

CAPITAL ASSET PRICING MODEL

GROUP 30

INTRODUCTION

The Capital Asset Pricing Model (CAPM) is a widely used financial framework that helps in determining the expected return on an investment based on its risk. This model plays a crucial role in portfolio management and asset pricing, providing a foundation for understanding the relationship between risk and return.



CHOSEN ASSETS

NVDA (NVIDIA CORPORATION)

Industry: Technology - Semiconductors

Brief Description: A leading graphics processing unit (GPU) manufacturer, known for its innovations in gaming, AI, and data centers.

MSFT (MICROSOFT CORPORATION)

Industry: Technology - Software

Brief Description: A global technology giant, widely recognized for its software products, including Windows, Office, and cloud services.

IBM (INTERNATIONAL BUSINESS MACHINES CORPORATION)

Industry: Technology - IT Services

Brief Description: A multinational technology and consulting company, offering a range of IT services, software, and hardware solutions.

AMZN (AMAZON.COM INC.)

Industry: E-commerce and Cloud Computing

Brief Description: A multinational technology and e-commerce giant, known for its online retail platform, cloud services, and digital streaming.

GOOGL (ALPHABET INC.)

Industry: Technology - Internet Services

Brief Description: The parent company of Google, involved in online advertising, search engines, and various internet-related services.

BLK (BLACKROCK INC.)

Industry: Financial Services - Asset Management

Brief Description: One of the world's largest investment management firms, offering a diverse range of financial products and services.

JPM (JPMORGAN CHASE & CO.)

Industry: Financial Services - Banking

Brief Description: A multinational investment bank and financial services company, providing a wide range of banking and financial solutions.

V (VISA INC.)

Industry: Financial Services - Payment Technology

Brief Description: A global payments technology company, facilitating electronic funds transfers worldwide.

DIS (THE WALT DISNEY COMPANY)

Industry: Entertainment and Media

Brief Description: A diversified multinational mass media and entertainment conglomerate, known for its film studio, theme parks, and media networks.

NFLX (NETFLIX INC.)

Industry: Technology - Streaming Services

Brief Description: A leading subscription-based streaming service, offering a wide variety of TV shows, movies, and original content.

CAPM EXPECTED RETURNS

The CAPM formula is used to estimate the expected return of an asset, taking into consideration the risk-free rate, the asset's beta, and the expected market return.

$$E(R_i) = R_f + \beta_i \times (E(R_m) - R_f)$$

$E(R_i)$: Expected return of the asset.

R_f : Risk-free rate (current yield of the government bond).

β_i : Beta of the asset, representing its sensitivity to market movements.

$E(R_m)$: Expected market return.

CAPITAL MARKET LINE (CML)

The Capital Market Line (CML) incorporates the concepts of risk and return in portfolio theory and is derived from the Capital Asset Pricing Model (CAPM).

- **Risk-Free Asset:** The CML incorporates a risk-free asset, typically represented by government bonds, allowing investors to lend or borrow money at the risk-free rate (R_f).
- **Efficient Portfolios:** The CML represents a set of efficient portfolios that maximize returns for a given level of risk or minimize risk for a given level of returns.
- **Tangency Point:** The tangency point with the Efficient Frontier is the optimal risky portfolio, combining the risk-free asset and the market portfolio.

The Sharpe Ratio (S) is a performance metric used to evaluate the risk-adjusted return of a portfolio. It plays a crucial role in the implementation of the CML:

