1. World Economic Situation and the impact of the COVID-19 pandemic

During these unprecedented times, the healthcare sector is responding to the rapid challenges arising from the disruption in supply chains and the constant need to adapt business processes in response to the COVID-19 pandemic.

The COVID-19 pandemic affected world economics. While currently there is no definitive treatment for this infectious disease, the pharmaceutical industry is assisting governments to address the COVID-19 unmet needs, from research and development actions on potential treatment strategies to balancing medicines supply chain in this time of crisis. Along this, pharmaceutical sectors are struggling to maintain natural market flow; as the recent pandemic affects access to essential medicines at an affordable price, which is the main goal of every pharmaceutical system. Facing such strong headwinds, many pharmaceutical majors showed some decline in revenues due to the pandemic.

This will have numerous short and long-term impacts on the health market, which can be seen from both global and local perspectives. Short term implications such as demand changes, supply shortages and regulation changes need to be taken into consideration. These impacts will of course have long-term consequences like approval delays, industrial growth slow down and possible trend changes in consumption in health-related products.

In this report we are going to make an analysis of the healthcare industry, specifically focusing on the pharmaceutical sector, accomplishing the following:

- Get data from Yahoo Finance.
- Analyze data using different statistics metrics.
- Show how to simulate thousands of portfolios using the same assets.
- Show how portfolio weights can be optimized for either volatility, returns, or Sharpe Ratio.
- Build the Markowitz efficient frontier.
- Build the Capital allocation line.
- Compare the optimal weights portfolio with a benchmark and determine the beta by linear regression.

The results presented in this report are present in a python file attached that should be considered to better support the results demonstrated in this report.

2. Securities Analysis: a brief overview

When evaluating investment performance, an investor should consider both the return and the risk associated with that return of different assets.

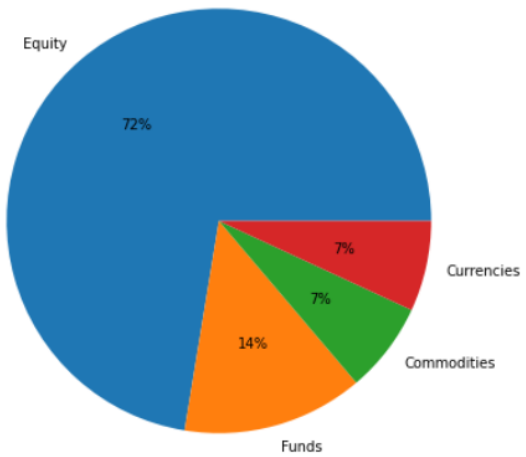
So, we decided to invest in different classes:

- **Equity**: Large-cap and small cap stocks from well-established health care companies around the world. We mainly focus on the healthcare industry more specifically the pharmaceutical domain.
- **ETF**: Some ETFs related to the pharmaceutical field.
- **Commodities**: We decided to consider commodities as they seem to protect against inflation and can enhance diversification of the portfolio.
- **Currencies**: In addition to commodities, we also decided to consider currencies for diversification purposes.

In annex 1, we provide a brief explanation of the securities that were considered.

For our analysis of the performance of each security we collected 8 years of data from January 1st, 2013 until December 31st, 2020. We start our analysis by presenting a pie chart with the initial securities distribution.

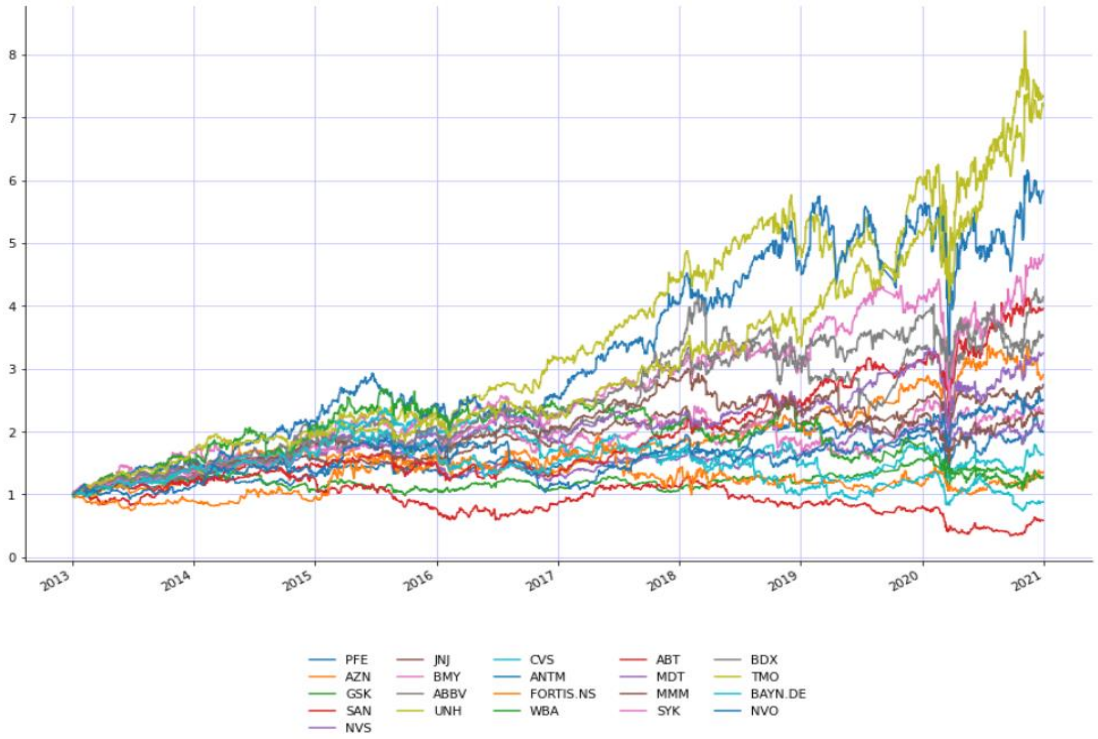
Graph I – Securities Distribution



In accordance with annex 1, we got the adjusted close information from Yahoo Finance for each of these securities based on the ticker and store these values in a data frame.

