Markowitz Portfolio Optimization

Results examples

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Abstract This article has the goal of presenting some of the results generated by the built code, with an emphasis on six specific stocks: PETR4, VALE3, BBAS3, BBDC4, ITUB4 and ABEV3. The chosen period for the results presented here were between 2012-04-29 and 2022-04-29. Further information can be found in the READ.md file from the GitHub repository[1].

1. Introduction

Regarding the explanation of what is a Markowitz portfolio optimization this description will be done briefly just so the reader can get to understand its concepts and examples shown here.

1.1. Markowitz model

In finance, the Markowitz Model – created by Harry Markowitz in 1952 – is a portfolio optimization model; it helps in the selection of the most efficient portfolio by analyzing various possible portfolios of the given securities through their mean returns and standard deviations. Here, it shows investors how to reduce their risk (which Markowitz made the assumption that the risk of a portfolio is based on the variability of returns from said portfolio).

1.2. Sharpe ratio

The Sharpe ratio was developed by William F. Sharpe and is used to help investors understand the return of an investment compared to its risk. In this project, the Sharpe ratio will be used to compare the performance of the Markowitz optimized portfolios compared to a risk-free rate (which could be an American or Brazilian treasury rate, for example, the chosen risk-free rate should be carefully chosen by the code user accordingly to the chosen securities i.e. a portfolio composed exclusively by Brazilian securities can be better compared through a Brazilian treasury rate.

[1] https://github.com/brunowmwm/Markowitz_portfolio

2. Result examples

In this section, the results will be shortly given, followed by the graphs created through the code.

2.1. Portfolio composed of PETR4.SA, VALE3.SA, ITUB4.SA, BBAS3.SA, BBDC4.SA and ABEV3.SA

Fig. 1: Simulations of 500 portfolios based on the securities mean returns, standard deviations and random weights which sum to 1 (no leverage).

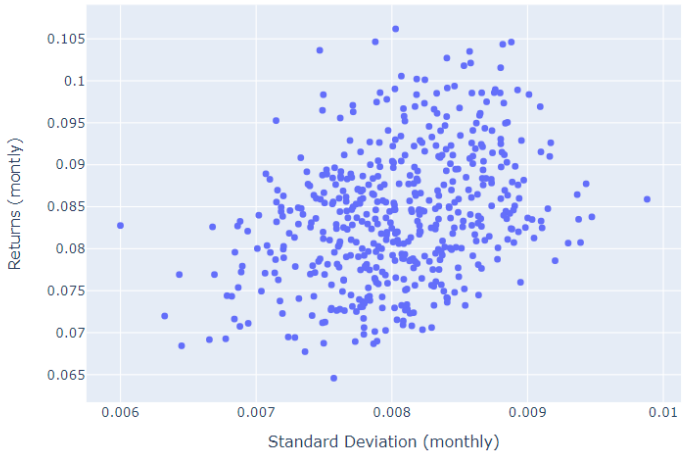

Fig. 2: The 500 previous simulations were compared to the optimal Markowitz portfolios

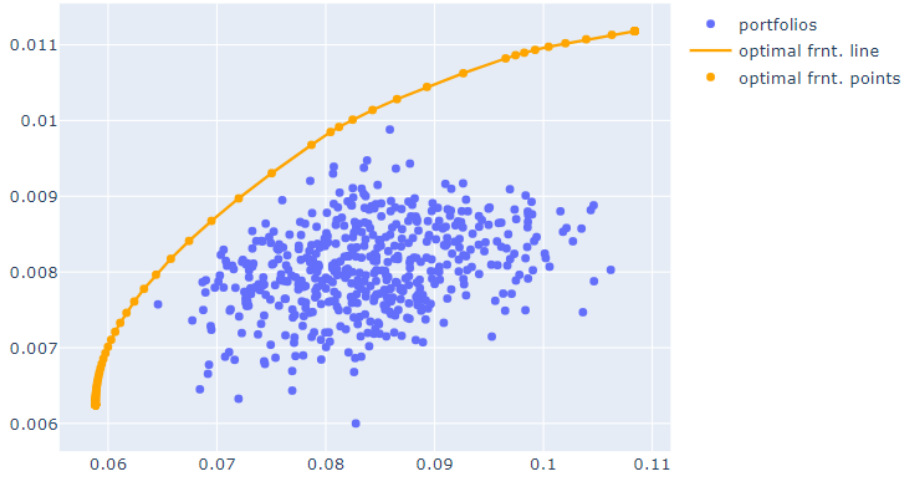

Table 1: Weights and results of each security to maximize the Sharpe ratio

	PETR4.SA	VALE3.SA	ITUB4.SA	BBAS3.SA	BBDC4.SA	ABEV3.SA	Sharpe	Monthly Return	Monthly Std. dev.
1	0.000003	58.646461	39.716105	1.637363	0.000058	0.000009	0.070868	0.010011	0.082471

3. Results

The results gave us a performance of a 1% monthly return with a standard deviation of 8,25%. There were many assets that didn't have a considerable weight on the portfolio, as so, they could be discarded and changed by other ones (which could consist of lesser risk, for example).

4. Considerations

Any number of stocks, within any chosen period can be tested through this code, this way the reader can have fun testing the Markowitz optimized portfolio in the way he chooses to. This data is free and can be used freely. Have fun!

References:

Wikipedia Contributors. Markowitz model. Wikipedia. Published June 12, 2021. Accessed May 10, 2022. https://en.wikipedia.org/wiki/Markowitz_model#:~:text=In%20finance%2C%20the%20Markowitz%20model,portfolios%20of%20the%20given%20securities.

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