UNIVERSITY OF SUSSEX

--------📖--------

INDIVIDUAL REPORT

ADVENTUROUS CAPITAL GROWTH PORTFOLIO

765N1: PORTFOLIO MANAGEMENT

Author : Tran Tuan Anh Vu (Andy Vu)

Reg No : 22212635

Candidate No : 259412

Brighton – 2023

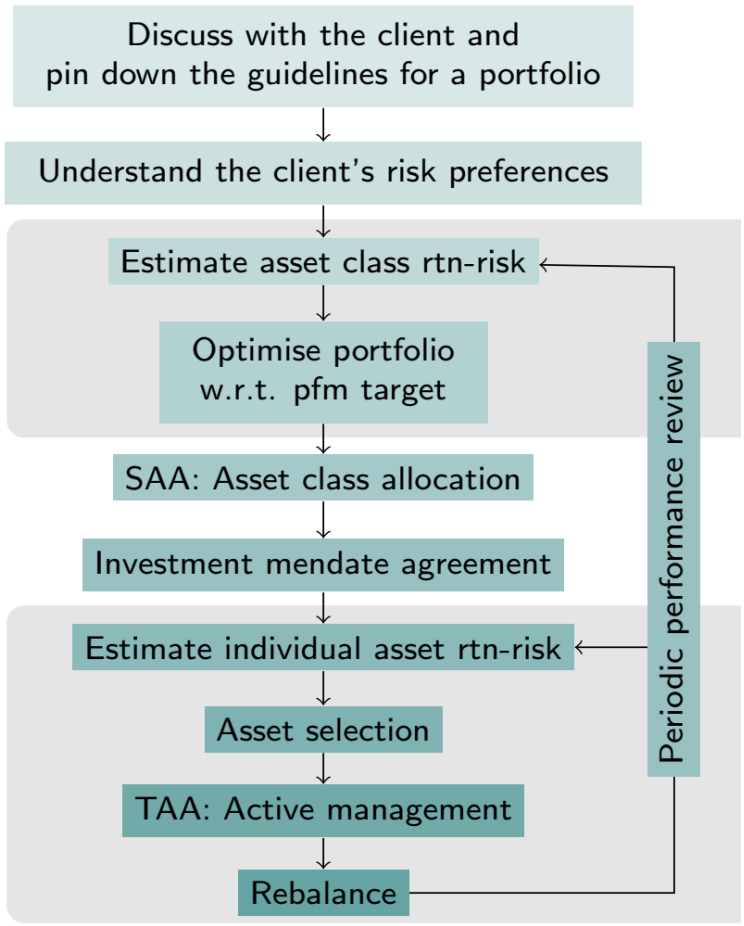
TABLE OF CONTENTS

Contents

1. Introduction:

An aim to build a simulated portfolio with net asset value is €10 million: Target volatility 17.5% +/- 1.5% as capital growth investment.

- ‘Adventurous" refers to an investor who is willing to take on a higher level of risk in pursuit of potentially higher returns. This means that the investor is comfortable with taking some risk, but not excessive risk, in order to achieve their investment goals.
- "Target volatility 17.5% +/- 1.5%" means that the investor is targeting a specific level of volatility in their portfolio, which is a measure of the amount of fluctuation in the portfolio's value over time. In this case, the target level of volatility is 17.5%, with a range of plus or minus 1.5%. This means the investor is willing to tolerate some volatility, but not too much.
- "Capital growth" refers to the investor's primary investment objective, which is to grow their investment capital over time. This means that the investor is looking to invest in assets that have the potential for long-term capital appreciation, rather than just generating income or preserving capital.



In this project, I will demonstrate the procedures of portfolio management, portfolio optimization and calibration to suit my investor's goals. And finally, will evaluate the effectiveness of the portfolio in practice

2. Quantitative analysis:

2.1. Background: Moderately Adventurous portfolio

An investor with an adventurous risk appetite, targeting a portfolio volatility of 17.5% +/- 1.5%, and with a focus on capital growth, is willing to take on some risk in pursuit of higher returns, but is also seeking to manage risk by targeting a specific level of portfolio volatility. The investor's primary objective is to grow their capital over time.

Based on this level of risk, weights of portfolio are divided as follows:

- Risk-free assets: 20%
- Global stocks: 60%

- Currency Futures: 10%
- Commodity Futures: 10%

2.2. Asset selection:

Identify the assets in the portfolio:

- ✓ Risk-free asset: Treasury securites have a stable volatility affect the stable of the portfolio. These are debt instruments issued by the U.S. Department of the Treasury to finance the government's operations. These securities are generally considered risk-free because they are backed by the full faith and credit of the U.S. government.
- CBOE 30 Year Treasury Yield Index (.TYX)
- CBOE 10 Year Treasury Yield Index (.TNX)
- CBOE 5 Year Treasury Yield Index (.FVX)

- ✓ Golbal stocks: The portfolio can invest in ETFs or international stock index futures for a degree of risk diversification. For a 60% allocation, are divided in about 40% in ETFs and 20% in international stock index.

For 40% ETFs investment, seven diversified index fund ETFs are selected and followed by an explanation of why these ETFs were chosen, considering factors like risk appetite, ESG factors, and general requirements.

1. iShares Core Growth Allocation ETF (AOR): This ETF seeks to track the investment results of an index composed of a portfolio of underlying equity and fixed income funds intended to represent a growth allocation target risk strategy.
2. Schwab U.S. Large-Cap Growth ETF (SCHG.K): This ETF seeks to track the performance of the Dow Jones U.S. Large-Cap Growth Total Stock Market Index, which represents the large-cap growth segment of the U.S. equity market.
3. Invesco QQQ Trust (QQQ.O): This ETF seeks to replicate the performance of the Nasdaq-100 Index, which includes 100 of the largest domestic and international non-financial companies listed on the Nasdaq Stock Market based on market capitalization.
4. iShares MSCI ACWI ETF (ACWI.O): The iShares MSCI ACWI ETF seeks to track the investment results of an index composed of large- and mid-capitalization developed and emerging market equities, providing a diversified exposure to global stocks.
5. iShares ESG Aware MSCI USA ETF (ESGU.O): This ETF seeks to track the investment results of an index composed of U.S. companies with positive environmental, social, and governance (ESG) characteristics, as identified by the index provider.
6. SPDR MSCI ACWI Low Carbon Target ETF (CRBN.K): This ETF seeks to provide investment results that, before fees and expenses, correspond generally to the total return performance of the MSCI ACWI Low Carbon Target Index, which represents companies with lower carbon emissions and lower potential carbon emissions.
7. FlexShares STOXX Global ESG Impact Index Fund (ESGG.K): This ETF seeks investment results that correspond generally to the price and yield performance, before fees and expenses, of the STOXX Global ESG Impact Index, which includes companies with a positive impact on ESG principles.

