Portfolio Theory in Investment Decision Making: A Case Study of Xiaomi, Apple, and Samsung

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Abstract. The study analyses the historical stock data of Xiaomi, Apple, and Samsung and examines their investment risk and return characteristics. It discusses the possibility of building an optimised asset portfolio. By examining key financial indicators, including each company's standard deviation, average return, expected portfolio return, Sharpe ratio and correlation coefficient were used to obtain the corresponding results. The author finds that Xiaomi has the highest average return. However, the positive correlation between Apple and Samsung is higher. This suggests that Apple and Samsung tend to move more in the same direction in the stock market. It combines these stocks into a portfolio that limits the benefits of diversification. Therefore, it is concluded that constructing portfolios to achieve effective risk diversification by considering correlations between assets is crucial. The analysis is beneficial to help investors build a suitable investment strategy. Investors can optimize the risk-adjusted return of the portfolio by choosing assets with low correlation.

Keywords: Xiaomi; Apple; Samsung; Portfolio; Risk Analysis; Sharpe Ratio; Correlation Coefficient

1 Introduction

In recent years, investors have sought maximum returns in the financial environment. It has led to significant growth in investment activity. Global financial markets continue to expand. It provides many investment opportunities [1]. However, with the increased potential for high returns comes the challenge of managing investment risk, especially in the smartphone industry. Companies like Xiaomi, Apple, and Samsung have become major forces in the smartphone industry. These companies have unique and typical risk and return characteristics. Therefore, understanding how to balance these key factors is important for investment decisions. This paper aims to show how to use Portfolio Theory [2] to minimise investment risk while maintaining an optimal level of return. The author will demonstrate how portfolio theory can be applied to reduce investment risk by constructing an optimal portfolio of Xiaomi, Apple, and Samsung stocks. The author will study historical data from 2020 to 2024, making case studies of Xiaomi, Apple, and Samsung. At the same time, the author will calculate the expected return, standard deviation, and Sharpe ratio [3] to evaluate the portfolio's performance. This study aims

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to provide investors with insights into applying portfolio theory to the real stock market, especially in the smartphone industry. The finding helps us understand diverse companies such as Xiaomi, Apple, and Samsung to reduce risk and increase investors' returns.

2 Method

2.1 Case Study

The author will use the case study method to study Xiaomi, Apple, and Samsung, the leading players in the smartphone industry [4]. Through a detailed analysis of their business models, financial performance, and market positions, the study will explore how these companies contribute individually and collectively to a diversified investment strategy.

Xiaomi is a relatively new diversified company with a lot of growth potential, but it also has much volatility. Its rapid expansion into international markets and focus on cost-effective innovation make it attractive to investors seeking high returns, albeit at higher risk.

Apple is a successful company in the field of intelligence. It can provide consistent and stable returns. Apple is known for its strong brand loyalty, ecosystem integration, and profitability, Apple is often considered a safe-haven stock in the tech sector.

Samsung has a diversified business portfolio， which offers a relatively balanced risk-reward structure. It provides stability and exposure to different sectors within the global economy in consumer electronics.

This case study aims to combine these stocks into a single portfolio to achieve a diversified investment strategy. By analyzing the correlations and individual characteristics of each company, the author seeks to demonstrate how diversification across different types of tech firms can optimize returns while mitigating overall investment risk.

2.2 Modern Portfolio Theory

Modern Portfolio Theory provides a portfolio construction framework. It can optimise returns for a given level of risk [5]. This theory illustrates the importance of diversified investment portfolios. Reduce investment risk by owning different assets. The theory can be applied to Xiaomi, Apple, and Samsung stocks. It can help investors determine the best investment portfolio.

Risk. In portfolio theory, volatility is often used to determine the degree of risk [6]. Volatility is the movement of asset prices over time. The more volatile the asset, the higher the risk, and vice versa. In this study, the author will quantify the risk level of each stock by calculating the standard deviation. Finally, this information is used to optimise the portfolio.To confirm investment risk accurately, standard deviation serves as a key statistical tool. A higher standard deviation indicates more uncertainty and bigger fluctuations in return, indicating that the asset carries more investment risk. Conversely, a lower standard deviation suggests more stable and predictable performance. The author aims to identify which stock contributes more to overall portfolio volatility

by comparing the historical standard deviations of Xiaomi, Apple, and Samsung. This approach enables the construction of a more balanced and risk-adjusted portfolio.

Return. Return is a key factor in determining investment returns [7]. The expected return on an asset is calculated based on the average of past returns over time. In this study, the authors will use historical stock data of Xiaomi, Apple, and Samsung from 2020 to 2024 to calculate their average returns. In addition, the expected portfolio return will be calculated using the weighted average of the returns of the individual stocks in the portfolio.The authors will also take into account outside variables that could affect these companies' returns, such as market trends, prevailing economic conditions, and industry-specific events, in order to increase the precision of these computations. To give a more balanced view of investing prospects, the risk-adjusted return—which accounts for volatility and other risk factors—will also be evaluated.