$$S = \frac{E(R_p) - R_f}{\sigma_p}$$

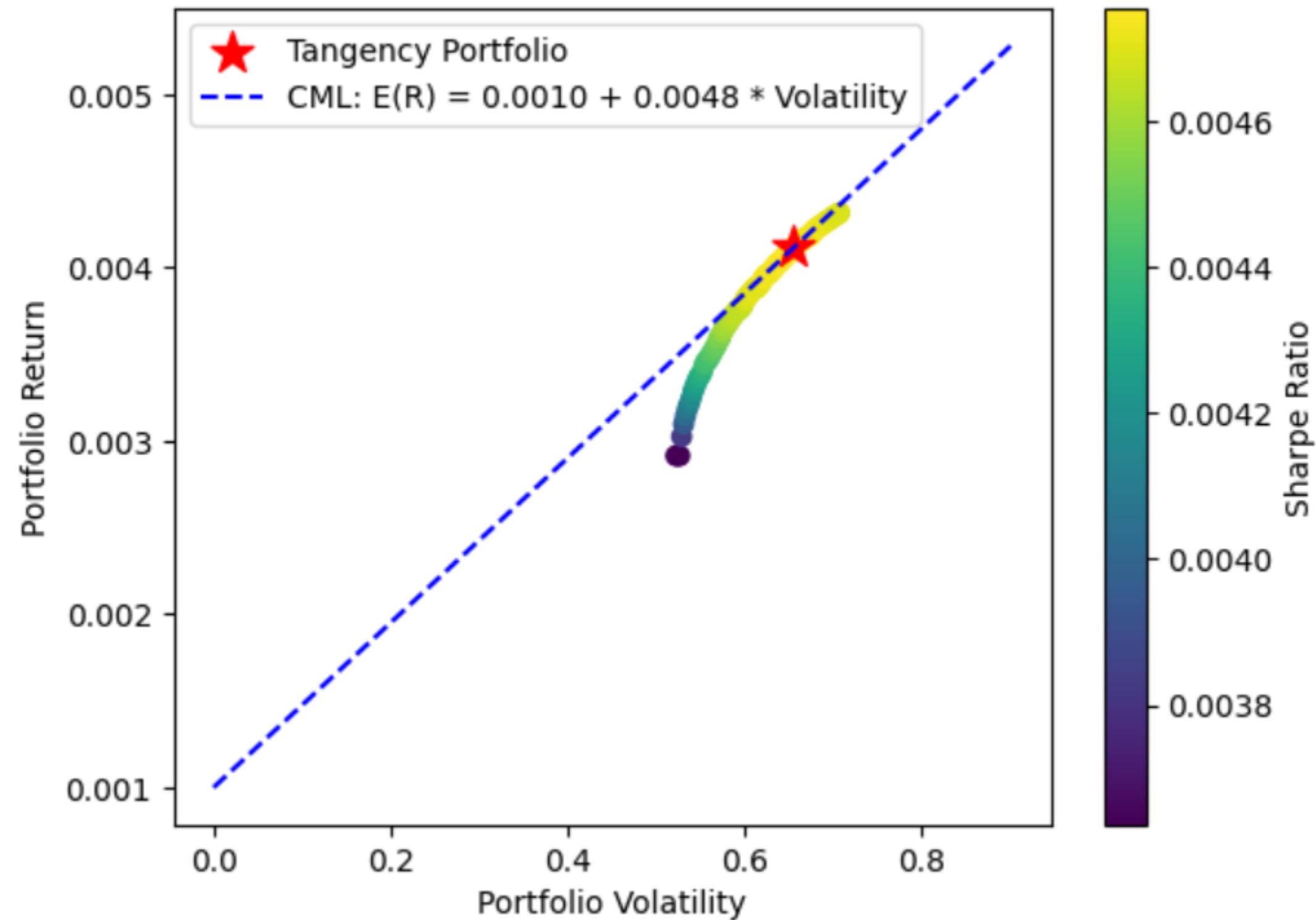
$E(R_p)$: Expected return of the portfolio.

R_f : Risk-free rate.

σ_p : Standard deviation of the portfolio.

- We calculated the Sharpe Ratios for various portfolios on the Efficient Frontier and highlighted the tangency point with the highest Sharpe Ratio.
- Portfolios along the CML, including the tangency portfolio, have higher Sharpe Ratios, indicating superior risk-adjusted returns.

