https://github.com/jardieljr/vba_project

VBA PROJECT

Automated Stock Portfolio optimization

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1.Project question

One of the most difficult tasks in finance is the optimal allocation of financial assets based on risk/return considerations. Indeed, Portoflio optimization is the process of selecting the best portfolio that provides the most profitable rate of return for each unit of risk taken by the investors.This can only be accomplished if reliable risk estimations and trustworthy and accurate predictions of relevant market data are available.To bring this goal closer, our project will answer the following question:

How to create an automated stock portfolio optimization program based on real data from the market?

2.Aim of the project

The main objective of this project is to maximize the value of a stock portfolio by identifying the most productive combination of assets that will yield the highest return.

To do so , we will construct an Automated Portfolio Optimization Program using VBA which will allow the user to :

1.Choose the number of stocks in the portfolio he wants to build.

2.Import automatically the historical data for each stock with a given ticker (from Yahoo Finance for instance) or using a Power Query request to update the data in real-time.

3.Compute automatically different metrics related to stock performance (returns, volatility, Sharpe Ratio…) and construct the efficient frontier.

4.The code will optimize the portfolio weights to maximize the Sharpe ratio, optimizing the trade-off between returns and volatility.

5.Finally, the user can select the “optimal” portfolio and its relative weights.

3.Usefulness of the project

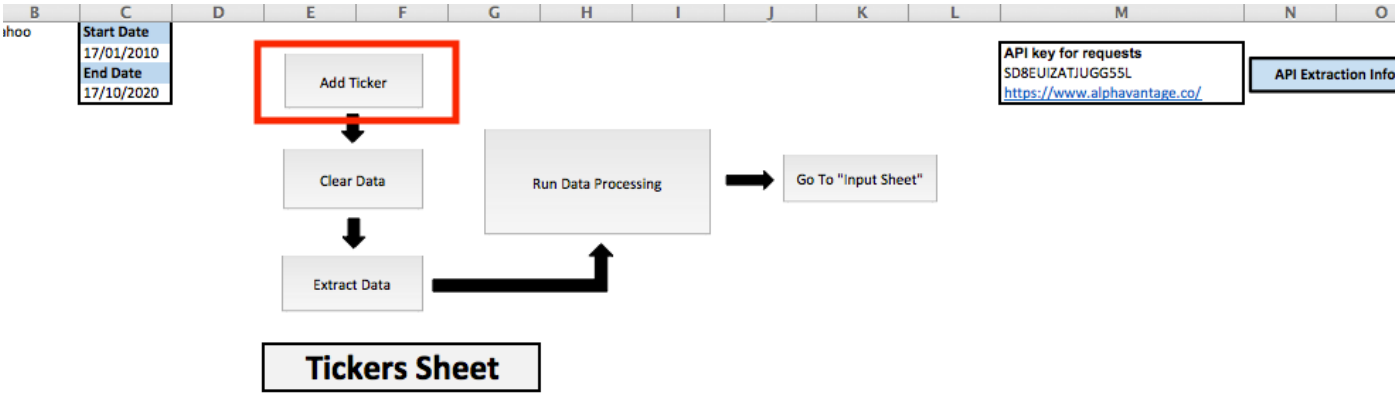
Constructing an Automated stock portfolio optimization is particularly useful as it allows for the prediction of possible outcomes as well as the estimation of the associated risks. We created a tool for the automated optimization of stocks by combining these knowledge areas and adding optimization routines.

- **A more stable portfolio creation:** Risk-based portfolio optimization allows, thanks to better diversification, to benefit from greater security, with a lower level of risk and reduced maximum losses.
- **Generation of long-term returns above the market average:** The minimum variance portfolio makes the most of the low volatility premium. Indeed, experience has shown that stocks with small price variations provide above-average returns over the long term. This bonus is not new, its existence has been proven for several decades.
- **Comparison of scenarios:** It is possible to produce and compare quickly and easily a large number of scenarios in order to spot the highest probability to achieve various objectives, for example lower requirements for current investments, protection of the value of existing assets or improvement of reliability.
- **Reporting tool :** Our tool provides consolidated, factual and up-to-date information about all the portfolio simulations using visual charts and putting the emphasis on the optimal potrfolio . Those Informations in the report are well organized and can be used for future planning and decision making.
- **Backtesting** : Our tool will allow us to simulate the investment strategy using historical prices to determine how well it would have performed in the past