Sharpe Ratio. The Sharpe ratio measures the return on investment after adjusting for risk [8]. It compares the excess return of an asset or portfolio with the volatility. The Sharpe ratio is calculated as follows in Equation (1).

$$S = \frac{E(R_p) - R_f}{\sigma_p} \tag{1}$$

Where $E(R_p)$ is the expected return of the portfolio, R_f is the risk-free rate, σ_p is the portfolio standard deviation.

A higher Sharpe ratio indicates that the portfolio provides a better return per unit of risk.When evaluating the performance of several portfolios or investments with differing risk levels, this statistic is especially helpful. Investors can use the Sharpe ratio to determine if the increased returns are appropriate given the amount of risk assumed. Additionally, by identifying assets that provide higher returns in relation to their volatility, the Sharpe ratio can be utilized as a tool for portfolio optimization, resulting in improved risk-adjusted performance.

3 Analysis

3.1 Company Selection

The companies selected for this case study are Xiaomi, Apple, and Samsung. These three are typical examples of the smartphone industry's unique risk-reward landscape.

Xiaomi is a well-known Chinese technology company, it focuses on electronic products such as smartphones and is a high-growth company. However, it has been volatile due to market competition and challenges.

Apple is a global technology giant. It is best known for the iPhone and other Apple products. Apple gets support from a strong brand, a stable customer base, and a diversified revenue stream. Therefore, Apple delivers solid growth rates.

Samsung is a South Korean smartphone company. It operates in several industries, including electronics and telecommunications. The diversified portfolio of Samsung makes it a balanced choice for risk-averse investors.

3.2 Analysis

Investing.com (2024) provides historical data for Xiaomi (1810.HK) [9]. Yahoo Finance (2024) provides historical data for Apple (AAPL) [10]. MarketWatch (2024) provides historical data for Samsung (005930.KS) [11] as shown in Table 1 and Table 2.

Table 1. Annual Opening Stock Prices of Xiaomi, Apple, and Samsung (2020-2024)

Year	Xiaomi	Apple	Samsung
2020	11.22	75.09	55.20
2021	35.25	129.41	83.00
2022	18.60	182.01	78.60
2023	11.22	125.07	55.50
2024	15.48	185.64	79.60

Table 2. Annual Closing Stock Prices of Xiaomi, Apple, and Samsung (2020-2024)

Year	Xiaomi	Apple	Samsung
2020	33.20	252.20	81.00
2021	18.90	192.53	78.30
2022	10.94	129.93	55.30
2023	15.60	177.57	78.50
2024	34.50	132.69	53.20

The author uses the historical data to calculate the results of standard deviation, average return, expected portfolio return and Sharpe ratio as Table 3.

Table 3. Risk and return of selected companies

Company	Standard deviation	Average return	Expected portfolio return	The Sharpe ratio
Xiaomi	9.51	17.1%	19.71%	0.0188
Apple	46.45	-11.20%	-11.19%	-0.0033
Samsung	12.31	-5.76%	-5.75%	-0.752

The author will further calculate the correlation coefficients [12] between Xiaomi, Apple and Samsung. The correlation coefficient between Xiaomi and Apple was 0.726. This indicates a positive correlation. It means the shares of both companies are moving in the same direction. Similarly, the correlation coefficient between Xiaomi and Samsung was 0.74. It also shows a positive relationship. The strongest positive correlation was between Apple and Samsung. The coefficient is 0.759. The positive correlation between these companies indicates room for diversification while stocks move together to a certain extent.

The optimisation process identified the portfolio with the highest Sharpe ratio, comprising the following allocations: 49.5% in Xiaomi, 17.1% in Apple, and 33.3% in Samsung.

3.3 Discussion

These high positive correlations mean that stock prices tend to move in the same direction. However, portfolio theory shows that even if there is a positive correlation between assets. It can optimise the risk and return of the portfolio through reasonable allocation of weights. The author will take into account the above correlations to make recommendations and strategies:

Reducing the weight of highly correlated stocks is crucial. Since all three companies show a high positive correlation, overinvesting does not reduce portfolio risk. Therefore, the author will recommend limiting the weight of each stock in your portfolio to avoid excessive concentration.

Introducing low-correlation assets can help Investors to diversify their risk by adding stocks from other industries or markets. For example, stock returns in the healthcare sector may be less correlated with those in the technology sector.

Finally, as markets and industries continue to change, investors should regularly evaluate and plan the weight of their portfolio to ensure it aligns with their risk and return.

4 Conclusion

In conclusion, this study aims to analyse the historical stock data of Xiaomi, Apple and Samsung to explore how to build an optimal investment portfolio by evaluating their return characteristics and investment risks. Calculating standard deviation, average return, expected portfolio return, the Sharpe ratio and correlation between companies. The author tried to understand the investment performance of these companies and their relationships with each other.

The study highlights the importance of considering asset correlations when constructing portfolios for effective risk diversification. At the same time, it provides a basis for investors to diversify their investments in the technology industry. This information helps investors make rational investment strategy decisions.

However, the study's small sample size may not fully reflect the technology industry's investment characteristics.

Future research could expand the sample scope and extend the period of the selected data. By taking into account external factors, a multi-factor model could be constructed. It can provide a comprehensive assessment of investment risk and return.

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