Politecnico di Milano

Computational Finance

Technical Report

Asset Allocation
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Contents

1 Portfolio Composition @ 12/11/2020

Ticker	Description	Sector	Exchange	Weights
AMZN	Amazon.com, Inc	Consumer Discretionary	Nasdaq	3.25%
MSFT	Microsoft Corporation	Technology	Nasdaq	3.25%
ZM	Zoom video communications, Inc	Communication Services	Nasdaq	6.5%
6758.T	Sony Corporation	Technology	TYO	9.75%
ENPH	Enphase Energy, Inc	Energy	Nasdaq	13%
MRNA	Moderna, Inc	Health Care	Nasdaq	13%
MC.PA	LVMH Moët Hennessy - Louis Vuitton Société Européenne	Luxury Goods	EPA	13.65%

Ticker	Description	Exchange	Weights
CWBFX	American Funds Capital World Bond Fund Class A	Nasdaq	35%
0P0000ZZBQ	Blackrock European Dynamic Fund Fd Accumulation	LSE	1.3%
BAFWX	Brown Advisory Sustainable Growth Fund Institutional Shares	Nasdaq	1.3%
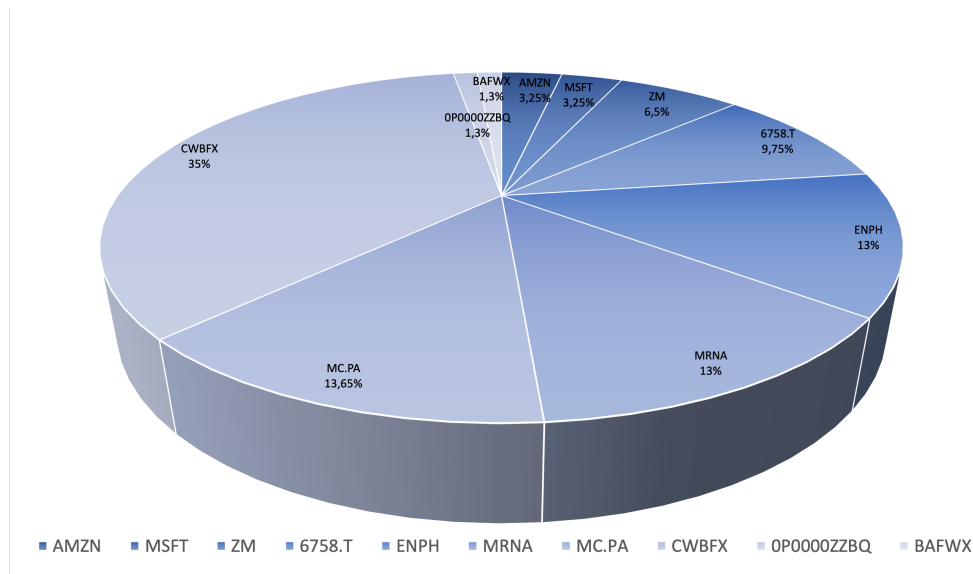
Figure 1: Portfolio Composition

2 Benchmark Composition

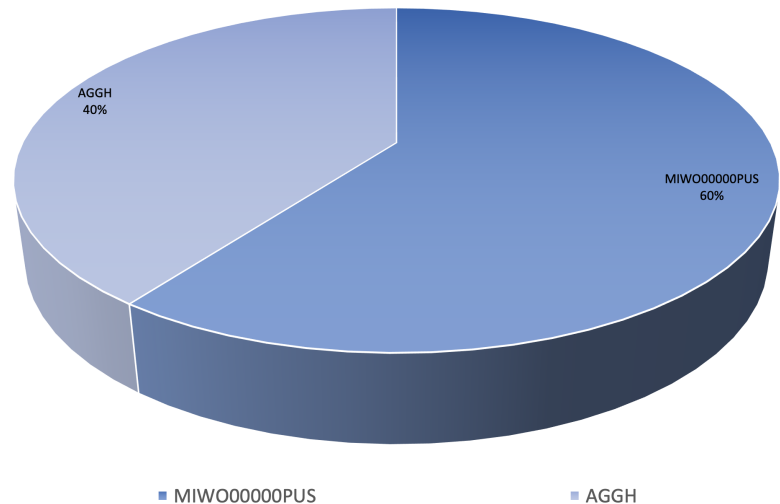| Ticker	Description	Weights
MIWO00000PUS	MSCI World	60%
AGGH	iShares Core Global Aggregate Bond UCITS ETF	40%

Figure 2: Benchmark Composition
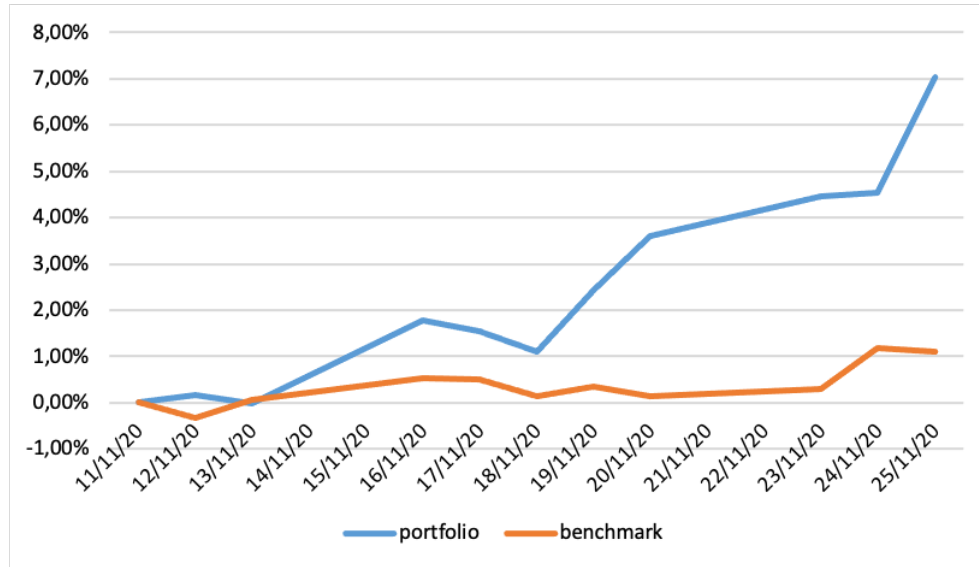
3 Performance analysis

Figure 3: Cumulative Performance

In absolute terms we can state that our portfolio had a good performance having managed to beat the benchmark during the entire period. At the end of the period we reach the peak obtaining a return higher than 7% and we kept a return greater than 0 all the time (to be precised, only one exception on the 13th November when the registered return was of -0.01%).
We managed to beat the benchmark, with an information ratio:

$$IR = \frac{\mathbb{E}[r_p - r_b]}{\sigma[r_p - r_b]} = 0.6007611$$

We stress the fact that this result is also due to the deviation from the benchmark that we presented in the previous evaluation, the weight for the equities was higher with respect to the one of the benchmark (65% vs 60%) and this extra 5% on the riskier assets, considering the overall good performance of all our stocks, contributed to the result.
While during the first period the portfolio maintained a return close to 0 with a small peak on the 16th November, after a decrease suffered on the 18th November, it started to grow maintaining a positive trend till the end.

More precisely, on the 16th November, the peak is lead by **MRNA** which announced a 95% effective Covid vaccine and reported a return of 9.06%. However the portfolio obtained a return of almost 2%. In fact all the other shares registered small positive and negative returns, except for **ENPH** which reached the value of 2.38%.

AMZN	MSFT	ZM	ENPH	MRNA	MC.PA	6758.T
-0.4%	-0.14%	-1.57%	2.38%	9.06%	1.61%	1.82%

CWBFX	0P0000ZZBQ	BAFWX
-0.24%	1.26%	-0.31%

The decrease on the 18th November is due to the fact that almost all of our stocks had negative returns, except for Zoom (as we can see in the table below); **MRNA**, after the announcement of the vaccine on 16th November, due to the market adjustment and news about other vaccines, registered a return of -4.61%.

