

PORTFOLIO OPTIMIZATION

BLUE TEAM 10

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PORTFOLIO OPTIMIZATION

Overview

The Commercial Banking Corporation (hereafter referred to as “the Bank”) tasked our team with creating an optimized stock portfolio that minimizes risk while maintaining a daily return of at least 0.25%. The portfolio consisted of six stocks: Apple (AAPL), Amazon (AMZN), Google (GOOG), Meta (META), Nvidia (NVDA), and Tesla (TSLA). Our analysis identified an optimal portfolio allocation of 40.19% AAPL, 0.10% AMZN, 10.38% GOOG, 19.32% META, 25.55% NVDA, and 4.46% TSLA. This results in a portfolio that achieves a daily return of 0.25% while maintaining a minimum level of risk of 1.53%. We also suggest a second portfolio allocation that maximizes the Sharpe ratio, increases returns to 0.30%, at a higher risk level of 1.80%, staying on the efficient frontier.

Methodology and Analysis

This section outlines the data and optimization modeling process to create the optimal portfolio.

Data

We obtained stock data from Yahoo Finance using a built-in package in Python. This provided us with the 2024 daily closing prices of the six stocks. Using these prices as a baseline, we created a variable that indicated daily percent change in stock prices. This was the foundation of our modeling process.

Modeling

Our optimization analysis minimizes portfolio risk while achieving a minimum daily return of 0.25%. We defined risk as the standard deviation of the portfolio and attempted to minimize this metric in the model's objective function. We also added two constraints to the model: one indicating that the portfolio could reach a maximum allocation of 100%, and the other establishing the minimum daily return of 0.25%.

Analysis

Using this setup, our team achieved an efficient frontier curve, shown in Figure 1.

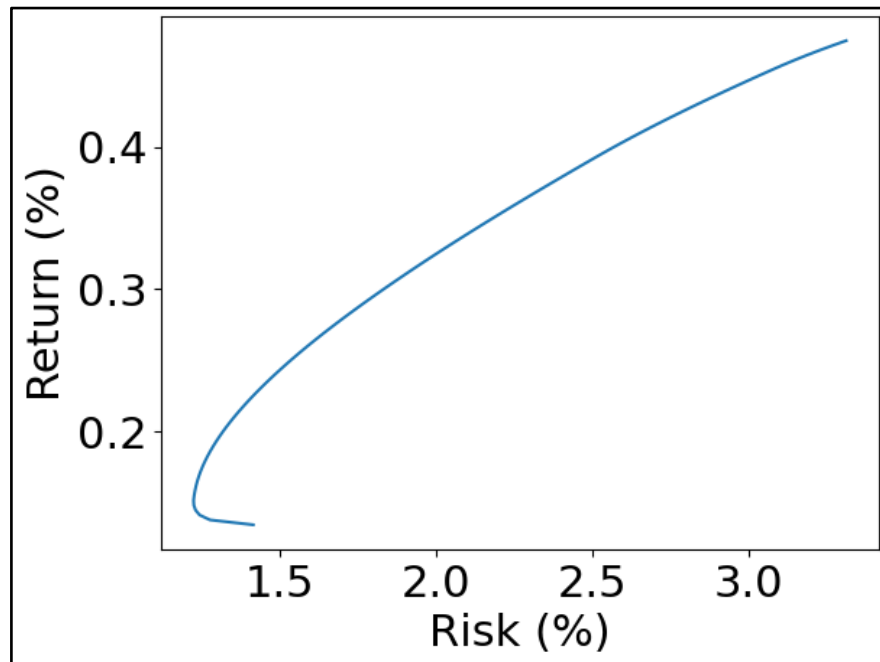


Figure 1: Efficient Frontier Curve

According to the efficient frontier, to achieve a minimum return of 0.25%, we have to assume an approximate risk value of at least 1.53%. If higher returns are desired, positions higher on the efficient frontier can be considered, although with more risk.

Results

Based on our optimization analysis, which minimizes portfolio risk while ensuring a minimum daily return of 0.25%, Table 1 presents the resulting optimal portfolio allocation.

Table 1: Minimum Risk Portfolio Allocation with 0.25% Daily Return

Ticker	Allocation
AAPL	40.19%
AMZN	0.10%
GOOG	10.38%
META	19.32%
NVDA	25.55%
TSLA	4.46%

This portfolio meets the minimum return requirement of 0.25% while minimizing risk at 1.53%. This approach is generally conservative, prioritizing risk minimization while maintaining the required return.

If the Bank is more tolerant of risk, it can take on a more aggressive position, moving further up the efficient frontier and increasing risk and return. To achieve this, we introduced the maximum Sharpe ratio portfolio, which optimally balances return and risk by maximizing the return per unit of risk. This approach provides the most efficient risk-adjusted return and is a practical benchmark for portfolio optimization. Table 2 presents the maximum Sharpe ratio portfolio allocation.

Table 2: Maximum Sharpe Portfolio Allocation with 0.30% Daily Return

Ticker	Allocation
AAPL	29.67%
AMZN	0.00%
GOOG	2.52%
META	22.29%
NVDA	38.08%
TSLA	7.45%

This portfolio achieves a daily return of 0.30% with a risk of 1.80%, achieving higher potential returns at the cost of increased risk. This allocation results in higher risk and returns than the minimum risk portfolio. In this portfolio, the proportion of more volatile stocks like NVDA and TSLA has increased, reflecting their higher return potential despite greater risk exposure.

Recommendations

Based on our optimization analysis, we recommend that the Bank determine an optimal risk appetite and return objectives when selecting the most suitable portfolio allocation.

- If the Bank's primary objective is capital preservation and stable returns, we recommend adopting the minimum risk portfolio.
- If the Bank is willing to accept higher volatility for improved returns, the maximum Sharpe ratio Portfolio provides a more efficient and optimized investment approach.
- Additionally, the Bank may consider adjusting allocations along the efficient frontier, moving further up to accept more risk based on evolving market conditions and investment preferences.

Conclusion

On behalf of the Bank, our team aimed to optimize the allocation of investment for six stocks to minimize risk while maintaining a daily return of at least 0.25%. We used daily stock closing price data in 2024 to optimize our objective function. Our results show that the optimal allocation per stock to achieve a daily return of 0.25% is listed in Table 1. This allocation ensures that risk is minimized to 1.53%. If the Bank desires a more risk-tolerant approach, it could also consider the maximum Sharpe ratio portfolio. This follows a more growth-oriented strategy aligned with investors seeking potentially greater returns while maintaining a strong risk-return balance, with a daily return of 0.30% and risk of 1.80%. This approach maintains alignment with the Bank's financial goals while offering flexibility to adjust risk exposure in pursuit of higher returns. Ultimately, we recommend that the Bank determine its tolerance for risk in this portfolio and adjust its strategy accordingly.