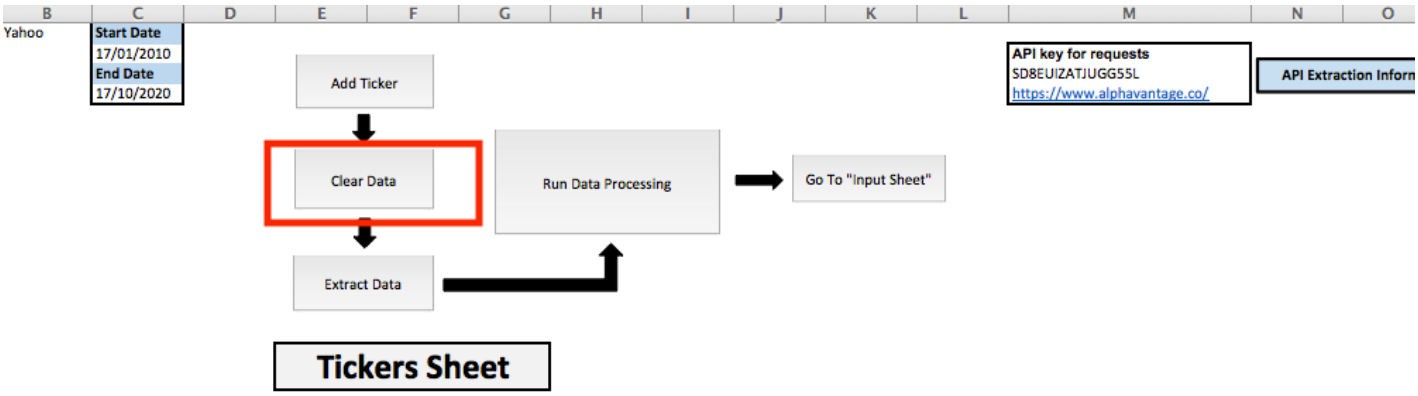
3.User Guideline

- In the Tickers sheet

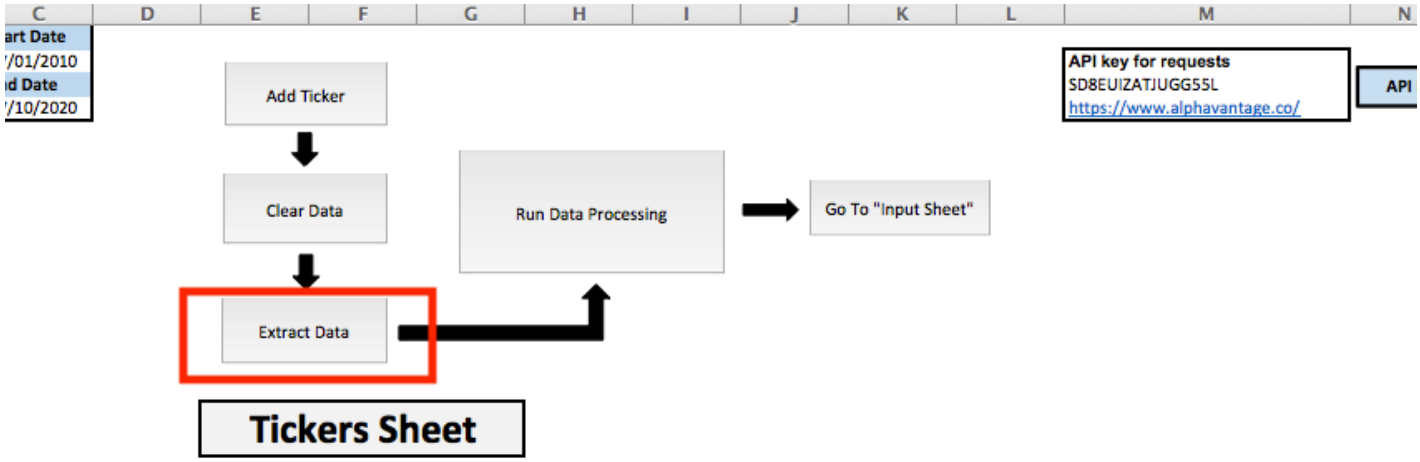
1.Input the stocks (tickers) you want to invest in. In order to do it, you need to click on the button "Add Ticker".



