Research on Investment Portfolios of the Low-Altitude Economy Sector in the Chinese Stock Market

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Abstract. This paper focuses on the low-altitude economy sector in the Chinese stock market, aiming to explore the applicability of the Markowitz Portfolio Theory in this sector. Using Python as a tool, 14 financial indicators were selected as common factors from four dimensions: profitability, operational capacity, development potential, and capital expansion ability. After data processing and principal component analysis, the top four stocks with the highest comprehensive scores were selected to construct an investment portfolio. The closing price data of the selected stocks were used to calculate the annualized rate of return, annualized covariance matrix, etc. The 1-year Chinese treasury bond yield was used as the risk-free rate to construct the efficient frontier and determine the optimal investment portfolio. The results show that the volatility of the optimal investment portfolio is lower than the average volatility of individual stocks, and the rate of return is higher than the average rate of return of individual stocks, verifying the feasibility of the Markowitz Portfolio Theory in this sector. It provides theoretical references and investment suggestions for investors. However, it also points out that investment decisions should not rely too much on historical data and should be combined with the actual situation.

Keywords: Markowitz Portfolio Theory, Principal Component Analysis, Low-Altitude Economy Sector

1 Introduction

Humans are progressively entering an era of low-altitude activity [1]. In 2021, the concept of the "low-altitude economy" was for the first time incorporated into China's national strategy. In 2024, it was included in the Government Work Report, followed by the introduction of a series of supporting policies. As a result, enterprises related to the low-altitude economy have received unprecedented attention from the public.

Against the backdrop of the Chinese government's increasing emphasis on the low-altitude economy and breakthroughs in related technologies, the low-altitude economy sector in the Chinese stock market has been significantly affected. Many stocks within this sector have been highly active, with their prices continuously rising and frequently becoming the focus of the market. However, due to the short formation time of the low-altitude economy sector in the Chinese stock market, there is a severe

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shortage of empirical research on relevant methods and theories. One of the most common approaches used in portfolio optimization is the Markowitz Model [2]. The Markowitz Portfolio Theory, as a symbol of the birth of modern portfolio management theory, for the first time provided rational investors with a specific mathematical method to select the optimal portfolio for investment. Markowitz model tries to maximize portfolio expected return for a given amount of portfolio risk, or homogeneously minimize risk for a given level of expected return, with the correct proportions of various securities. This model presumes that investors are rational and markets are efficient, tends to illustrate an asset's return as a normally distributed random variable, identifies risk as the standard deviation of return, and demonstrates a portfolio [3]. From the perspective of investors, this paper selects stocks using the principal component analysis method and examines the applicability of the Markowitz Portfolio Theory in the low-altitude economy sector, theoretically optimizing investment strategies for diversified investment.

The marginal contributions of this paper mainly include: filling the gap in relevant empirical research on the Markowitz Portfolio Theory; applying the principal component analysis method to stock selection and conducting empirical research on portfolio theory.

2 Research Design

2.1 Sample Selection

The research period is from January 1, 2024, to September 30, 2024 (considering that some companies' annual reports have not been released, the third-quarter report is used as the cut-off time). The financial indicators and stock price data of 324 listed companies in the low-altitude economy sector of the Chinese stock market are selected as research samples.

2.2 Empirical Research Tools

This paper uses Python as the tool for empirical research.

2.3 Construction of the Investment Portfolio

Factor Selection. Financial indicators can, to a large extent, represent the value of a company and are closely related to the company's stock price. It facilitates investors to make well-informed decisions by examining a company's overall financial health. In this study, financial indicators are selected as the common factors required for principal component analysis. The broad categories into which the financial indicators can be classified are profitability, liquidity, solvency, and valuation [4]. The investment value of the stocks of 324 companies is comprehensively evaluated from such four dimensions. The above four primary financial indicators can be further represented by 14 secondary indicators. Therefore, this study selects the following 14 sec-

ondary financial indicators as common factors: operating revenue, net profit, owner's equity, basic earnings per share, net assets per share, operating revenue per share, return on total assets, return on equity, growth rate of operating profit, current ratio, quick ratio, price - earnings ratio, price - to - book ratio, and current assets [5].

