

Trading Algorithms

Portfolio Management

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Outlines

- Introduction
- Key Concepts in Portfolio Management
- Portfolio Management Strategies
- Modern Portfolio Theory
- Black Litterman Model
- Factor Models

Introduction

➤ What is Portfolio Management?

- The process of selecting and managing investments to meet your financial goals.
- Balancing risk and return to achieve optimal growth.

➤ Why is Portfolio Management Important?

- Grow your wealth over time.
- Protect your assets from market volatility.
- Achieve financial security for the future.

Importance of Portfolio Management

Example: Consider an investor who has \$10,000 to invest and two investment options:

- Stock A with an expected return of 15%
- Stock B with an expected return of 10%
- Let's say Stock A is much riskier than Stock B

Without Portfolio Management: the investor might put all their money into Stock A because it has a higher expected return, If something goes wrong in the market, Stock A might lose 50% of its value, leaving the investor with only \$5,000.

With Portfolio Management: The investor might decide to split their investment into both stocks to diversify their risk. They could invest \$5,000 in Stock A and \$5,000 in Stock B. The expected return of the portfolio would be:

$$R_p = w_A * r_A + w_B * r_B = 0.5 * 15\% + 0.5 * 10\% = 12.5\%$$

In this case, even if Stock A loses 50% of its value, the investor still has the returns from Stock B to offset some of the loss. Their portfolio would be worth \$7,500 which is significantly better than the \$5,000 they would have with the all-in strategy.

Key Concepts in Portfolio Management

- Asset Allocation
- Diversification
- Rebalancing
- Risk Tolerance
- Active & Passive Management

Portfolio Management Strategies

- Modern Portfolio Theory
- Black Litterman Model
- Traditional Portfolio Management Methods

Modern Portfolio Theory

- **MPT** is a mathematical framework for assembling a portfolio of assets such that the expected return is maximized for a given level of risk.
- The theory assumes that investors are **risk-averse**; for a given level of expected return, investors will always prefer the less risky portfolio.
- **MPT** emphasizes that individual asset risk should be considered in relation to its impact on the overall portfolio's risk and return. It's not just about minimizing individual risk, but optimizing the trade-off between risk and return for the entire portfolio.

Core Concepts of MPT

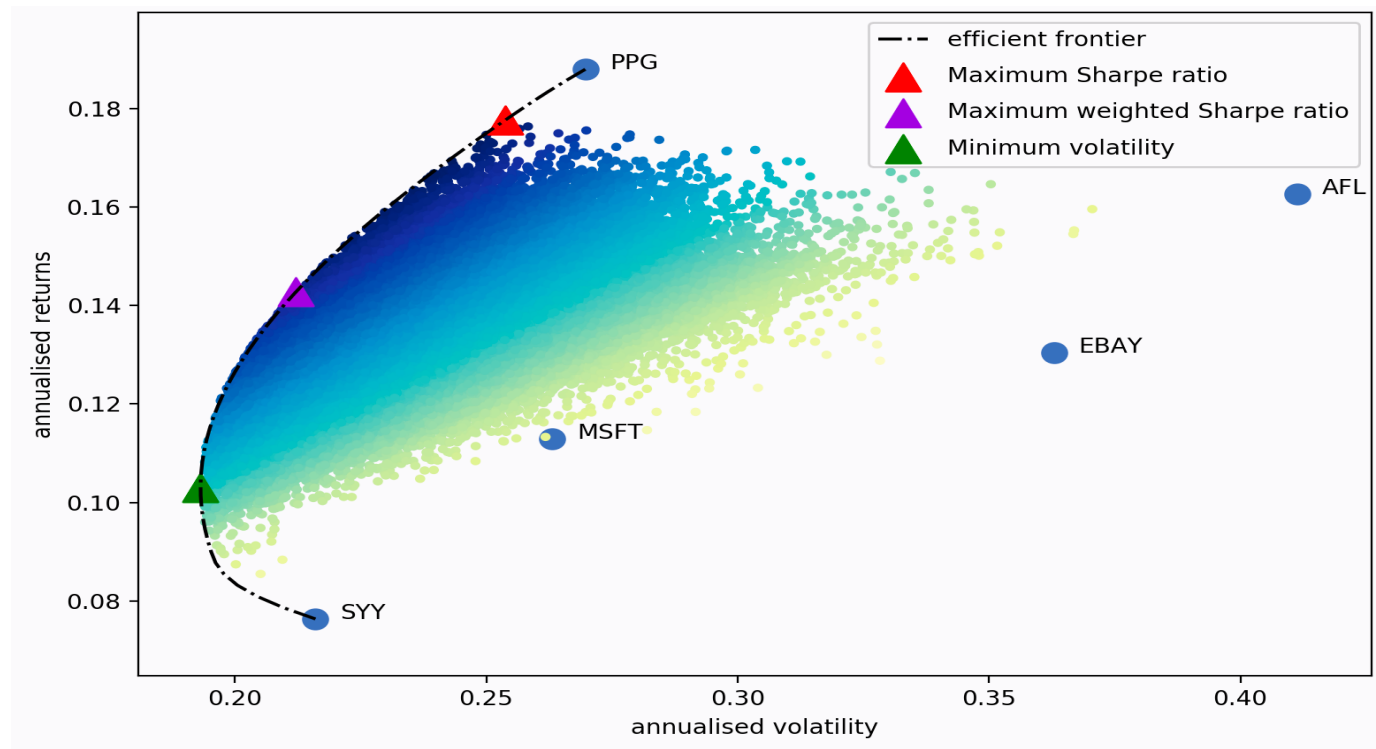
- Expected Return of a Portfolio:

$$R_p = \sum_{i=0}^n w_i r_i$$

- Risk of a Portfolio:

$$\sigma_p^2 = \sum_{i=1}^n w_i^2 \sigma_i^2 + \sum_{i=1}^n \sum_{j \neq i}^n w_i w_j \sigma_i \sigma_j \rho_{ij}$$

MPT



MPT Pros & Cons

- Diversification
- Efficient Portfolios
- Variance-Based Assessment
- Assumption of Normal Distribution
- Reliance on Historical Data

Black Litterman Model

- Built upon MPT
- Incorporate Investor Views
- Optimize Asset Allocation

Traditional Portfolio Management Methods

- Follow-the-Winner
- Follow-the-Loser
- Pattern-Matching
- Meta-Learning

Factor Models

- Factor models are statistical models used in finance and investing to explain and predict the returns of securities or portfolios.
- These models attempt to capture the systematic factors or underlying sources of risk that drive asset returns.
- The basic idea behind factor models is that the returns of securities or portfolios can be explained by the exposure to these underlying factors.
- By identifying and quantifying the factor exposures, investors can better understand and manage the risk and return of their investments.

Math Representation of a Factor Model

- If a portfolio contained n assets with returns r_i , factor loadings F_i , factor returns f_i , and idiosyncratic returns e_i , the portfolio's return R_p would be:

$$R_p = \sum_{i=1}^n F_i f_i + e_i$$