AMZN	MSFT	ZM	ENPH	MRNA	MC.PA	6758.T
-1%	-1.35%	3.3%	-0.2%	-4.61%	2.35%	-1.51%

CWBFX	0P0000ZZBQ	BAFWX
0.04%	0.21%	-1.43%

In the following days our portfolio recovered and showed a positive trend till the end of the period (from 19th-25th November). The portfolio reached the peak on 25th November thanks to the fact that almost all of our stocks had positive returns; in particular **MRNA**, dragged by the signing of a contract with the European Union for an anti-Covid vaccine, registered a return higher than 10%.

AMZN	MSFT	ZM	ENPH	MRNA	MC.PA	6758.T
1.93%	-0.22%	3.55%	2.01%	10.53%	-0.13%	3.26%

CWBFX	0P0000ZZBQ	BAFWX
-0.08%	0.36%	0.62%

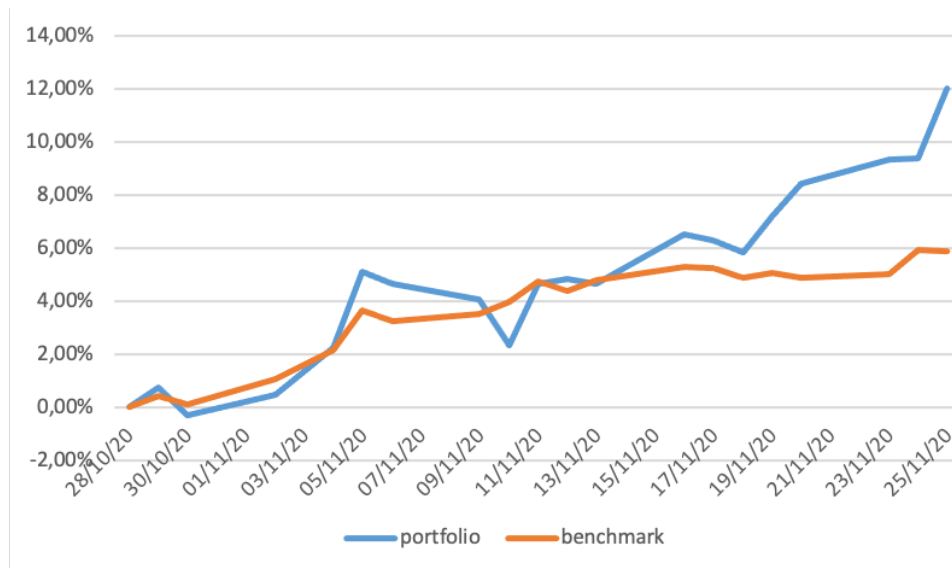In the following we report the performance analysis of the whole period, from 28/10/20 to 25/11/2020:

Figure 4: Cumulative Performance

4 Qualitative analysis

4.1 Introduction

The recent prospect of a reliable vaccine will revive hopes of a recovery all over the world and expectations about a return to normality have grown. The prospect of a recovery is encouraging and companies are expected to start growing again at a more normal pace, always bearing in mind that the crisis has given a further push to online life and stressed the need for sustainable development.

4.2 Details

4.2.1 Big tech companies

Referring to the technological titles, that have benefited from the structures and habits of the pandemic economy, as losers, could be deceptive. In fact, American big tech will undoubtedly continue to grow in the future. With the widespread distribution of anti-Covid vaccines, the possibility of a downsizing of the main technological titles is concrete, but nowadays big tech are moving on peaks unknown to most.

4.2.1.1 Amazon.com, Inc (AMZN)

Here are some numbers that show the explosive growth of Amazon during the pandemic that has affected much of the retail world [1]:

1. The market capitalisation has grown by $570 billion;

2. Actions are gone up of beyond 60% this year. Today they are worth approximately $3000;

3. Jeff Bezos, founder, CEO, and president of Amazon, that currently holds a share of 11.1%, saw its equity grow by more than 50% from the beginning of 2020. Forbes estimates its assets at $178.5 billion, compared to $114.7 billion at the end of 2019;

Following the vaccine news, analyst Laura Martin conducted a survey to evaluate consumer shopping habits and upcoming plans. Surveying roughly 330 consumers, 80% of respondents stated they would shop the same or more online post-pandemic.[2]

In addition, we expect AMZN to be one of the largest beneficiary of the close Black Friday and the next Christmas holidays despite possible attempts to encourage shopping in stores in order to support businesses during the pandemic.

Coherently with the words written above about the company, Stifel said: "Amazon has been a primary beneficiary of the pandemic given the increased penetration of e-commerce , helped by higher online grocery and consumables spend, and the continued dislocation in offline retail. Under a recovery scenario, we see Amazon continuing to benefit from these developments, ..."[3].

4.2.2 Zoom video communications, Inc (ZM)

Analysts have commented Zoom results during the pandemic, calling it "one of the best quarters in the history of software"[4] (Figure 5). Zoom continues to grow, and does so both financially and as a number of downloads on mobile platforms. There is no doubt that the pandemic has accelerated the process of spreading it for work or study purposes. Growing users (in full lockdown they had touched the 300 million active users every day) and turnover, but also the number of downloads. By April Zoom had been the most downloaded (non-game) app on Android and iOS, a real boom that led to reach and exceed 500 million installations on the Play Store[5].

However if we stick to the results of the last month, while the Computer and Technology sector gained 2.55%, the company lost 16.9% of its capitalization. Zoom has an estimated Zacks Rank (it ranges from 1 (Strong Buy) to 5 (Strong Sell)) of 3 (Hold) and moreover, still following Zacks ratings, the company ranked in the bottom 25% of the Technology sector.[6]

On the other hand according to another analyst, Zane Chrane, "Even if you're a Zoom denier and believe Covid is no longer a tailwind for adoption, it's clear that the pandemic and 'remote work experiment' have catalyzed and accelerated long-term structural shifts in the way people communicate, travel and conduct business" [7] and the company may obtain spikes in the value of its shares in the wake of news like the announced closure of New York City public schools which led to an increase of the 5.5%.
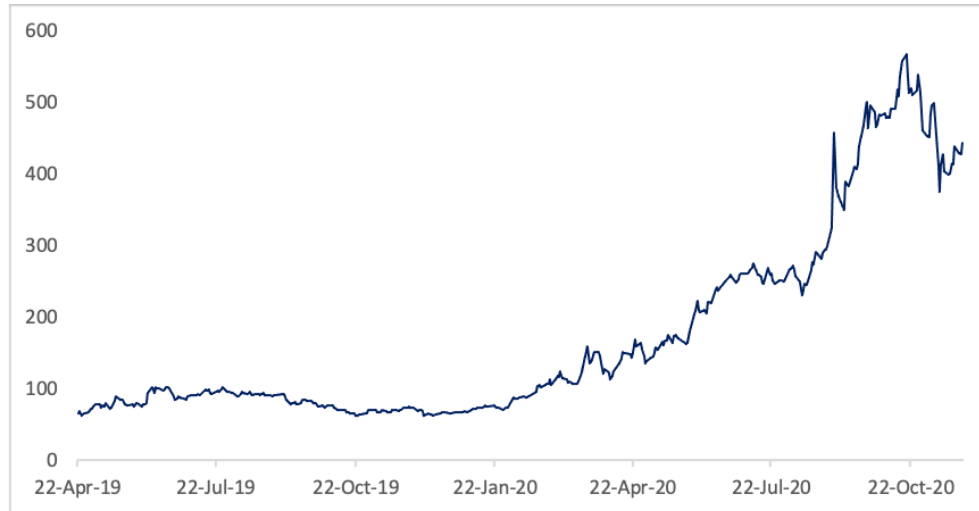

Figure 5: ZM share price

4.2.3 Sony Corporation (6758.T)

The video game sector has been among those that have benefited from more people staying at home as a result of the coronavirus pandemic. That has raised questions over the sustainability of that bounce in a post-pandemic environment, and this questions are becoming crucial after the announcements of upcoming vaccines. "The increase of gaming that we have seen partly is because of stay home, not just working from home, but vacationing from home where people are not traveling, and even the weekends you stay home," Goyal pointed out. "This increase, part of that will be reverted as and when Covid goes away, and in my base case it doesn't go away entirely until the end of 2021"[8].
Recently the launch of the PlayStation 5 sold out in all markets around the world. Then Sony posted a message in which thanked its fans, in fact because of them it has been possible to achieve the best launch ever in the history of PlayStation. Sony has confirmed that there are new stocks of PS5 coming in and that these will arrive by the end of the year, so it is very likely that there will be a new wave of availability just in conjunction with the Christmas holidays[9].

