

PORTFOLIO ANALYSIS

PORTFOLIO JUNE 2017 - JUNE 2021

Prepared by Kirill Wolkow



PORTFOLIO

- Apple
- Microsoft
- Tesla
- Amazon
- BYD
- NIO
- BioNTech
- Netflix
- Disney

APPLE

Name:	Apple
Ticker:	APPL
Foundation:	1st of April, 1976
Registered Office:	Cupertino, California, USA
Management:	Tim Cook (CEO), Arthur D. Levinson (Chairman), Jeff Williams (COO)
Employees:	147'000 (2020)
Revenue:	USD 275 Billion (2020)
Industry:	Computer hardware, Computer software, Retail, Consumer electronics

MICROSOFT

Name:	Microsoft
Ticker:	MSFT
Foundation:	4th of April, 1975
Registered Office:	Redmont, Washington, USA
Management:	Satya Nadella (CEO), John W. Thompson (Chairman), Brad Smith (President)
Employees:	167'000 (2020)
Revenue:	USD 143 Billion (2020)
Industry:	Software development, Computer hardware, Consumer electronics, Social networking service

TESLA MOTORS

Name:	Tesla Motors
Ticker:	TSLA
Foundation:	1st of July, 2003
Registered Office:	Palo Alto, California, USA
Management:	Elon Musk (CEO), Robyn Denholm (Chairman), Drew Baglino (CTO), Zach Kirkhorn (CFO)
Employees:	71'000 (2020)
Revenue:	USD 32 Billion (2020)
Industry:	Automotive, Battery energy storage, Solar energy generation

AMAZON

Name:	Amazon
Ticker:	AMZN
Foundation:	5th of July, 1994
Registered Office:	Seattle, Washington, USA
Management:	Jeff Bezos (CEO, President, Chairman), Andy Jassy (CEO-elect), Brian Olsavsky (Senior VP, CFO)
Employees:	1'300'000 (2020)
Revenue:	USD 387 Billion (2020)
Industry:	Cloud computing, E-commerce, Artificial intelligence, Consumer electronics

BYD

Name:	BYD (Build Your Dreams)
Ticker:	BYDDF
Foundation:	February 1995
Registered Office:	Shenzhen, Guangdong, China
Management:	Wang Chuanfu (Chairman, CEO)
Employees:	230'000 (2020)
Revenue:	USD 27 Billion (2020)
Industry:	Automobiles, Buses, Electric bicycle, Truck, Forklift, Solar panels, Rechargeable batteries

NIO

Name:	NIO
Ticker:	NIO
Foundation:	November 2014
Registered Office:	Shanghai, China
Management:	William Li (Chairman, CEO), Lihong Qin (President), Wei Feng (CFO)
Employees:	7'000 (2020)
Revenue:	USD 2.5 Billion (2020)
Industry:	Automotive

BIONTECH

Name:	BioNTech
Ticker:	BNTX
Foundation:	2008
Registered Office:	Mainz, Rhineland-Palatinate, Germany
Management:	Ugur Sahin (CEO), Özlem Türeci (CMO), Sean Marett (CBO, CCO), Sierk Poetting (CFO, COO), Ryan Richardson (CSO)
Employees:	1'300 (2019)
Revenue:	USD 550 Million (2020)
Industry:	Biontechnology