By plotting the normalized adjusted closes, we can see the relative performance of each security. The ideal portfolio will benefit from securities that tend to covary in opposing ways.

Graph II – Normalized adjusted close prices for equity.



Graph III – Normalized adjusted close prices for ETF

Graph IV – Normalized adjusted close prices for Commodities.

Graph V – Normalized adjusted close prices for Currencies.

3. Descriptive Statistics: Metrics Used

In this chapter we present the descriptive statistics that were the basis of our portfolio analysis. Due to the number of securities chosen for this analysis please consider the python file attached to this report as it also presents brief explanations of each line of code and supports the results that will complement our analysis.

3.1. Returns

There are two ways to calculate the returns of each of these securities:

- **Simple Returns:** Weighted sum of the simple returns of the securities of the portfolio, the formula consists of dividing the price time t by the price at time $t-1$;

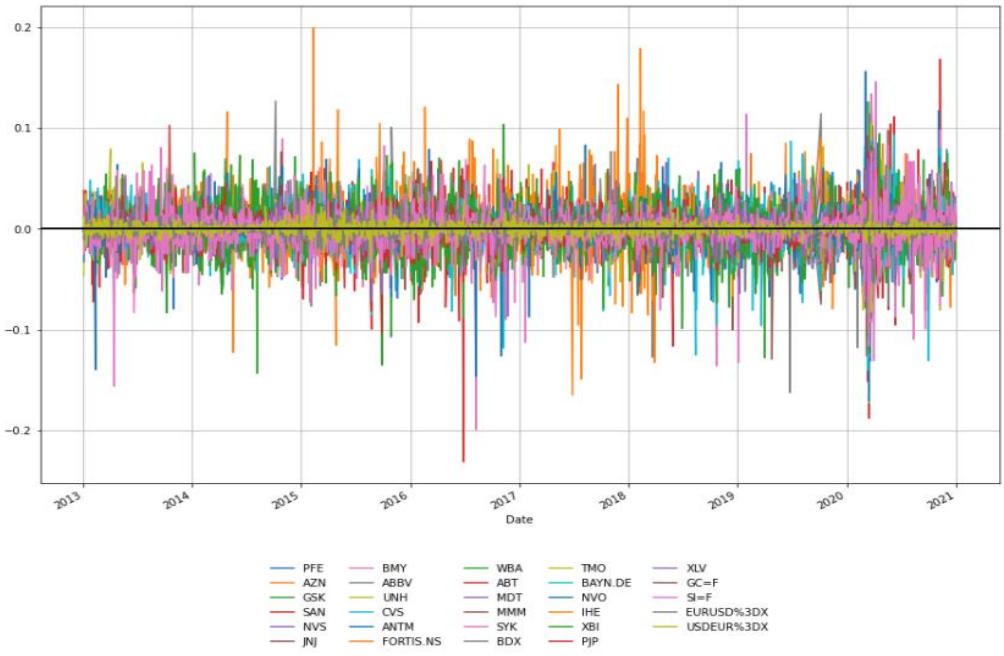
$$rt = \frac{Pt}{Pt-1} - 1$$

- **Log Returns:** Returns are compounded continuously. It is calculated by taking the natural log of the ending value divided by the beginning value.

$$rt = \log\left(\frac{Pt}{Pt-1}\right)$$

For this analysis we considered log returns, since the these allow easier-time aggregation, making returns of different securities easier to compare. In the python file attached to this report the returns were calculated both daily and yearly. We present bellow the daily log returns of each security.

Graph VI – Log returns for each security



3.2. Volatility

Volatility is a statistical measure of the dispersion of returns for a given security or market index. In most cases, the higher the volatility, the riskier the security. Volatility is often measured as either the standard deviation or variance between returns from that same security or market index. Volatility tends to change rapidly due to company conditions and general market conditions. Issues such as epidemics or political crises modify the volatility of assets through agents' risk on behavior. We present below the formulas:

$$Variance = \sigma^2 = \frac{\sum_{t=1}^{N}(Rt - \overline{Rt})^2}{N}$$

$$Standard\ Deviation = \sqrt{\sigma^2}$$

Where Rt is the log price of the security i at time t.

3.3. Sharpe Ratio

The Sharpe ratio, is defined as:

$$Sharp\ ratio = (\frac{Rp - Rf}{\sigma p})$$

Where Rp is the return of the portfolio, Rf is the risk-free rate and σp is the standard deviation of the portfolio's excess return.

For simplicity's sake, during our analysis we considered a risk-free asset with a $Rf = 1\%$.

The Sharpe ratio has become the most widely used method for calculating the risk-adjusted return. Modern Portfolio theory states that adding assets to a diversified portfolio that has low correlations can decrease portfolio risk without sacrificing return.

The greater a portfolio's Sharpe ratio, the better its risk-adjusted-performance. If the analysis results in a negative Sharpe ratio, it either means the risk-free rate is greater than the portfolio's return, or the portfolio's return is expected to be negative.

3.4. Correlation

The correlation coefficient is defined by:

$$\rho = \frac{\sum_{i=1}^{n}(xi - \bar{x})(yi - \bar{y})}{\sqrt{\sum_{i=1}^{n}(xi - \bar{x})}\sqrt{\sum_{i=1}^{n}(yi - \bar{y})}}$$

Where x and y are the securities, xi and yi the observations and $\bar{x}$ and $\bar{y}$ are the average returns of the securities.

A positive correlation means that the securities return tend to go together, for instance, a better-than-expected return for one security is likely to occur along with a much better return for the other security. A negative correlation indicates a tendency for the returns of one security to offset another, for instance, a better-than-expected return for one security may lead to a worse than expected return for the other security.