4.2.4 LVMH Moët Hennessy-Louis Vuitton Société Européenne (MC.PA)

The French brand on Monday 23 November broke a historical record: it reached the largest capitalization of the Parisian Stock Exchange (Figure ??). After a period of high uncertainty, characterized by several rebounds, in which the stock has grown by almost 20% since the beginning of the year, the leader in luxury has exceeded 250 billion euros of capitalization; these days, the price of its shares is about 494 Euros.
Never before had any listed company in Paris ever reached this threshold, moreover, this record was recorded even after the impact that the company has suffered because of the virus. The reasons for this growth are to be attributed to the context of positive Stock Exchange motivated, not only by the announcements on the state of progress of scientific research on anti-Covid-19 vaccines, but also by the agreement announced at the end of October with Tiffany & Co. This is considered the largest acquisition in the history of luxury.
LVMH continued to perform well on the market, like other French luxury brands, thanks to its dimension and to the resistance to the pandemic crisis. As was pointed out on Tuesday morning during

the luxury summit, Milano Fashion Global Summit 2020 (MFGS), organized by Class Editori, "in Francia, tutti i gruppi del lusso sono in crescita in Borsa dall'inizio dell'anno, ..."[10]

Louis Vuitton Moët Hennessy stands out from its competitors thanks to its world-class Wines & Spirits division. The division is the second largest contributor to LVMH's results, thanks to the extremely high margins of prestigious brands such as Hennessy, Dom Pérignon and, of course, Moët & Chandon. LVMH's sales of wines and spirits are largely taken up by the interruptions caused by COVID-19 and it may be a further increase due to the approaching Christmas holidays.[11]
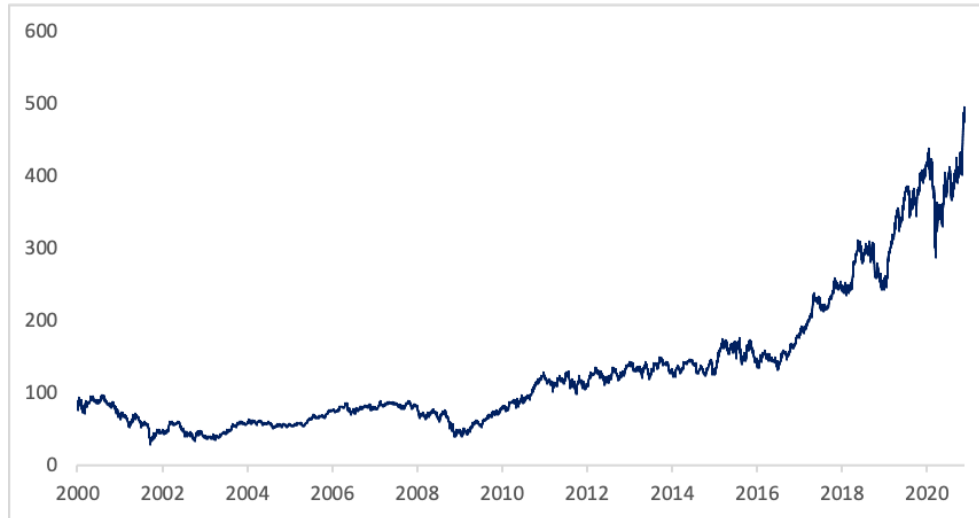

Figure 6: MC.PA share price

4.2.5 Enphase Energy, Inc (ENPH)

The cleantech industry, which includes solar energy, wind power, and hydropower, have grown with increasing concerns over climate change across the globe. New US President Joe Biden's climate ambitions have given a further push to cleantech stocks, as investors expect the world's largest economy to be on a path to energy transition. According to The International Energy Agency's (IEA) Renewable 2019 report, renewable energy capacity is set to expand 50% between 2019 and 2024, primarily led by solar energy[12].

ENPH is the world's leading supplier of microinverter-based solar storage systems, operating in more than 21 countries. The company reported excellent results in the third quarter (finished in September 2020) driven mainly by the increase in demand for its microinverter products. Analysts predict that ENPH's revenues will increase by 21.5% in the last quarter of 2020 and by 61.8% next year.

On 16 November ENPH signed an agreement with Mspectrum, the Manila Electric Company's Renewable Energy Division (MERALCO). Mspectrum will distribute ENPH's IQ 7 microinverter family to residential and commercial installers in the Philippines in the first quarter of 2021.

From the start of the year, ENPH shares earned 393.9% and it is currently traded 3.1% below its maximum (Figure 7). ENPH's POWR assessments reflect this positive and promising perspective. It has an overall rating of "Strong Buy" with an "A" for Trade Grade, Buy Hold Grade and Peer Grade. Among the 19 titles in the solar sector, it is in first place.[12]
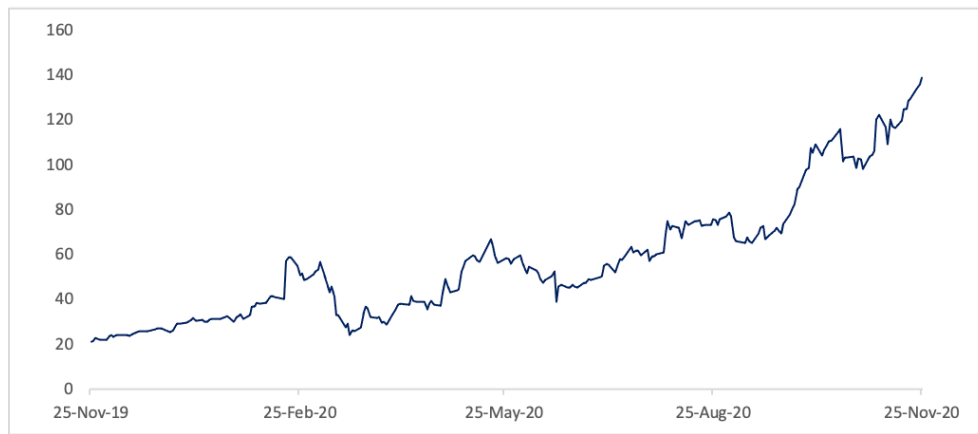
Figure 7: ENPH share price

4.2.6 Moderna, Inc (MRNA)

As for the other biotech companies, many investors consider Moderna to be risky, with fortunes largely dependent on the success or failure of its experimental COVID-19 vaccine, mRNA-1273. In fact, if a drug's clinical and regulatory success can mean huge gains, any failure in the development process can literally decimate an investor's portfolio.

It could be the logistics that proves to be the winning shot for Moderna, in fact, mRNA-1273 can remain stable at -20 degrees Celsius (about -4 Fahrenheit) for six months, at temperatures between 2 and 8 degrees Celsius (about 35-46 degrees Fahrenheit) for 30 days and at room temperature for 12 hours. For this reason, the vaccine can be easily distributed using existing transport infrastructure. Differently, Pfizer's BNT162b2 vaccine candidate must be stored at -70 degrees Celsius (-94 degrees Fahrenheit): this makes transport and storage difficult even in developed countries[13].

These days investors are showing increasing confidence in Moderna, its shares were jumping about 6% higher on Wednesday. The nice gain came after the biotech announced that on the 25 November the European Commission approves the sixth contract for an anti-Covid vaccine with the American company. The contract, announced by Ursula von der Leyen, concerns about the agreement to secure 80 million doses of Moderna's COVID-19 vaccine mRNA-1273 with an option to purchase up to 160 million doses. This is just the latest in a series of offers for Moderna's coronavirus vaccine, in fact the company has previously made supply agreements with the United States, Canada, Japan, United Kingdom, Israel, Qatar and Switzerland[14].