NETFLIX

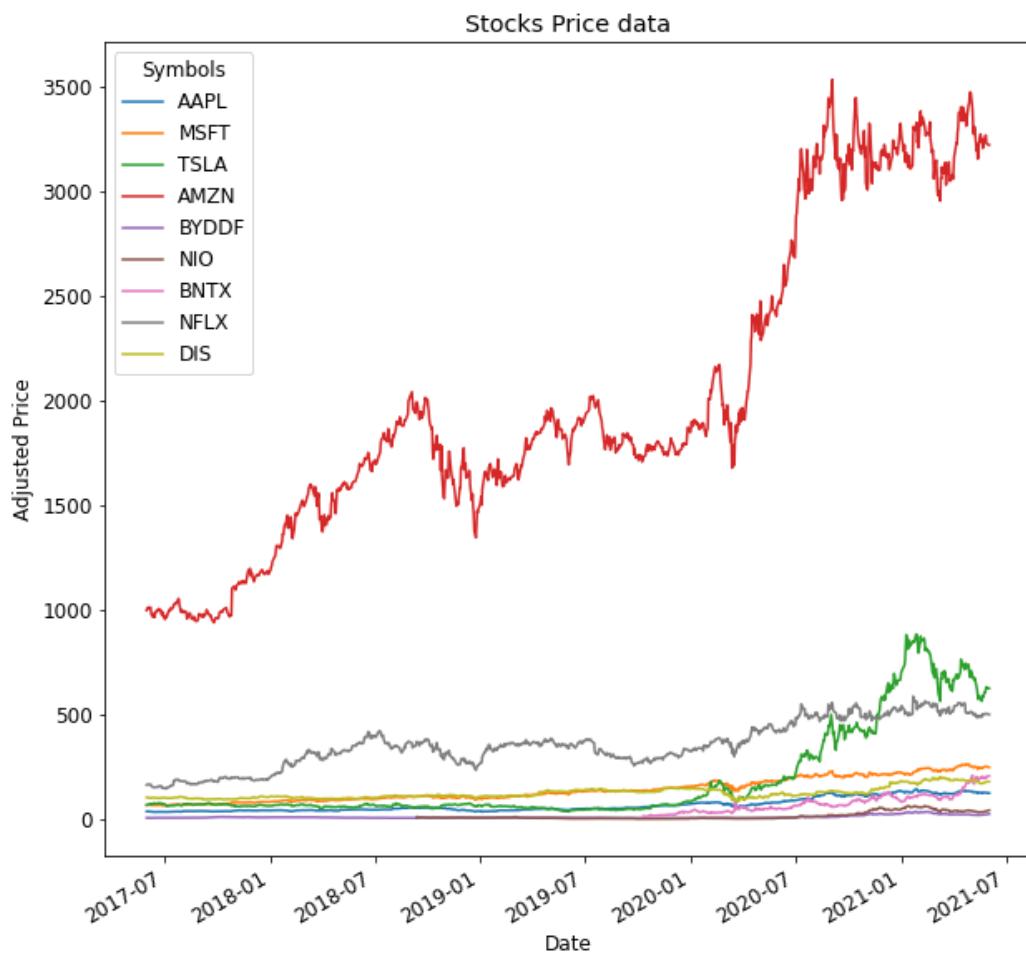
Name:	Netflix
Ticker:	NFLX
Foundation:	29th of August, 1997
Registered Office:	Los Gatos, California, USA
Management:	Reed Hastings (Chairman, Co-CEO), Ted Sarandos (Co-CEO, CCO), Greg Peters (COO, CPO)
Employees:	12'000 (2020)
Revenue:	USD 25 Billion (2020)
Industry:	Tech & Entertainment, Mass media

DISNEY

Name:	The Walt Disney Company
Ticker:	DIS
Foundation:	16th of October, 1923
Registered Office:	Burbank, California, USA
Management:	Bob Iger (Executive chairman), Bob Chapek (CEO)
Employees:	223'000 (2020)
Revenue:	USD 65 Billion (2020)
Industry:	Mass media, Entertainment