Data Source. The iFinD database is used to obtain all the data of the 14 common factors of each constituent stock in the low-altitude economy sector during the research period. After removing missing values and outliers, the average value of the data in the third quarter of 2024 is calculated for the obtained data, resulting in 262 samples and 14 factors required for principal component analysis. To eliminate differences in quantity and dimension of the data, the data is standardized, and the standardized sample covariance matrix is calculated.

Principal Component Analysis. The strength of PCA lies in its ability to reduce the dimensionality of complex datasets while retaining the most important information [6]. The investment portfolio of the Markowitz model may not be optimal from a financial perspective [7] . Therefore, this paper uses the PCA method to select stock targets from a financial standpoint. Python is used to obtain the eigenvalues and eigenvectors of the covariance matrix, and the contribution rate and cumulative contribution rate of the principal components are calculated to determine the principal components. By normalizing the original dataset and constructing a correlation matrix, the PCA approach helps to extract the principal components that represent the greatest variance in the dataset [8]. After dimension reduction using principal component analysis, based on this, taking the correlation coefficients of each component with the original indicators as weights, the original indicators are expressed as linear combinations of the principal components, and the scores of each principal component are calculated. Finally, taking the variance contribution rate of each principal component as the weight, a linear combination is used to construct an evaluation index function. The comprehensive scores of each stock are calculated through this function, sorted from high to low, and the top four stocks in terms of comprehensive scores are selected to construct an investment portfolio [9][10].

2.4 Markowitz Portfolio Theory

Data Selection and Processing. According to the comprehensive score results, this paper selects the top four stocks (SF Holding Co., Ltd, ZTE Corporation, Seres Group Co., Ltd, and Sinomems Technology Co., Ltd) as the investment portfolio objects to verify the applicability and feasibility of the Markowitz theory in the low-altitude economy sector of the Chinese stock market. The closing prices of the four stocks from January 1, 2024, to September 30, 2024, are obtained from the iFinD website of Tonghuashun, and outliers are removed as statistical data. Python is used to further process the data. First, the annualized average return rate and annualized covariance matrix of each stock are obtained, and the logarithmic return rate is used to calculate the return rate. At the same time, the 1-year Chinese treasury bond yield of 1.5374% (data from the China Money Network on March 21, 2025) is used as the risk-free rate.

Constructing the Efficient Frontier and Determining the Optimal Investment Portfolio. Python is used to randomly generate various investment portfolios by

changing the holding ratios of the four stocks, and the expected returns and volatilities of these portfolios are calculated (this paper simulates 100,000 random portfolios using Python) to construct the efficient frontier. Finally, an optimization function is used to solve for the expected return and volatility of the optimal investment portfolio, and the proportion of each constituent stock is obtained [11][12].

3 Result Analysis

Based on the principal component analysis, the comprehensive scores of each constituent stock are obtained, and finally, the top four stocks are selected, as shown in Table 1. These four stocks are SF Holding Co., Ltd (002352.SZ), ZTE Corporation (000063.SZ), Seres Group Co., Ltd (601127.SH), and Sinomems Technology Co., Ltd (688582.SH).

Table 1. Company name and composite score

Ticker Symbol	Company Name	Composite Score
002352.SZ	SF Holding Co., Ltd	3.198201
000063.SZ	ZTE Corporation	2.595273
601127.SH	Seres Group Co., Ltd	2.565578
688582.SH	Sinomems Technology Co., Ltd	2.257844

Through further processing of the closing price data, the annualized returns and annualized return volatilities of the four stocks are obtained (see Table 2). Seres Group Co., Ltd has the highest annualized return (62.53%), but its volatility is also relatively large. The average return of the four stocks is 0.350337, and the average volatility is 0.482436. The average return is less than the average volatility. In addition, this paper constructs a Markowitz investment portfolio and obtains the optimal investment portfolio.