9

5 Quantitative analysis

5.1 Backtest

As in the previous evaluation, in order to obtain the weights for our portfolio we choose to perform both a qualitative and a quantitative analysis. More precisely we start from a numerical approach to achieve our objectives and then, on top of that, we add the information obtained from the latest financial/economical/political news proposed in the previous section.

Our qualitative analysis will have a big weight since we think that the historical data may not completely explain the exceptional situation due to the Covid pandemic.

To confirm our intuition we implement a VaR backtest in order to determine how well our strategy would perform using historical data. We focus on the number of failures between expected losses and actual losses and we examine how they are distributed: if there is a clustering of VaR violations in a certain period or the total number is too high, then we have evidence to believe that our model cannot rely completely on the quantitative analysis.

We compute the VaR at 99% confidence level through an historical simulation considering the realized values of returns with a lookback period of 250 days (1 year) since typically it is considered a good time window to have a consistent estimation. The charts (in section 7 we report the results for Amazon, Enphase and LVMH; for the complete results check the matlab code `Backtest.m`) represent the estimated VaR for each day in our timeline together with the actual returns registered for each stock in our portfolio, so that we can have a visual impact of the violations. In the tables a series of test are performed to verify whether our null hypothesis (the historical data can explain the situation today) is confirmed or rejected. We observe that for most of our stocks the tests based on the total number of failures accept the null hypothesis while we notice that those based on the nearness of the failures are generally rejected. For this reason, we zoom on the time series where there is a large and sudden change in the value of the returns namely the period that starts with the pandemic. At this point we decide to re-perform the aforementioned tests on this interval; as we expected generally, also the tests based on the total number of exceptions reject the null hypothesis. In fact, zooming, we are considering a smaller timeline while before the bigger time window and the low number of exceptions before the Covid period gave us as a result to accept the null hypothesis. This statistical analysis has thus confirmed our intuition: this period cannot be explained only by past data, also a qualitative approach is needed in order to take care of the exceptional events of the period.

Tests:

- TL: Traffic lights test, based on number of exceptions.

- Bin: VaR binomial test, based on number of exceptions.

- POF: Kupiec's proportion of failures test, assesses if the proportion of failures is consistent with the VaR confidence level.

- TUFF: Assesses if the number of periods until the first failure is consistent with the VaR confidence level.

- CC/CCI: Conditional coverage test, assesses if the independence of failures on consecutive time periods is consistent with the VaR confidence level.

- TBF/TBFI: Extention of Kupiec's time until first failure (TUFF), it takes into account not only the time until the first failure, but also the time between all failures.

5.2 Computation

As we introduced before, we begin with the numerical approach. Our objective is the maximization of the information ratio:

$$IR = \frac{\mathbb{E}[r_p - r_b]}{\sigma[r_p - r_b]}$$

where:
r_p = portfolio return
r_b = benchmark return

We obtain the *maximum IR portfolio* exploiting the Excel solver under the usual constraints of the weights ($\sum_{i=1}^{N} w_i = 1$, $w_i \geq 0 \ \forall i \in N$), moreover we add a constraint on the bond fund (CWBFX) in order to have weights consistent with the benchmark composition (we have already deepened this argument in the previous report in section 5).

AMZN	MSFT	ZM	ENPH	MRNA	BAFWX	MC.PA	6758.T	0P0000ZZBQ	
0.00%	14.26%	2.72%	8.08%	5.92%	29.53%	16.18%	12.94%	10.37%	1
0.00%	9.27%	1.77%	5.25%	3.85%	19.19%	10.52%	8.41%	6.74%	0.65

Table 1: Maximum IR portfolio composition

To visualize the set of the portfolios with the minimum variance at a given return, we estimate the efficient frontier through the calculation of 25 portfolios using 3 different methods: the first one is based on the sample mean as estimator, the second one uses shrinkage estimators while the last one uses the resampled frontier. As we can see from a visual inspection, the first two methods have the following problems:

- in figure 8 we can see how the frontiers obtained are too optimistic (i.e. given a value for the standard deviation the expected return is higher with respect to the one of the third method).

- Moreover in figure 10, 11:

    - the weights along the frontier change too sharply
    - the portfolios are not much diversified
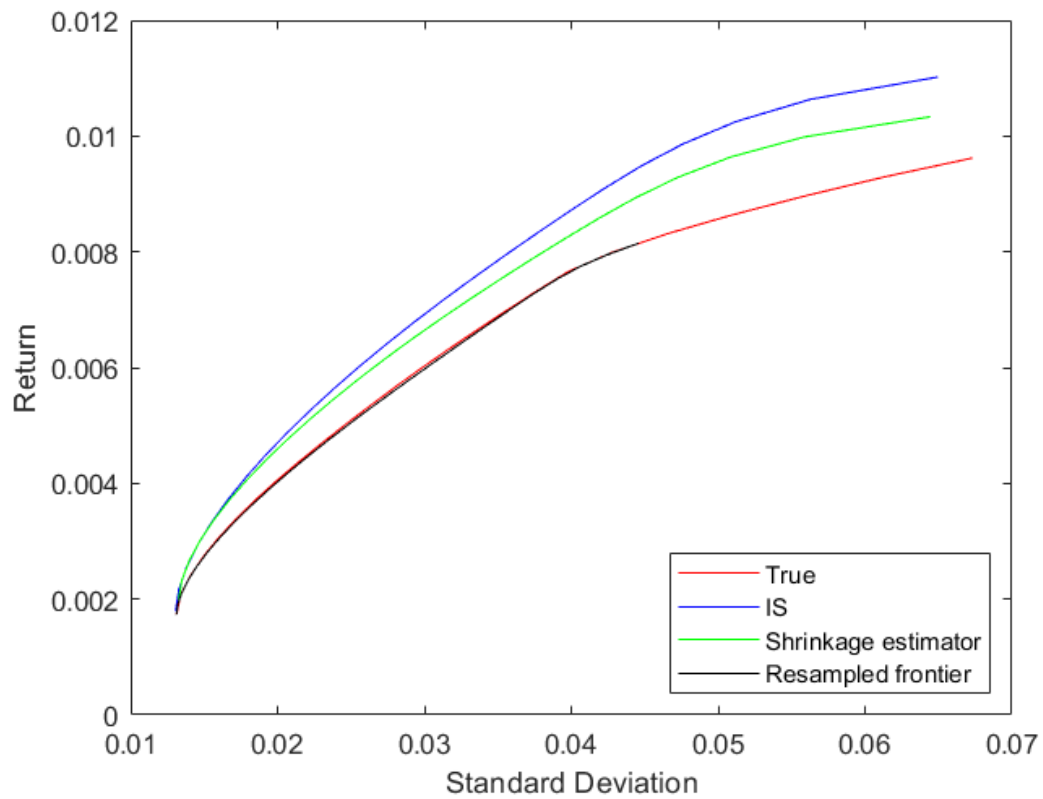   - the compositions vary too much from simulation to simulation

Figure 8: Efficient frontiers in comparison

From now on each asset in our portfolio is associated to a specific color, we add our legend:
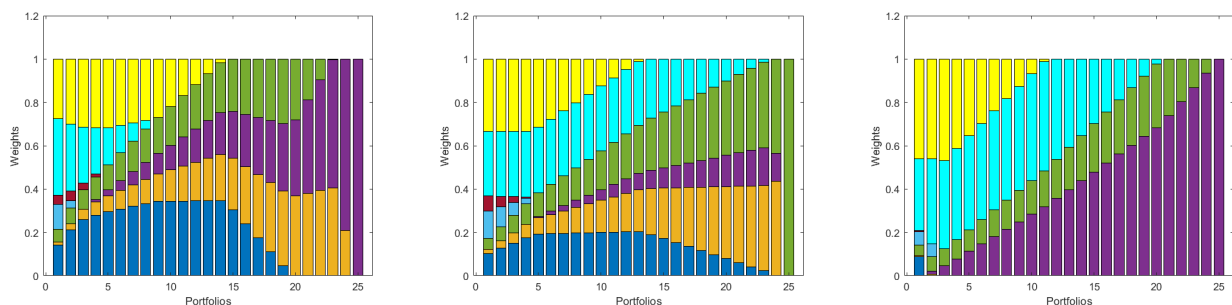