Efficient Frontier and CML



SECURITY MARKET LINES (SML)

The Security Market Line (SML) is a fundamental concept in finance that illustrates the relationship between an asset's expected return and its systematic risk (beta).

$$E(R) = R_f + \beta \times (E(R_m) - R_f)$$

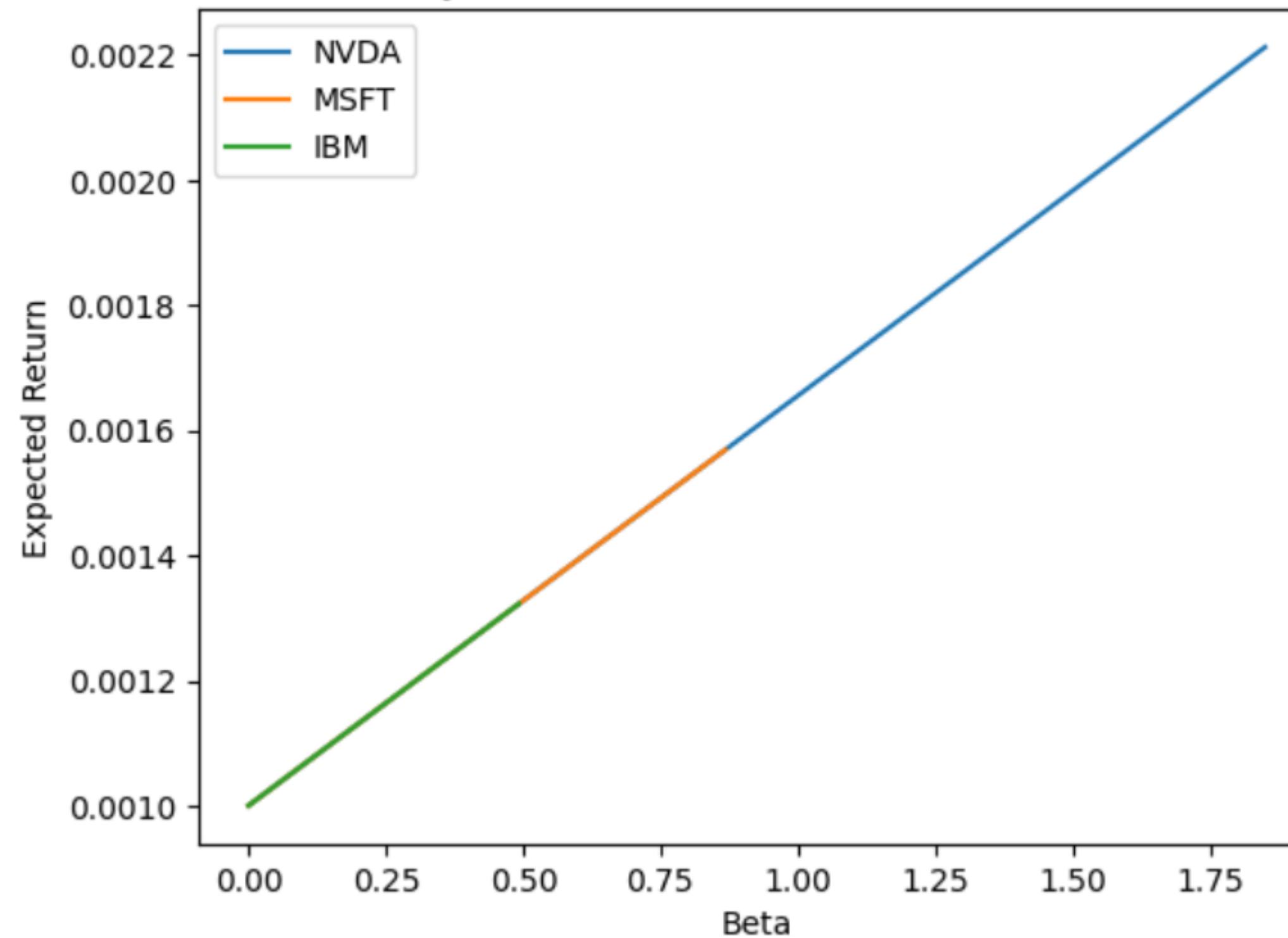
$E(R)$: Expected return of the asset.