Reasons for choosing these ETFs:

1. Diversification: The selected ETFs provide diversified exposure to various asset classes, sectors, and regions. By investing in these ETFs, we can diversify our portfolio across different markets and reduce the overall risk.
2. Risk appetite: The chosen ETFs generally align with our portfolio's risk appetite (moderately adventurous), as they primarily invest in equities or have a growth-oriented approach. However, it's essential to research each ETF's historical

performance and risk metrics when we are evaluating our portfolio to ensure they meet our specific risk appetite.

3. ESG factors: ESGU.O, CRBN.K, and ESGG.K explicitly focus on ESG principles, providing exposure to companies with positive environmental, social, and governance characteristics. This aligns with the requirement to demonstrate that our portfolio incorporates ESG principles structurally.
4. Cost-efficiency: The ETFs listed have relatively low expense ratios compared to actively managed funds, which can help us reduce the overall cost of investing and potentially improve our returns over time.

For the rest 20% on international stock index, based on result after apply filter strictly morning star and ESG standard:

- ESG (Environmental, Social, and Governance) which are three broad categories of factors that investors may consider when evaluating companies for investment. ESG factors are non-financial in nature and are used to assess a company's overall sustainability and societal impact. Environmental factors refer to a company's impact on the environment, including its carbon footprint, energy efficiency, waste management practices, and natural resource use. Social factors include the company's impact on society, such as its labor practices, human rights record, community engagement, and diversity and inclusion policies. Governance factors include the company's management structure, accountability, transparency, and ethical business practices.
- The Morningstar Sustainability Rating is a measure of environmental, social and governance (ESG) risks in a fund's underlying holdings compared to its peers. The Morningstar Rating for funds describes how well a fund has balanced return and risk or volatility in the past. Morningstar assigns star ratings to mutual funds based on a variety of factors, including the fund's historical performance, its risk level, and the fees it charges.

About Industry factor analysis:

- Technology Sector: This sector has a potential for growth due to its focus on innovation and disruption. Some of the stocks in this portfolio that have focus on this issue such as SCHG, QQQ, AAPL, MSFT and GOOG.
- Environmental Sector: This sector has the potential for growth due to the increasing demand for sustainable and renewable energy solutions. The LOWC ETF in portfolio invests in companies involved in this sector.
- Consumer Goods Sector: This sector includes companies that produce and sell products that are consumed by individuals on a daily basis. Stocks like TSLA and AMZN in the portfolio belong to this sector and have potential for growth due to their innovative and disruptive business models.
- Healthcare Sector: This sector includes companies involved in the research, development, and distribution of healthcare-related products and services. The JNJ stock in the portfolio belongs to this sector and has potential for growth due to the increasing demand for healthcare solutions.
- Financial Sector: This sector includes companies involved in banking, financial services, and payment processing. Stocks like V, MA, and JPM in the portfolio belong to this sector and have potential for growth due to the increasing use of digital payments and the overall growth of the financial industry.

=> Every stocks and ETFs are chosen which 3 stars and above

=> This rating indicates that these ETFs, stocks are good options for investors who are willing to take on a moderate level of risk in order to potentially achieve higher returns.

Investors may consider a company's environmental performance to determine how sustainable its business practices are and whether it is taking steps to mitigate climate change.

=> Most of selected score are from 70 and above: indicates that the company has scored well on a range of environmental, social, and governance factors relative to its peers, and is likely taking steps to manage its sustainability risks and improve its societal impact.

- ✓ Reason for choosing currency and commodity future: make the portfolio more diversification. Take more risk to get higher return.
- COMEX Gold Composite Commodity Future Aug 2023
- NYMEX Light Sweet Crude Oil (WTI) Electronic Energy Future Aug 2023
- Eurex EUR vs USD Currency Future Aug 2023
- Eurex GBP vs USD Currency Future Aug 2023
- Eurex GBP vs CHF Currency Future Aug 2023

2.3. Portfolio construction

It's important to note that while these industries may have potential for growth, there is no guarantee that the portfolio will perform well in the future. Therefore, it's important to diversify the portfolio and monitor it regularly to ensure that it is still suitable for investors' investment goals and risk appetite.
For this portfolio, I use Conditional Value at Risk (CVaR) portfolio optimization.