4. Portfolio Composition

The expected return on a portfolio is the weighted average of the projected returns obtained multiplying the weight of each asset by the respective returns:

$$E(Rp) = \sum_{i=1}^{m} wi * E(Ri)$$

Where wi is the weight of each asset i in the initial portfolio and $E(Ri)$ is the expected return of each asset i; and the variance of a portfolio is given by

$$Var(Rp) = \sum_{i=1}^{n}\sum_{j=1}^{n} wi * wj * \sigma i * \sigma j * \rho i, j$$

Where σp, represents the standard deviation of asset I and ρ represents the correlation between the two assets.

So, the question now arises considering the statistical metrics presented before which securities are, we going to choose for our portfolio?

To know the right allocation strategy, we need to understand what our tolerance for risk is. If temporary losses are something important, maybe we should consider lower-risk options like bonds. If you can support setbacks in the pursuit of aggressive long-term growth, investing in stocks is a good option.

Neither strategy is an all-or-nothing decision. Even the most cautious investor should mix in a few blue-chip stocks or an index fund, knowing that those safe bonds will offset any losses. And even the most fearless investor should add some bonds to soft a precipitous drop.

Choosing among various asset classes does not just manage risk. Greater rewards come from diversification.

Most professionals divide all investments broadly into two categories, traditional and alternative assets:

- **Traditional assets:** include stocks, bonds, and cash. Cash is money in the bank, including savings accounts and certificates of deposit.
- **Alternative assets:** are everything else, including commodities, real estate, foreign currency, art, collectibles, derivatives, and private equity.

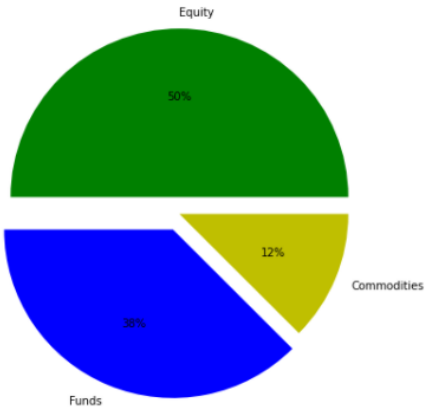
If we consider, the correlation between two securities the smaller the correlation the more the diversification value. By this logic, when the two assets are perfectly negatively correlated, the diversification should produce maximum risk reduction.

With this mind, we decided to build a portfolio using the following securities:

Table I – Selected Securities for our Portfolio

Ticker	Type	Security
PFE	Equity	PFIZER
AZN	Equity	ASTRAZENECA
GSK	Equity	GLAXOSMITHKLINE
JNJ	Equity	JOHNSON & JOHNSON
IHE	Fund	ISHARES US PHARMACEUTICALS'
XBI	Fund	SPDR S&P BIOTECH
PJP	Fund	INVESCO DYNAMIC PHARMACEUTIC
GC=F	Commodity	GOLD

Graph VII – Distribution of selected securities



With these assets in mind, we are now going to perform some portfolio optimization using different approaches to find out the perfect weights adjusted to returns, volatility and Sharpe ratio.

5. Portfolio Optimization

Using the metrics presented, we now have a way to evaluate how well our portfolio is allocated. It involves, calculating the expected returns, the expected volatility, and then from here we use the Sharpe Ratio to quantify how well our portfolio is allocated based on a risk perspective. The big question here is, if we know that we want to get a higher Sharpe ratio, what is the portfolio allocation we need to achieve this?

We are going to approach this in two different ways:

- First, we are going to test different random allocations and see which ones produces the highest Sharpe Ratio and the lowest volatility.
- Second, we will use mathematical optimization defined by some constrains to arrive at the optimal allocation.

In both scenarios we are going to use Monte Carlo Simulation allowing us to perform risk analysis by simulating models of possible outcomes according to a chosen probability distribution for a parameter that has an inherent uncertainty.

Using Monte Carlo simulation, we were able to generate 50.000 random portfolios with these securities while also store the returns, volatilities, and weights of each security in a data frame. Obviously, each portfolio will have its own level of risk and expected return. For example, some

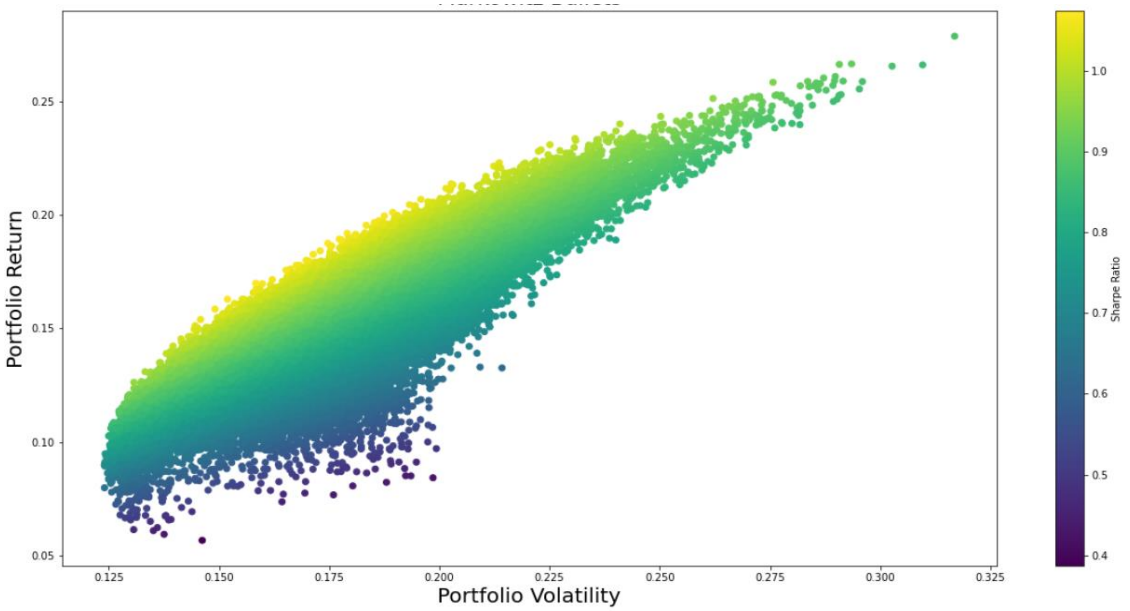
portfolios may dominate in mean-variance (Markowitz portfolio selection theory): for the same level of risk different combinations will give different results. Regarding the Monte Carlo Simulation it is important to note that the data was annualized, we considered 252 trading days.