Figure 9: Legend

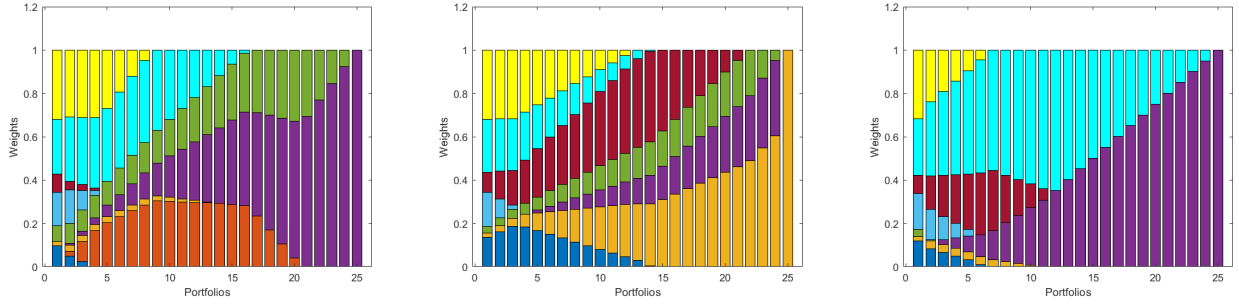Figure 10: Portfolio composition - IS: here 3 different simulations

Figure 11: Portfolio composition - Shrinkage estimator: here 3 different simulations
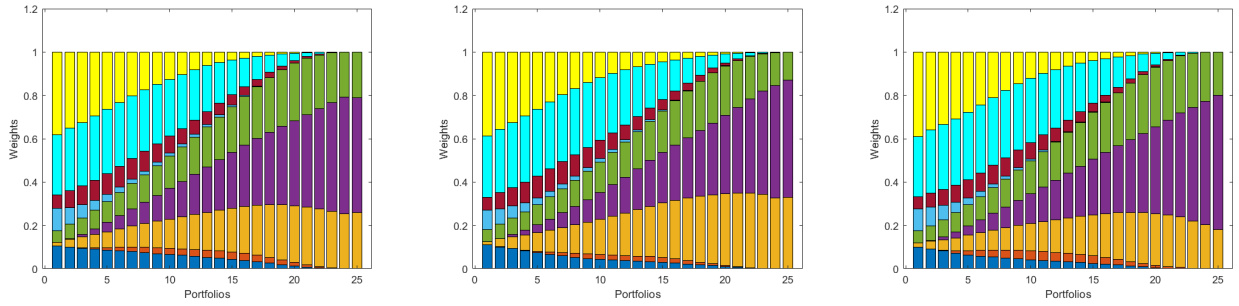

Figure 12: Portfolio composition - resampled frontier: here 3 different simulations

For these reasons we decide to develop our considerations relying on the efficient resampled frontier. Finally, among the elements belonging to the *efficient frontier*, we highlight the one with *maximum IR*: it is the 13th in the figure and it has IR=0.1956
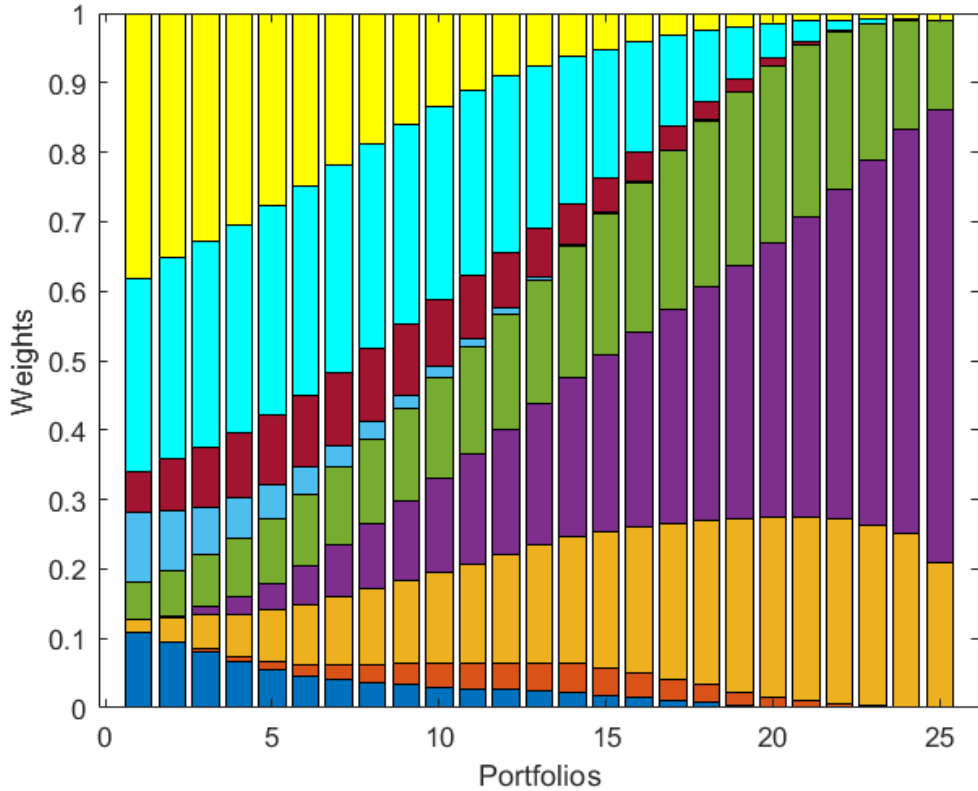

Figure 13: Efficient frontier

In figure 14 we isolate the *two selected portfolios* in order to visualize the portfolio obtained with Excel in the standard deviation-return plain. As we can see in the legend, we stress that the blue cross identifies the maximum IR portfolio while the red circle defines the maximum IR portfolio on the efficient frontier. First of all, their position in the chart underlines the difference in the values of return and volatility. The one obtained with Excel has lower return and lower variance since, without considering the fixed 35% of the bond fund, it invests about the 25% of its total in the other funds which, as we can see in figure 23, are of great use to lower the variance at the expense of the return. Moreover the 3 most profitable firms (Zoom, Enphase and Moderna) do not have big weights.

On the contrary, the portfolio on the frontier has bigger expected return to the detriment of the volatility since the 3 most profitable companies are predominant in the composition. We also notice how in both portfolios an high amount of money is invested in Sony; as we can see from the barplot, unless we are considering the extreme event (maximize the expected return without minding the variance), the company is very useful to have a low volatility but still it allows to have a good return.
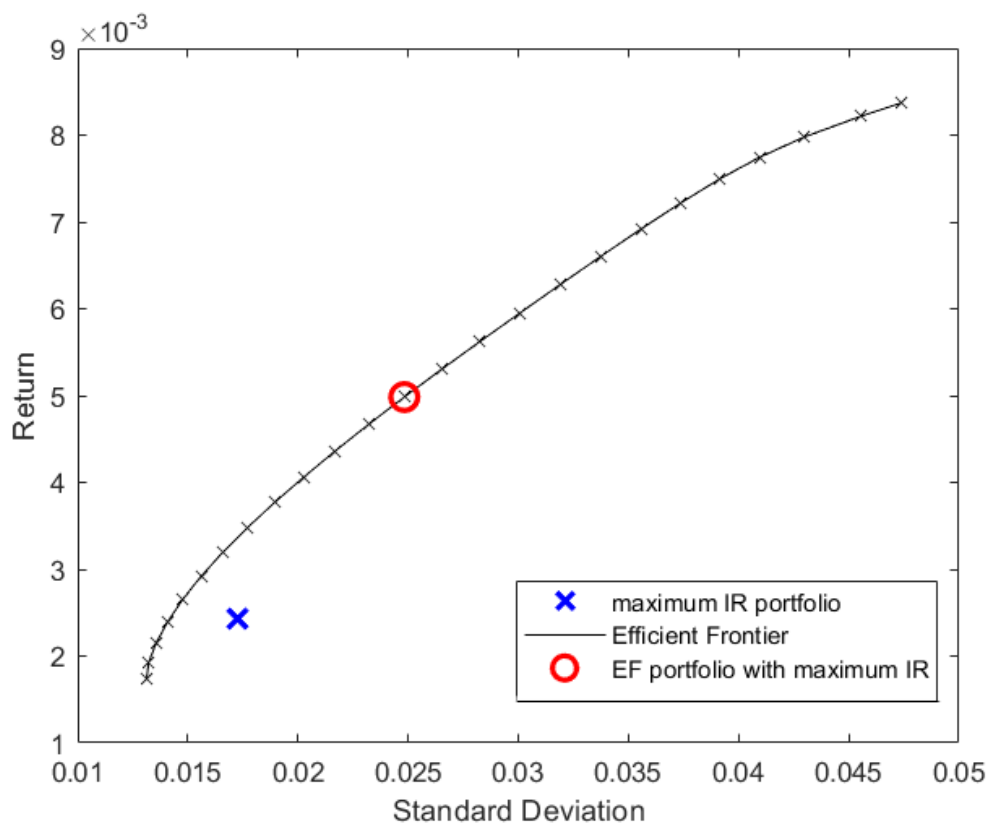
Figure 14: Efficient Resampled Frontier and maximization of IR