FINANCIAL STATISTICS

ADJUSTED DAILY CLOSING PRICES

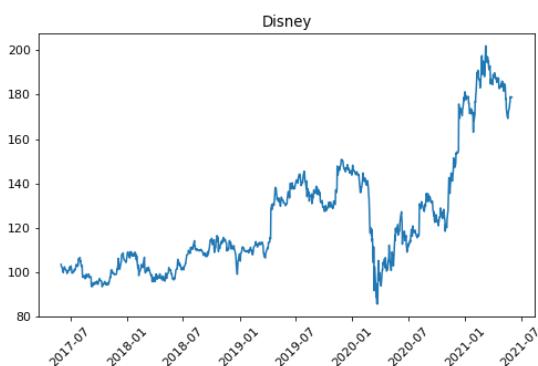
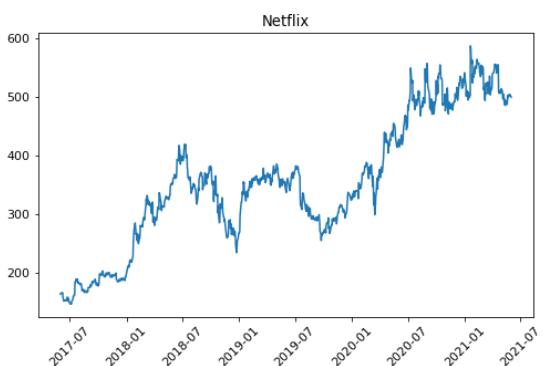
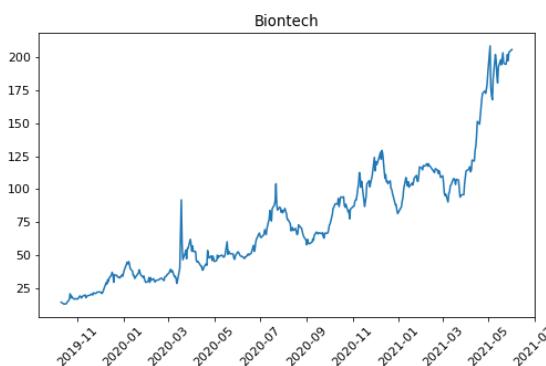
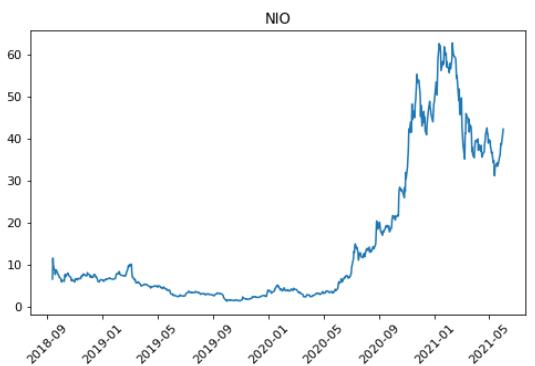
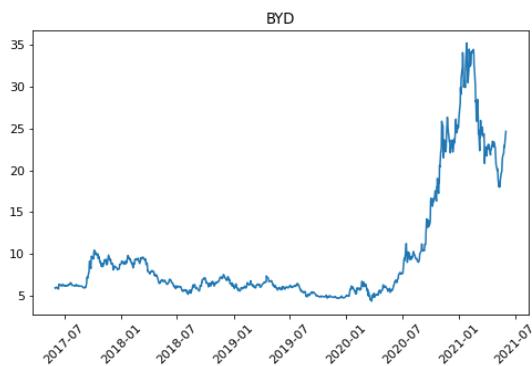
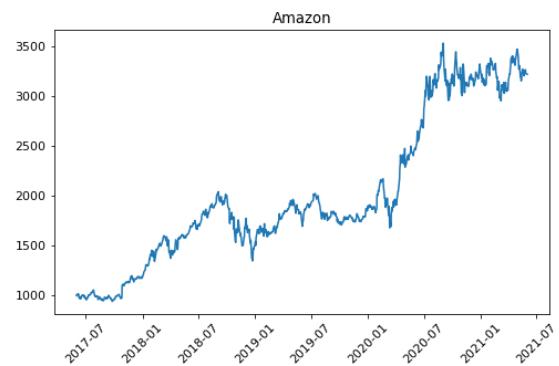
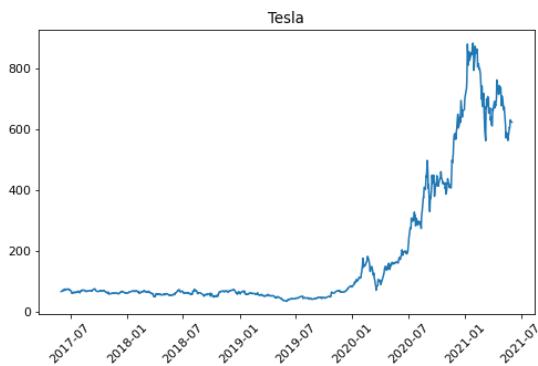


Mind that the amazon stock has a great impact on the graph, because of its higher value.

Overall all stocks had a huge growth in the last 5 years.

