

Risk Management Report

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Analysts:
Duarte Gomes
Joana Serra
João Reis

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Executive Summary

This report evaluates the impact of portfolio rebalancing on downside risk and diversification. Using daily data between January 2024 and February 2026, we assess the effectiveness of adding a defensive asset (Coca-Cola) to an existing technology- and growth-oriented portfolio.

Three Value at Risk (VaR) frameworks are employed to quantify short-horizon risk: Historical Simulation, EWMA-filtered volatility models, and Bootstrap Monte Carlo simulation.

Results indicate that introducing Coca-Cola significantly compresses the left tail of the portfolio return distribution, reducing extreme downside exposure by approximately 60–90 basis points depending on the methodology.

Standalone risk analysis reveals that despite identical portfolio weights, tail risk remains structurally concentrated in Novo Nordisk due to elevated volatility clustering.

Finally, diversification analysis using the Diversification Ratio confirms that adding a defensive consumer staples exposure improves risk distribution across assets and enhances overall portfolio stability.

Overall, the rebalanced allocation demonstrates meaningful improvements in both tail-risk resilience and portfolio diversification.

1 Introduction

This report analyzes the effect of portfolio rebalancing on risk exposure and diversification. The objective is to evaluate whether introducing a defensive asset can improve portfolio stability while maintaining exposure to high-growth equities.

The baseline portfolio consists of five equities obtained from the course dataset. A sixth asset, Coca-Cola (KO), is introduced in the rebalanced portfolio using price data retrieved from Yahoo Finance.

1.1 Portfolio Construction

Baseline Portfolio

Asset	Weight
Microsoft (MSFT)	25%
Novo Nordisk (NVO)	25%
LVMH (LVMHF)	25%
Micron (MU)	15%
ASML (ASML)	10%

Rebalanced Portfolio

Asset	Weight
Microsoft (MSFT)	20%
Novo Nordisk (NVO)	20%
LVMH (LVMHF)	20%
Micron (MU)	15%
ASML (ASML)	10%
Coca-Cola (KO)	15%

2 Short-Horizon Risk & Rebalancing Impact

2.1 Methodology

To rigorously quantify the short-horizon downside risk and evaluate the efficacy of the proposed rebalancing strategy, daily portfolio returns were modeled using historical data from January 1, 2024, to February 27, 2026.

Three analytical frameworks are used:

- Historical Simulation VaR
- EWMA-Filtered VaR
- Bootstrap Monte Carlo VaR

For each framework we compute the 99% Value at Risk (VaR), representing the maximum expected loss over a 1-day horizon at a 1% significance level.

2.2 Key Findings & Risk Attribution

The strategic reallocation—specifically the introduction of Coca-Cola funded by trimming high-beta exposures—results in a more resilient portfolio.

Risk Metric (1-Day 99%)	Baseline	Rebalanced	Delta
Historical VaR	4.78%	3.99%	-79 bps
EWMA VaR ($\lambda = 0.99$)	4.08%	3.48%	-60 bps
Bootstrap MC VaR	4.93%	4.05%	-88 bps

The results show clear tail-risk compression after rebalancing.

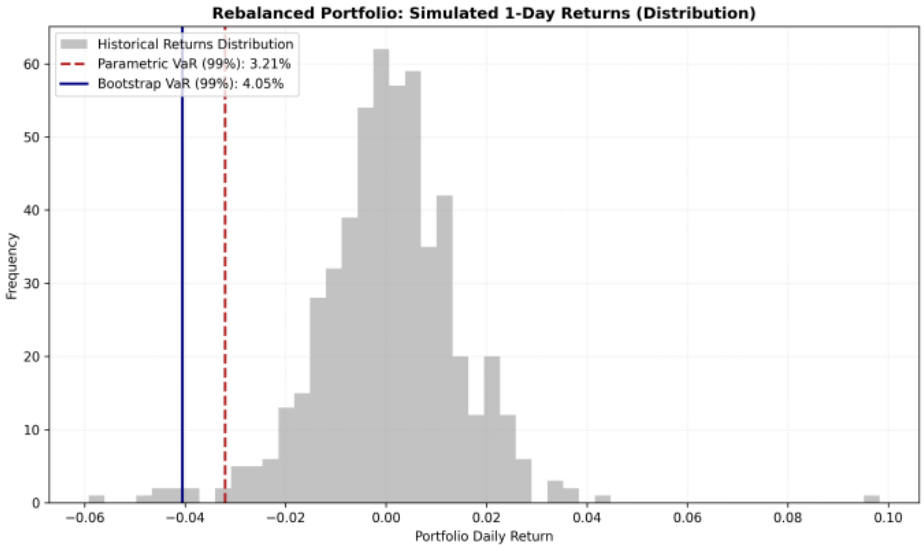


Figure 1: Simulated 1-day return distribution of the rebalanced portfolio.