Here we recall table 1 together with the composition of the EF portfolio with maximum IR:

AMZN	MSFT	ZM	ENPH	MRNA	BAFWX	MC.PA	6758.T	0P0000ZZBQ	
0.00%	14.26%	2.72%	8.08%	5.92%	29.53%	16.18%	12.94%	10.37%	1
0.00%	9.27%	1.77%	5.25%	3.85%	19.19%	10.52%	8.41%	6.74%	0.65
2.39%	4.07%	16.96%	20.45%	17.79%	0.47%	6.80%	23.41%	7.65%	1
1.55%	2.64%	11.03%	13.30%	11.57%	0.30%	4.42%	15.22%	4.97%	0.65

Figure 15: Maximum IR portfolio and EF portfolio with maximum IR in comparison
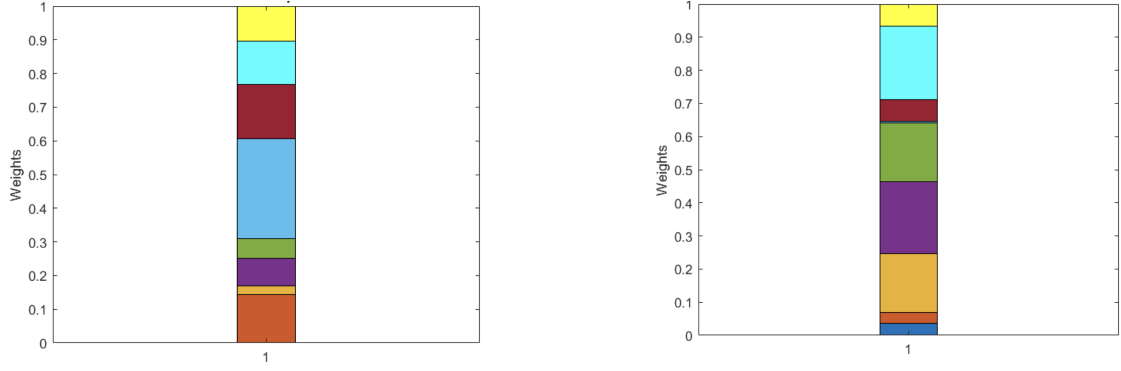
5.3 View

In light of what we said at the beginning, in order to mix the analysis based on past information with the current one, we try to blend in the estimation of the returns one view from experts. In line with the consideration of section 4.2.1.1, we found out that most of the analysts rank Amazon stock as a 'strong buy'[15]. So, following the approach presented by *Attilio Meucci, The Black-Litterman Approach: Original Model and Extensions, 2008*, we assess a qualitative view on the stock since we do not have a high level of confidence on the view. To do that we resort to the quantiles of the distribution induced by the market, putting parameter η in formula (11) equal to 2 as a "very bullish" forecast. Then, we estimate the portfolio frontier both using the prior and the posterior distributions, observing that the two are quite similar. Coherently with the "very bullish" view, we perceive a slight increase of Amazon weight for the latest portfolios (i.e. those with higher returns) in the posterior case with respect to the prior one. Moreover, in posterior distribution case, again for the latest portfolios, we notice that the weight of Sony is a bit increasing while, on the contrary, the one of Moderna is decreasing. Probably this is due to the effect of the correlation among the stocks.
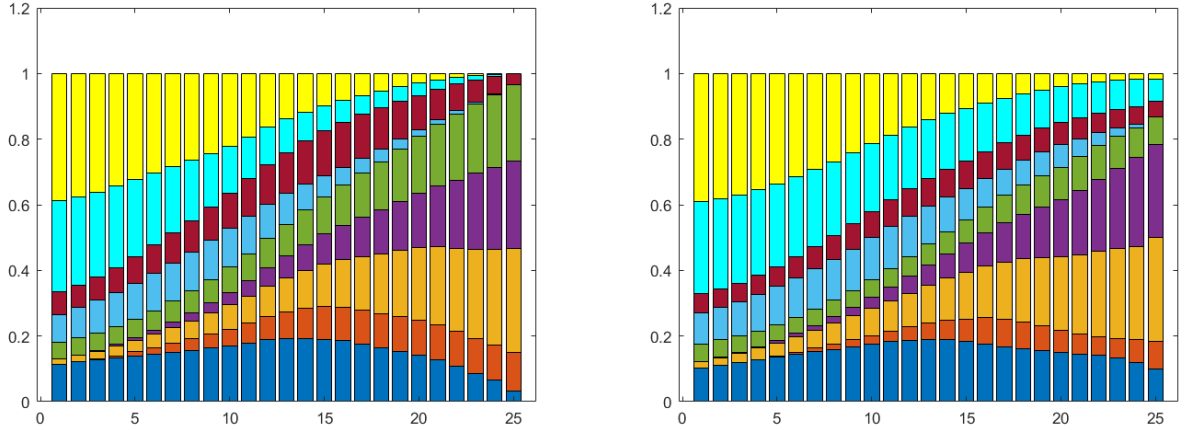

Figure 16: Prior and Posterior distributions EFs in comparison

As before, we isolate the portfolio with the highest IR (number 15th in figure 16 on the right) and we compare it with the previous ones. The IR (0.1976) is slightly above the one of the portfolio on the resampled frontier (0.1956); moreover we notice that except for the big amount of money invested in Amazon, the remaining composition is more similar to the one of the portfolio that maximizes the IR. For what concerns the increasing contribute of Amazon stock, we notice that this trend is already present in the prior distribution case, so we conclude that this is mainly due to the market weight of the stock and not to the view itself.

6 Portfolio Composition @ 27/11/2020

We can now merge the information obtained from the algorithms, the considerations on the impact of each stock in terms of variance/return and the views of the experts to obtain, finally, our final composition.

Considering the very good performance of the last two weeks of our portfolio and the general positive reviews on our stocks extrapolated from the financial news, in order to not lose much money from the transaction costs, we decide to modify the weights only if we have serious reasons to do that. The aforementioned positive reviews on Amazon lead us to not rely on the 0 weight proposed by the Excel algorithm and thus we decide to keep our positions. This can be useful since, as we said before, we want to avoid unnecessary fees and moreover, as it can be seen from the barplot in figure 23, an amount of money invested in this company can be useful to lower the variance.

We did not find many information about Microsoft; the algorithm that maximizes the IR suggests a 9.27% of our total assets, however the company in the last period does not have managed to bring us particularly good results and we have not found reasons which lead to think that the trend can change in the near future, so we decide to leave intact our positions.

Mixing the negative results of the very last period explained in the last paragraph of section 4.2.2, the fact that the previsions, due to the news about the vaccine are not too good, the low weight proposed by the "maximum IR portfolio", considering also that Zoom is useful to increase the absolute return but it has an high variance, taking also advantage of the slight ascent of the last few days we decide to sell all our positions in the company.

Enphase and Moderna can be combined in the same argument: the two firms are the ones that have brought us the best results so far and moreover the news for the very next future time are still positive. The Excel algorithm does not suggest a big investment in the companies, while the one we selected on the resampled frontier, since it has a higher absolute return (check figure 14), has weights more in line with ours. Again we keep our positions.