Table II – Monte Carlo Simulation, an example of 5 random portfolios

	Returns	Volatility	Sharpe Ratio	PFE weight	AZN weight	JNJ weight	GSK weight	IHE weight	XBI weight	PJP weight	GC=F weight
0	0.205406	0.225603	0.910478	0.119127	0.253125	0.004744	0.151436	0.046438	0.371525	0.037111	0.016494
1	0.145912	0.163572	0.892032	0.075642	0.045965	0.140711	0.163064	0.015852	0.185446	0.159756	0.213565
2	0.193182	0.194088	0.995333	0.101854	0.193871	0.149230	0.048045	0.078999	0.300520	0.017931	0.109551
3	0.170241	0.181559	0.937664	0.150998	0.031701	0.159050	0.007522	0.224746	0.226133	0.037226	0.162624
4	0.155665	0.178982	0.869723	0.332370	0.071385	0.189483	0.060893	0.033745	0.088148	0.166499	0.057477

Now producing a bunch of different weights is one thing, but it helps to see the results of our simulation using a graph. We will use a scatter plot that shows the relationship between the overall volatility of our portfolio, and the expected returns. Ideally, what we should see is that as we take on more risk, we should be getting higher risk-adjusted returns. The opposite can be said for volatility, the less volatility we take on the lower the expected return we should be getting.

Graph VII – Markowitz Bullets



The resulting plot above is called the Markowitz Bullet. Each one of these points represents a portfolio with different returns, volatility, and different weight allocations. Using python, we were able to extract the portfolio with the highest Sharpe ratio and the portfolio with the lowest volatility:

Portfolio with highest sharpe ratio

Returns	0.190642
Volatility	0.178036
Sharpe Ratio	1.014635
PFE weight	0.031976
AZN weight	0.136001
JNJ weight	0.390514
GSK weight	0.026383
IHE weight	0.013443
XBI weight	0.268139
PJP weight	0.003812
GC=F weight	0.129733

Portfolio with lowest volatility

Returns	0.087510
Volatility	0.123553
Sharpe Ratio	0.627340
PFE weight	0.087650
AZN weight	0.031909
JNJ weight	0.207617
GSK weight	0.100421
IHE weight	0.039764
XBI weight	0.005756
PJP weight	0.017668
GC=F weight	0.509215

Looking at the results we were able to find the portfolio with the highest Sharpe ratio. Now a question arises is this allocation of securities optimal?

All optimization and minimization require a metric to optimize on. In this approach, we are going to try optimizing to find the best results. Before presenting the results there are some key concepts that need to be addressed first:

- **Efficient Frontier:** the set of optimal portfolios that offer the highest expected return for a defined level of risk or the lowest risk for a given level of expected return. Portfolios that lie bellow the efficient frontier are considered sub-optimal because they do not provide enough expected return for that given level of risk.
- **Utility Function:** Economic concept that measures preferences/satisfaction that consumers receive for choosing and consuming a product or service.
- **Capital Allocation Line:** The optimal portfolio consists of a risk-free asset and an optimal risky asset portfolio. The optimal risky asset portfolio is at the point where the CAL is tangent to the efficient frontier. This portfolio is optimal because the slope of CAL is the highest, which means we achieve the highest returns per additional unit of risk.

The capital allocation line formula is presented below:

$$E(rp) = rf + (\frac{E(ra) - rf}{\sigma a})\sigma p$$

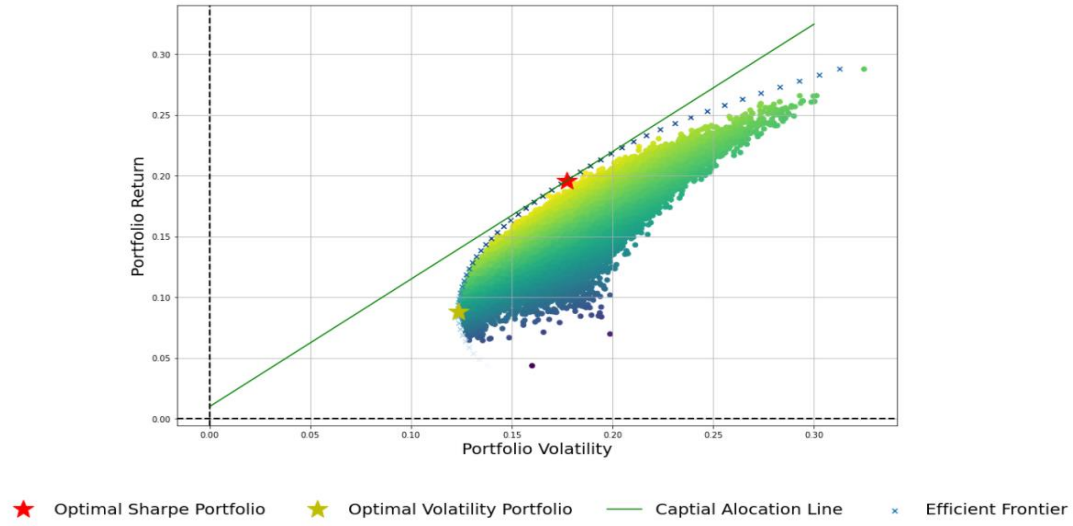
Where rf is the risk-free rate and $(\frac{E(ra)-rf}{\sigma a})$ is the Sharpe ratio.