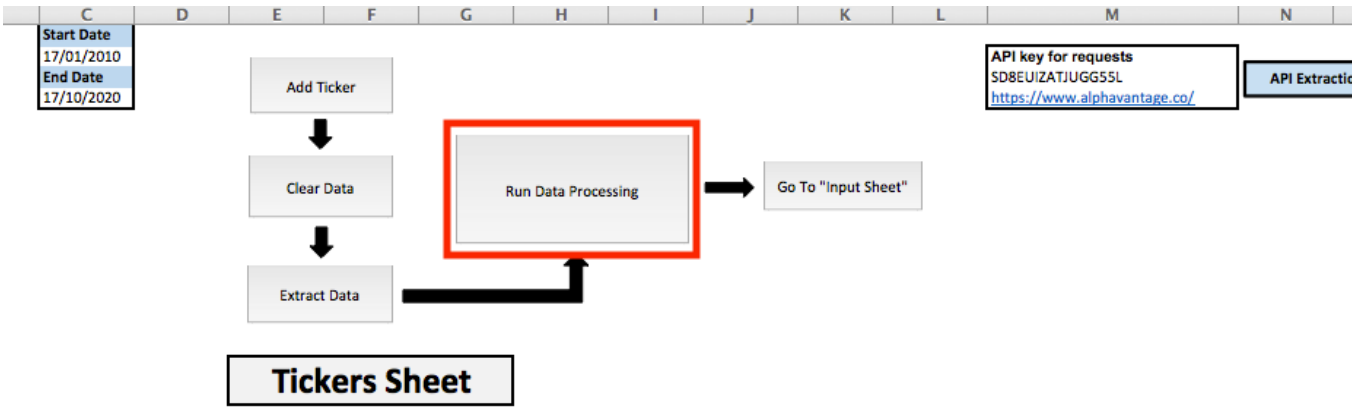
2.In order to clear Data from a previous simulation runned by the last user, you have to click on the “Clear Data “ button.



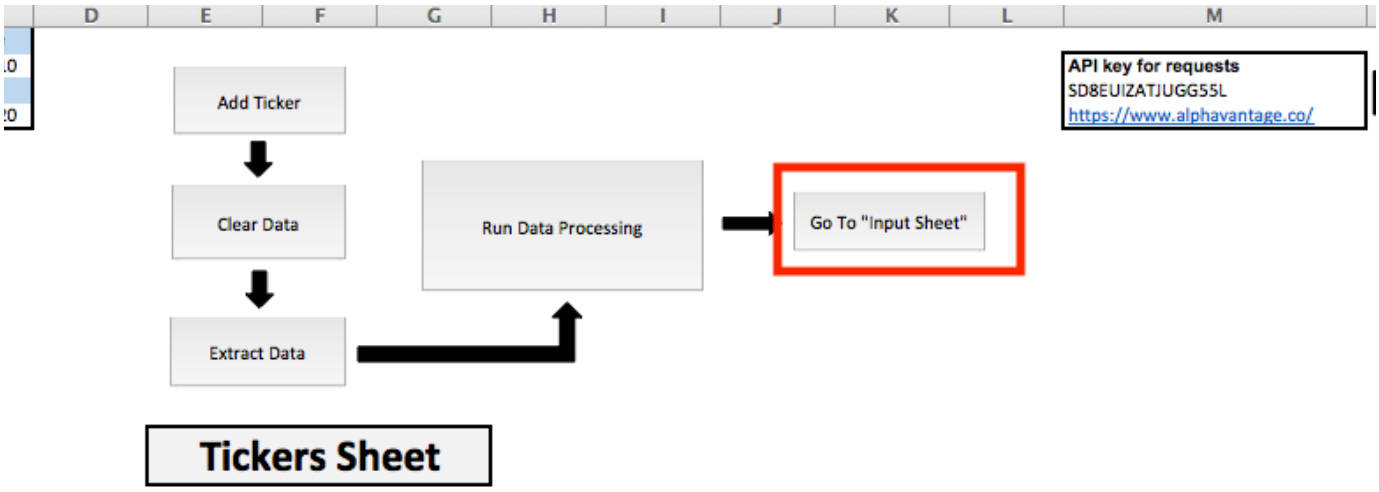
3. In order to withdraw the daily stocks data of the tickers already chosen from Yahoo Finance accessed by using the Alphavantage platform , you need to click on “Extract Data “ button.