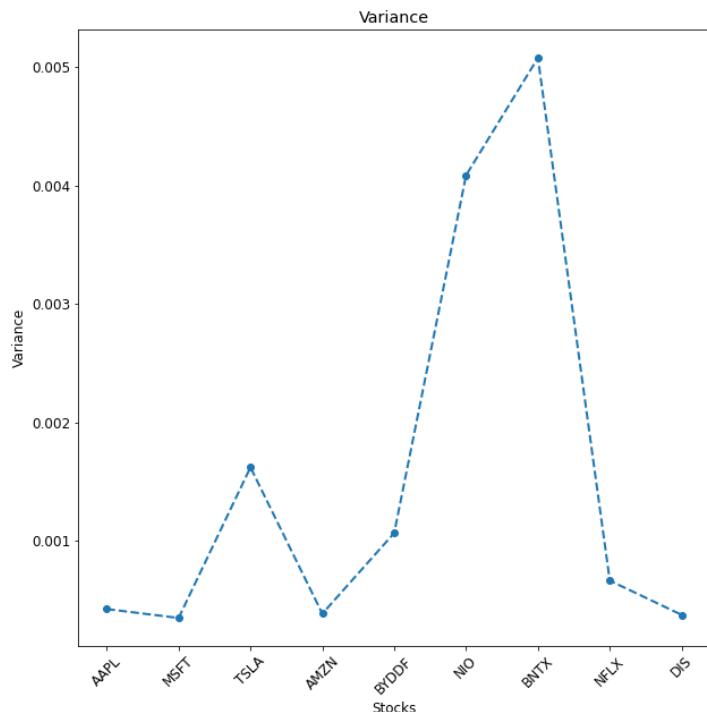
FINANCIAL STATISTICS

ADJUSTED DAILY CLOSING PRICES - SEPARATED



FINANCIAL STATISTICS

VARIANCE



The variance in prices of stocks are an important indicator of how volatile this investment will be (how returns can fluctuate).

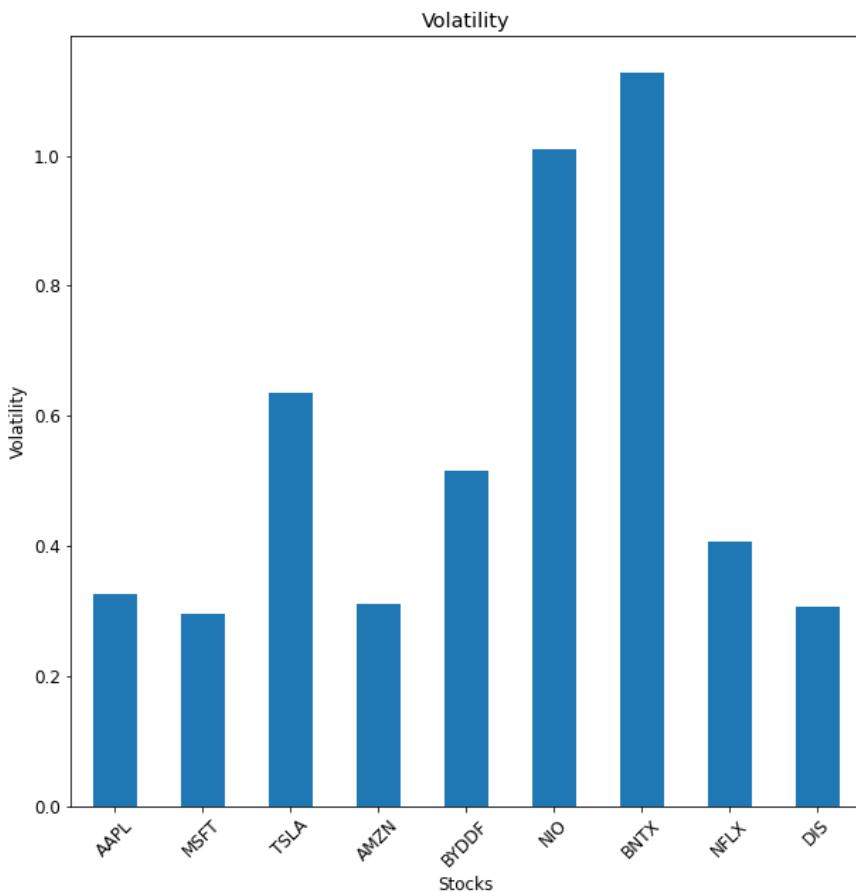
As you see, Biontech and NIO have the highest variance, thus Microsoft and Disney have the lowest.

