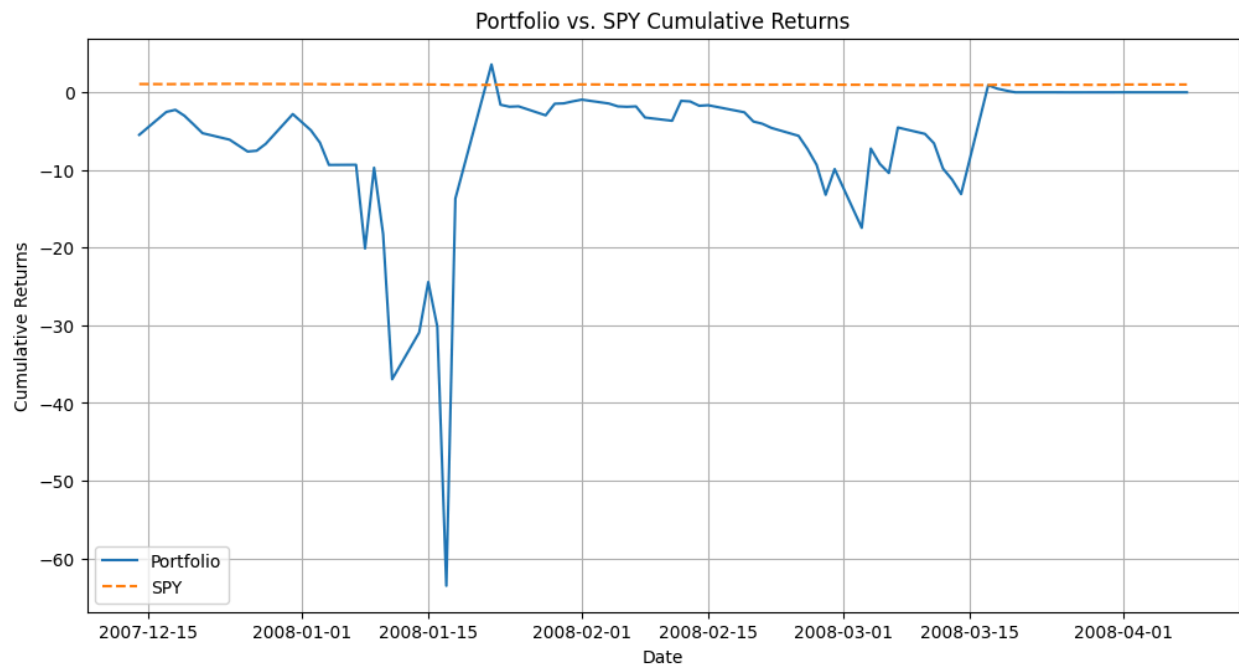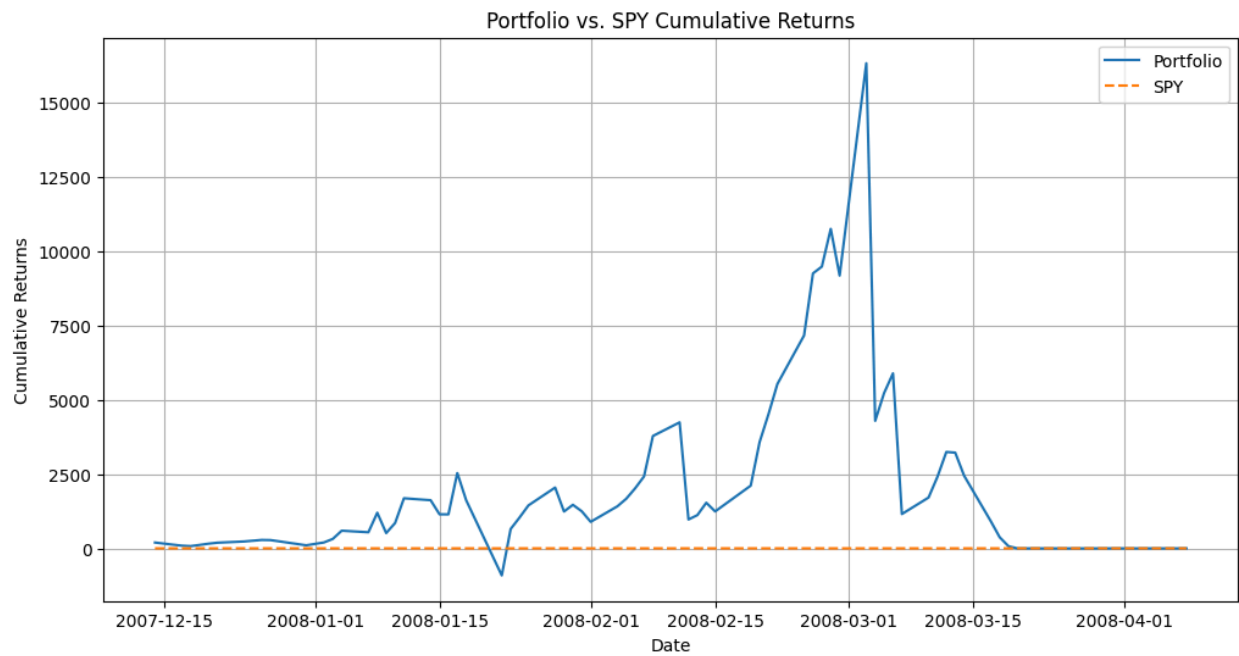
Portfolio vs. SPY Cumulative Returns
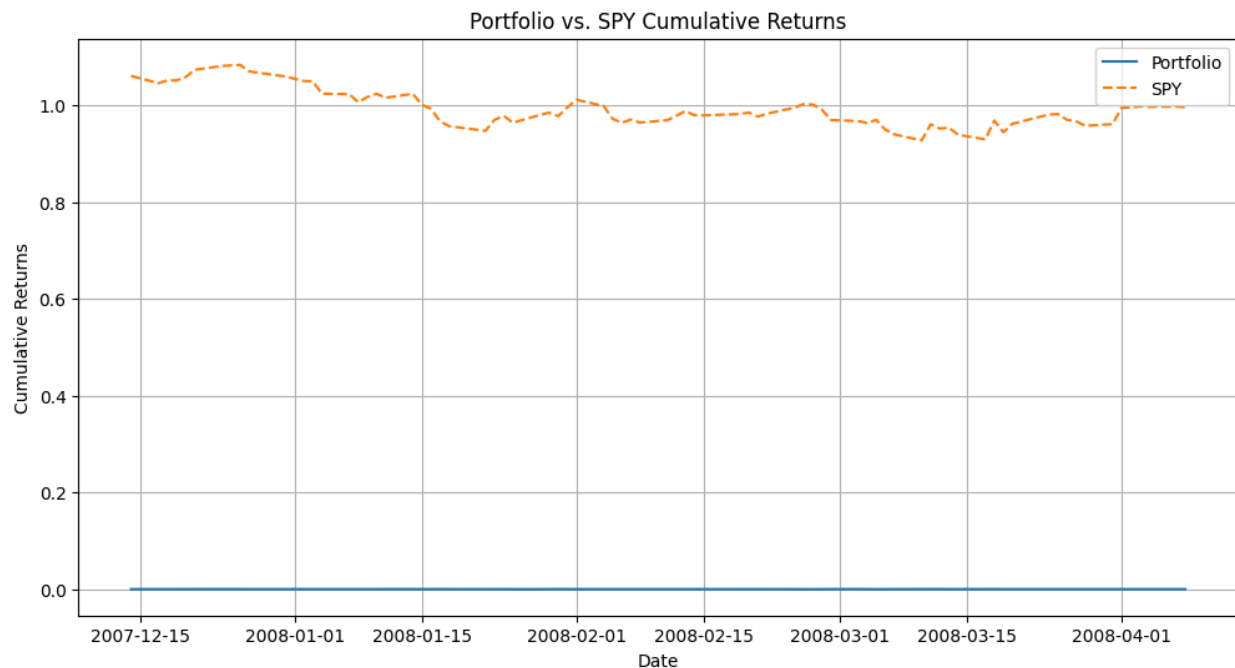
On the analysis of returns distributions, we realize that it is normally distributed returns.

4.2 Sensitivity Analysis

The analysis revealed significant sensitivity of the strategy's performance to both target beta settings and look-back periods. Specifically:
- Strategies with a target beta of 0 generally exhibited lower volatility and drawdowns, aligning with a conservative risk posture. Conversely, a target beta of 1 showed higher mean returns, accompanied by increased risk metrics.
- Short-term look-back periods tended to capture recent market dynamics more effectively, leading to more responsive but sometimes riskier portfolio adjustments. In contrast, long-term periods offered stability but at the cost of potentially overlooking recent market shifts.

5. Limitations

This study focused on a selected ETF portfolio and a specific time frame. Future analyses could expand the asset universe and cover different time periods to validate these findings further.