An investor in this scenario has many options:

- He has the possibility to choose a portfolio only composed by the risk-free instrument. In this scenario he will be on the y axis because it assumes a residual risk
- He could include this risk-free asset in his portfolio however he will not be in the efficient frontier because he will not have the initial assets defined above.

Investors use both the efficient frontier and the Capital Allocation Line to achieve different combinations of risk and return based on what they desire. The optimal portfolio is found at the point where the Capital Allocation Line is tangent to the efficient frontier. This asset weight combination gives the best risk-to-reward ratio, as it has the highest slope for the Capital Allocation Line.

Graph IX – Optimal Sharpe Portfolio and Optimal Volatility Portfolio



Below are the characteristics of the simulated portfolio with highest Sharpe ratio and the optimal portfolio:

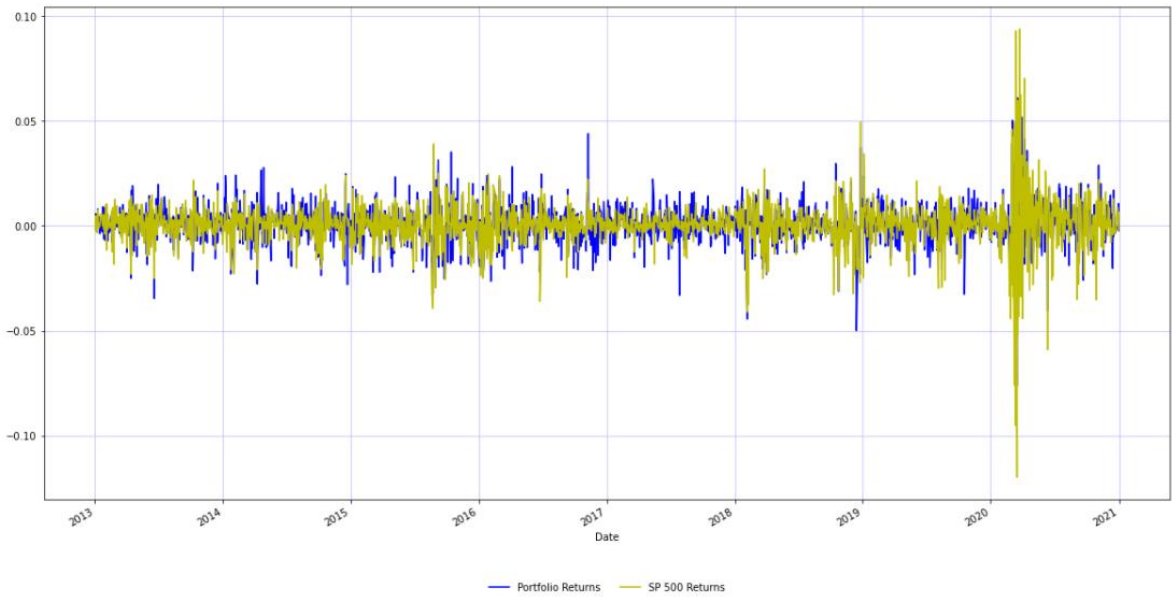
Table III – Comparison between Portfolios

	Max Sharpe Ratio Portfolio	Optimal Sharpe Ratio Portfolio
Returns	0.190642	0.194697
Volatility	0.178036	0.177121
Sharpe Ratio	1.014635	1.042773
PFE weight	0.031976	0.000000
AZN weight	0.136001	0.189700
JNJ weight	0.390514	0.452700
GSK weight	0.026383	0.000000
IHE weight	0.013443	0.000000
XBI weight	0.268139	0.240300
PJP weight	0.003812	0.000000
GC=F weight	0.129733	0.117300

6. Comparing Portfolio performance and the benchmark

Since almost half the value of the portfolio is built by equity, we selected the S&P 500 as our benchmark. As we can see by the graph presented below the portfolio returns tend to be more stable than the benchmark returns

Graph X – Daily portfolio returns vs benchmark returns



To compare the portfolio against investment in the market, we will use the Capital Asset Pricing Model.

The CAPM model describes the expected return of any asset as linear function of its beta. According to CAPM, the beta is the only relevant measure of an asset's risk:

- $\beta > 1$: A beta that is greater than one indicates that the security's price is theoretically more volatile than the market. This indicates that adding the stock to a portfolio will increase the portfolio's risk but may also increase its expected return.
- $\beta < 1$: A beta value that is less than 1 means that the security is theoretically less volatile than the market. Including this stock in a portfolio makes it less risky than the same portfolio without the stock.

The beta of a portfolio is calculated as:

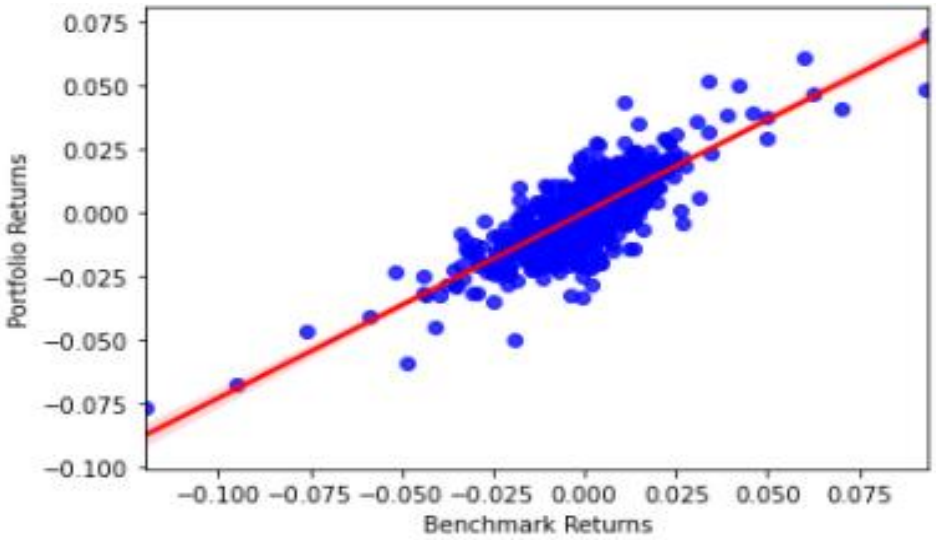
$$\beta = \frac{Cov(Rp, Rm)}{Var(Rm)}$$

And the CAPM model is given by:

$$Ri = Rf + \beta i * (Rm - Rf)$$

In this report we are going to calculate the Beta using least square regression model.