Table 2. Risk and return of stocks

Ticker Symbol	Company Name	Annualized Returns	Return Volatilities
002352.SZ	SF Holding Co., Ltd	0.028938	0.275381
000063.SZ	ZTE Corporation	0.477062	0.428889
601127.SH	Seres Group Co., Ltd	0.625331	0.588452
688582.SH	Sinomems Technology Co., Ltd	0.270025	0.637021

Using the Python tool and assigning 100,000 random weights, different portfolio expected returns and volatilities are obtained, and the efficient frontier is constructed. On the efficient frontier, the minimum volatility is 0.262724, and the corresponding expected return is 0.112066. By introducing the capital market line tangent to the efficient frontier, that is, the position of the market portfolio (optimal investment portfolio) point in Fig.1, the weights of each stock are as shown in Table 3. For the optimal investment portfolio, the expected return is 0.535221, and the volatility is 0.184430. It can be found that at this time, the expected return is higher than the av-

erage return of the four stocks, and the volatility is lower than the average volatility of the four stocks, achieving a higher return while taking less risk, which also verifies the Markowitz Portfolio Theory.

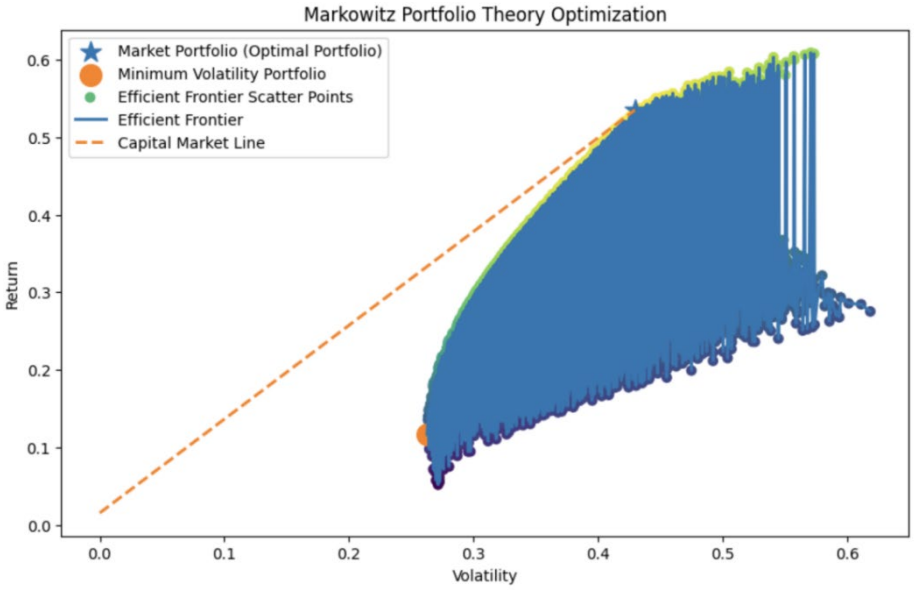

Fig. 1. Optimization

Table 3. Optimal Portfolio Weights

Company Name	SF Holding Co., Ltd	ZTE Corporation	Seres Group Co., Ltd	Sinomems Technology Co., Ltd
Optimal Portfolio Weights	close to 0	60.77%	39.23%	close to 0

4 Conclusion

The research results show that the volatility of the optimal investment portfolio is lower than that of individual stocks, and the return rate has a significant increase compared with some individual stocks. This proves that the Markowitz Portfolio Theory is feasible in the low-altitude economy sector of the Chinese stock market, which has guiding significance for investors' investments in this sector and can provide optimal investment portfolio suggestions for investors' future investments.

However, it should be noted that historical data cannot accurately predict future changes. The returns and risks of stocks change constantly. There are limitations result from its unrealistic assumptions. When investing, investors should not rely too much on historical data. Instead, they should combine the actual situation with the Markowitz Portfolio Theory before making investment decisions.

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