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Research on the Allocation of Investment Funds

——Empirical Analysis of Five Listed Companies

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Abstract: With the purpose of improving the optimal portfolio strategy of American listed companies, this paper studies the capital allocation of the investment subject under different models, and finally gives the portfolio countermeasures of the investment subject. This paper research the proportion of investment funds allocated by each company under three models: maximum Sharpe ratio model, minimum variance model, and equal weight model through returns of five companies from 2022-9-23-23 to 2023-2-15. It concluded that the allocation of MCD has the largest weight in maximum Sharpe ratio model and minimum variance model. Finally, the specific investment funds are calculated according to the calculated weight and the return rate from 2023-1-16 to 2023-2-15 and compared with the market data, discovering the conclusion that the equal weight model has the highest return, followed by the largest Sharp ratio model, the minimum variance model, and the market has the lowest return. The results verify the feasibility and effectiveness of the equal weight model in the portfolio and give the corresponding countermeasures and suggestions for investors to help them avoid risks and obtain the maximum returns in the financial market.

Keywords: portfolio theory, equal weight model, return rate, investment

1. Introduction

The American economist-Markowitz first proposed the portfolio theory innovatively, and conducted a systematic, in-depth and fruitful research which are efficient in following research. Portfolio model theory has been proved generally to be conducive in financial practice and it also has been reflected widely useful in aspects of portfolio selection and asset allocation for whether companies or individual. Portfolio optimization model is extremely significant in the financial field, capital market and plays a crucial role in the market economy's development [1]. Portfolio management is a complex process of reallocating ceaselessly existing funds to different financial products within a certain range of risks to maximize returns to satisfy the financial demands of investors [2]. It reflects the need for investors to evaluate the benefits of securities investment while diversifying asset risk as much as possible through portfolio model optimization in financial and capital market [3].

There has been much research on portfolio model and investment decision. For instance, one research firstly designed a predictive model called autoregressive moving average (ARMA) and used

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traditional Mean-Variance model to construct an optimal portfolio with risky assets based on collected blue-chip stocks from S&P for investigations [4]. In addition, the maximum Sharpe ratio model is also widely used, using ensemble learning and maximum Sharpe ratio portfolio theory. One research proposed a two-stage portfolio optimization method by considering asset forecast information to enhance the performance and robustness of a portfolio in actual commercial business [5]. Moreover, one study compares the out-of-sample performance of mixed portfolio method-Minimum Variance and Maximum Sharp ratio in two asset universes covering multiple asset types and for two estimation methods (full covariance and single-index model) which applied universally in capital market [6].

However, in existing studies, there is a lack of research on combining the maximum Sharpe ratio model and minimum variance model together to find the weight, and then predict the return of investment, let alone provide investors with accurate investment advice within a certain period of time. Therefore, the research in this article makes up for the research gap in this part of the financial market.

The paper is constructed as follow. In the second part, we will analyze the collected and calculated data and introduce the three models used in detail. In the third part, the conclusions of the study will be obtained, and a brief discussion made. Finally, we will get a conclusion and propose the shortcomings of this method.

2. Data

The data used in this paper comes from investing.com and S&P500. This paper selected stocks following 5 companies which are Tesla, Amazon, SEDG, MEIP and MCD for their return rates from 2022-9-23 to 2023-2-15. This paper considered to choose these data as they were all performance well and have relatively high beta during this period, and these companies from different fields including electric energy, E-commerce retail, solar-edge technology, bio-pharmaceutical and food in order to diversify the risk and avoid high correlation. Some illustrations and statistic of these return rates are shown in the table 1 below.

Table 1: Descriptive statistics of the selected stocks.

	Tesla	Amazon	MEIP	SEDJ	MCD
Mean	-0.0019	-0.0010	-0.0013	0.0032	0.0008
Variance	0.0022	0.0009	0.0039	0.0017	0.0001
Max	0.11	0.1218	0.2688	0.1913	0.0409
Min	-0.1224	-0.0843	-0.3352	-0.1032	-0.0294

From the data showing above, this paper finds that the highest average return is ‘SEDJ’, while the lowest average return is belonged to ‘Tesla’-0.0019. Comparing their variances, ’MEIP’ has the largest variance while ‘MCD’ has the lowest variance. Moreover, the highest max return and the lowest min return are both ‘MEIP’. However, the lowest max return and the highest min return is both in ‘MCD’.