4. In order to calculate the average return for each stock , the covariance matrix and correlation between all the stocks already chosen , you need to click on “Run data processing”.

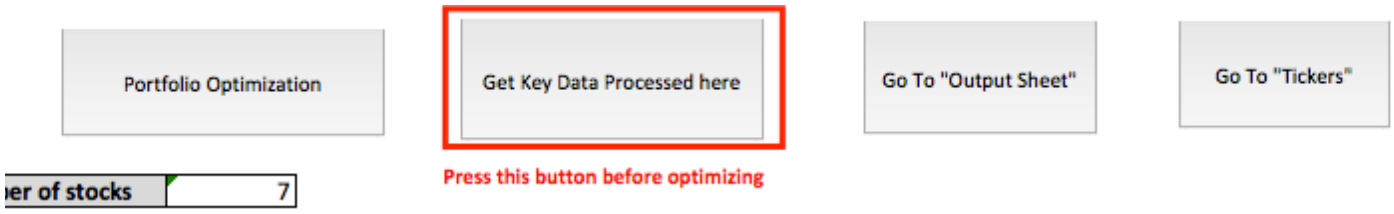


5. Click on “Go to Input Sheet” , you will be redirected to the Input Sheet.

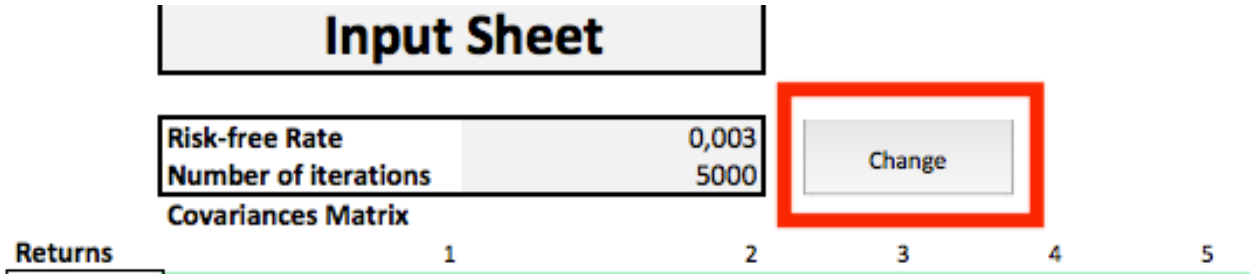


- **In the Input Sheet**

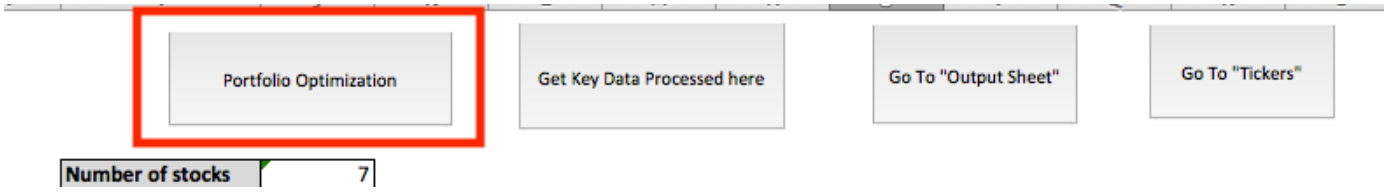
6. In order to display all the computation of the different stocks runned by the code . Click on "Get Key Data Processed here "