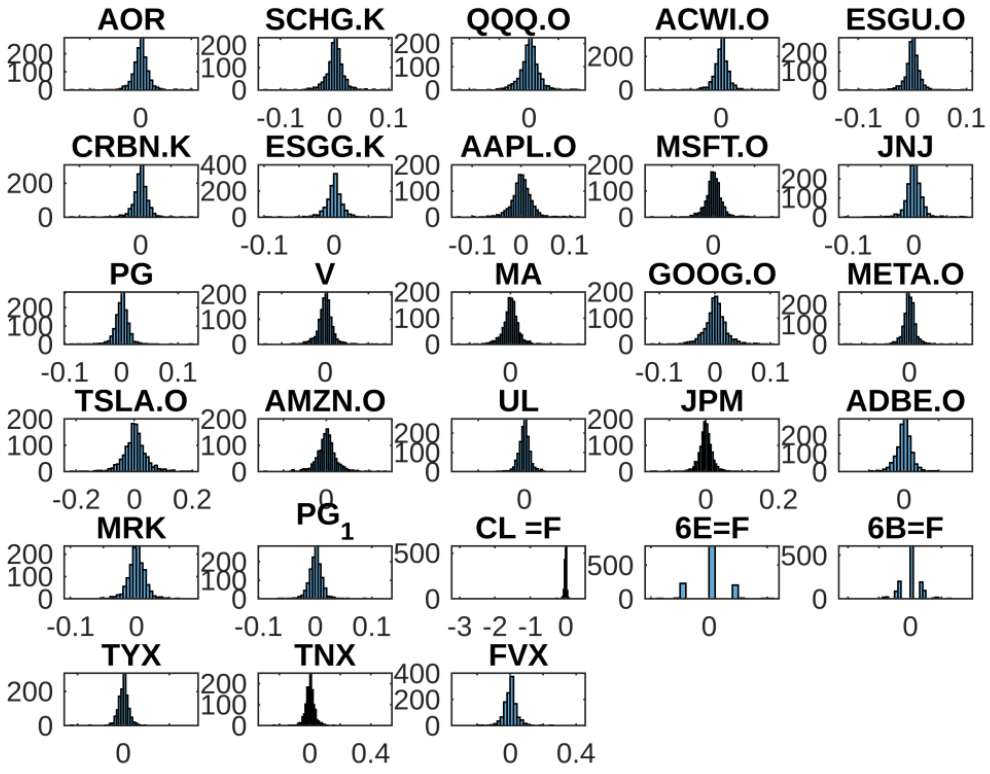


Figure 1: Check the histogram of returns

Use 2000 scenarios to simulate the portfolio, and we have

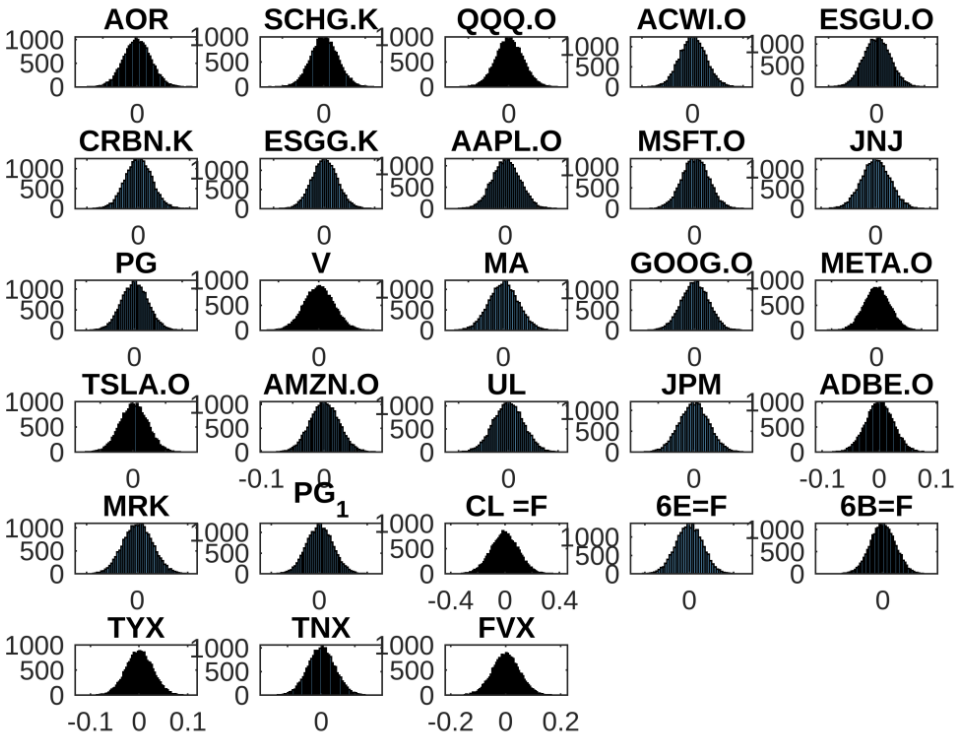


Figure 2: Histogram of asset scenarios

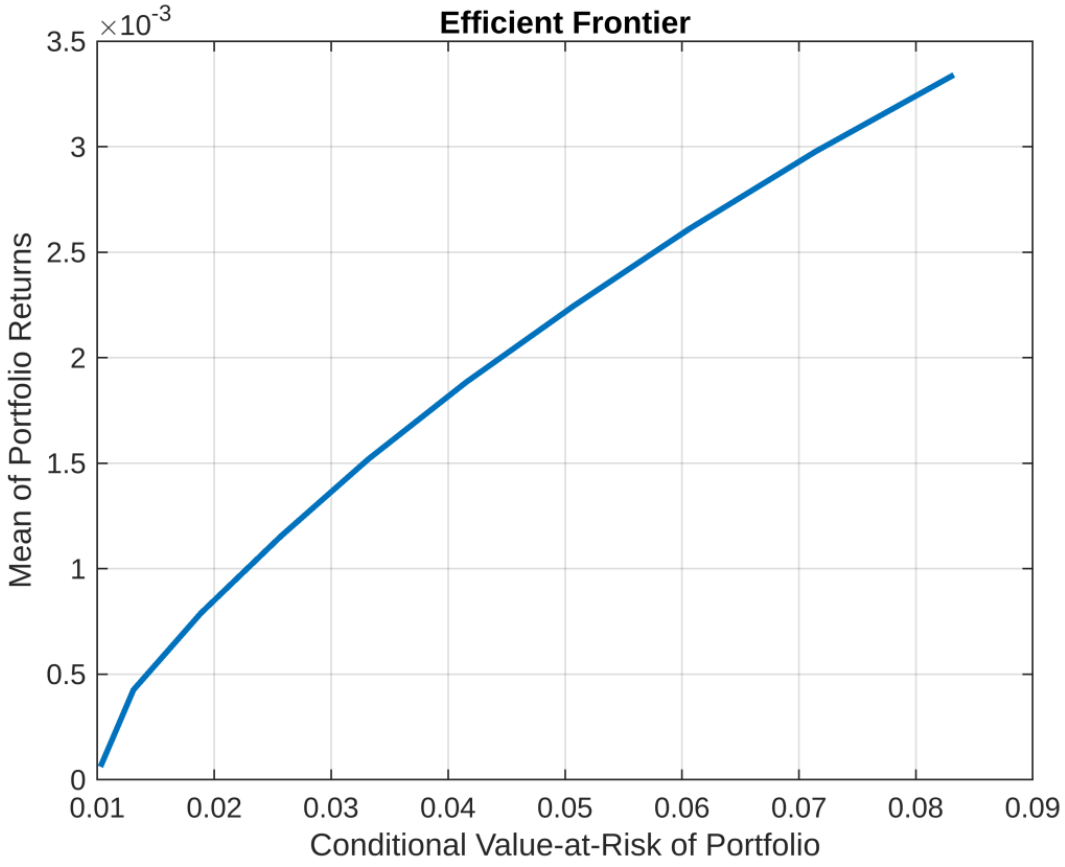


Figure 3: Efficient Frontier

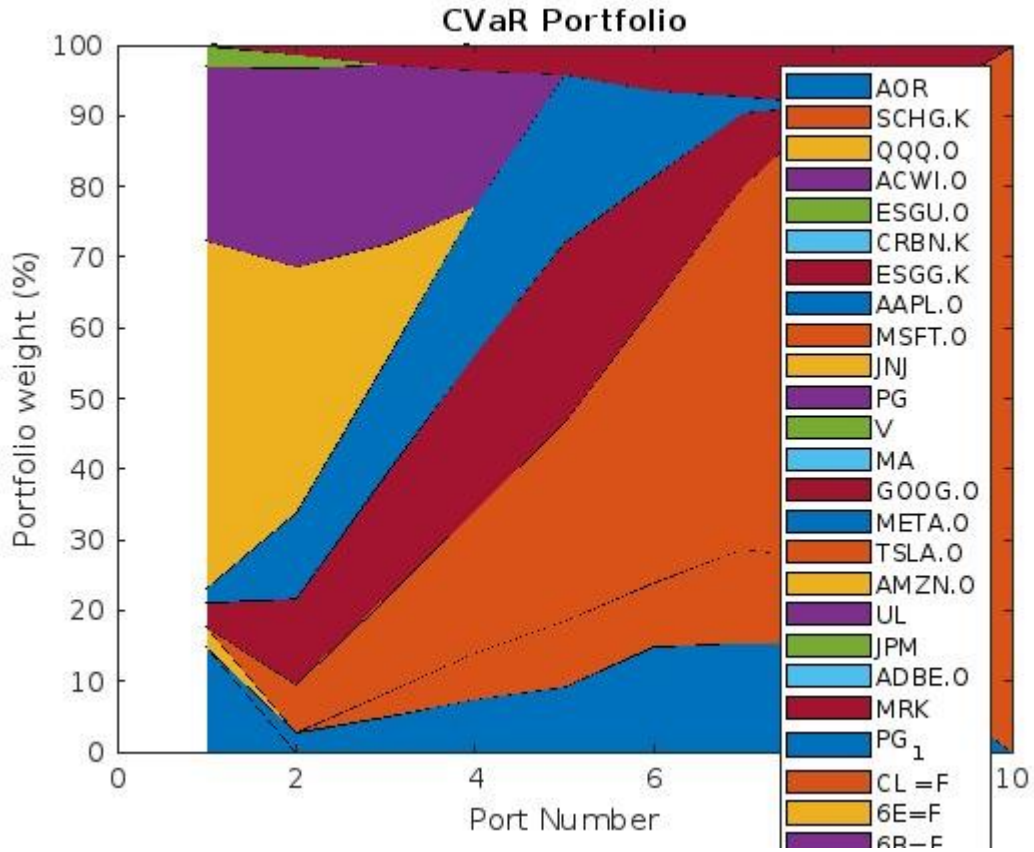


Figure 4: Portfolio weight - simulated

Step 3: Estimate asset return – risk:

Simulated Portfolio	Return	Vol
1	2.2730e-05	0.0102
2	3.2076e-04	0.0125
3	6.1879e-04	0.0175
4	9.1683e-04	0.0235
5	0.0012	0.03
6	0.0015	0.0378
7	0.0018	0.0469
8	0.0021	0.0569
9	0.0024	0.0679
10	0.0027	0.0847

Easy can be seen that portfolio 3 appropriate with our investor's aim: Target volatility 17.5% +/- 1.5%