Graph X – Least square regression model



Using python, the beta is equal to 0.729 meaning the portfolio is less risky than the market.

Since we were able to calculate the beta of the portfolio there is another important measure that we can calculate, the Treynor Ratio.

The Treynor ratio, also known as the "reward-to-volatility ratio", is a performance metric for determining how much excess return was generated for each unit of risk taken on by a portfolio. It is given by:

$$Treynor\ Ratio = \frac{Rp - Rf}{\beta p}$$

The Treynor ratio for our portfolio is 0.253.

In summary our optimal portfolio metrics are the following:

```
----------------------------------------
Optimal Portfolio Return:  19.4697
----------------------------------------
Optimal Portfolio Volatility:  17.7121
----------------------------------------
Optimal Portfolio Sharpe Ratio:  1.0428
----------------------------------------
Optimal Portfolio Treynor Ratio 0.2532
----------------------------------------
Optimal Portfolio Beta 0.7293
----------------------------------------
```

7. Final Remarks

In conclusion we found out that investing in a diversified portfolio is more favorable than only investing in individual instruments.

A diversified portfolio gives us the ideal “reward to risk” ratio that minimizes risk for any given level of expected returns. We were able to simulate different portfolios using a Monte Carlo simulation and by using optimization procedures find the portfolio that maximizes the Sharpe ratio.

We also concluded that including a risk- free instrument into the portfolio helps in the construction of the Capital Allocation Line, which is necessary for constructing a portfolio, where investors can choose their ideal position according to their degree of risk aversion.

Apart from diversifying through assets types, the portfolio construction and management should follow any policy or company events or even any international macro or microeconomic effects on the international economy, such as the coronavirus outbreak.

Identifying these impacts may guide policymakers in evidence-informed planning and decision-making to combat associated challenges. For proper planning to prevent long-term complications, short-term impacts should be identified and further be measured with appropriate data-analysis.

Annex I

1. PFIZER INC

Sector: Health Care

Industry: Pharmaceuticals

Pfizer Inc. is one of the world's largest research-based pharmaceuticals firm, producing medicines for cardiovascular health, metabolism, oncology, inflammation and immunology, and other areas, with about 10 products that fetch approximately $1 billion or more in annual revenue. Its top prescription products include cholesterol-lowering Lipitor, pain management drugs Celebrex and Lyrica, pneumonia vaccine Prevnar, and erectile dysfunction treatment Viagra, as well as arthritis drug Enbrel, antibiotic Zyvox, and blood-thinner Eliquis. The company also makes and sells generic drugs and consumer health products. Pfizer operates around the world and gets about 55% of its revenue from international customers.

2. ASTRAZENECA

Sector: Health Care

Industry: Pharmaceuticals

AstraZeneca's products run the gamut from A (blood pressure drug Atacand) to Z (prostate and breast cancer drug Zoladex). One of the world's major pharmaceutical firms, AstraZeneca specializes in drugs for cardiovascular, metabolic, neurological, gastrointestinal, respiratory, oncology, and infection therapy areas. The firm's biggest sellers include cholesterol reducer Crestor, cardiovascular drug Brilinta, acid reflux remedy Nexium, and Symbicort for asthma. AstraZeneca also markets drugs that aim to treat high cholesterol, diabetes, pain, viral diseases, and various cancers. The company has more than 30 factories globally and R&D centers in the UK, US, Sweden, and China, and its products are sold in more than 100 countries.

3. GLAXOSMITHKLINE

Sector: Health Care

Industry: Pharmaceuticals

GlaxoSmithKline (GSK) gives anxiety, asthma, and other ailments the ax. One of the top five pharmaceutical firms in the world, GSK's bestsellers include respiratory, neurological, cardiovascular and dermatology drugs, as well as vaccines and antivirals and consumer healthcare products. It boasts four billion-dollar drugs: Advair/Seretide, its stalwart asthma medication; Relvar/Breo Ellipta, a chronic obstructive pulmonary disease treatment; and two HIV medications, Triumeq and Tivicay. In the consumer healthcare business, GSK racks up big sales from its Sensodyne toothpaste brand, joint-

pain relief medicine Voltaren, and fever relief medicine Panadol. Based in the UK, GSK has customers across the globe.

4. SANOFI

Sector: Health Care

Industry: Pharmaceuticals

Sanofi is a major French pharmaceutical firm that develops and manufactures prescription and over-the-counter drugs. Its pharmaceutical unit specializes in rare diseases, multiple sclerosis (MS), oncology, immunology, diabetes, and cardiovascular illness; the big sellers are Aubagio (MS), Lantus (diabetes), Lovenox (thrombosis), and Plavix (atherothrombosis). Sanofi's vaccines business, Sanofi Pasteur, manufactures vaccines for flu, meningitis, and pneumonia and its consumer healthcare business makes cough and cold, pain, and digestive remedies. Drugs are manufactured in nearly 75 sites located in more than 30 countries; the US is Sanofi's biggest market. Sanofi was founded in 1973 by a French oil company and became a limited company in 1994.

5. NOVARTIS

Sector: Health Care

Industry: Pharmaceuticals

Although it is based in neutral Switzerland, Novartis has been aggressive in attacking illnesses on multiple fronts, including pharmaceuticals and vaccines. One of the world's largest pharmaceuticals, the company develops, manufactures, and markets branded and generic prescription drugs, active pharmaceutical ingredients (APIs), biosimilars, and ophthalmic products. The company's Innovative Medicines segment develops and manufactures prescription drugs for blood pressure, cancer, and other ailments. Its Sandoz segment is among the largest manufacturers of generic drugs in the world; it also makes APIs. Novartis generates most of its revenue from international customers.