Under the hood, the formula implemented by this function is given by:

$$s^2 = \frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N - 1}$$

FINANCIAL STATISTICS

VOLATILITY



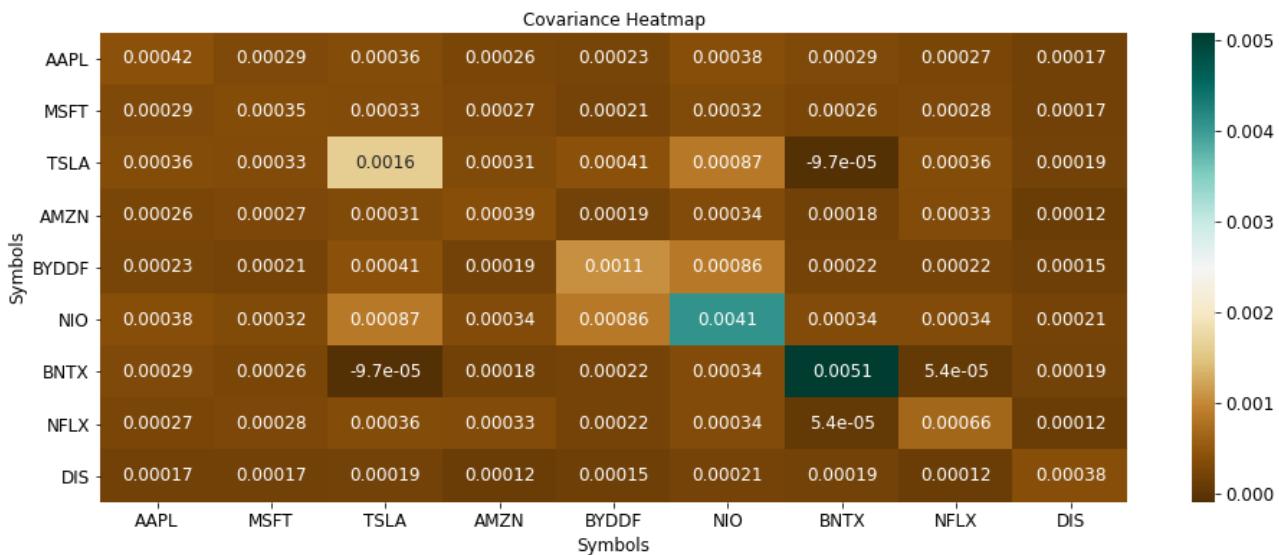
Similar to variance, Biontech and NIO have the highest volatility. And the stocks, Disney and Microsoft the lowest.

The volatility was calculated with the following formula:

$$s = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N - 1}}$$

FINANCIAL STATISTICS

COVARIANCE



Covariance measures the directional relationship between the returns on two assets.

A positive covariance means that returns of the two assets move together while a negative covariance means they move inversely. Risk and volatility can be reduced in a portfolio by pairing assets that have a negative covariance.

Assets can have a positive covariance, negative covariance, or no covariance:

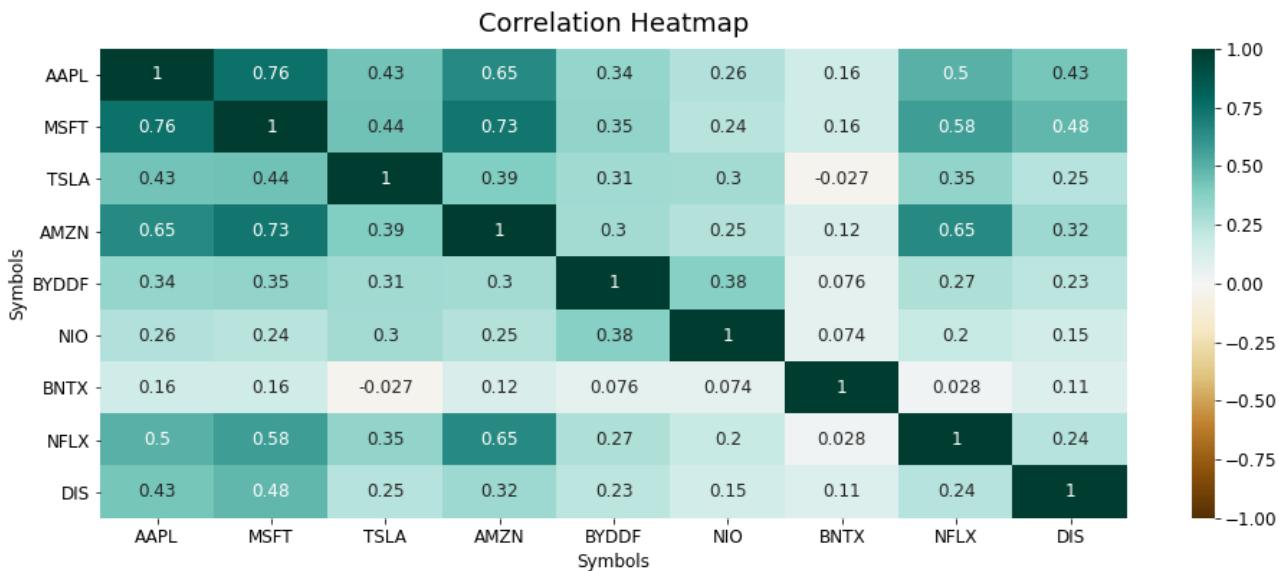
- Positive covariance — when one asset increases in value, the other usually increases in value. The covariance value will be greater than 0.
- Negative covariance — when one asset increases in value, the other usually decreases in value. The covariance value will be less than 0.
- Uncorrelated assets — when there is no quantifiable pattern to the response of two assets. The covariance value is equal to 0.

The covariance can be calculated with the given formula:

$$cov_{x,y} = \frac{\sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y})}{N - 1}$$

FINANCIAL STATISTICS

CORRELATION



You can think of correlation as a scaled version of covariance, where the values are restricted to lie between -1 and +1.

A correlation of -1 means negative relation, i.e, if correlation between Asset A and Asset B is -1, if Asset A increases, Asset B decreases.

A correlation of +1 means positive relation, i.e, if correlation between Asset A and Asset B is 1, if Asset A increases, Asset B increases.

A correlation of 0 means no relation, i.e, if correlation between Asset A and Asset B is 0, they dont have any effect on each other.

The correlation can be calculated with following formula:

$$\rho_{X,Y} = \frac{cov_{X,Y}}{\sigma_X \sigma_Y}$$

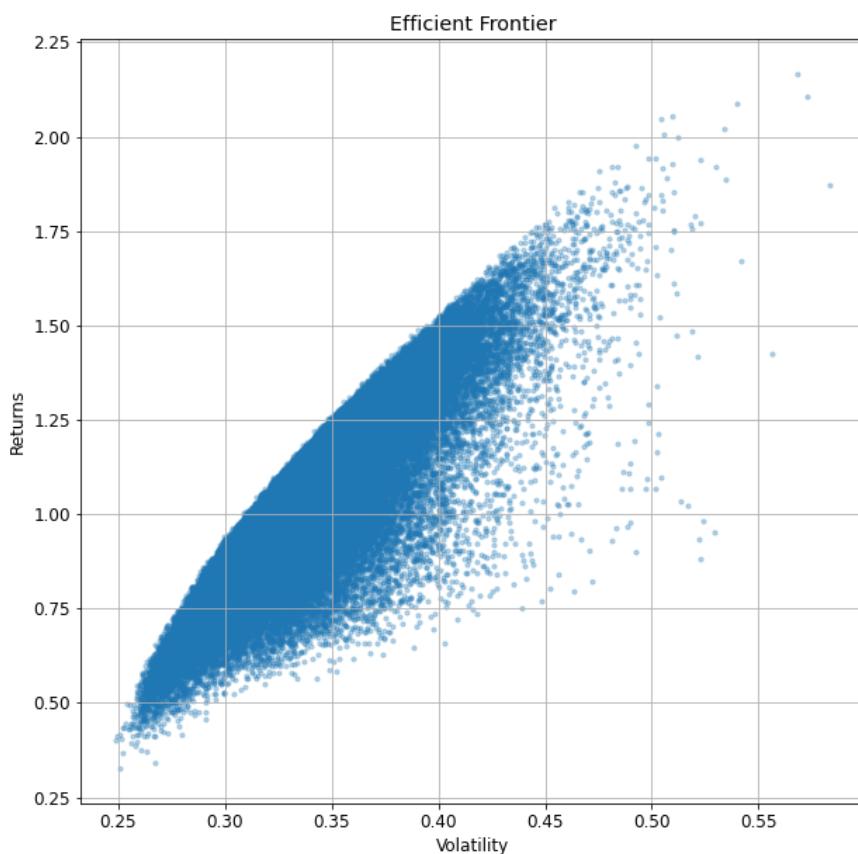
PORTFOLIO

EFFICIENT FRONTIER

This is the aim of going through all the topics above, to plot the efficient frontier. Efficient frontier is a graph with 'returns' on the Y-axis and 'volatility' on the X-axis. It shows us the maximum return we can get for a set level of volatility, or conversely, the volatility that we need to accept for certain level of returns.

Now we calculate 100'000 different portfolios and plot it on the graph below. Each point on the line (left edge) represents an optimal portfolio of stocks that maximises the returns for any given level of risk.

The point (portfolios) in the interior are sub-optimal for a given risk level. For every interior point, there is another that offers higher returns for the same risk.



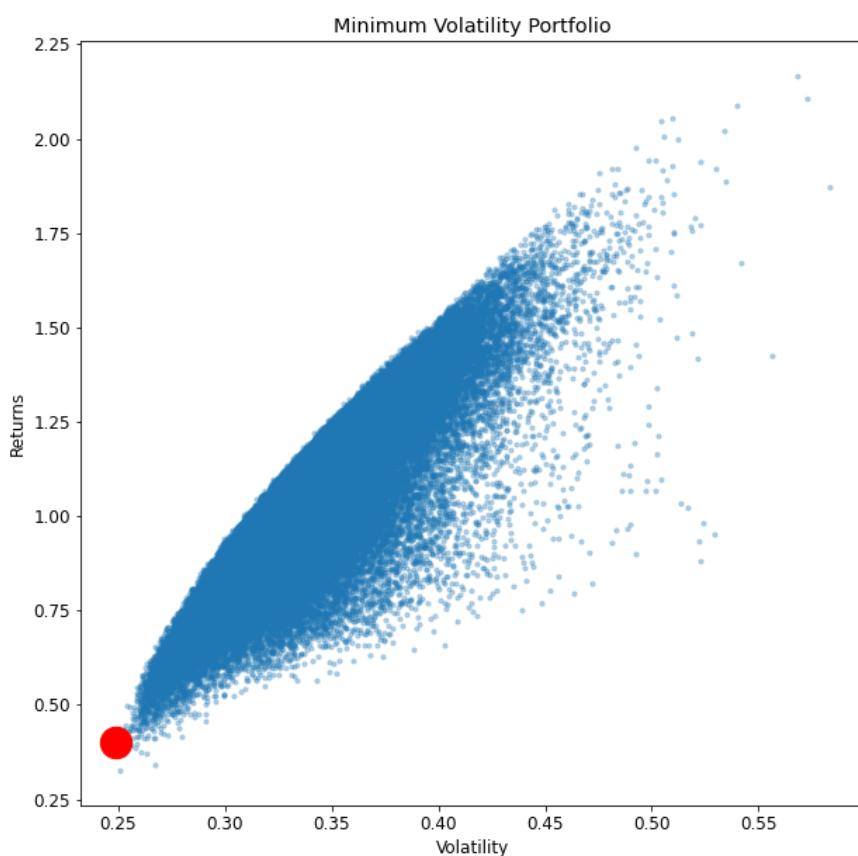
PORTFOLIO

MINIMUM VOLATILITY PORTFOLIO

The red dot denotes the most efficient portfolio with minimum volatility. It is worthwhile to note that any point to the right of efficient frontier boundary is a sub-optimal portfolio.

We found the portfolio with minimum volatility, but you will notice that the return on this portfolio is pretty low. Any sensible investor wants to maximize his return, even if it is a tradeoff with some level of risk. The question arises that how do we find this optimal risky portfolio and finally optimize our portfolio to the maximum?

This is done by using a parameter called the Sharpe Ratio.