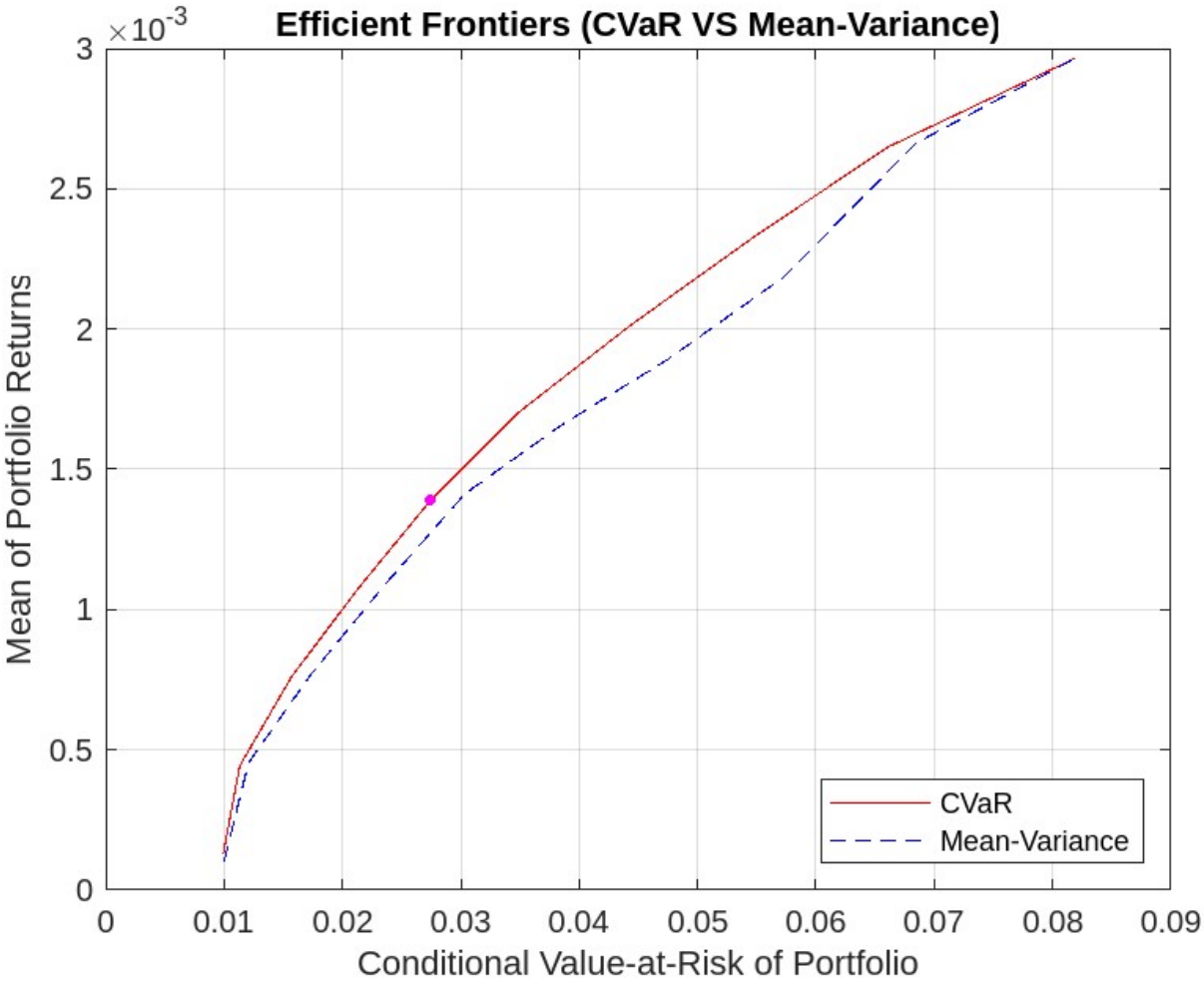


Figure 5: Portfolio Mean-Var

Step 4: Using the Cvar optimization method to optimize portfolio 3:

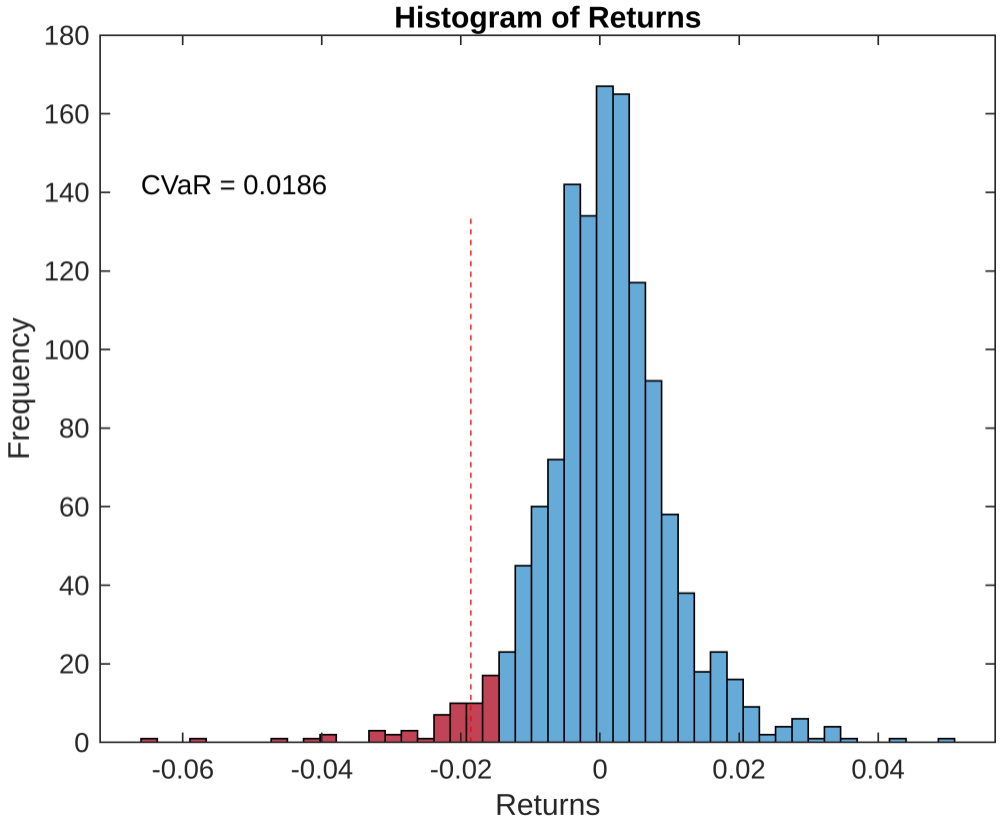


Figure 6: Visualise histogram of portfolio 3 return

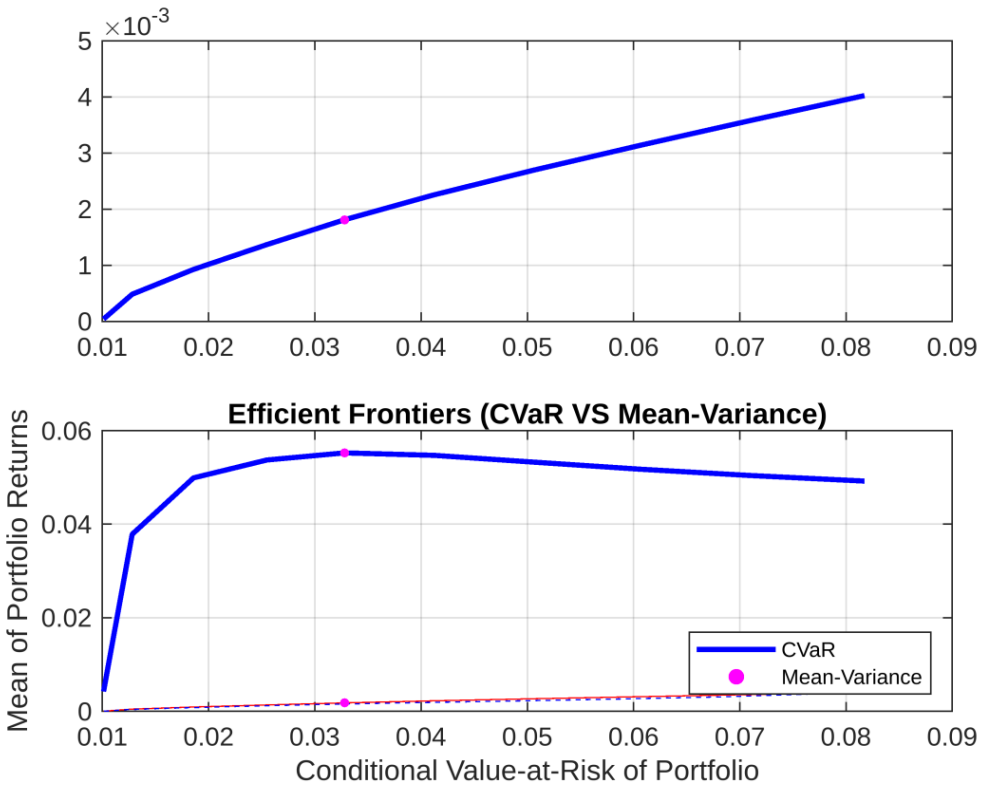


Figure 7: CVaR and Mean-Variance Portfolio Optimization

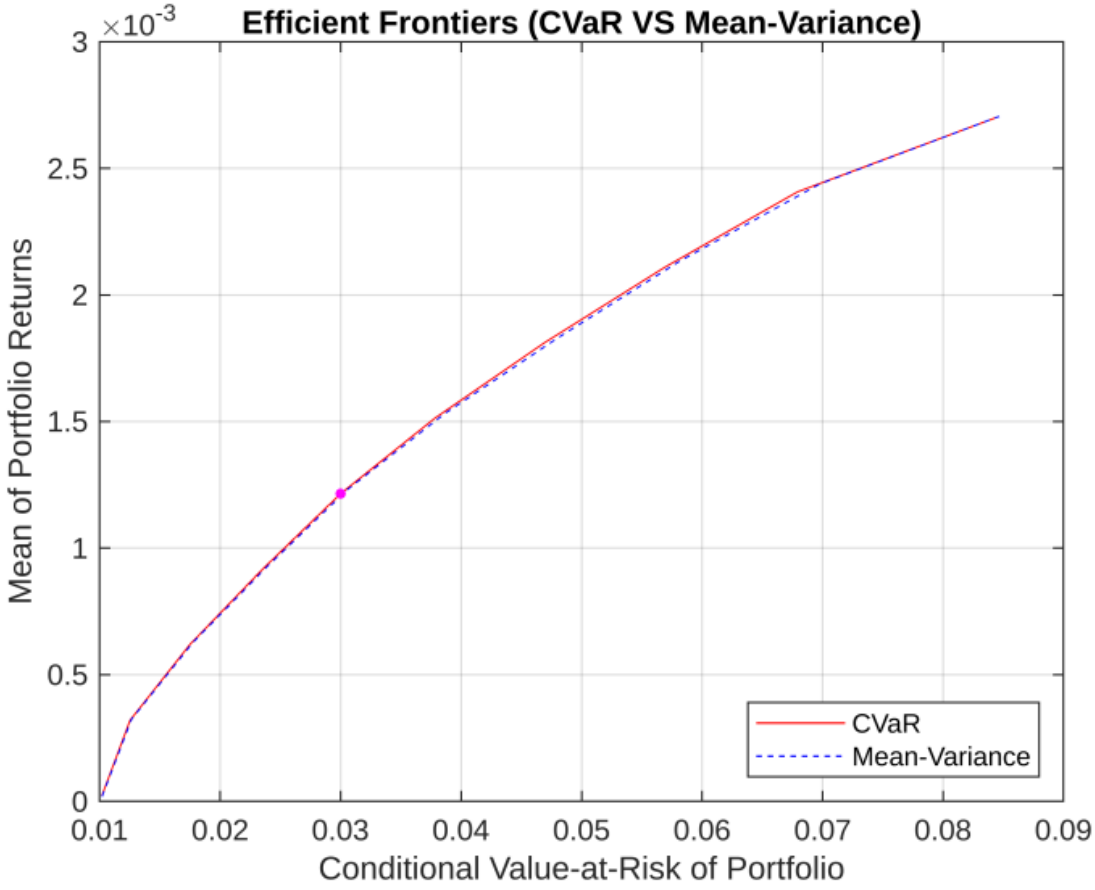


Figure 8: Portfolio after optimizing

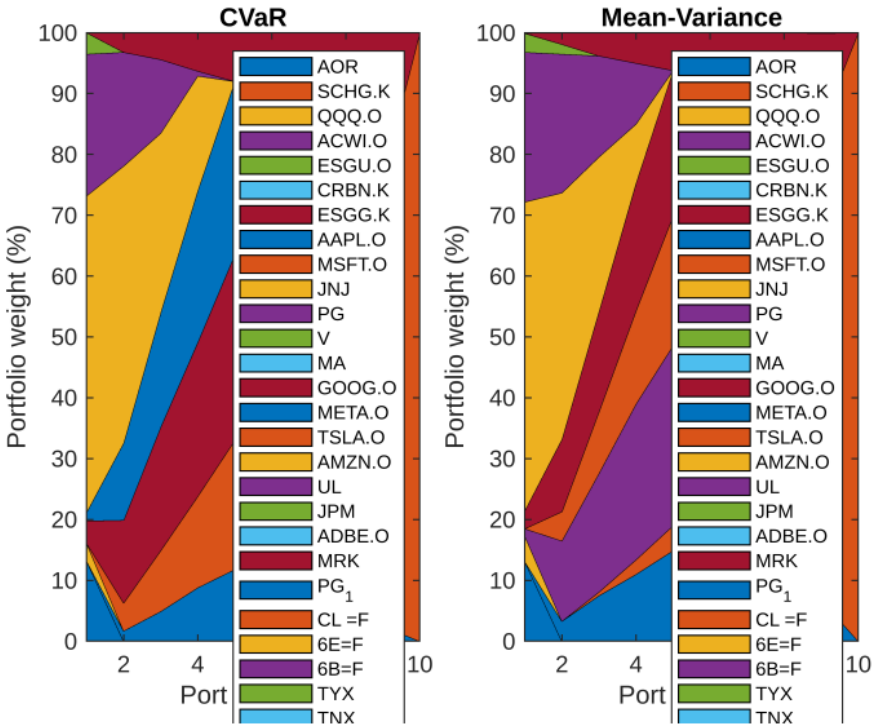


Figure 9: Portfolio weight and Mean-Var after optimizing

Finally, we can have weights of each asset in optimised portfolio:

Asset	W1 (Visualised portfolio)	W2(Optimised Portfolio)
'AOR'	0	0
'SCHG.K'	0	0
'QQQ.O'	0	0
'ACWI.O'	0	0
'ESGU.O'	0	0
'CRBN.K'	0	0
'ESGG.K'	0	0
'AAPL.O'	0.0083	0.0752
'MSFT.O'	0.0618	0.0057
'JNJ'	0	0
'PG'	0	0.1954
'V'	0	0
'MA'	0	0
'GOOG.O'	0	0
'META.O'	0	0
'TSLA.O'	0.1008	0.1008
'AMZN.O'	0	0
'UL'	0	0
'JPM'	0	0
'ADBE.O'	0	0
'MRK'	0.1448	0.1652
'PG_1'	0.2072	0
'CL=F'	0	0
'6E=F'	0.2696	0.2538
'6B=F'	0.1672	0.1657
'TYX'	0	0
'TNX'	0	0
'FVX'	0.0403	0.0382