6. JOHNSON & JOHNSON

Sector: Health Care

Industry: Pharmaceuticals

Johnson & Johnson (J&J) is a diversified health care giant operating through more than 260 companies located in more than 60 countries. Its Pharmaceuticals division is focused on manufacturing medicines for infectious diseases, neurological, cardiovascular, pulmonary hypertension, autoimmune, and oncology ailments. Top sellers are psoriasis drugs Remicade and Stelara and cancer drug Zytiga. J&J's Medical Devices division offers surgical equipment, orthopedic products, and contact lenses, among other items. Finally, J&J's Consumer business makes over the counter (OTC) drugs and products for

baby, skin, oral, women's, and first-aid care. The company operates worldwide but makes about half of revenue in the US.

7. BRISTOL-MYERS

Sector: Health Care

Industry: Pharmaceuticals

Pharmaceutical giant Bristol-Myers Squibb (BMS) treats an array of maladies through its vast lineup of therapies. The company's blockbuster drugs include Eliquis for stroke prevention, cancer treatment Opdivo, and rhemuatoid arthritis treatment Orencia. Most of the firm's sales come from products in the areas of hematology, oncology, cardiovascular, fibrosis, and immunology. BMS has global research facilities and manufacturing plants, mainly in the US and Europe. The US accounts for about 60% of sales.

8. ABBVIE INC

Sector: Health Care

Industry: Biotechnology

AbbVie is vying for dominance in the world of medications. The firm develops and commercializes biopharmaceutical and small molecule drugs, with a focus on immunology, oncology, virology, and neuroscience. Its primary product is Humira, best known as a rheumatoid arthritis drug; it accounts for some 60% of sales and is the world's top-selling prescription drug. Other key products include cancer treatment Imbruvica and hepatitis C drug Mavyret. Products are sold globally, but the US is AbbVie's largest market. With the pending expiration of Humira's patent protection, AbbVie is looking for the next big thing. The company tie-up with Allergan for $63 billion in 2019. The US generates about 70% of total sales.

9. UnitedHealth Group Incorporated

Sector: Health Care

Industry: Health Care Providers & Service

UnitedHealth Group is a leading US health insurer offering a variety of plans and services to group and individual customers nationwide. Its UnitedHealthcare health benefits segment manages health maintenance organization (HMO), preferred provider organization (PPO), and point-of-service (POS) plans, as well as Medicare, Medicaid, state-funded, and supplemental vision, and dental options. In addition, UnitedHealth's Optum health services units OptumHealth, OptumInsight, and OptumRx provide wellness and care management programs, financial services, information technology

solutions, and pharmacy benefit management (PBM) services to individuals and the health care industry.

10. CVS Health Corporation

Sector: Health Care

Industry: Health Care Providers & Service

CVS Health Corp. is a leading pharmacy benefits manager with approximately 105 million plan members as well as the nation's largest drugstore chain. It runs approximately 9,900 retail and specialty drugstores. In addition to its standalone pharmacy operations, the company operates CVS locations inside Target stores and runs a panel of healthcare professionals, Caremark National Pharmacy and Therapeutics Committee. The company also offers walk-in health services through its retail network of MinuteClinics that are in around 1,100 CVS stores. CVS also serves an estimated 34 million people through traditional, voluntary, and consumer-directed health insurance products and related services.

11. Anthem Inc

Sector: Health Care

Industry: Health Care Providers & Service

Health benefits provider Anthem, through several subsidiaries, provides health coverage to approximately 43 million members in the US. One of the nation's largest health insurers, Anthem is a Blue Cross and Blue Shield Association licensee in more than a dozen states (where it operates as Anthem, Empire, and BCBS) and provides non-BCBS plans under the Unicare, Amerigroup, CareMore, Simply Healthcare, HealthSun, HealthLink, and other brands in numerous states across the US. Plans include PPO, HMO, POS, indemnity, and hybrid plans offered to employers, individuals, and Medicare and Medicaid recipients. Anthem also provides administrative services to self-insured groups, as well as specialty insurance.

12. Fortis Healthcare Limited

Sector: Health Care

Industry: Health Care Providers & Service

Fortis Healthcare Ltd. is a health care provider. The Company operates multi- specialty hospitals, a boutique-style hospital, and various satellite and heart command centers.

13. Walgreens Boots Alliance, Inc.

Sector: Health Care

Industry: Drug Retail

The company, formed when US-based Walgreen Co. bought its European counterpart Alliance Boots, includes more than 21,000 retail and wholesale pharmacies in about a dozen countries, selling prescription and many other health and wellbeing products. Walgreens Boots Alliance also includes wholesale operations serving more than 250,000 pharmacies, hospitals, health centers and doctors in upwards of 20 countries. Its retail and business brands include Walgreens, Duane Reade, Boots, and Alliance Health care, as well as health and beauty product brands such as No7, Soap & Glory, and Liz Earle, Botanics, Sleek MakeUP and YourGoodSkin. More than three quarters of its revenue comes from the US. Walgreens Alliance Boots was formed in 2014.

14. Abbott Laboratories

Sector: Health Care

Industry: Health Care Equipment & Supplier

With activities ranging from filling baby bottles to making generic medications and cardiovascular devices, Abbott Laboratories is a diverse health care products manufacturer. Its cardiovascular and neuromodulation segment makes products for cardiac rhythm management, electrophysiology, and other areas of cardiovascular care. Abbott's diagnostics division makes laboratory testing systems and point-of-care tests. The nutritional products division makes such well-known brands as Similac infant formula and Ensure supplements. Abbott also sells branded generic medicines (including gastroenterology and women's health products) in emerging markets and makes the FreeStyle diabetes care line.