R_f : Risk-free rate.

β : Beta of the asset.

$E(R_m)$: Expected market return.

Security Market Lines (SML) for Selected Assets



Significance

Assets above the SML are considered undervalued, offering higher expected returns for the given risk.

Assets below the SML are overvalued, providing lower expected returns for the risk.

PORTFOLIO PERFORMANCE ANALYSIS

Portfolio Return and Risk Calculation

Risky Portfolio Return:

Reflects the expected gain from the selected assets in the portfolio.

Utilizes optimal weights (opt_w) and the mean returns of chosen assets.

Risky Portfolio Risk:

Represents the potential variability or volatility of returns in the portfolio.

Determined by optimal weights and the covariance matrix of selected assets

Evaluating Performance Function

Portfolio Performance Function:

Measures the portfolio's effectiveness in terms of return and risk.

Allows for a nuanced assessment of portfolio outcomes.

Efficient Frontier and Capital Market Line (CML)

Efficient Frontier:

Demonstrates the trade-off between risk and return for different portfolio compositions.

Offers insights into achievable returns at varying risk levels.

Capital Market Line (CML):

Incorporates the risk-free rate and the market portfolio.

Highlights optimal portfolios for risk-averse investors.

Tangency Portfolio

Significance of Tangency Point:

Marks the portfolio with the highest Sharpe Ratio on the Efficient Frontier.

Represents the optimal balance between risk and return.

COMPARISION

Both the Markowitz mean-variance optimization and the CAPM approach are widely used in portfolio management for constructing optimal portfolios, but they have distinct methodologies and considerations. Here's a comparison and contrast of the portfolios constructed using these two approaches:

Markowitz Mean-Variance Optimization:

1. Objective: Markowitz optimization aims to maximize the expected return of a portfolio for a given level of risk or minimize the risk of a portfolio for a given level of return.
2. Method: It considers the expected returns, standard deviations, and correlations of assets to construct an efficient frontier of portfolios. The efficient frontier represents the set of portfolios that offer the highest expected return for a given level of risk or the lowest risk for a given level of return.

Markowitz Mean-Variance Optimization:

3. Insights Gained:

- Markowitz optimization allows investors to visualize the trade-off between risk and return and select the portfolio that best fits their risk tolerance.
- It provides insights into the diversification benefits of combining different assets in a portfolio and the potential reduction in portfolio risk through diversification.
- Investors can identify the optimal portfolio on the efficient frontier based on their risk preferences.
- Markowitz optimization does not explicitly consider the relationship between asset returns and the market, and it may not fully capture systematic risk factors.

CAPM Approach

1. Objective: The CAPM approach aims to construct an optimal portfolio by considering the relationship between asset returns and market returns while accounting for the risk-free rate.
2. Method: It uses the CAPM formula to calculate the expected return of each asset based on its beta (systematic risk) and the market return. The optimal portfolio is then constructed by combining the risky assets and the risk-free asset in proportions that maximize the Sharpe ratio.

CAPM Approach

3. Insights Gained:

- The CAPM approach explicitly considers the systematic risk of assets and their sensitivity to market movements.
- It provides insights into how investors should allocate their capital between risky assets and the risk-free asset to achieve the optimal risk-adjusted return.
- CAPM helps investors understand the trade-off between risk and return in the context of the market and the risk-free rate.
- CAPM assumes that investors are rational and risk-averse and that markets are efficient, which may not always hold true in practice.

Key Insights Gained from Each Method:

- Markowitz optimization emphasizes the diversification benefits of combining assets to achieve optimal risk-return trade-offs.
- CAPM highlights the importance of considering systematic risk factors and the market environment when constructing portfolios.
- Markowitz optimization allows for a more flexible approach in portfolio construction, while CAPM provides a structured framework based on market theory.
- Both approaches provide valuable insights into portfolio management, and investors may choose one or a combination of both methods based on their investment objectives, risk tolerance, and market views.

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THANK YOU