The last two risky firms are LVMH and Sony; in the past one of the main drivers to buy these stocks was our will to keep an exposure not only in the US market. All the algorithms suggest to keep this exposure and, being in agreement with it, we continue with this strategy.

In the previous period evaluation we decided to deviate from the benchmark, this was one of the factors that led us to our good performance. Now to not blow away our earnings, we decide to near back to the benchmark, increasing our exposure to the bond fund up to 37%. In accord to the maximum IR algorithm we invest the remaining money, obtained from the sale of Zoom stocks, in the fund BAFWX, less risky than the other companies as it can be seen from the past performances. The money are invested only in this fund and not in 0P0000ZZBQ since this one is quoted in GBP and thus we would slip into transaction costs.

Remark: we stress that the strange numbers in the final composition are connected to the fact that we do not make any change in the number of shares that we had in the previous period and thus the weight is obtained from the number of shares and not viceversa.

The final portfolio composition is the following:

Ticker	Description	Sector	Exchange	Weights
AMZN	Amazon.com, Inc	Consumer Discretionary	Nasdaq	3.028%
MSFT	Microsoft Corporation	Technology	Nasdaq	2.962%
6758.T	Sony Corporation	Technology	TYO	9.900%
ENPH	Enphase Energy, Inc	Energy	Nasdaq	13.834%
MRNA	Moderna, Inc	Health Care	Nasdaq	15.893%
MC.PA	LVMH Moët Hennessy - Louis Vuitton Société Européenne	Luxury Goods	EPA	12.972%

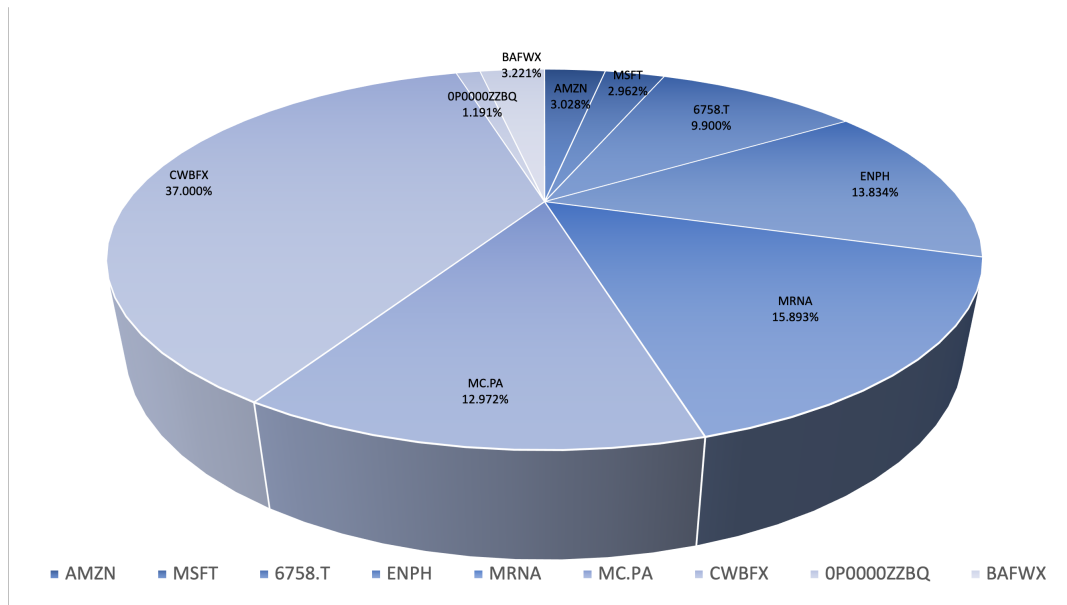| Ticker	Description	Exchange	Weights
CWBFX	American Funds Capital World Bond Fund Class A	Nasdaq	37.000%
0P0000ZZBQ	Blackrock European Dynamic Fund Fd Accumulation	LSE	1.191%
BAFWX	Brown Advisory Sustainable Growth Fund Institutional Shares	Nasdaq	3.221%

Figure 17: Portfolio Composition

7 Backtest Results
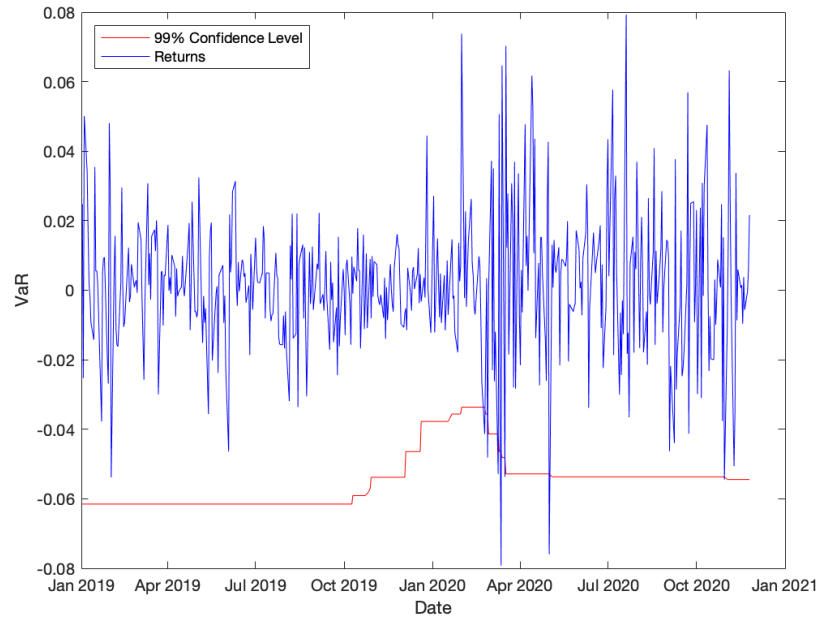
7.1 Amazon.com, Inc (AMZN)

7.1.1 2 years

Figure 18: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"AMZN"	"VaR"	0.99	0.98545	481	7	4.81	1.4553	288	0

PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"AMZN"	"VaR"	0.99	green	accept	accept	accept	accept	accept	reject	reject

7.1.2 Covid period

Figure 19: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"AMZN"	"VaR"	0.99	0.96552	203	7	2.03	3.4483	10	0

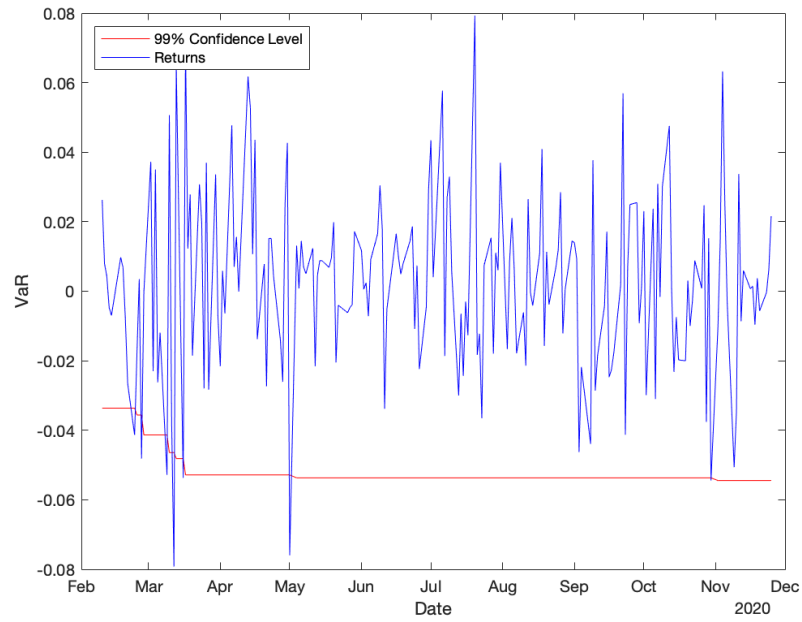| PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"AMZN"	"VaR"	0.99	yellow	reject	reject	accept	reject	accept	reject	reject