7. Enter the Risk-free rate value and the number of iterations wanted by clicking on the "Change" button

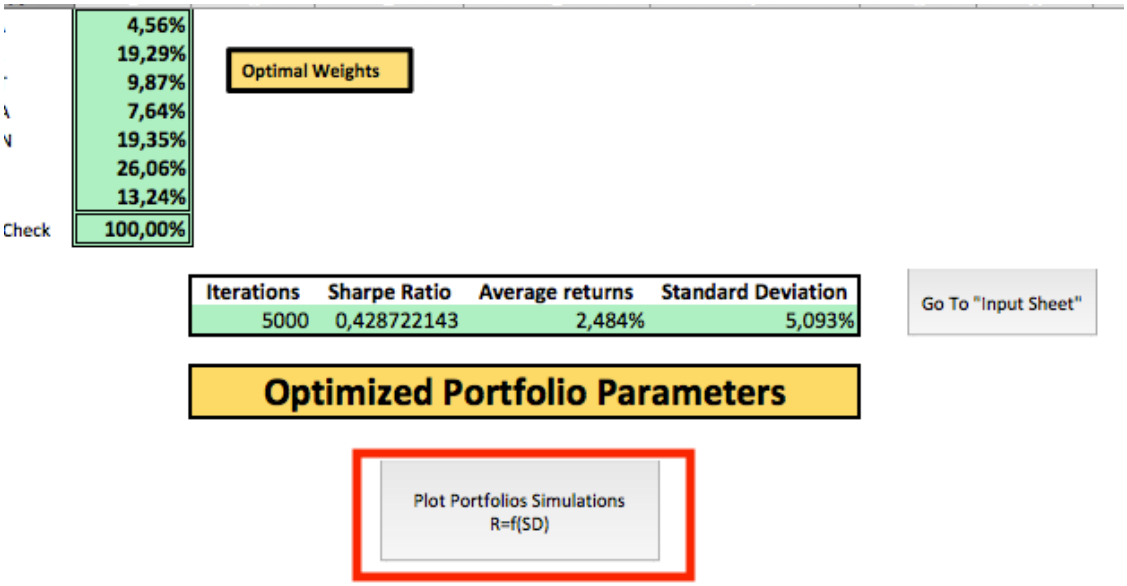


8. In order to run the Portfolio optimization process (weights , number of iterations, sharpe ratio,average return and volatility of the portfolio).Click on "Portfolio Optimization" button, you will be automatically directed to the Output sheet.