3. Method

3.1. Maximum Sharpe Ratio

The Sharpe ratio which applied widespread is ratio between the expected return of the portfolio and the cover of the risk-free rate and the return standard deviation of the portfolio. The main idea is to estimate the financial return of the asset portfolio under the risk, so that the investor's risk and return are expressed through a unified mathematical relationship. The Sharpe ratio model comprehensively

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measures the rate of return and risk of the investor's portfolio, the larger the ratio, the more conspicuous the effect of the portfolio. Because the Sharpe ratio comprehensively indicates the risk and return traits reflected in financial market, its characters are universally used to evaluate the performance of the asset portfolio, guide the operation efficiency of the capital market, construct an effective portfolio of assets, and lead investment decisions. Meanwhile, Sharpe ratio has become the 'gold standard' of performance evaluation [7]. The mathematical expressions are shown below.

$$\max\left(\mathrm{E}(\mathrm{R_p})\text{-}\frac{\mathrm{r_f}}{\sigma_\mathrm{p}}\right) \tag{1}$$

$$\sum \mathrm{X_i} = 1\ (\mathrm{X_i} \geq 0) \tag{2}$$

$E(R_p)$, r_f, σ_p, X_i Which represents expected return of portfolio P, return of risk-free assets, standard deviation, the corresponding weight during the observation period, respectively.

3.2. Minimum Variance

The minimum variance portfolio has the lowest risks in all methods of measuring portfolios and is also suitable for investors who try to avoid risks. A minimum variance portfolio can maximize return values with minimizing risk and holding own violate investment types, however, when combined will create a diversified portfolio with lower volatility than any risks included. Moreover, Reza Raei introduced an innovative combination, and showed the superiority of the composition model which verifies the practical application of minimum variance model in the financial market convincingly [8]. The mathematical expressions are shown below.

$$Min(X^T W X) \tag{3}$$

$$\sum \mathrm{X_i} = 1 (\mathrm{X_i} \geq 0) \tag{4}$$

$\mathrm{X^i}$ represents the corresponding weight during the observation period.

3.3. Equal Weight

Equal weight is a proportion measure that in case of equal weight indices, all the stocks are given equal weightage. Equal weight Stock portfolio is widely used in portfolio decisions and its performance is generally better than the market value-weighted stock portfolio [9]. In addition, Torluccio et al. have illustrated that excepting that equal weighted portfolio is more flexible than the cap weighted portfolio, and that it outperforms mean – variance-based portfolio strategies out of sample which proves to investors the feasibility and effectiveness of the equal weight model in the financial market [10]. Its mathematical expression is:

$$W_i = \frac{1}{n} \tag{5}$$

n represents total number of investment objects selected, W_i is the weight of each company which are equal.

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4. Empirical Results

The author wrote the relevant program of python and used the return rates collected in the first 70 days from 2022-9-23 to 2023-1-15 to obtain the corresponding investment weight of five companies. The related weights for the portfolios are illustrated in the following Table 2.

Table 2: Weights of three models.

	Tesla	Amzn	MEIP	SEDJ	MCD
Maximum sharp ratio model	0	0	0	0.11	0.89
Minimum variance model	0.009	0.115	0.023	0	0.853
Equal weight model	0.2	0.2	0.2	0.2	0.2

The corresponding investment weight of five companies: 0,0,0,0.11,0.89 respectively under maximum sharp ratio; 0.009,0.115,0.023,0,0.853 respectively under minimum variance model;0,2,0,2,0,2,0,2,0,2 respectively under equal weight, Where the authors found that the MCD had the greatest weight in both the Sharpe ratio and the minimum variance model.

When selecting the market data, the same time period data of 30 days of S & P500 is selected as the reference for comparison. Based on the calculated weights, calculating the returns of original 10,000 dollars in 30 days from 2023-1-16 to 2023-2-15, related results are shown below, it is apparent to discover that the equal weight model return is greater than other models and the market return under S&P500. The detailed evaluation is shown in Table 3.

Table 3: Return values of different models.

Type of model	Max sharp model	Minimum variance model	Equal weight model	S&P500
Present value	10000	10000	10000	10000
Future value	10301.627	10230.895	13146.107	9898

5. Conclusion

This article selected five listed companies as the research object, collecting the 100 days return rates from 2022-9-23 to 2023-2-15 , writing related python program under the basis of the largest sharp ratio model, the minimum variance model, the equal weight model to determine the proportion of investors, then , on the proportion and the subsequent collection of following 30 days return rates to predict the specific number under certain amount of endowment to get which kind of investment capital allocation can let investors get the maximum return. This empirical study is different from the previous portfolio optimization model, comparing the three models and S & P500 together, and provides the best investment advice for investors in the period from 2-23 to 2023-2-15 in 2022 concretely.

Above conclusions may have certain limitations, first is the empirical test selected only five companies' stock during 2022-9-23 to 2023-2-15 period, which cannot determine whether it is widely used. Secondly, other portfolio optimization models are not within the scope of the empirical paper, it may be more effective than the weight model and have higher returns.

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