➔ Risk analysis on your portfolio optimisation outcome:

Step 1: Calculate each individual asset betas:

'AOR'	'SCHG.K'	'QQQ.O'	'ACWI.O'	'ESGU.O'	'CRBN.K'	'ESGG.K'
0.3007	0.2531	0.2487	0.2588	0.2462	0.2617	0.2683
'AAPL.O'	'MSFT.O'	'JNJ'	'PG'	'V'	'MA'	'GOOG.O'
0.2093	0.2152	0.2561	0.2414	0.2035	0.2252	0.2442
'META.O'	'TSLA.O'	'AMZN.O'	'UL'	'JPM'	'ADBE.O'	'MRK'
0.2153	0.3108	0.2971	0.221	0.1755	0.2091	0.1907
'PG_1'	'CL =F'	'6E=F'	'6B=F'	'TYX'	'TNX'	'FVX'
0.2414	0.3488	0.3500	0.3807	0.1695	0.0579	0.0363

Step 2: Using a rolling window of 252 trading days to estimate the Sharpe ratio optimised portfolio, benchmarked by s&p500.

- Set rbs = 7, which mean rebalanced every 7 trading days(weekly). This helps to track the variation and trends of the data week by week, and thereby make reliable decisions regarding portfolio management or predicting future asset performance.

Use a 'parfor' function loop to cycle through time cycles. On each cycle traversal, we compute the optimal portfolio model using the estimateMaxSharpeRatio(ep) function. This function will calculate the maximum Sharpe ratio based on the risk parameters of the portfolio defined in ep. Then this maximum Sharpe scale value is stored in a vector variable maxsharpe, with its index (i).

Step 3: Use the identified max sharpe ratio portfolios to identify the portfolio performance:

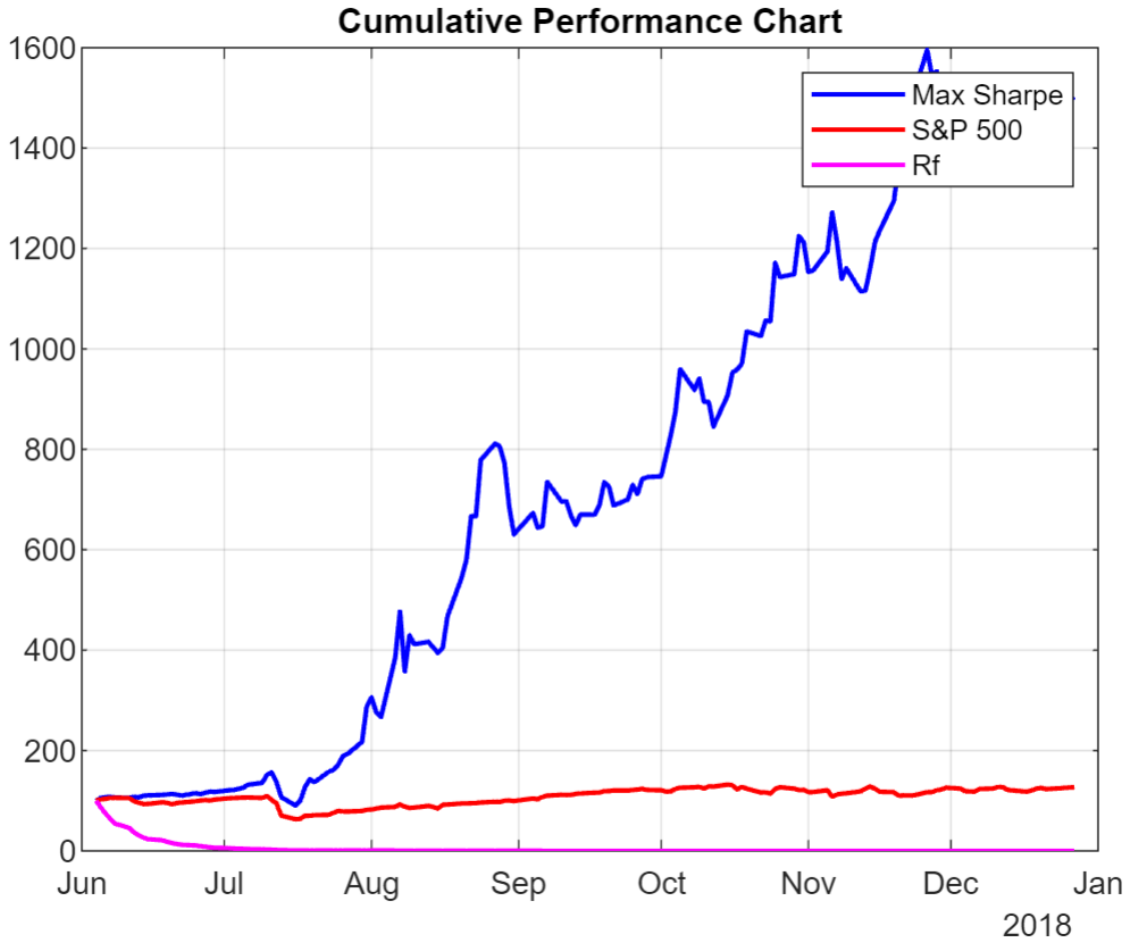


Figure 10: Cumulative Performance Chart

➔ Investigate the out-sample performance of the portfolio: uses the Jenson index to measure a portfolio's relative performance against the S&P 500

Step 1: cost adjustment: calculate adjusted costs based on the portfolio's maximum Sharpe ratio and Sharpe ratio information.

Step 2: calculate performance: calculate the performance of the portfolio after adjusting for costs. This performance is calculated by subtracting the adjusted cost from the unadjusted performance.

Step 3: calculate the total value of the portfolio: calculate the total value of the portfolio after each cycle based on the performance calculated in the previous step.