3 Standalone Risk of the Highest-Weighted Exposure

3.1 Methodology

To evaluate concentration risk, we compute standalone 1-day 99% VaR for the highest-weighted equities in the rebalanced portfolio.

The following assets each represent 20% of the allocation:

- Microsoft (MSFT)
- Novo Nordisk (NVO)
- LVMH (LVMHF)

Three risk frameworks are used:

- Historical Simulation VaR

- EWMA Filtered VaR
- Bootstrap Monte Carlo VaR

3.2 Empirical Results

Stock	Historical VaR	EWMA VaR	Bootstrap VaR
MSFT	3.63%	5.22%	3.76%
NVO	8.29%	12.28%	8.37%
LVMHF	5.01%	4.45%	5.10%

Across all methodologies, Novo Nordisk exhibits the highest tail risk.

3.3 Risk Concentration and Transmission

Despite identical portfolio weights, downside exposure is asymmetric. Tail risk remains concentrated in Novo Nordisk due to elevated volatility.

3.4 Approximate Tail Risk Impact

Scaling standalone VaR by portfolio weight:

$$Impact \approx w_i \times VaR_i$$

For Novo Nordisk:

$$0.2 \times 8.37\% \approx 1.67\%$$

Relative to portfolio Bootstrap VaR of 4.05%, this implies roughly 40% of tail risk is driven by this single exposure.

4 Portfolio Diversification Analysis

4.1 Methodology

Diversification is evaluated using the Diversification Ratio (DR), defined as the ratio between the weighted average asset volatility and total portfolio volatility.

Higher values indicate stronger diversification.

4.2 Results & Discussion

Portfolio	Diversification Ratio
Baseline (Without Coca-Cola)	1.3542
Rebalanced (With Coca-Cola)	1.5089

Adding Coca-Cola increases the diversification ratio and spreads risk more evenly across assets.

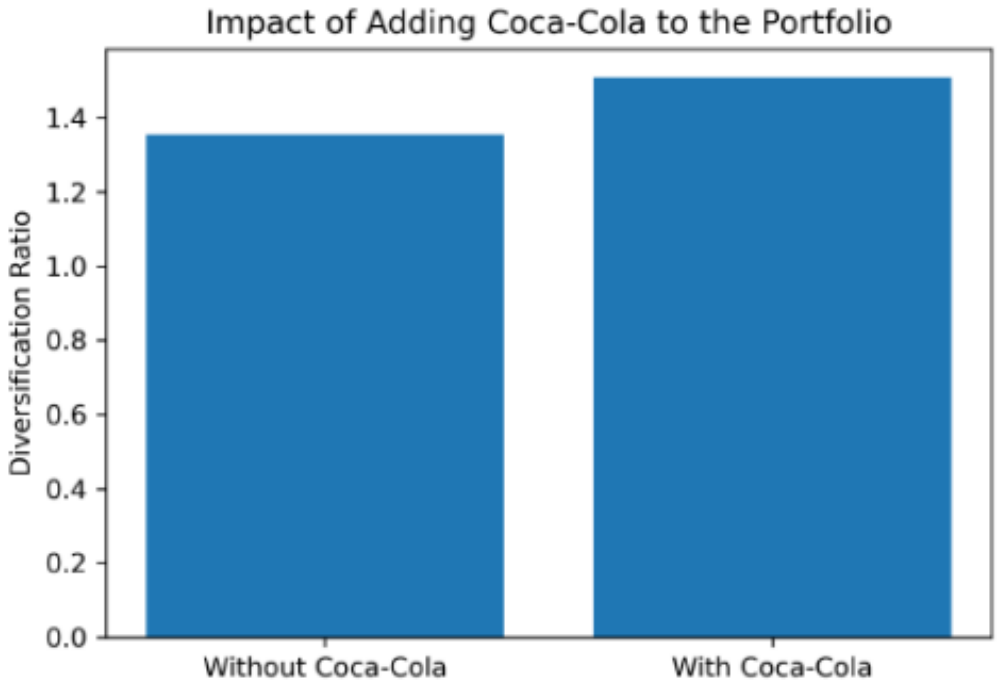


Figure 2: Diversification ratio before and after rebalancing.

5 Conclusion

The analysis demonstrates that portfolio rebalancing through the introduction of a defensive asset can significantly improve portfolio stability.

Risk modeling shows that adding Coca-Cola compresses the left tail of the return distribution and reduces extreme downside risk.

However, standalone risk analysis indicates that tail risk remains partially concentrated in Novo Nordisk due to its volatility dynamics.

Finally, diversification metrics confirm that the rebalanced allocation achieves a more balanced distribution of risk across assets.

Overall, the results highlight the importance of both asset selection and weight allocation in managing portfolio risk and improving diversification.