15. Medtronic plc

Sector: Health Care

Industry: Health Care Equipment & Supplier

Medtronic plc is a maker of products that include those for cardiac rhythm disorders, cardiovascular disease, advanced and general surgical care, respiratory and monitoring solutions, renal care, neurological disorders, spinal conditions and musculoskeletal trauma, urological and digestive disorders, and ear, nose, and throat and diabetes conditions. Medtronic makes defibrillators and pacemakers that issue electrical impulses or shocks to keep hearts beating normally. Its Cardiac and Vascular Group also produces catheters, stents, valves, balloons, and surgical ablation technologies used to treat vascular and heart disease. The company's Restorative Therapies Group makes nerve and brain stimulation devices, implantable drug delivery systems, and surgical devices for ear, nose,

and throat (ENT) and spinal conditions. Headquartered in Dublin, Ireland, for tax purposes, the US is Medtronic's primary market which it serves from offices in Minnesota. Medtronic was founded in 1949 and serves hospitals, physicians, clinicians, and patients in more than 150 countries worldwide.

16. 3M Company

Sector: Industrial

Industry: Industrial Conglomerates

The diversified company's products fall under four segment categories: Safety & Industrial, Transportation & Electronics, Health Care, and Consumer. 3M boasts some of the world's most recognizable consumer brands including Post-it notes, Scotch tapes, Scotchgard fabric protectors, Scotch-Brite scouring pads, Filtrete home air filters, and ACE bandages. 3M sells products directly to users and through numerous e-commerce and traditional wholesalers, retailers, distributors, and dealers worldwide. The company generates about 60% of its sales outside the US. 3M was founded in 1902 as a small mining venture in Northern Minnesota called Minnesota Mining and Manufacturing Company.

17. Stryker Corporation

Sector: Health Care

Industry: Health Care Equipment & Supplier

Stryker's surgical products include such instruments as drills, saws, and even cement mixers. The company operates through three primary segments: MedSurg, Orthopaedic, and Neurotechnology and Spine. MedSurg's products include instruments, endoscopy, medical products, sustainability, and other medical specialties. The Orthopedic segment makes artificial hip and knee joints, trauma implants, and other orthopedic supplies. The Neurotechnology and Spine segment provides neurosurgical, neurovascular, and spinal implant devices. Stryker's products are marketed globally to doctors, hospitals, and other health care facilities via direct sales personnel and distributors. The US generates about 75% of total sales.

18. Becton, Dickinson, and Company

Sector: Health Care

Industry: Health Care Equipment & Supplier

The company's BD Medical segment is one of the top global manufacturers of syringes and other injection and infusion devices. BD Medical also makes IV catheters and syringes, pre-fillable drug delivery systems, self-injection devices for diabetes patients, and related supplies such as anesthesia trays and sharps disposal systems. The BD Life Sciences segment makes products for the safe collection

and transportation of diagnostic specimens; it also makes instruments and reagent systems that detect cancers, infectious diseases, and health care associated infections. BD Interventional provides vascular, urology, oncology, and surgical specialty products. The company's domestic operations accounts for more than 55% of the total revenue.

19. Thermo Fisher Scientific Inc

Sector: Health Care

Industry: Life Sciences Tools & Services

Thermo Fisher Scientific preps the laboratory for research, analysis, discovery, or diagnostics. The company makes and distributes analytical instruments, scientific equipment, consumables, and other laboratory supplies. Products range from chromatographs and spectrometers to Erlenmeyer flasks and fume hoods to gene-sequencers. Moving into other areas, it offers testing and manufacturing of drugs, including biologicals. Thermo Fisher also provides specialty diagnostic testing products, as well as clinical analytical tools. The company tallies more than 400,000 customers worldwide. Its key markets are pharmaceutical and biotech, diagnostics, and health care, academic and government, and industrial and applied research. Nearly half of the company's sales were generated in the US.

20. Novo Nordisk A/S

Sector: Health Care

Industry: Pharmaceuticals

Novo Nordisk is one of the world's leading producers of diabetes therapies including human insulin, insulin analogues, and injection devices. It makes modern insulin analogues Levemir and NovoLog (which mimic natural insulin regulation more closely than human insulin), Victoza for type 2 diabetes, and Saxenda, which treats obesity. The firm also has products in the areas of hemostasis management (blood clotting), human growth hormone, and estrogen replacement therapy. The company has affiliates in some 80 countries and markets products in about 170 countries. The not-for-profit Novo Nordisk Foundation, through its Novo A/S subsidiary, controls the voting power in Novo Nordisk.

21. IHE: ISHARES US PHARMACEUTICALS

iShares U.S. Pharmaceuticals ETF is an exchange-traded fund incorporated in the USA. The Fund seeks investment results that correspond to the price and yield of the Dow Jones US Select Pharmaceuticals Index.

22. XBI: SPDR S&P BIOTECH

SPDR S&P Biotech ETF is an exchange-traded fund incorporated in the USA. The Fund seeks to replicate the performance of the S&P Biotechnology Select Industry Index, an equal-weighted index.

The Index tracks all the US common stocks listed on the NYSE, American Stock Exchange, NASDAQ National Market and NASDAQ Small Cap exchanges.

23. PJP: INVESCO DYNAMIC PHARMACEUTIC

Invesco Dynamic Pharmaceuticals ETF is an exchange-traded funds incorporated in the USA. The Fund tracks the Dynamic Pharmaceutical Intellidex Index which holds 30 US pharmaceuticals companies screened based on a variety of investment merit criteria including: price momentum, earnings momentum, quality, management action, & value.

24. XLV: Health Care Select Sector SPDR Fund

Health Care Select Sector SPDR Fund is an exchange-traded fund incorporated in the USA. The Fund's objective is to provide investment results that correspond to the performance of The Health Care Select Sector Index. The Index includes companies involved in health care equipment and supplies, health care providers and services, biotechnology & pharmaceuticals.