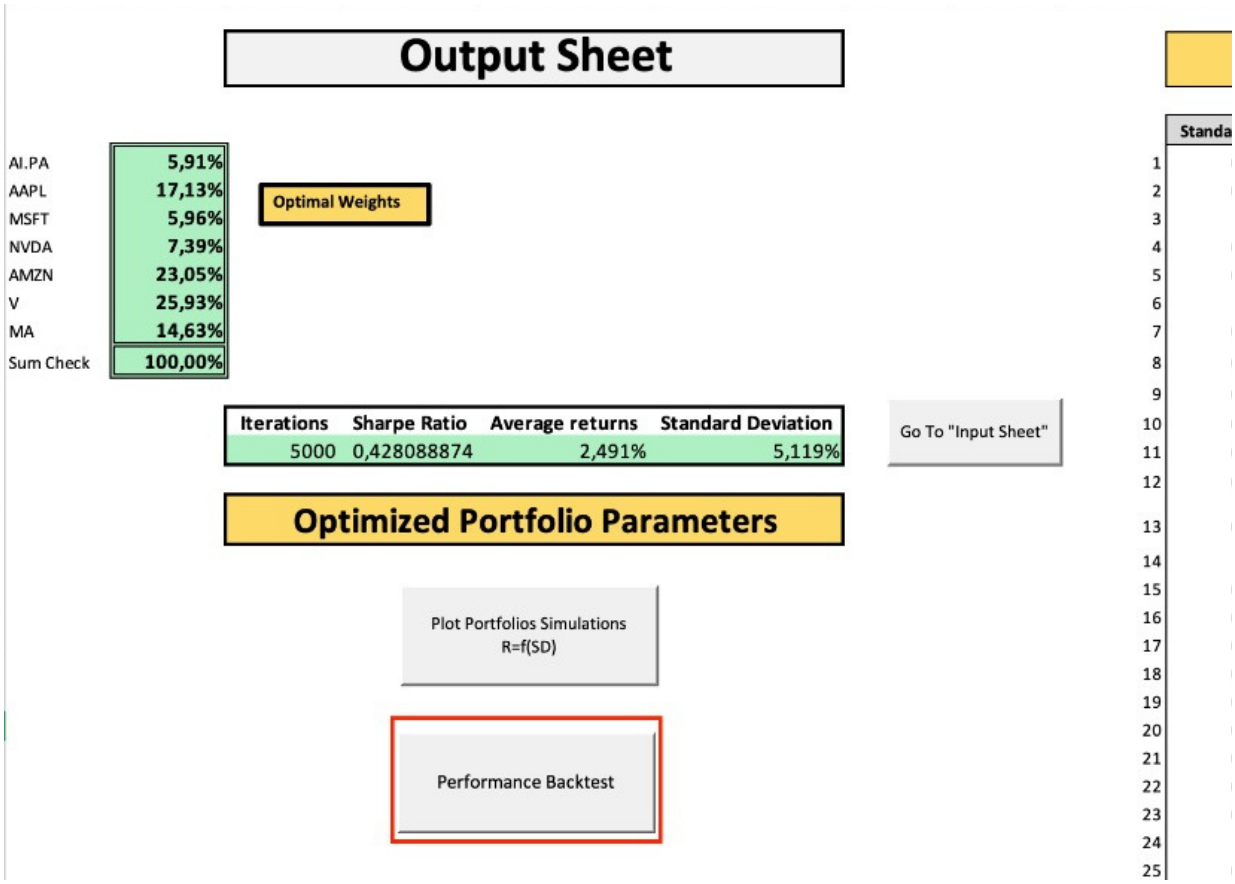


In the Output Sheet

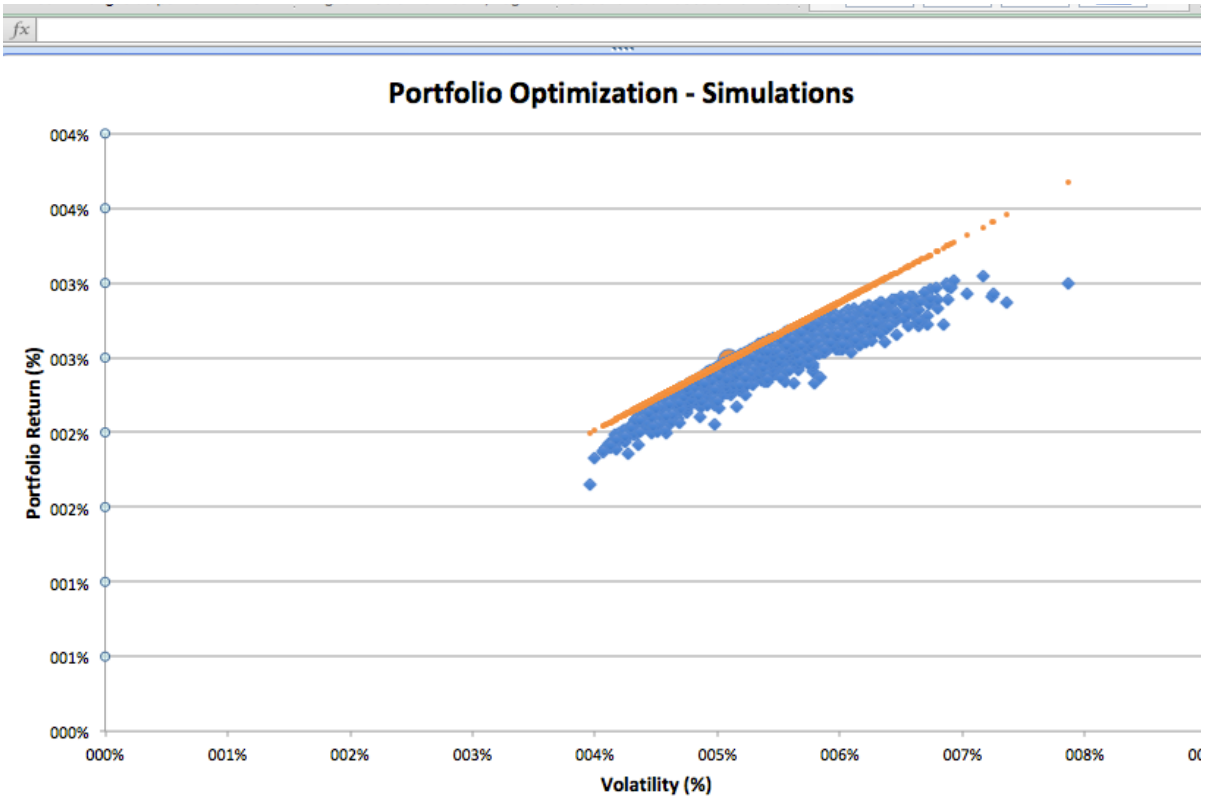
9. In order to visualize the Portfolio optimization chart including all the different simulations .Click on the "Plot Portfolios Simulations R=f(SD)" button, you will be automatically directed to the Simulation chart Sheet.