Step 4: Calculate the Jenson index:

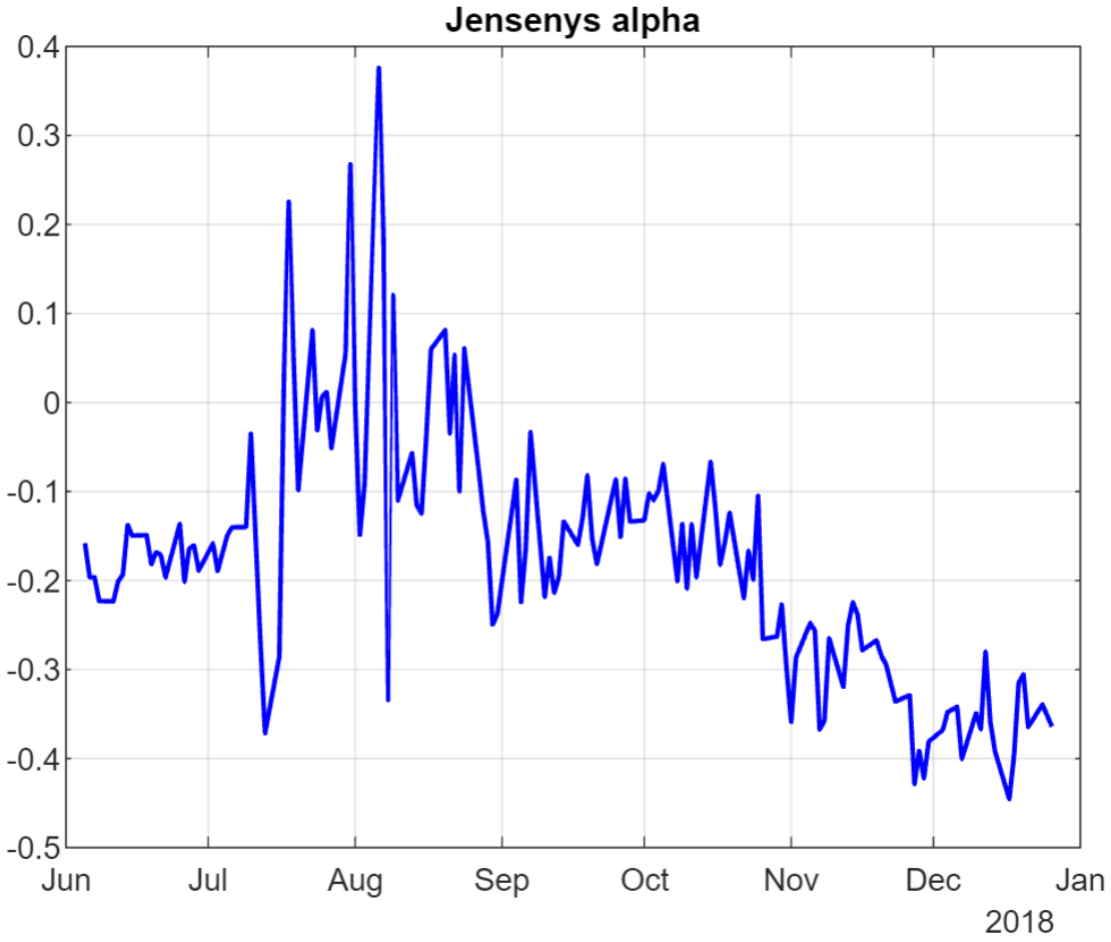


Figure 11: Jensen index

Beta results for the max sharpe portfolio: 0.192052699334892

3. Investor report

3.1. Key Investor Information Document (KIID)

Objectives and Investment Policy

- Portfolio aims to provide a moderately risky portfolio with a volatility of 17.5% +/- 1.5% over the long term (5 consecutive years or more starting at the time of investment).
- A portfolio that invests at least 60% of its total assets in equity securities (e.g. stocks) of companies whose headquarters or principal business is located in the United States (Nasdaq), United Kingdom (foreign exchange market in London).
- The remaining 40% is divided into global equity and risk-free assets

Investment Advisors (IAs) may use derivatives (i.e. investments whose prices are based on one or more underlying assets) to help achieve the Fund's investment objectives.

- The Fund can flexibly invest in addition to the above-mentioned asset classes.
- Recommendation: This portfolio may not be suitable for short-term investment.
- Your units will be cumulative (i.e. dividend income will count towards their value). Your units will be denominated in Euros, the base currency of - the portfolio.

Risk and Reward Profile

- The risk category shown is not guaranteed and may change over time. The lowest category does not mean risk free.
- The risk portfolio is rated six due to the nature of its investments which include the risks listed below.

The value of equities and equity-related securities can be affected by daily stock market movements. Other influential factors include political, economic news, company earnings and significant corporate events

Particular risks not adequately captured by the risk indicator include:

-Counterparty Risk: The insolvency of any institutions providing services such as safekeeping of assets or acting as counterparty to derivatives or other instruments, may expose the financial loss.

Past Performance

4. Summary and future research:

Summary:

Using an initial capital of 10 million euros, the project's objective was to build a moderately risky investment portfolio with a target volatility of 17.5% +/- 1.5%. The goal of the research was to determine the best asset allocation that would provide the required risk and return characteristics. This was done using a variety of quantitative studies and optimisation approaches.

- In order to accomplish this goal, firstly gathered historical data on a certain collection of assets, such as stocks, bonds, and other financial instruments.
- Then, in order to calculate the predicted returns and volatility of these assets, I thoroughly analysed the historical returns and risk metrics of these assets.
- Next, utilized modern portfolio theory and optimization techniques to construct an efficient frontier of portfolios with different risk-return profiles. The optimization process

involved finding the asset allocation that maximized the Sharpe ratio, which represents the trade-off between risk and return.

- After conducting the optimization, identifine the portfolio that met the target volatility of 17.5% +/- 1.5%. This portfolio represented an optimal balance between risk and return, considering the investor's risk tolerance and investment horizon.

Future Research:

While the current project successfully constructed a moderately risky portfolio meeting the specified criteria, there are several avenues for future research to further improve the investment strategy:

- Robustness Analysis: Perform robustness analysis to determine how sensitive the performance of the portfolio is to variations in important premises, such as anticipated returns, volatility, and correlations between assets.
- Factor Models: to better capture the risk variables driving asset returns and improve portfolio performance, consider using factor models like the Fama-French Three-Factor Model or the Carhart Four-Factor Model.
- Diversification Benefits: Look at how multiple asset classes or alternative assets, such commodities or real estate, may diversify a portfolio.
- Dynamic Asset Allocation: Take into account solutions for dynamic asset allocation that change the composition of the portfolio over time in response to shifting economic and market conditions.