7.2 Enphase Energy, Inc (ENPH)

7.2.1 2 years

Figure 20: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"ENPH"	"VaR"	0.99	0.98129	481	9	4.81	1.8711	140	0

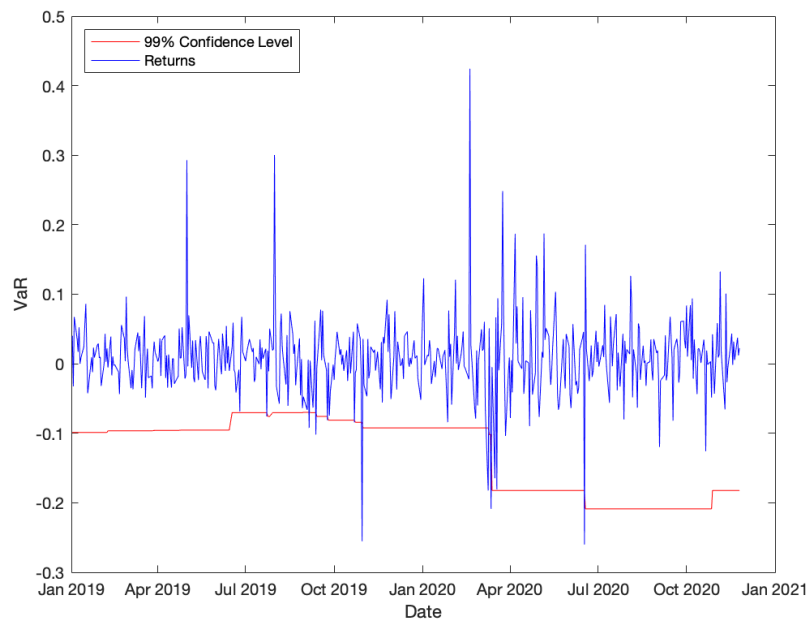| PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"ENPH"	"VaR"	0.99	yellow	accept	accept	accept	accept	accept	reject	reject

7.2.2 Covid period

Figure 21: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"ENPH"	"VaR"	0.99	0.98522	203	3	2.03	1.4778	20	0

PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"ENPH"	"VaR"	0.99	green	accept	accept	accept	accept	accept	accept	accept

7.3 LVMH Moët Hennessy-Louis Vuitton Société Européenne (MC.PA)
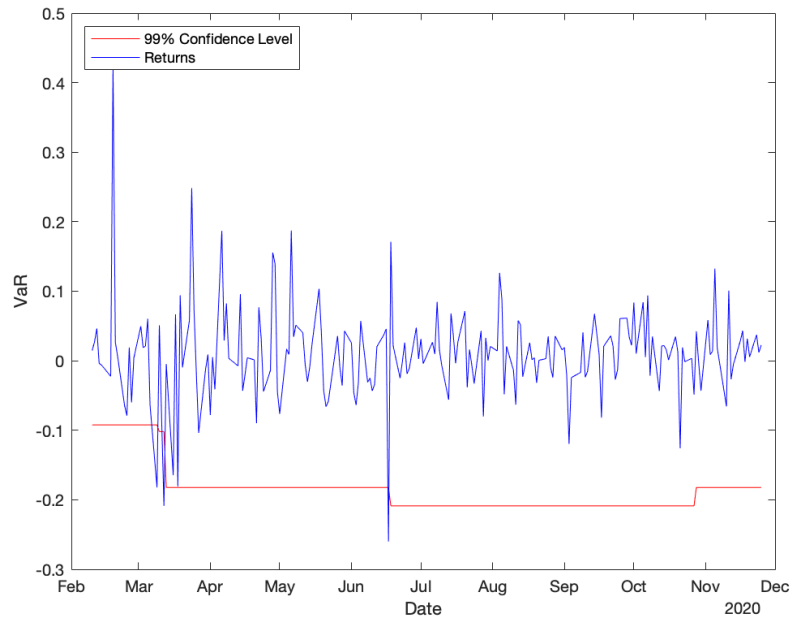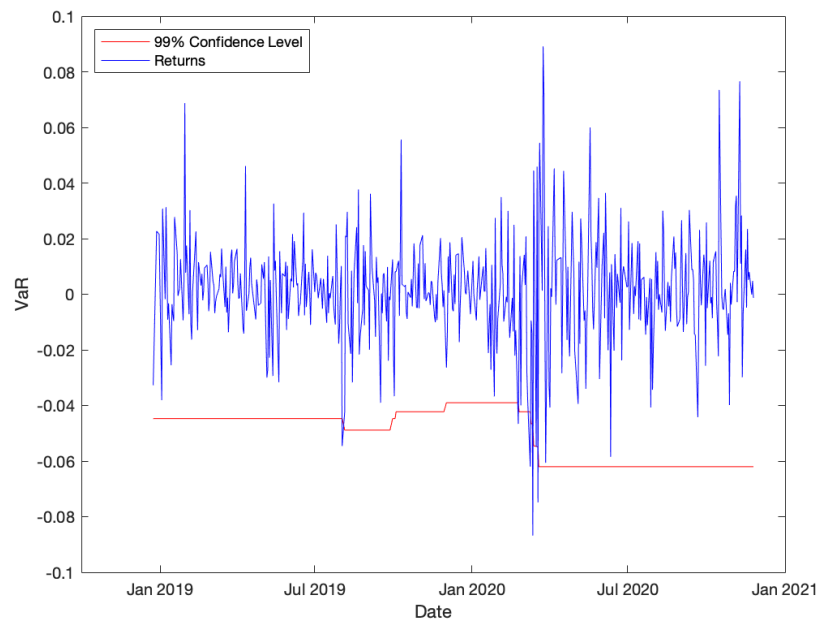
7.3.1 2 years

Figure 22: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"MC.PA"	"VaR"	0.99	0.9878	492	6	4.92	1.2195	154	0

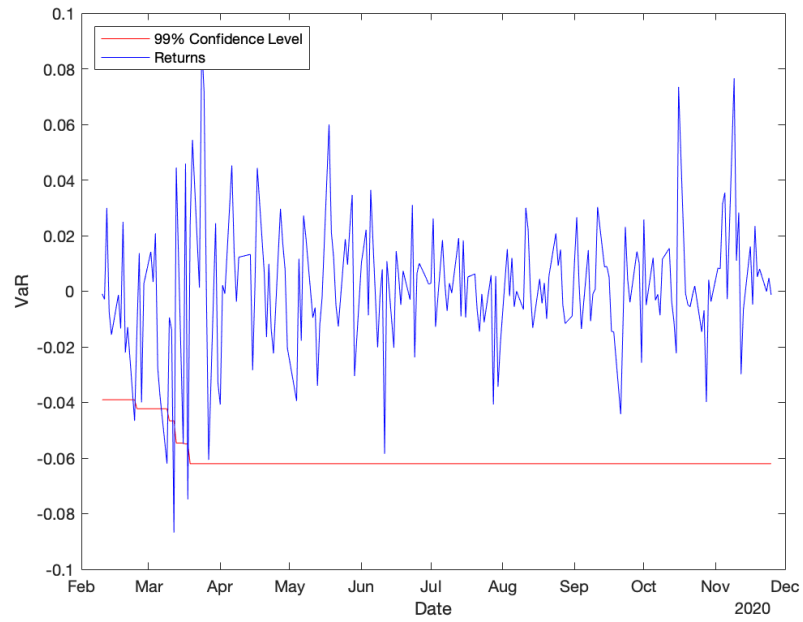| PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"MC.PA"	"VaR"	0.99	green	accept	accept	accept	accept	accept	reject	reject

7.3.2 Covid period

Figure 23: VaR historical simulation

PortfolioID	VaRID	VaRLevel	ObservedLevel	Observations	Failures	Expected	Ratio	FirstFailure	Missing
"MC.PA"	"VaR"	0.99	0.97561	205	5	2.05	2.439	11	0

PortfolioID	VaRID	VaRLevel	TL	Bin	POF	TUFF	CC	CCI	TBF	TBFI
"MC.PA"	"VaR"	0.99	yellow	reject	accept	accept	accept	accept	reject	reject

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