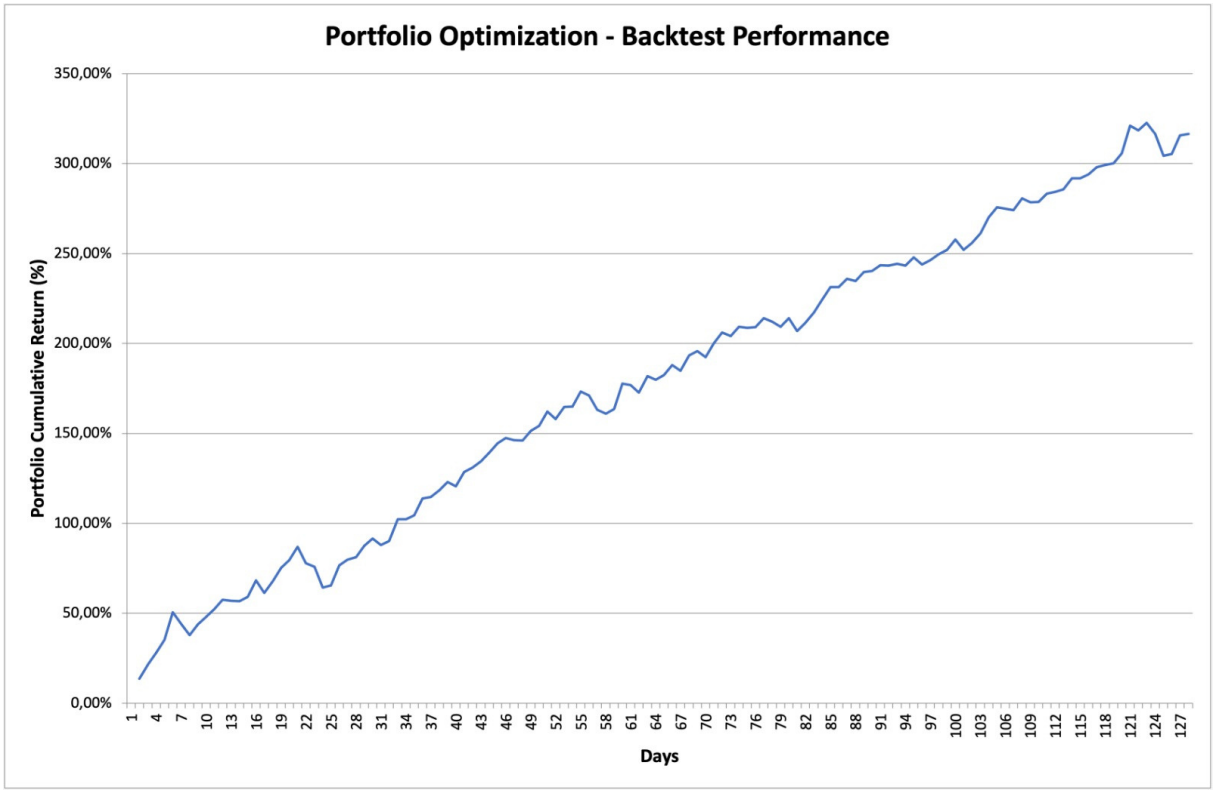
In order to have the performance backtest, you need to click in the button highlighted below.



- **In the Simulation chart Sheet**



- **In the Performance Backtest Sheet**



3.Limits of our project

- The first limitation of our tool is the extraction time. We used Alphavantage to extract the data from Yahoo Finance, therefore we are using a free API key generated from Alphavantage. This API key allows us to perform only 5 requests per minute. Hence, we can approaximately extract the data from each stock each 12 seconds which makes our data extraction quite long in time. The user has to wait for all the data to be extracted. To overcome this issue, we advise to the user to get a premium Alphavantage key so the hole extraction can be performed in a matter of a second.

- A second limitation of Worbook is that the user has to press numerous buttons to get along all the different steps. This can be quite difficult to understand in a first time if the user hasn't read the PDF guide and the instructions given. As a matter of fact, we chose to segment the hole process in various steps (which explains the different buttons) to make our tool more robust to bugs and easier to debug for some reasons.

- Thirdly, for some start date in the 'Ticker' sheet, it is possible that the number of data samples are not the same between stocks if for example some companies have been created after the start date. This creates bugs in our covariances matrix computations and hence makes our portfolio optimization impossible. Therefore, it is very important that the user makes sure that at the start date ordered by the user in the Tickers Form, each company selected was indeed listed on the stock market.