PORTFOLIO

SHARPE RATIO

The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Volatility is a measure of the price fluctuations of an asset or portfolio.

The risk-free rate of return is the return on an investment with zero risk, meaning it's the return investors could expect for taking no risk.

The optimal risky portfolio is the one with the highest Sharpe ratio. The formula for this ratio is:

$$\text{sharperatio} = \frac{R_p - R_f}{\sigma_p}$$

R_p = return of portfolio

R_f = risk-free rate

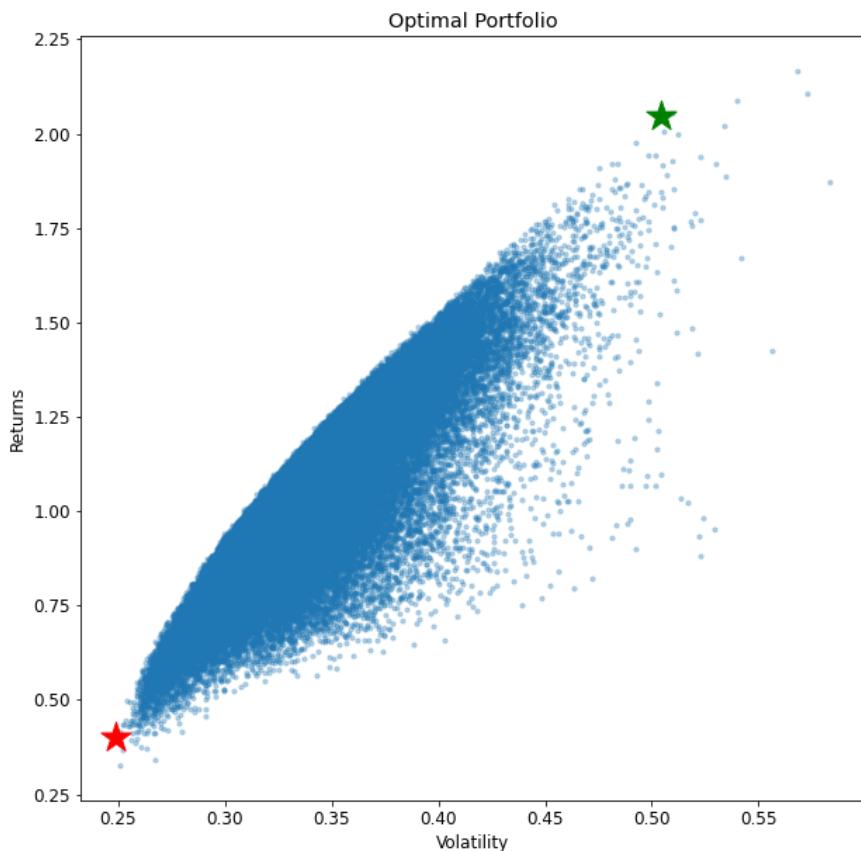
σ_p = standard deviation of portfolio

PORTFOLIO

OPTIMAL PORTFOLIO

An optimal risky portfolio can be considered as one that has highest Sharpe ratio.

You can notice that while the difference in risk between minimum volatility portfolio and optimal risky portfolio is 25,5%, the difference in returns is a whopping 165%. We can plot this point too on the graph of efficient frontier (green star).



SUMMARY

MINIMUM VOLATILITY PORTFOLIO

VOLATILITY **24,9%**

RETURNS **39,9% (7,98% per anno)**

WEIGHTS

AAPL	16,2%
MSFT	13,6%
TSLA	1,4%
AMZN	22,1%
BYDDF	12,8%
NIO	0,2%
BNTX	0,7%
NFLX	1,1%
DIS	31,9%

OPTIMAL RISKY PORTFOLIO

VOLATILITY **50,4%**

RETURNS **204,5% (40,9% per anno)**

WEIGHTS

AAPL	2,4%
MSFT	2,2%
TSLA	31,5%
AMZN	1,1%
BYDDF	14,4%
NIO	31,2%
BNTX	12%
NFLX	2,5%
DIS	2,7%

PORTFOLIO ANALYSIS

PORTFOLIO JUNE 2017 - JUNE 2021

Prepared by Kirill Wolkow

REACH ME

kirillwolkow.dev@gmail.com

